



National Park Service  
U.S. Department of the Interior  
Glen Canyon National Recreation Area  
Arizona-Utah

---

## **Deepen Castle Rock Cut Environmental Assessment**

February 2008

---



# Deepen Castle Rock Cut

---

## Environmental Assessment

### Summary

Castle Rock Cut is located in a natural saddle between Castle Rock and Antelope Island in Lake Powell, which is part of the Glen Canyon National Recreation Area located in Kane County, Utah. Since the creation of Lake Powell, a reservoir created by Glen Canyon Dam, Castle Rock Cut has been used as a boat passage from Wahweap Bay to Warm Creek Bay and uplake areas. Castle Rock Cut was originally excavated to an elevation<sup>1</sup> of 3,622 feet in the 1970s to allow boats to traverse the cut at a lake level of 3,627 feet or higher. Additional excavation in 1993 deepened the cut to its current elevation of 3,615 feet.

Currently, the southwestern United States is experiencing a multi-year drought that has contributed to declining lake levels at many reservoirs, including Lake Powell. With the exception of 2005, inflows to Lake Powell have been below average since 2000. In 2007, the lake reached a maximum level of 3,612 feet in June and a minimum of 3,598 feet in March. The existing Castle Rock Cut is open to boaters only when the elevation of Lake Powell is at 3,620 feet or higher. As a result, during occasional low lake levels prior to 2003 and continuously since 2003, the closure of Castle Rock Cut has required boaters to detour via Antelope Canyon (hereafter referred to as “the Channel”) to reach Warm Creek Bay and other uplake destinations.

This detour has resulted in longer travel times, additional user costs, and reduced safety. Boat travel via the Channel is approximately 12 miles longer and requires an hour or more of additional travel time in each direction. As a result of this ongoing closure of Castle Rock Cut, the National Park Service (NPS) proposes to deepen the cut to an elevation of 3,580 feet, thus allowing boat traffic to traverse the cut at lake levels of 3,585 feet or higher.

This Environmental Assessment (EA) has been prepared pursuant to the requirements of the National Environmental Policy Act of 1969 and NPS policies and procedures. The purpose of the EA is to provide the decision-making framework that (1) analyzes a reasonable range of alternatives to meet the project objectives, (2) addresses the potential impacts associated with the excavation of Castle Rock Cut, and (3) identifies mitigation measures to lessen the degree or extent of these impacts. Because excavation of Castle Rock Cut and disposal of excavated materials would disturb 58 acres of Waters of the United States entirely beneath the ordinary high water mark of 3,700 feet, a permit under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act would be required. A water quality certification would also be required from the Utah Department of Environmental Quality in accordance with Section 401 of the Clean Water Act.

External (public) scoping was conducted to inform various agencies and the public about the proposed deepening of Castle Rock Cut and to generate input on the preparation of this EA. During the 30-day scoping period, approximately 1,630 responses were received from the public through letters, e-mail, or on the Planning, Environment, and Public Comment Web site.

Approximately 1,470 responses were in favor of the project, stating that proceeding with the project would improve boater safety, particularly when passing through the Channel; reduce fuel and boat maintenance costs; reduce emissions; reduce water and air pollution caused by boats traveling uplake via the longer route through the Channel; reduce travel time to uplake

<sup>1</sup> Elevations in this document are referenced to mean sea level.

destinations; and benefit the local economy. These comments are also summarized in *Public Scoping* and *External Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*.

Approximately 149 responses were opposed to the project, in general stating that the project would violate NPS mandates; favor one group of recreationists (i.e., boaters versus hikers, birdwatchers, etc.); create pollution and cause damage to the lakeshore to effect a short-term solution to a temporary drought; be a waste of taxpayer money and park economic resources; harm threatened or endangered species and other natural resources; and negatively impact the aesthetic and backcountry values of Glen Canyon NRA. These comments are also summarized in *Public Scoping* and *External Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*.

Approximately 11 responses received were neutral toward the project and had general comments questioning the budget, the best width and depth of the cut, and the impacts on the environment, traffic, and safety. These comments are also summarized in *Public Scoping* and *External Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*.

Consultation with Native American tribes has occurred and is discussed in *Native American Consultation*. In addition, concerns regarding economic impacts to tribes can be found in *Socioeconomic Environment* and *Environmental Justice (Title VI of the Civil Rights Act and Executive Order 12898)*. Discussions of the impacts on Rainbow Bridge National Monument can be found in *Visitor Use and Experience* and *Archaeological and Ethnographic Resources*.

## Public Comment

If you wish to comment on this EA, comments may be posted at <http://parkplanning.nps.gov/> or mailed to the name and address provided below. This EA will be available for public review for 30 days. Public comments must be received by March 20, 2008. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. Though you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Castle Rock Cut EA  
Glen Canyon National Recreation Area  
P.O. Box 1507  
Page, AZ 86040-1507  
Attention: Stan Austin, Acting Superintendent

# TABLE OF CONTENTS

<b>PURPOSE AND NEED .....</b>	<b>1</b>
Introduction.....	1
Background .....	1
Purpose and Need.....	4
Relationship to Other Plans and Policies .....	5
Impairment.....	5
Unacceptable Impacts .....	6
Appropriate Use.....	7
Public Scoping .....	7
Impact Topics Retained for Further Analysis.....	8
<b>Impact Topics Dismissed from Further Analysis.....</b>	<b>8</b>
Topography, Geology, and Soils .....	8
Wetlands.....	9
Floodplains.....	9
Prime and Unique Farmlands .....	9
Hazardous Materials.....	9
Air Quality.....	9
Water Supplies and Water Conservation.....	10
Habitat for Fish and Other Aquatic Organisms .....	10
Historic Structures .....	10
Cultural Landscapes.....	10
Museum Collections.....	11
Land Use .....	11
 <b>ALTERNATIVES CONSIDERED.....</b>	 <b>13</b>
<b>Alternatives Carried Forward .....</b>	<b>13</b>
Alternative 1–No Action Alternative.....	13
Alternative 2–Preferred Alternative .....	14
<b>Alternatives Considered and Dismissed.....</b>	<b>14</b>
Alternative 3–Deeper Cut Alternative.....	14
Other Sites .....	16
<b>Mitigation Measures .....</b>	<b>16</b>
Water Quality.....	16
Wildlife and Habitat.....	17
Threatened or Endangered Species .....	17
Visual Resources .....	18
Archaeological and Ethnographic Resources .....	18

Alternative Summaries.....	18
Identification of the Environmentally Preferred Alternative .....	21
<b>AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES .....</b>	<b>23</b>
<b>Cumulative Effects .....</b>	<b>23</b>
<b>Water Quality .....</b>	<b>24</b>
Intensity Level Definitions .....	24
Existing Conditions .....	24
Impacts of Alternative 1–No Action Alternative .....	25
Impacts of Alternative 2–Preferred Alternative .....	26
<b>Wildlife and Habitat (breeding, cover, food, travel, general) .....</b>	<b>26</b>
Intensity Level Definitions .....	26
Existing Conditions .....	27
Impacts of Alternative 1–No Action Alternative .....	28
Impacts of Alternative 2–Preferred Alternative .....	29
<b>Endangered or Threatened Species.....</b>	<b>30</b>
Intensity Level Definitions .....	30
Existing Conditions .....	30
Impacts of Alternative 1–No Action Alternative .....	31
Impacts of Alternative 2–Preferred Alternative .....	31
<b>Recreational Fisheries .....</b>	<b>31</b>
Intensity Level Definitions .....	31
Existing Conditions .....	32
Impacts of Alternative 1–No Action Alternative .....	32
Impacts of Alternative 2–Preferred Alternative .....	33
<b>Other Water-Related Recreation.....</b>	<b>34</b>
Intensity Level Definitions .....	34
Existing Conditions .....	34
Impacts of Alternative 1–No Action Alternative .....	34
Impacts of Alternative 2–Preferred Alternative .....	35
<b>Visual Resources .....</b>	<b>35</b>
Intensity Level Definitions .....	35
Existing Conditions .....	36
Impacts of Alternative 1–No Action Alternative .....	36
Impacts of Alternative 2–Preferred Alternative .....	36
<b>Wilderness Areas .....</b>	<b>37</b>
Intensity Level Definitions .....	37
Existing Conditions .....	38
Impacts of Alternative 1–No Action Alternative .....	38
Impacts of Alternative 2–Preferred Alternative .....	38
<b>Visitor Use and Experience.....</b>	<b>40</b>
Intensity Level Definitions .....	40
Existing Conditions .....	40
Impacts of Alternative 1–No Action Alternative .....	42
Impacts of Alternative 2–Preferred Alternative .....	42

<b>Energy Consumption or Generation</b> .....	<b>45</b>
Intensity Level Definitions .....	45
Existing Conditions .....	45
Impacts of Alternative 1–No Action Alternative .....	45
Impacts of Alternative 2–Preferred Alternative .....	46
<b>Safety</b> .....	<b>46</b>
Intensity Level Definitions .....	46
Existing Conditions .....	47
Impacts of Alternative 1–No Action Alternative .....	47
Impacts of Alternative 2–Preferred Alternative .....	49
<b>Soundscape</b> .....	<b>49</b>
Intensity Level Definitions .....	49
Existing Conditions .....	51
Impacts of Alternative 1–No Action Alternative .....	51
Impacts of Alternative 2–Preferred Alternative .....	51
<b>Archaeological and Ethnographic Resources</b> .....	<b>52</b>
Section 106 Consultation .....	53
Intensity Level Definitions .....	54
Existing Conditions .....	55
Impacts of Alternative 1–No Action Alternative .....	57
Impacts of Alternative 2–Preferred Alternative .....	57
<b>Socioeconomic Environment</b> .....	<b>58</b>
Intensity Level Definitions .....	59
Existing Conditions .....	59
Impacts of Alternative 1–No Action Alternative .....	60
Impacts of Alternative 2–Preferred Alternative .....	60
<b>Environmental Justice (Title VI of the Civil Rights Act and Executive Order 12898)</b> .....	<b>61</b>
Intensity Level Definitions .....	61
Existing Conditions .....	62
Impacts of Alternative 1–No Action Alternative .....	62
Impacts of Alternative 2–Preferred Alternative .....	63
<b>NPS Operations</b> .....	<b>63</b>
Intensity Level Definitions .....	63
Existing Conditions .....	64
Impacts of Alternative 1–No Action Alternative .....	64
Impacts of Alternative 2–Preferred Alternative .....	64
<b>CONSULTATION AND COORDINATION</b> .....	<b>67</b>
<b>External Scoping</b> .....	<b>67</b>
<b>Native American Consultation</b> .....	<b>68</b>
<b>Environmental Assessment Review and List of Recipients</b> .....	<b>71</b>
<b>List of Preparers</b> .....	<b>71</b>
<b>REFERENCES</b> .....	<b>73</b>

## LIST OF TABLES

Table 1. Estimated Probabilities That Lake Levels Would Be Above a Certain Elevation at the End of September and at the End of March* .....	13
Table 2. Alternatives Summary and Extent to Which Each Alternative Meets Project Objectives .....	19
Table 3. Environmental Impact Summary by Alternative .....	19
Table 4. Visitation Statistics: Glen Canyon and Rainbow Bridge .....	42

## LIST OF FIGURES

Figure 1. Project location. ....	2
Figure 2. Project vicinity. ....	3
Figure 3. General plan view showing locations of excavation and disposal areas. ....	15
Figure 4. Aerial photograph showing proximity of the project to the proposed wilderness area. ....	39
Figure 5. Typical cross-section showing depth, width, slopes, and elevations of proposed cut. ....	44
Figure 6. Regional map of the project area. ....	48

# PURPOSE AND NEED

## Introduction

Castle Rock Cut is located in Kane County, Utah, near the Utah–Arizona border, in the Glen Canyon National Recreation Area (NRA). The project area is approximately 1.5 miles east of Wahweap Marina in Lake Powell just south of Castle Rock (Figures 1 and 2). When inundated, Castle Rock Cut is used as a passage between Wahweap Bay and uplake destinations. The existing Castle Rock Cut was originally constructed in the 1970s by excavating the area to an elevation of approximately 3,622 feet. Additional excavation in 1993 deepened the cut to its current elevation of approximately 3,615 feet. During occasional low lake levels prior to 2003 and continuously since 2003, the closure of Castle Rock Cut has required boaters to detour via the channel that passes Antelope Point public launch ramp and Antelope Point Marina (“the Channel”) to reach Warm Creek Bay and all other uplake destinations. The Antelope Point launch ramp and marina, together referred to as Antelope Point Marina, are managed by Antelope Point Holdings, LLC.

The purpose of this Environmental Assessment (EA) is to examine the environmental impacts associated with the proposal to deepen Castle Rock Cut to 3,580 feet. Excavation would take place in the existing cut and would allow the cut to be open to boat traffic drafting 4 feet or less at 3,585 feet. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1508.9), and the National Park Service (NPS) Director’s Order (DO) 12 (*Conservation Planning, Environmental Impact Analysis, and Decision-making*).

## Background

The project area is approximately 1.5 miles east of Wahweap Marina in Lake Powell just south of Castle Rock. Lake Powell is not a natural lake but is the common name for the reservoir associated with Glen Canyon Dam. The Colorado River in Glen Canyon flows northeast to southwest. Wahweap Creek and Warm Creek, both major ephemeral tributaries of the Colorado River, flow northwest to southeast within 1 to 2 miles west and east of the project area, respectively. The project area is located in a saddle between Castle Rock and Antelope Island.

Castle Rock, a steep-walled butte, lies within 1 mile northwest of Castle Rock Cut. Antelope Island, originally Antelope Plateau, overlooks the Colorado River and forms the end of the ridge. Both Castle Rock and Antelope Island are surrounded by water when Lake Powell is at its full pool elevation of 3,700 feet, the Ordinary High Water Mark (OHWM). At full pool, Lake Powell inundates the project area to a depth of nearly 100 feet. Currently, the level of Lake Powell has dropped to less than 3,600 feet.

The greater project vicinity is in the Great Basin Desertscrub biotic community and supports sparse vegetation mainly composed of shadscale (*Atriplex confertifolia*) and blackbrush (*Coleogyne ramosissima*). The specific project area is located completely below the high water mark of 3,700 feet and has been inundated much of the past 40 years. The exposure of the predominantly Navajo sandstone soil substrate as lake levels have decreased has created a disturbed environment in the project area. Vegetation in this disturbed area is dominated by the non-native five-stamen tamarisk (*Tamarix chinensis*) and Russian thistle (*Salsola* spp.). The area surrounding the existing cut is undeveloped and consists of Navajo sandstone covered with fines and sediment deposited by the changing water levels of Lake Powell.

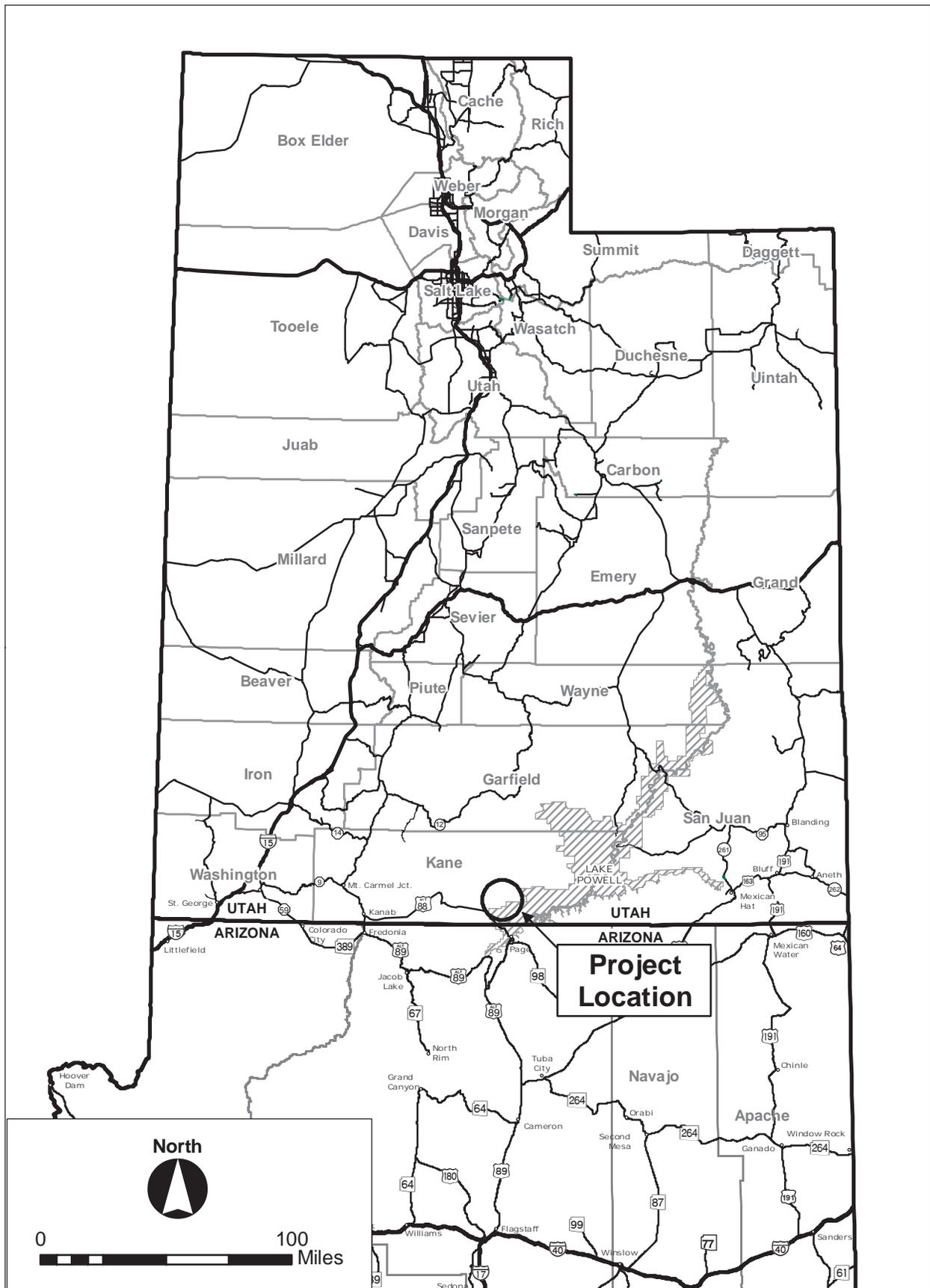


Figure 1. Project location.

W107-095WEPA/EA/fig 1



Figure 2. Project vicinity.

W07-095/NEPA/EA/fig2

Currently, the southwestern United States is experiencing a multi-year drought that has contributed to declining lake levels at many reservoirs, including Lake Powell. With the exception of 2005, inflows to Lake Powell have been below average since 2000 (Reclamation 2007a). In 2007, the lake reached a maximum level of 3,612 feet in June and a minimum of 3,598 feet in March (Reclamation 2007b). The existing Castle Rock Cut is open to boaters only when the elevation of Lake Powell is at 3,620 feet or higher; as a result, the cut has been continuously closed since 2003. The lake level is expected to further decline as the drought continues, making it desirable to deepen the cut to allow boat traffic a more direct travel route to uplake destinations.

The existing Castle Rock Cut was originally constructed in the 1970s by excavating the area to an elevation of approximately 3,622 feet. Additional excavation in 1993 deepened the cut to its current elevation of approximately 3,615 feet. During occasional low lake levels prior to 2003 and continuously since 2003, the closure of Castle Rock Cut has required boaters to detour via the Channel to reach Warm Creek Bay and all other uplake destinations. This detour has resulted in longer travel times that have detracted from boaters' recreational experience and enjoyment, created additional user costs, and reduced safety. Boat travel via the Channel is approximately 12 miles longer than passage through Castle Rock Cut and can require an hour or more of additional travel in each direction. An economic analysis completed by Jones and DeMille Engineering (2003) estimates that the additional cost to lake users of detouring through the Channel is \$14,261 per day (\$5.2 million per year) on average. This cost is likely higher due to the steep rise in gasoline prices during 2006–2008. The analysis also suggests that the reduced accessibility negatively affects recreational visitation numbers.

Use of the Channel affects public safety by increasing travel time for NPS emergency response to accidents on Lake Powell. Furthermore, heavy boat traffic through the Channel creates high wake and rough water conditions that represent hazards to boaters. These conditions have also resulted in structural damage and increased maintenance costs at the Antelope Point Marina. Since Castle Rock Cut was closed in 2003 and boaters were redirected through the Channel, boater perception of personal safety while traveling from Wahweap Bay to Warm Creek Bay has decreased.

## Purpose and Need

The purpose of this project is to improve navigation and access from the southwestern end of Lake Powell to areas uplake and to enhance the visitor experience and enjoyment of the southwestern end of Lake Powell during periods when the lake level is below 3,620 feet.

The project is needed to accomplish the following objectives:

1. Decrease visitor and staff safety risk factors associated with concentrated use of the Channel.
2. Provide more direct access for visitors and staff to uplake locations, thereby decreasing transit time, which may provide a savings on fuel consumption.
3. Improve emergency response time to uplake locations.
4. Minimize impacts to the Glen Canyon NRA natural and cultural resources, including the wilderness area on Antelope Island.

## Relationship to Other Plans and Policies

Current plans and policy that pertain to this proposal include the Glen Canyon National Recreation Area General Management Plan (GMP) (NPS 1979), the Rainbow Bridge National Monument GMP (NPS 1993), and the 2006 NPS Management Policies (NPS 2006). The following information explains how this proposal meets the goals and objectives of these plans and policies:

- This project is consistent with the Glen Canyon NRA GMP in that it provides for the enhanced “public outdoor recreation use and enjoyment of Lake Powell.” The GMP identifies the actions, impacts, and mitigating measures necessary to resolve the issues facing the NRA.
- This project is consistent with the Rainbow Bridge National Monument GMP (1993) in that the GMP specifically identifies visitor carrying capacity for the bridge, including management of visitor number via size and use of docking facilities (from Glen Canyon NRA, Rainbow Bridge is only accessible by water). This project will not modify in any way the current docking system at the bridge, nor change the visitor carrying capacity identified in the GMP.
- The proposal is consistent with the goals and objectives of the 2006 NPS Management Policies (NPS 2006) in that it meets the park purposes and legislatively authorized uses. It also addresses the stated requirement that the park “must exercise good judgment ... and that safeguarding of human life must not be compromised. The proposed project was developed to correct an unsafe situation at the Channel as well as to improve emergency response time uplake.

## Impairment

The Organic Act of 1916 (16 U.S. Code [USC] 1-4; 1916) and the General Authorities Act of 1970 (16 USC 1a-1 et seq.) establish direction for the management of lands reserved for national parks. Both acts prohibit any “impairment” of national park resources or values. A resource impairment is defined as “an impact that, in the professional judgment of the NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values” (NPS 2006). Several factors determine whether an anticipated resource impact would constitute an impairment of the resources:

- The resources and values that would be affected
- The severity, duration, and timing of the impact
- The direct and indirect effects of the impact
- The contribution of the anticipated impact to the overall cumulative condition of the resource

The NPS 2006 Management Policies require analysis of potential effects to determine whether actions would impair park resources (NPS 2006). The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid or to minimize, to the greatest degree practicable, adverse impacts to park resources and values. However, the laws give the NPS the management discretion to allow impacts to park resources and values when necessary and to appropriate to fulfill the purposes of a park as long as the impact does not constitute impairment of the affected resources and values.

Though Congress has given the NPS the management discretion to allow certain impacts in parks, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

1. necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
2. key to the natural or cultural integrity of the park; or
3. identified as a goal in the park's GMP or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. A determination on impairment is made in the *Conclusion* section for each of the resource topics carried forward in this document.

## Unacceptable Impacts

The impact threshold at which impairment occurs is not always readily apparent. Therefore, the NPS applies a standard that offers greater assurance that impairment will not occur. The NPS will accomplish this objective by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment but are not acceptable in a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Virtually every form of human activity that takes place in a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Therefore, for the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would:

- be inconsistent with a park's purposes or values, or
- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with
  - park programs or activities, or
  - an appropriate use, or

- the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations in the park.
- NPS concessioner or contractor operations or services.

In accordance with Management Policies, park managers must not allow uses that would cause unacceptable impacts to park resources. To determine if unacceptable impact could occur to the resources and values of Glen Canyon NRA and Rainbow Bridge National Monument, the impacts of proposed actions in this EA were evaluated based on the previously listed criteria. A determination on unacceptable impacts is included in the impact analysis section for each of the resource topics carried forward in this document.

## Appropriate Use

Section 1.5 of NPS 2006 Management Policies, *Appropriate Use of the Parks*, directs that the NPS must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed in a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 of NPS 2006 Management Policies, *Process for Determining Appropriate Uses*, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for:

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the NPS; and
- whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it.

Removal of and/or contouring sandstone near or in a marina area is a common and oftentimes vital action in park units that have major water recreational components. Proper location, sizing, construction materials, and methods would ensure that unacceptable impacts to park resources and values would not occur. The proposed project to deepen the existing Castle Rock Cut is consistent with the park's GMP and other related park plans. With this in mind, the NPS finds that the proposed project is an acceptable use at Glen Canyon NRA.

## Public Scoping

Scoping is a process to identify the resources that may be affected by a project proposal and to explore possible alternative ways of achieving the proposal while minimizing adverse impacts. Glen Canyon NRA conducted scoping with the public and interested/affected groups and agencies.

Scoping was initiated by posting project information on the NPS Planning, Environment, and Public Comment (PEPC) Web site on November 2, 2007. A scoping flier was also distributed to inform the public of the proposal to deepen Castle Rock Cut and to generate input on the preparation of this EA. The scoping flier was mailed on November 5, 2007, to 175 recipients, including various federal and state agencies, affiliated Native American tribes, local governments, non-profit organizations, and other interested parties.

During the 30-day scoping period, approximately 1,630 comments were received. The majority of respondents were in favor of deepening Castle Rock Cut. The remaining responses included some who were neutral to the project and some who were opposed to the project, including two Native American tribes. More information regarding scoping can be found in *Consultation and Coordination*.

## Impact Topics Retained for Further Analysis

Impact topics for this project have been identified on the basis of federal laws, regulations, and orders; NPS 2006 Management Policies and NPS general knowledge of the resources in the project area; and the public comments and concerns received during the initial public scoping period from November 2, 2007, through December 4, 2007. As a result, the following resources and values could be affected by development at the cut location. To identify the potential impacts of the project, these topics are analyzed in the *Environmental Consequences* chapter.

- Biological characteristics (water quality, wildlife and habitat, and threatened and endangered species)
- Human use characteristics (recreational fisheries, other water-related recreation, visual resources, wilderness areas, visitor use and experience, energy consumption or generation, safety, soundscape, archaeological and ethnographic resources, socioeconomic environment, environmental justice, and NPS operations)

A summary of mitigation measures is included on page 16.

## Impact Topics Dismissed from Further Analysis

### Topography, Geology, and Soils

According to NPS 2006 Management Policies, the NPS will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue (NPS 2006). These policies also state that the NPS will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources.

Excavation of Castle Rock Cut would result in the removal of approximately 400,000 cubic yards of natural Navajo sandstone and accumulated silts and sediments and the disposal of such materials in a 50-acre disposal area immediately north of Castle Rock Cut. Castle Rock Cut has been excavated twice previously. The elevation of the cut would be lowered by approximately 35 feet, and the topography in the disposal area would rise by approximately 5 feet. Important topographic or geologic features in the area include the adjacent Antelope Island and nearby Castle Rock.

Given that this project would not impact Antelope Island or Castle Rock, and that the area has been previously disturbed, the proposed action would result in negligible adverse impacts to

topography, geology, and soils. Because these effects are negligible, this topic has been dismissed from further analysis in this document.

## **Wetlands**

Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. In addition, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers (Corps) to regulate, through a permitting process, the discharge of dredged or fill material into Waters of the United States. NPS policies for wetlands strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands.

No wetlands are present in the project area. Therefore, a Statement of Findings for wetlands is not required, and this impact topic has been dismissed.

## **Floodplains**

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction in the 100-year floodplain unless no other practicable alternative exists. In accordance with DO 77-2 *Floodplain Management*, construction in a 100-year floodplain requires the preparation of a Statement of Findings for floodplains.

The proposed project would take place entirely below the OHWM and would not be located in a 100-year floodplain. Therefore, a Statement of Findings for floodplains is not required, and this impact topic has been dismissed.

## **Prime and Unique Farmlands**

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects on prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil-seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. According to the NRCS, the project area does not contain prime or unique farmlands. Therefore, the topic of prime and unique farmlands has been dismissed from further consideration.

## **Hazardous Materials**

The geology of this area is Navajo sandstone. There are no agricultural interests near the project location; therefore, no significant sources of persistent pesticides from land runoff or percolation are present. There are no public records of petroleum spills, hazardous substances, or other contaminants in the project vicinity. Occasional fuel spills may occur at the marinas on Lake Powell (e.g., Wahweap Marina), but any such spill is expected to remain localized without affecting the project area. Because there are no agricultural lands present or records of hazardous material contamination, this topic was dismissed from further analysis.

## **Air Quality**

The project is in an area designated as a Class II airshed. Class II airsheds have good air quality with no additional air quality restrictions above those required by the National Ambient Air Quality Standards (NAAQS). To be in compliance with NAAQS, an area must not exceed 9 particles per

million (ppm) of carbon monoxide in an 8-hour period, 150 µg/m<sup>3</sup> of particulate matter containing particles with diameters of 10.0 microns or less in a 24-hour period, 0.08 ppm of ozone in an 8-hour period, 0.14 ppm of sulfur oxides in a 24-hour period, 1.5 µg/m<sup>3</sup> of lead quarterly, and 0.053 ppm of nitrogen dioxides annually. The project is in an area that complies with all NAAQS and conformity procedures do not apply to this project; therefore, this topic has been dismissed from further analysis.

## Water Supplies and Water Conservation

Glen Canyon Dam was constructed to regulate the release of water downstream in accordance with the 1922 Colorado River Compact and the 2007 Record of Decision on Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead. The NPS is responsible for the regulation of recreational use of the water at Lake Powell, and the U.S. Bureau of Reclamation (Reclamation) is responsible for Glen Canyon Dam operations and maintenance as well as the storage/distribution of water downstream in accordance with the above-referenced guidelines. Because this alternative is not associated with, or does not impact in any way, water supplies or water conservation practices at Lake Powell, the topic of water supplies and water conservation was dismissed from further analysis.

## Habitat for Fish and Other Aquatic Organisms

This dry region would not be expected to support amphibians. A few species may range into the project area but they are rarely found along the edges of larger bodies of water and are not likely to occur in the project area. Several species of native desert fish once ranged upstream of the Colorado River along perennial reaches of the Wahweap Bay and Warm Creek Bay drainages; however, habitat for these species has never existed in the project area. Prior to the creation of Lake Powell, the project area was upland desertscrub community and did not have a perennial drainage to support native desert fish. These species are not adapted to life in the impounded waters of Lake Powell, and the abundance and large number of exotic game fish species in the lake precludes the ability of these species to migrate into the project area from suitable habitat in the tributaries of the lake (see *Recreational Fisheries*). Neither the no action nor the proposed action would change the suitability of the habitat for these species; therefore this topic has been dismissed from further analysis.

## Historic Structures

NPS uses the term “historic structures” to refer to both prehistoric and historic buildings and structures, which are defined as constructions that shelter any form of human habitation or activity. The project area contains no historic structures, nor are any known to exist in the broader area of potential effect (refer to *Archaeological and Ethnographic Resources*). Therefore, the topic of historic structures was dismissed from further analysis.

## Cultural Landscapes

According to NPS DO 28, *Cultural Resource Management Guideline*, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of sediment, land use, systems of circulation, and types of structures that are built. Though a cultural landscape inventory has not been conducted for the Glen Canyon NRA, the known and suspected archaeological and ethnographic resources are not likely to comprise or contribute to a discernable cultural landscape; therefore, this topic has been dismissed from further consideration.

## **Museum Collections**

According to the NPS DO 24 *Museum Collections*, the NPS requires the consideration of impacts on museum collections (i.e., historic artifacts, natural specimens, and archival manuscript materials), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, NPS Museum Collections. There are no museum collections housed in the project area or in the broader area of potential effect. Therefore, the topic of museum collections has been dismissed from further consideration.

## **Land Use**

In 1972, Congress created the Glen Canyon NRA to “provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto in the states of Arizona and Utah and to preserve scenic, scientific, and historic features contributing to public enjoyment of the area” (NPS 2007a). Because this alternative would not change the existing land use classification of the project area, this topic was dismissed from further analysis.



# ALTERNATIVES CONSIDERED

A list of alternatives that could potentially meet the project objectives defined in *Purpose and Need* was developed by an interdisciplinary team of NPS employees. A total of three action alternatives and the No Action Alternative were originally identified for this project. Of these, two of the action alternatives were dismissed from further consideration, as described later in this chapter. One action alternative and the No Action Alternative are carried forward for further evaluation in this EA. A summary table comparing alternative components was presented in the *Summary* at the beginning of this document.

Reclamation provided the following table to illustrate the relative amounts of time Castle Rock Cut would be open under various excavation scenarios over the next 5-, 10-, and 20-year periods (Table 1). These estimates do not include influences from climate change, which are expected to reduce inflows to Lake Powell and are therefore higher than what would be expected if climate change were included in the estimates.

**Table 1. Estimated Probabilities That Lake Levels Would Be Above a Certain Elevation at the End of September and at the End of March\***

Date	Lake Elevation (feet)	Probability That Lake Levels Would Be Above This Elevation at the Specified Time Interval		
		5 years (2008–2012)	10 years (2008–2017)	20 years (2008–2027)
September 30 (seasonal high)	3,620	60%	62%	64%
	3,585	81%	81%	82%
	3,565	91%	91%	91%
March 31 (seasonal low)	3,620	40%	50%	55%
	3,585	80%	78%	78%
	3,565	88%	87%	87%

\*Probabilities based on 100 modeling runs using inflow and lake level elevation data from 1906 to 2005. Model does not take into account potential long-term climate change, including global warming. Modeled elevations are based on existing and target excavation depths, with 5 feet added as a minimum freeboard for passage of houseboats and personal watercraft (Reclamation 2007c).

## Alternatives Carried Forward

### Alternative 1—No Action Alternative

This alternative results in no construction or further excavation at Castle Rock Cut and would not require a Corps permit. This alternative represents the baseline or benchmark to compare the impacts of the action alternatives. Because Lake Powell is a navigable water subject to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, work cannot occur below the OHWM of Lake Powell without Corps authorization (permit). Consequently, Alternative 1 would result in no changes to the existing Castle Rock Cut, which would continue to be available for use by boat traffic only at lake levels of 3,620 feet or higher. During times of lower levels, boat traffic would continue to use the Channel to reach uplake destinations.

This alternative would not result in the deposition of materials below the OHWM or any work occurring in Waters of the United States. Though the No Action Alternative is not a practicable alternative because it could not accomplish the overall purpose of this project, it will be carried forward for analysis throughout this decision document as a baseline for comparison.

## Alternative 2–Preferred Alternative

At the time of NPS public scoping, the proposed action was described as deepening the channel depth of Castle Rock Cut to 3,600 feet to make the cut available to boats drafting 4 feet or less when the lake level is 3,605 feet or higher. However, lake levels have generally declined since 2000 and have not reached 3,600 feet at the end of March since 2003. Furthermore, during the peak boating season (June–September), lake levels did not reach 3,600 feet in 2004 and only slightly exceeded 3,600 feet in August and September of 2005, 2006, and 2007, making the cut impassable at 3,600 feet for larger boats during the latter part of the boating season. For these reasons, excavation of the cut to 3,600 feet was determined in internal NPS feasibility review to not meet the project purpose and need, and the project was redefined, as outlined in the following paragraph.

Alternative 2–Preferred Alternative: This alternative would deepen the channel depth of Castle Rock Cut to the 3,580-foot elevation and make the cut available to boats drafting 4 feet or less when the lake level is above the 3,585-foot level. The cut would have a maximum bottom width of 80 feet. The south side of the existing cut would act as the southern boundary of the proposed cut and would be excavated vertically to the 3,580-foot elevation. All work would extend north, with the northern bank being sloped from the bottom at an approximate 1.5:1 slope, resulting in a top channel width of approximately 150 feet. This alternative would result in the excavation of 8 acres along an approximately 3,200-foot length in the existing Castle Rock Cut. The disposal area for excavated materials would be located entirely below the OHWM between 3,610 and 3,640 feet in elevation. The excavated materials would consist of approximately 400,000 cubic yards of natural sandstone and would be disposed of in a 50-acre area immediately north of the enlarged cut, resulting in an average depth of fill of approximately 5 feet (Figure 3). The total area of disturbance in Waters of the United States would be 58 acres.

Work would be completed within 5 years, depending on reservoir levels and available funding. Excavation in any one year would not go below the lake level at the time of construction. First-year activities would include the drilling and blasting of sandstone bedrock to the target elevation of 3,580 feet and the excavation of materials to the lake level at that time, anticipated to be approximately 3,600 feet. The remainder of the blasted bedrock would remain in place as fractured material. Within the 5-year period, additional material would be excavated down to the 3,580-foot elevation, if the lake level at the time of construction and available funding permit. In any one year, construction would occur between December 15 and June 15.

## Alternatives Considered and Dismissed

The following alternatives were considered for project implementation, but were ultimately dismissed from further analysis.

### Alternative 3–Deeper Cut Alternative

This alternative would deepen the channel to an elevation of 3,560 feet, providing access to boats drafting 4 feet or less at lake levels of 3,565 feet. This alternative would increase the average time the cut is open by 33 days, or 27 percent (to 111 days or 91 percent from 78 days or 64 percent) over the existing cut elevation and 11 days, or 9 percent (to 111 days or 91 percent from 100 days or 82 percent) over the Proposed Action during the peak boating season over the next 20 years.

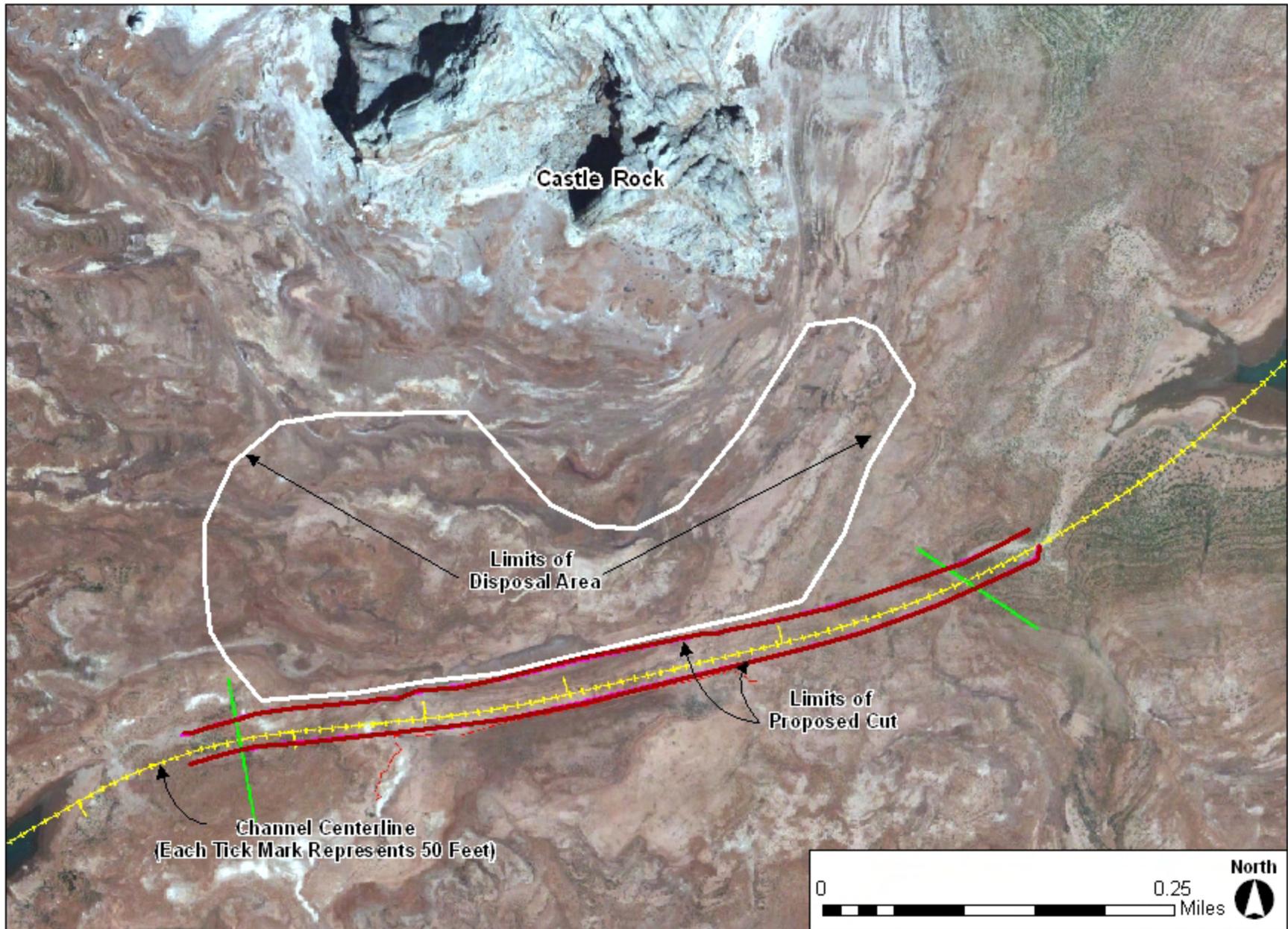


Figure 3. General plan view showing locations of excavation and disposal areas.

This alternative would be estimated to increase the average time the cut is open on a year-round basis by 117 days or 32 percent (to 317 days or 87 percent from 201 days or 55 percent) over the existing cut elevation and 32 days or 9 percent (to 317 days or 87 percent from 285 days or 78 percent) over the Preferred Alternative over the next 20 years. This alternative would result in the excavation of 10 acres along an approximately 6,250-foot length and the disposal of approximately 965,000 cubic yards of natural sandstone below the OHWM in a 50-acre disposal area immediately north of the enlarged cut. The total area of disturbance in Waters of the United States would be 60 acres.

Though this alternative would increase the amount of time the cut is open, it would require the disposal of more than twice the amount of excavated material than required under Alternative 2 and create a deeper mark on the landscape. Though Alternative 3 would satisfy the overall project purpose and need, portions or all of Castle Rock Cut would be readily visible when the cut is not inundated, thereby creating a substantially greater visual impact on the landscape than would occur with Alternative 2. In addition, Alternative 3 would have a greater cost than Alternative 2. Therefore, Alternative 3 has been dropped from further consideration and analysis.

## Other Sites

No other cuts exist that could be modified to allow boating traffic to travel between Wahweap Bay and Warm Creek Bay more quickly than the current Channel route. Use of alternative sites for a cut therefore would require excavating a previously undisturbed area and depositing materials in an area that has not been previously disturbed. This action would result in greater volumes of excavated materials, which would require a larger deposition site than that required for excavation in the existing Castle Rock Cut. This action would require substantially more effort and result in greater environmental impacts to Glen Canyon NRA resources than would occur at the existing site. Therefore, the use of an alternative site for a cut is financially not practicable, is more environmentally damaging than the preferred alternative, and has been dropped from further consideration.

## Mitigation Measures

The following mitigation measures have been developed to minimize the degree and/or severity of adverse effects and would be implemented during construction of the action alternative, as needed.

### Water Quality

To minimize potential impacts to water quality, the following mitigation measures will be incorporated into the preferred alternative:

- If lake elevations are projected to rise to a sufficient level to allow water to enter Castle Rock Cut, excavation work would cease to reduce increased turbidity due to construction activities.
- If lake elevations are projected to rise to a sufficient level to allow water to enter Castle Rock Cut, excavation work would cease and all construction equipment would be removed to a location above the anticipated high lake level until water recedes below the cut level.
- Best Management Practices would be implemented, in addition to meeting the terms and conditions of the Corps permit and the Section 401 water quality certification, to minimize erosion and sedimentation and to meet state water quality standards for particulates.

- The NPS and/or its construction contractor would prepare a Storm Water Pollution Prevention Plan and submit the Notice of Intent and the Notice of Termination to the Utah Department of Environmental Quality (UDEQ).
- Existing mitigation measures related to fuel and fecal material would be continued. These include laws and regulations, including Glen Canyon NRA-specific regulations such as required portable toilet facilities for campers within ¼ mile of Lake Powell.
- Diesel fuel and hydraulic fluids would be stored in sealed containers in UDEQ-approved secondary containment in an isolated area on the project site. A vehicle fluid leakage and spill plan would be prepared and submitted to UDEQ prior to implementation.

## Wildlife and Habitat

To minimize impacts to wildlife and wildlife habitat, the following mitigation measures will be incorporated into the preferred alternative:

- NPS Best Management Practices will be used for the control of invasive plant species.
- To prevent the potential spread of quagga mussels, the hulls, engines, and other submersible parts of any boats used during project construction and any other equipment that will be used in Lake Powell will be professionally decontaminated by a Glen Canyon NRA concessioner before entering and after leaving the lake.

## Threatened or Endangered Species

- To protect any unknown or undiscovered threatened, endangered, or special status species, the construction contract will include provisions for the discovery of such. These provisions will require the cessation of construction activities until NPS staff evaluates the project impact on the discovery and will allow modification of the contract for any protection measures determined necessary to protect the discovery.
- To minimize the potential for the project to harm California condors that might travel into the project area from northern Arizona, all personnel working at the site will implement the following measures:
  - If a condor is spotted directly on or over the construction site, activities will cease until the bird leaves or is driven off by a Glen Canyon NRA biologist.
  - Construction workers and supervisors are instructed to avoid interaction with condors and to immediately contact the Interpretation and Resources Division (928-608-6265) at the Glen Canyon NRA if and when condors settle at the construction site.
  - The construction site will be cleaned up at the end of each day (e.g., trash removed, scrap materials picked up) to minimize the likelihood of condors visiting the site.
  - All dead animals found within 500 feet of the construction zone will be immediately disposed of by placing the carcass in the nearest available Dumpster. Dumpsters will be emptied on a regular basis so as not to encourage roosting by condors that may be attracted to odor coming from the Dumpsters.

- To prevent water contamination and potential poisoning of condors, a spill prevention and cleanup plan will be developed and implemented for this project. It will include provisions for immediate cleanup of any hazardous substance and will define how each hazardous substance will be treated in case of leakage or spill. This plan needs to consider possible leakage from support vehicles as well as drill rigs. Please forward a digital copy of the plan on CD to our environmental specialist at Glen Canyon NRA, P.O. Box 1507, Page, AZ 86040. This plan will need to be provided at least 2 weeks prior to the start of construction, including preliminary setup activities.
- All construction personnel will be given a copy of “California Condors in Arizona.” These may be obtained by contacting the Arizona Game and Fish Department, 5000 W. Carefree Highway, Phoenix, AZ 85086-5000. The phone number is 623-236-7625.
- Project personnel are strictly prohibited from hazing condors (chasing, flapping arms, throwing objects, honking horn, etc.)

## Visual Resources

To minimize impacts to visual resources, the following mitigation measures will be incorporated into the preferred alternative:

- Visual effects of the disposal site would be mitigated by depositing more material in lower areas of the deposition site than in higher areas and grading the area to blend with the surrounding topography. Over time, natural weathering of deposited materials would create small areas of erosion that would blunt the edges and allow the deposited material to blend into the surrounding landscape.
- Light shields would be used at the construction site if nighttime excavation takes place.

## Archaeological and Ethnographic Resources

To minimize impacts to unknown cultural resources, the following mitigation measure will be incorporated into the preferred alternative:

- If previously unidentified cultural resources are discovered during construction-related activities, construction activities will be halted. The NPS would be notified immediately, and arrangements would be made for the appropriate assessment and treatment of those resources.

## Alternative Summaries

The following tables summarize the alternatives considered and the impacts of each alternative carried forward in this document. Table 2 provides a brief summary of the No Action Alternative and the two action alternatives and explains how well each of the alternatives meets the project objectives.

**Table 2. Alternatives Summary and Extent to Which Each Alternative Meets Project Objectives**

<b>Alternative 1– No Action Alternative</b>	<b>Alternative 2– Preferred Alternative</b>	<b>Alternative 3– Deeper Cut Alternative</b>
Castle Rock Cut would not be deepened. The existing Castle Rock Cut would continue to be used when lake levels are at 3,620 feet or higher. During lower lake levels, boat traffic would continue to use the Channel.	Castle Rock Cut would be deepened to 3,580 feet to make the cut available to boat traffic at 3,585 feet or higher. In addition, a disposal area of no more than 50 acres would be located directly to the north for excavated materials. The total area of disturbance in Waters of the United States would be 58 acres.	Castle Rock Cut would be deepened to 3,560 feet to make the cut available to boat traffic at 3,565 feet or higher. In addition, a disposal area of no more than 50 acres would be located directly to the north for excavated materials. The total area of disturbance in Waters of the United States would be 60 acres.
<b>Meets Project Objectives?</b>	<b>Meets Project Objectives?</b>	<b>Meets Project Objectives?</b>
No. This alternative would leave the cut at its current elevation. At this elevation, the cut is projected to be open 78 days of the peak boating season over the next 20 years. This alternative meets the objective for minimizing impacts to park resources because no construction would occur.	Yes. This alternative would allow the cut to be open to boat traffic a projected 100 days of the peak boating season over the next 20 years. Alternative 2 would decrease the time required for boats to travel uplake and would reduce boats traveling through the Channel. This alternative would minimize environmental impacts to the extent possible and would not result in unacceptable impacts or impairment to any park resources.	Yes. This alternative would allow the cut to be open to boat traffic a projected 111 days of the peak boating season over the next 20 years. Alternative 3 would require the disposal of more than twice the amount of excavated material than that of Alternative 2 and create a deeper mark on the landscape. Though Alternative 3 would meet the project objectives, it would not minimize environmental impacts to the extent possible and would result in unacceptable impacts.

Table 3 summarizes the level of impact for each analysis area covered in this EA for Alternative 1–No Action Alternative and Alternative 2–Preferred Alternative. Alternative 3–Deeper Cut Alternative is not carried forward for impact analysis because it would result in unacceptable impacts, and therefore is not included in Table 3. The *Environmental Consequences* chapter provides a more detailed explanation of these impacts.

**Table 3. Environmental Impact Summary by Alternative**

<b>Impact Topic</b>	<b>Alternative 1–No Action Alternative</b>	<b>Alternative 2–Preferred Alternative</b>
<b>Water Quality</b>	No impact because no construction would occur	If watercraft use increases due to the deepening of Castle Rock Cut, pollution from fuel and fecal matter may increase, resulting in a minor adverse impact; a negligible short-term adverse impact would occur from increased suspended sediment in the construction area
<b>Wildlife and Habitat</b>	No impact because no construction activities would occur	Approximately 58 acres of altered habitat would be removed, resulting in a minor adverse impact; the deepening of the cut would have a negligible adverse impact by creating a physical barrier to faunal migration
<b>Endangered or Threatened Species</b>	No impact because no construction activities would occur	No impact because there is no suitable habitat for endangered or threatened species in the project area

**Table 3. Environmental Impact Summary by Alternative**

<b>Impact Topic</b>	<b>Alternative 1—No Action Alternative</b>	<b>Alternative 2—Preferred Alternative</b>
<b>Recreational Fisheries</b>	The number of sport anglers is expected to continue decreasing, which would have a minor adverse impact on recreational fishing	The dispersion of sport anglers across the lake and the subsequent sport fish harvest is expected to have a moderate long-term beneficial impact on recreational fishing and the number of sport fish in the lake
<b>Other Water-related Recreation</b>	Traffic would continue to be diverted through the Channel, which would have a moderate long-term adverse impact on water-related recreation	Less traffic in the Channel and shorter travel times uplake would result in a moderately beneficial long-term impact
<b>Visual Resources</b>	No impact because no construction would occur	If excavation takes place at night, there would be a minor adverse short-term impact; the exposed cut and disposal area would have a minor adverse impact on aesthetics
<b>Wilderness Areas</b>	No impact because no construction would occur	No construction activities would impact the proposed wilderness area; the deposition area may have a minor indirect negative impact on the viewshed from the wilderness area
<b>Visitor Use and Experience</b>	Boat traffic would continue to pass through the Channel, resulting in a moderate adverse impact due to continued congestion; no impact on visitation to Rainbow Bridge National Monument	Castle Rock Cut would be open longer, resulting in a moderate beneficial impact because congestion in the Channel would be reduced and a wider channel would be available with lighted buoys; a moderate increase in visitation to Rainbow Bridge National Monument would be expected
<b>Energy Consumption or Generation</b>	Travel through the Channel would result in a continuing increase in fuel consumption, which would have a minor long-term adverse impact locally	By increasing the amount of time Castle Rock Cut is open, fuel consumption required for traveling between Wahweap Bay and Warm Creek Bay would decrease, resulting in a minor long-term beneficial impact
<b>Safety</b>	Traffic would continue to travel through the Channel, with the associated safety issues resulting in a minor long-term adverse impact	By decreasing traffic through the Channel, the preferred alternative would decrease the danger, resulting in a minor beneficial long-term impact
<b>Soundscape</b>	If boater visitation continues to drop, a negligible decrease in noise levels is expected; noise levels in the Channel and in front of Antelope Point Marina would be higher when the cut is closed, resulting in a minor long-term adverse impact	Boaters would disperse more widely across the lake due to the opening of Castle Rock Cut, resulting in a minor long-term beneficial impact
<b>Archaeological and Ethnographic Resources</b>	No impact to known historic properties	No impact to known historic properties; increased visitation to Rainbow Bridge National Monument would have an indirect negligible impact on Rainbow Bridge
<b>Socioeconomic Environment</b>	A minor adverse impact would be expected due to decreased visitation	A moderate long-term beneficial impact would occur due to increased visitation and a reduction in boat user costs
<b>Environmental Justice</b>	The Navajo Nation receives revenue from Antelope Point Marina; a minor positive impact would occur to Antelope Point Marina because traffic would continue to travel through the Channel	The Navajo Nation receives revenue from Antelope Point Marina; a minor adverse impact to Antelope Point Marina would be expected due to traffic having a second travel route uplake

**Table 3. Environmental Impact Summary by Alternative**

Impact Topic	Alternative 1–No Action Alternative	Alternative 2–Preferred Alternative
<b>NPS Operations</b>	A continuing minor long-term adverse effect on NPS operations would occur because of the additional travel time uplake by NPS emergency and maintenance personnel and equipment	A moderate long-term benefit would occur by decreasing the time spent traveling uplake by NPS emergency and maintenance personnel

## Identification of the Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in NEPA and defined in CEQ guidelines. The CEQ provides direction that “[t]he environmentally preferable alternative is the alternative that would promote the national environmental policy, as expressed in NEPA’s Section 101, by:

- fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations;
- assuring for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- preserving important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life’s amenities; and
- enhancing the quality of renewable resources and approach the maximum attainable recycling of depletable resources.”

*Alternative 1–No Action Alternative:* This alternative would not result in any surface disruption to the area around Castle Rock Cut. However, this alternative would also result in Castle Rock Cut not being passable when Lake Powell is below 3,620 feet in elevation, which has been the case since 2003. This would require boaters to deviate around Castle Rock Cut through the Channel, the main channel of the historic Colorado River. This additional 12 miles of boating adds at least an hour of travel time and results in increased fuel consumption. Increased fuel consumption results in direct adverse impacts to water quality in Lake Powell and air quality in the local area. Safety concerns raised by boaters about the rough water in the Channel would continue.

*Alternative 2–Preferred Alternative:* This alternative best meets the purpose and need of the project and the criteria identified previously and is the environmentally preferred alternative. Alternative 2 would involve excavating a 3,200-foot-long channel and disposing of this material in a 50-acre area north of the channel, disturbing 58 acres of the area around Castle Rock Cut. This area would be excavated to allow Castle Rock Cut to be navigable when Lake Powell is above 3,585 feet in elevation. Castle Rock Cut would be usable an additional 22 days, or 18 percent of the peak

boating season, according to Reclamation forecasts about Lake Powell water levels. All of the physical ground disturbance impacts generated by Alternative 2 would be limited to areas below the OHWM of Lake Powell. Therefore, these areas and impacts would be inundated by Lake Powell at some point in the future. The impacts would also be limited to a relatively small area.

A deepened Castle Rock Cut would allow visitors to avoid having to boat through the Channel of the Colorado River. Visitors have expressed significant safety concerns about the extremely choppy waters of the Channel during the busy summer season. Increasing the amount of time that Castle Rock Cut is usable would also reduce boaters' fuel consumption. This would result in fewer adverse impacts to air and water quality compared with Alternative 1. A deepened Castle Rock Cut would also contribute significantly to visitors' enjoyment of Glen Canyon NRA because it would allow them to more conveniently and quickly access some of the most popular destinations on Lake Powell.

Compared with Alternative 1, Alternative 2 better achieves "a balance between population and resource use." Alternative 2 maximizes safety on Lake Powell by increasing the time when Castle Rock Cut is open and minimizing the amount of time when boaters would need to travel through the Channel. Alternative 2 allows visitors to more conveniently access Lake Powell's most popular features, which would enhance visitors' enjoyment of the park. This would increase their ability to connect with the natural environment, thus attaining "the widest range of beneficial uses of the environment without degradation." Finally, Alternative 2 would have no unacceptable impacts on park resources or values, preserving "important historic, cultural and natural aspects of our national heritage."

# AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

This section is organized by impact topic or resources. Each section first describes the affected environment or existing condition of each resource, followed by a discussion of the anticipated direct, secondary, and cumulative effects on that resource resulting from the implementation of the No Action Alternative and the Preferred Alternative. The potential for impairment of each resource is stated. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **Type** describes the classification of the impact as beneficial or adverse, direct or indirect.
  - *Beneficial:* A beneficial impact would maintain positive current conditions of the natural environment, the human environment, or other park resources, or would improve conditions of the existing resources.
  - *Adverse:* An adverse impact would cause deterioration from current conditions of the natural environment, the human environment, or other park resources, or would allow current adverse actions to continue to the detriment of the existing resources.
  - *Direct:* An effect that is caused by an action and occurs in the same time and place.
  - *Indirect:* An effect that is caused by an action that is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur. Are the effects site-specific, local, regional, or even broader?
- **Duration** describes the length of time an effect will occur, either short-term or long-term.
  - *Short-term:* The effects of the action, whether beneficial or adverse, would be temporary and would exist only during the construction activities or during the short period thereafter during which resources would adapt to the changes caused by construction.
  - *Long-term:* The effects of the action, whether beneficial or adverse, would continue into the foreseeable future, assuming future conditions allowed the impact to continue.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, major, and impairment. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this EA.

## Cumulative Effects

The CEQ regulations require the assessment of cumulative impacts in the decision-making process for federal projects. While direct impacts generally occur at the same time and place as a proposed action, cumulative impacts are defined as the incremental impact of that action when added to other past, present, or reasonably foreseeable future actions in the general project area. In addition, indirect or secondary impacts could also occur later in time or farther removed in distance

from the proposed action. Cumulative impacts are considered for the No Action Alternative and the Preferred Alternative.

Cumulative impacts were determined by combining the impacts of the Preferred Alternative with the following plans and/or projects that have been or are likely to be implemented in the general Lake Powell area.

- Glen Canyon Dam Long-Term Experimental Plan Environmental Impact Statement
- 2007 Record of Decision on Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead
- Rainbow Bridge Programmatic Agreement (PA) and GMP
- Previous deepening activities at Castle Rock Cut

## Water Quality

### Intensity Level Definitions

- Negligible:** Impacts are not detectable, are well below water quality standards for the designated use, and are within historical ambient or desired water quality baseline conditions.
- Minor:** Impacts are detectable, are well below state and/or Environmental Protection Agency (EPA)-established water quality numeric standards for the designated use, and are within the historic water quality baseline at all times. State anti-degradation policy is not violated.
- Moderate:** Impacts are detectable and within state or EPA-established water quality numeric standards for the designated use but exceed the historic water quality baseline on a limited time and space basis. State anti-degradation policy is not violated.
- Major:** Impacts are detectable and persistently alter the historic water quality baseline but do not violate state anti-degradation policy. State or EPA-established water quality numeric standards for the designated use are locally approached, equaled, or slightly singularly exceeded on a short-term and temporary basis.
- Impairment:** Impacts routinely exceed state or EPA-established water quality numeric standards for the designated use or the state anti-degradation policy is violated.

### Existing Conditions

Lake Powell falls under several water use classifications as designated by the UDEQ. The use classifications protect the water in Lake Powell for use for domestic purposes with prior treatment as required by the Utah Division of Drinking Water (Class 1C); for recreation such as boating, swimming, and wading (Class 2A/2B); for warm water species of game fish and other warm water aquatic life (3B); and for agricultural uses, including irrigation of crops and stock watering (Class 4).

Utah's antidegradation policy (Utah Administrative Code [UAC], Rule R317-2, Standards of Quality for the State) establishes a plan to maintain and improve water quality of the state's waters for

public water supplies; the propagation of wildlife, fish, and aquatic life; and agricultural, industrial, recreational, and other legitimate uses. The policy states that no waste will be discharged into any waters of the state that would compromise the beneficial uses of the receiving waters (NPS 2003).

Lake Powell has not been designated as high-quality water and is not afforded special protection under Utah statutes. Some reduction in water quality is allowable as long as beneficial uses are not affected. The main sources of pollution for Lake Powell are emissions and fuel leakage from boats and fuel docks, fecal contamination from visitors, and contaminants transported into Lake Powell by the Colorado River and other inflow sources.

Water quality standards are primarily achieved by controlling pollutants permitted in point source discharges into receiving waters through Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) permits and implementation of best management practices for non-point sources of pollution.

Several studies have been conducted in Lake Powell to assess levels of hydrocarbon pollution. Three studies examined hydrocarbon contamination in high use and marina areas as well as remote and low use areas. These studies were carried out to support evaluation of special efforts, including development of the Uplake Development Concept Plan and a personal watercraft special rule. These hydrocarbon examinations follow recommendations developed in "A Monitoring Plan for the Occurrence of Hydrocarbon Constituents in the Reservoirs of Lakes Powell, Mead, and Mohave – Arizona, Nevada, and Utah" developed by the NPS and the U.S. Geological Survey (USGS). Data from these studies contribute to a baseline understanding of hydrocarbon pollution in Lake Powell. A study conducted in cooperation with the UDEQ determined hydrocarbon concentrations in marina areas. One study conducted in cooperation with the USGS focused on the impact of high, medium, and low visitor use in side canyons. Another research effort in cooperation with USGS determined hydrocarbon concentrations in water at sentinel sampling sites for long-term comparison. None of these studies indicated unacceptable levels of hydrocarbon pollution, and no water quality standards were exceeded.

### **Impacts of Alternative 1–No Action Alternative**

This alternative would not result in direct increases in point or non-point sources of water pollution. Emissions and fuel leakage from boats and fuel docks, improper waste management, and contaminants from inflows would continue to be the main sources of water pollution. Because no construction action would be taken, no water quality certification would be required for this alternative.

*Cumulative Effects:* Alternative 1 would not contribute to any adverse or beneficial cumulative impacts to the water quality in the general project area because no change in the type or amount of pollution would occur.

*Conclusion:* This alternative would not have an impact on water quality because no construction activities would occur. As such, this alternative would not contribute to any cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any

unacceptable impacts and is consistent with Clean Water Act Section 402, UAC Rule R317-2, and Section 4.6.3 of NPS 2006 Management Policies.

## Impacts of Alternative 2–Preferred Alternative

Barges and other construction equipment may discharge minor amounts of fuel or other fluids onto the soil of the project area or into the lake. Following construction, emissions and fuel leakage from boats traveling between Wahweap Bay and Warm Creek Bay would be expected to decrease from existing conditions. This decrease would be expected due to the shorter distance and travel time using Castle Rock Cut. This beneficial impact would potentially be offset by localized pollution increases from fuel and fecal material if watercraft use in the Castle Rock Cut area increases because of the opening of the cut. Water pollution resulting directly or indirectly from construction activities would have the potential for only minor adverse impacts to water quality.

This alternative would result in a negligible short-term adverse impact to water quality from increased suspended sediment in the immediate construction area. Water Quality Certification would be required from the UDEQ. The conditions of the state water quality certification would be included as a special condition of any Corps permit issued to ensure that the project meets state water quality standards. A NPDES permit under Section 402 of the Clean Water Act would also be required.

*Cumulative Effects:* Alternative 2 would not contribute to any adverse or beneficial cumulative impacts to water quality in the general project area because no change in the type or amount of pollution would be expected.

*Conclusion:* This alternative would have the potential for minor adverse impacts to water quality due to increases in fuel and fecal matter discharges into the water during and following construction activities. However, no violations of water quality standards would be expected. As such, this alternative would not contribute to any cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Clean Water Act Section 402, UAC Rule R317-2, and Section 4.6.3 of NPS 2006 Management Policies.

## Wildlife and Habitat (breeding, cover, food, travel, general)

### Intensity Level Definitions

**Negligible:** Wildlife and habitats would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species population.

**Minor:** Effects on wildlife and habitats would be detectable, though the effects would likely be short-term, localized, and would be small and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

- Moderate:** Effects on wildlife and habitats would be readily detectable, long-term, and localized, with consequences at the population level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:** Effects on wildlife and habitats would be obvious and long-term and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.
- Impairment:** The impact would contribute substantially to the deterioration of natural resources to the extent that the park's wildlife and habitat would no longer function as a natural system. Wildlife and its habitat would be affected over the long-term to the point that the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and the resource could not be experienced and enjoyed by future generations.

## Existing Conditions

Native vegetation in the general project area (above 3,700 feet) is sparsely vegetated shadscale saltbush (*Atriplex confertifolia*) scrub-dominated Great Basin desertscrub (Turner 1994). Plant species diversity is low; however, some shrub, forb, and grass species represented in this community include Torrey's joint fir (*Ephedra torreyana*), Mormon tea (*Ephedra viridis*), rubber rabbitbrush (*Ericameria nauseosa*), sand sage (*Artemisia filifolia*), plains pricklypear (*Opuntia erinacea*), low woollygrass (*Dasyochloa pulchella*), James' galleta (*Pleuraphis jamesii*), and sand dropseed (*Sporobolus cryptandrus*) (Hill 2005).

As a result of long-term inundation, areas below 3,700 feet are largely devoid of native vegetation. Plants occupying this disturbed habitat include primarily Russian thistle (*Salsola* spp.), red brome (*Bromus rubens*), Mediterranean grass (*Schismus* spp.), and five-stamen tamarisk (*Tamarix chinensis*). Though terrain recently exposed by receding water levels is barren of vegetation, the above invasive exotic species become more common near the current level of the lake, with the latter species growing abundantly in the existing dry Castle Rock Cut channel, the bottom of which lies at approximately 3,615 feet near its center, descending gradually to water level at each end. The disposal area to the north between 3,610 feet and 3,640 feet is dominated by Russian thistle and, to a lesser extent, by tamarisk.

The project area lies on the Colorado Plateau in the Great Basin desert region. The lack of water limits the species and abundance of wildlife, as well as plants. Nearby Page, Arizona, approximately 10 miles southeast, receives less than 6.5 inches of annual precipitation. Only desert-adapted species occur in the project vicinity. Despite dry conditions, small herds of mule deer (*Odocoileus hemionus*) roam the hills, mesas, and broken terrain. Desert bighorn sheep (*Ovis canadensis*) inhabit the rocky buttes and canyons of the area, occasionally crossing more open terrain between rocky areas. More commonly seen herbivores include black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), and antelope squirrel (*Ammospermophilus* spp.). Nocturnal rodents include one or more species of woodrats (*Neotoma* spp.), pocket mice (*Chaetopidus* spp. and *Perognathus* spp.), kangaroo rats (*Dipodomys* spp.), and deer mice (*Peromyscus* spp.) (NPS 2007b).

The prominent mammal predator is the coyote (*Canis latrans*); however, the nocturnally active, ring-tailed cat (*Bassariscus astutus*), common gray fox (*Urocyon cinereoargenteus*), badger (*Taxidea taxus*), western spotted skunk (*Spilogale gracilis*), and bobcat (*Felis rufus*) feed on the abundance of

desert rodents and rabbits. Mountain lions (*Felis concolor*), though rarely seen, range into the desertscrub in pursuit of deer and pronghorn. Seventeen species of bats occur or range seasonally in the Glen Canyon NRA, and half or more of these species are likely to range into the project area (NPS 2007b).

About 30 desert birds occur or range seasonally in the project area. Only the golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), common raven (*Corvus corax*), loggerhead shrike (*Lanius ludovicianus*), and house finch are year-round residents. Several birds are summer residents, including the western burrowing owl (*Athena cunicularia hypugaea*), lesser nighthawk (*Chordeiles minor*), northern mockingbird (*Mimus polyglottos*), and black-throated sparrow (*Amphispiza bilineata*). The bald eagle (*Haliaeetus leucocephalus*), northern shrike (*Lanius excubitor*), white-crowned sparrow (*Zonotrichia leucophrys*), dark-eyed junco (*Junco hyemalis*), horned lark (*Eremophila alpestris*), and merlin (*Falco columbarius*) are winter residents, while sage sparrow (*Amphispiza belli*) and northern harrier (*Jacana spinosa*) are present year-round. Peregrine falcons nest on Castle Rock and may not be there all year.

Several other birds are present at various times of year but are considered to be migrants. Notable among these are the ferruginous hawk (*Buteo regalis*), sage thrasher (*Oreoscoptes montanus*), and western meadowlark (*Sturnella neglecta*) (NPS 2007c). Measures to mitigate potential impacts to the California condor are included under *Mitigation Measures*.

Due to the presence of Lake Powell, a large number of aquatic birds are found in the project area, some only seasonally. These species include, but are not limited to, the western grebe (*Aechmophorus occidentalis*), great blue heron (*Ardea herodias*), common merganser (*Mergus merganser*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), and American coot (*Fulica americana*) (NPS 2007c).

Numerous species of lizards and snakes occur in the Great Basin desertscrub community adjacent to the project area. Lizards include the desert spiny lizard (*Sceloporus magister*), desert horned lizard (*Phrynosoma platyrhinos*), and tiger whiptail (*Cnemidophorus tigris*). Common Great Basin desertscrub snake species include the nightsnake (*Hypsiglena torquata*), gophersnake (*Pituophis catenifer*), glossy snake (*Arizona elegans*), western patch-nosed snake (*Salvadora hexalepis*), striped whipsnake (*Masticophis taeniatus*), long-nosed snake (*Rhinocheilus lecontei*), common kingsnake (*Lampropeltis getula*), and western rattlesnake (*Crotalus oreganus [viridis lutosus]*) (NPS 2007d).

## Impacts of Alternative 1–No Action Alternative

This alternative would not result in any effect on existing wildlife or habitat because no construction activities would occur. The availability and structure of currently available habitat would not be affected nor would there be any changes to the pattern of wildlife utilization of this habitat.

*Cumulative Effects:* Alternative 1 would not contribute to any adverse or beneficial cumulative impact in the general project area because no construction would occur.

*Conclusion:* This alternative would have no effect on wildlife or wildlife habitat because no construction activities would occur. As such, this alternative would not contribute to any cumulative impacts to wildlife or wildlife habitat when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or

(3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.4.1 of NPS 2006 Management Policies.

### Impacts of Alternative 2--Preferred Alternative

Because Great Basin desertscrub habitat in the saddle between Castle Rock and Antelope Island has been inundated intermittently since the 1960s, only exotic invasive species now occur in areas formerly inundated below 3,700 feet. This alternative would inundate, at least seasonally, approximately 8 acres of altered Russian thistle and tamarisk vegetation, which would recolonize to some degree as lake levels fall and expose the channel floor. Disposal of excavated material and other construction activities, such as equipment offloading and movement, would affect no more than 50 acres of tamarisk and Russian thistle north of the channel. The acreage of Russian thistle and tamarisk vegetation affected by these activities is relatively insignificant compared with the number of acres of similar vegetation lost and regained annually due to normal fluctuations in lake levels. Construction and disposal areas not inundated would likely revegetate, depending on summer rainfall. The adverse impact to wildlife of removing or altering approximately 58 acres of altered Russian thistle and tamarisk vegetation under Alternative 2 would be minor. The interruption of the migration route to Antelope Island may have a minor positive impact by preventing cattle from the Warm Creek Allotment from accessing Antelope Island.

A second adverse impact of Alternative 2 would be the continued interruption of faunal migration routes along the saddle due to the deepening of Castle Rock Cut and the creation of a vertical south channel bank that would create a physical barrier to migration. Because this interruption of migration has been occurring intermittently over the past half century, the adverse impact would be negligible.

*Cumulative Effects:* Castle Rock Cut has been previously excavated, which created a previously existing barrier to faunal migration routes. In addition, prior to 2003, management of Glen Canyon Dam resulted in the inundation of the entire project area, creating an additional barrier to faunal migration. This inundation barrier would be expected to return if water levels increase in the future. Alternative 2 would contribute to an adverse cumulative impact by deepening the cut, leading to a more impassable barrier to faunal migration and would result in more frequent inundation.

*Conclusion:* A minor adverse impact would occur by removing altered Russian thistle and tamarisk vegetation. A minor positive impact would be expected as the interruption of the migration route would prevent cattle from traveling to Antelope Island. However, a negligible adverse impact to wildlife would be expected from the interruption of the migration route. This alternative would contribute to an adverse cumulative impact to wildlife and wildlife habitat when considered with other past, present, and reasonably foreseeable future actions by adding to the faunal migration barrier created by previous excavations and frequent inundation. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.4.1 of NPS 2006 Management Policies.

# Endangered or Threatened Species

## Intensity Level Definitions

- Minor:** Effects on special status species would be discountable (i.e., extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated) or completely beneficial.
- Moderate:** Effects on a listed species might occur as a direct or indirect result of the proposed action, and the effect would either not be discountable or completely beneficial. Moderate impacts to species would result in a local population decline due to reduced survivorship, declines in population, and/or a shift in the distribution; no direct casualty or mortality would occur.
- Major:** Major impacts would involve a disruption of habitat, nests, and breeding grounds of a protected species such that direct casualty or mortality would result in removal of individuals of a protected species from the population.
- Impairment:** Effects could jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species in and/or outside the park boundaries.

## Existing Conditions

No critical habitat has been designated in the project area. The project area lies in the known seasonal range of the endangered Southwestern willow flycatcher (*Empidonax traillii extimus*) (Utah Department of Wildlife Resources [UDWR] 2007a). However, no suitable cottonwood/willow and tamarisk vegetation community is present along the shore of Lake Powell in the project vicinity.

The project lies in the known distribution of the Mexican spotted owl (*Strix occidentalis lucida*) (UDWR 2007b). However, the project area lies approximately 1,200 feet below the known elevation range for the species, and the project area does not support mixed conifer or pine forest with multi-layered foliage structure or canyon habitats regionally preferred by this species.

The project area also lies in the foraging/movement range of the endangered California condor (*Gymnogyps californianus*) (UDWR 2007c). An experimental population of these birds was introduced in the area of the Vermillion Cliffs in northern Coconino County, Arizona, approximately 15 miles south of the project area. Occasional foraging or dispersing condors may wander into the project vicinity but would not be expected to remain for extended periods.

The humpback chub (*Gila cypha*), bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), and razorback sucker (*Xyrauchen texanus*), all endangered species, were historically known in the Colorado River and some of its major tributaries in Kane and San Juan counties. Despite the hydrologic connection that Lake Powell provides between the project area and existing populations higher in the drainage, humpback chub, bonytail chub, and Colorado pikeminnow are currently restricted to unimpounded portions of the Colorado River and its major tributaries upstream and in Lake Mead and Lake Mohave downstream. In 2006, razorback sucker was stocked in the San Juan River with a few (10 to 20 fish) also released into Wahweap Bay. In November 2006, gill net sampling yielded two razorback suckers that were subsequently released back into Wahweap Bay. Similar sampling in November 2007 did not produce any razorback suckers, and none of these fish have been sampled or seen since November 2006. The current status of this introduced population is unknown.

## Impacts of Alternative 1–No Action Alternative

As a result of the lack of suitable habitat, no federally listed threatened or endangered species are known or expected to occur in the project area. No construction would take place; therefore, Alternative 1 would not affect listed species.

*Cumulative Effects:* Alternative 1 would not contribute to any adverse or beneficial cumulative impact in the general project area because no construction would occur.

*Conclusion:* This alternative would have no effect on threatened or endangered species because suitable habitat is not present in the project area. As such, this alternative would not contribute to any cumulative impacts to threatened or endangered species when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.4.2.3 of NPS 2006 Management Policies.

## Impacts of Alternative 2–Preferred Alternative

As a result of the lack of suitable habitat, no federally listed threatened or endangered species are known or expected to occur in the project area. No portion of the site lies in or near designated critical habitat for any listed species. Therefore, Alternative 2 would not affect listed species.

*Cumulative Effects:* Alternative 2 would not contribute to an adverse or beneficial cumulative impact on threatened or endangered species because no suitable habitat for threatened or endangered species is found in the project area.

*Conclusion:* This alternative would have no effect on threatened or endangered species because no suitable habitat or designated critical habitat for these species is found in the project area. As such, this alternative would not contribute to any cumulative impacts to threatened or endangered species when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.4.2.3 of NPS 2006 Management Policies.

## Recreational Fisheries

### Intensity Level Definitions

**Negligible:** No impact to the angler experience or only temporary effects are expected. No noticeable change in angler experience or in the defined indicators of angler satisfaction or behavior are expected.

**Minor:** Changes in angler use and/or experience would be detectable, though the changes would be slight and likely short-term. The angler would be aware of the effects

associated with the alternative but would not appreciably limit or enhance critical characteristics of the experience.

**Moderate:** Critical characteristics of the desired experience would be changed or the number of participants engaging in an activity would be altered. Angler satisfaction would begin to decline or increase as a direct result of the effect.

**Major:** Multiple critical characteristics of the desired experience would be eliminated, detracted from, or greatly enhanced; participation would be greatly reduced or increased. Angler satisfaction would substantially decline or increase.

**Impairment:** The effect would contribute substantially to the elimination of, or detracting from, the desired angler experience or intended angler use of an area in the preserve. Angler uses and/or angler satisfaction would be affected over the long-term such that the park's purpose could not be fulfilled and park resources could not be experienced by existing and future generations.

## Existing Conditions

Prior to the construction of Glen Canyon Dam and the formation of Lake Powell, the upper Colorado River drainage and many of its tributary waters were inhabited by several species of native fish. In addition to the now federally endangered humpback chub (*Gila cypha*), bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), and Colorado pikeminnow (*Ptychocheilus lucius*), these species included bluehead sucker (*Catostomus [Pantosteus] discobolus*), flannelmouth sucker (*Catostomus [Pantosteus] latipinnis*), roundtail chub (*Gila robusta*), and speckled dace (*Rhinichthys osculus*). Previously, Warm Creek and Wahweap Creek may have included perennial reaches supporting populations of some of these native fish species. With the formation of Lake Powell, inundation of the project area and surrounding plateau habitat below 3,700 feet, and the introduction of numerous exotic fish species, native fish were essentially eliminated from the Lake Powell reach of the Colorado River.

Several species of game fish have been stocked into Lake Powell. These include the black bullhead (*Ameiurus melas*), northern pike (*Esox lucius*), channel catfish (*Ictalurus punctatus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), and walleye (*Sander vitreus*). A few fish species have been brought in as bait, and others were unintentionally introduced into Lake Powell, including the red shiner (*Cyprinella lutrensis*), common carp (*Cyprinus carpio*), gizzard shad (*Dorosoma cepedianum*), threadfin shad (*Dorosoma petenense*), and fathead minnow (*Pimephales promelas*) (Gustaveson 2007).

## Impacts of Alternative 1—No Action Alternative

This alternative would have no effect on fish species in Lake Powell. The number of sport anglers in the southwestern end of Lake Powell is expected to continue to remain depressed as lake levels remain low and access to uplake destinations requires using the Channel route. This would have a minor adverse effect on the sport fishery at Lake Powell as high angler use and success benefits the Lake Powell fish community.

*Cumulative Effects:* If future dam management operations result in a continued decrease in elevations of Lake Powell, Castle Rock Cut will remain dry at its current elevation, which would contribute to a long-term cumulative adverse effect on the recreational fishery at Lake Powell.

*Conclusion:* A minor adverse effect would occur as a result of this alternative by continuing the adverse impacts of decreasing angler activities. This alternative would contribute to an adverse cumulative impact to recreational fisheries when considered with other past, present, and reasonably foreseeable future actions if future dam management operations result in a continued decrease in lake levels. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2.2.5 of NPS 2006 Management Policies.

## Impacts of Alternative 2–Preferred Alternative

This alternative would provide an aquatic connection for fish through Castle Rock Cut. This connection would allow fish species preferring shallow waters near the shore to pass between Wahweap Bay and Warm Creek Bay and increase the amount of shallow water habitat in that area by approximately 8 acres when the channel area is inundated. This change would increase the rate of interaction between the Wahweap Bay and Warm Creek Bay populations of inshore, shallow water fish species. The main benefit for fish living in the immediate area of the channel would be the creation of approximately 8 acres of additional shallow water habitat, resulting in a negligible long-term benefit.

Deepening Castle Rock Cut would provide an aquatic connection that would directly benefit Lake Powell anglers because it would reduce the time needed to reach more distant portions of the lake. The direct effect of deepening the Castle Rock Cut channel and dispersing anglers more widely would be an increase in the average number and size of the harvest of fish (Gustaveson 2007).

The Lake Powell Fish Management Plan indicates that striped bass (*Morone saxatilis*) are often overpopulated due to their successful natural reproduction and lack of natural predators in Lake Powell. An overpopulation of large striped bass feeding on smaller baitfish as well as smaller individuals of other game fish species reduces the overall numbers of those species. The Lake Powell Fish Management Plan calls for increased angler harvest as a management tool to keep striped bass in balance with available prey. Deepening Castle Rock Cut would allow easier access to uplake areas where striped bass abound and would be consistent with this management plan. The subsequent increased harvest of striped bass would be expected to have a valuable impact on striped bass numbers and the health of the fishery.

*Cumulative Effects:* Alternative 2 would not contribute to an adverse or beneficial cumulative impact on recreational fisheries because the lower elevation will keep Castle Rock Cut inundated even during lower lake levels.

*Conclusion:* This alternative would have a long-term moderate and beneficial impact on the recreational fisheries of Lake Powell by increasing angler pressure on game fish and dispersing anglers across the lake. As such, this alternative would not contribute to any cumulative impacts to recreational fisheries when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment

of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2.2.5 of NPS 2006 Management Policies.

## Other Water-Related Recreation

### Intensity Level Definitions

- Negligible:** No impact to the visitor experience would occur or only temporary effects are expected. No noticeable change in the visitor experience or in the defined indicators of visitor satisfaction or behavior are expected.
- Minor:** Changes in visitor use and/or experience would be detectable, though the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative but would not appreciably limit or enhance critical characteristics of the experience.
- Moderate:** Critical characteristics of the desired experience would be changed or the number of participants engaging in an activity would be altered. Visitor satisfaction would begin to decline or increase as a direct result of the effect.
- Major:** Multiple critical characteristics of the desired experience would be eliminated, detracted from, or greatly enhanced; participation would be greatly reduced or increased. Visitor satisfaction would substantially decline or increase.
- Impairment:** The effect would contribute substantially to the elimination of, or detraction from, the desired visitor experience or intended visitor use of an area in the preserve. Visitor uses and/or visitor satisfaction would be affected over the long-term such that the park's purpose could not be fulfilled and park resources could not be experienced by existing and future generations.

### Existing Conditions

The Glen Canyon NRA is a popular destination for a variety of water-related recreational activities. In addition to fishing, boating, sightseeing, and swimming are popular. Boat tours run daily from Wahweap Marina, and a variety of privately owned watercraft are found on the lake, including houseboats, powerboats, and personal watercraft, both powered and non-powered.

### Impacts of Alternative 1—No Action Alternative

This alternative would maintain current conditions. All boat traffic traveling between Wahweap Bay and uplake destinations would continue to be routed through the Channel until the lake returns to an elevation of 3,620 feet or higher and existing Castle Rock Cut can be opened again. This travel pattern results in traffic congestion, longer travel times to reach desired destinations, and increased user costs associated with the extended travel time between Wahweap Bay and Warm Creek Bay. Because drought conditions are expected to continue for several years, lake levels are expected to continue decreasing. Therefore, Alternative 1 would have a long-term moderate adverse effect on water-related recreation, thereby negatively impacting the recreational experience and enjoyment of park visitors.

*Cumulative Effects:* Alternative 1 would contribute to an adverse cumulative impact if future dam operations continue to lower lake levels, resulting in a continually dry Castle Rock Cut, forcing boat traffic to continue to travel via the Channel.

*Conclusion:* This alternative would have a long-term moderate adverse effect on water-related recreation by continuing traffic congestion, decreasing safety of passage uplake, and continuing increases in costs and time to travel uplake. If future dam operations result in continuing lowered lake levels, this alternative would contribute to an adverse cumulative impact to water-related recreation when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2 of NPS 2006 Management Policies. No recreation area resources would be impaired nor would there be any unacceptable impacts.

## Impacts of Alternative 2—Preferred Alternative

This alternative would open Castle Rock Cut to boats drafting 4 feet or less at a lake level of 3,585 feet. This alternative would result in boat traffic being able to use either Castle Rock Cut or the route through the Channel to travel between Wahweap Bay and uplake destinations. This would result in a beneficial long-term moderate impact to water-related recreation. Less traffic in the Channel would create safer passage conditions with less congestion, less likelihood of collisions due to high traffic, and fewer capsized boats because of high wakes. Boaters traveling through Castle Rock Cut would experience shorter travel times to uplake areas of Lake Powell, which would encourage boating recreation and enhance visitors' recreational experience and enjoyment, compared with Alternative 1. Therefore, Alternative 2 would have a moderate beneficial long-term effect on water-related recreation.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because the cut would be open at lower elevations and would be less affected by future dam operations.

*Conclusion:* This alternative would have a moderate beneficial long-term effect by opening Castle Rock Cut at lower lake levels, resulting in decreased congestion, greater safety for boaters, and lower costs and travel times to reach uplake destinations. This alternative would not contribute to any cumulative impacts to water-related recreation when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2 of NPS 2006 Management Policies.

## Visual Resources

### Intensity Level Definitions

**Negligible:** Visual resources would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the aesthetic character of the area.

- Minor:** Effects on visual resources would be detectable, though the effects would likely be short-term, localized, and would be small and of little consequence to the aesthetic character of the area. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Effects on visual resources would be readily detectable, long-term, and localized, with consequences to the aesthetic character of the area. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:** Effects on visual resources would be obvious and long-term and would have substantial consequences to the aesthetic character of the area. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.
- Impairment:** The impact would contribute substantially to the deterioration of visual resources to the extent that the area's aesthetic character would be compromised over the long-term to the point that the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and the resource could not be experienced and enjoyed by future generations.

## Existing Conditions

Glen Canyon NRA is a popular destination prized for its scenic cliffs and canyons as well as its water-based recreation. Lake Powell is used frequently by houseboats and other recreation watercraft. In more remote backcountry areas, the night sky has little light pollution. Light pollution occurs at Lake Powell in more populated and frequently used areas, such as around the marinas and at popular camping areas.

## Impacts of Alternative 1—No Action Alternative

Current aesthetic features such as scenic cliffs, river canyons, clarity and level of lake water, and the presence of vegetation would not be impacted by leaving Castle Rock Cut at its current elevation because no construction would occur.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative effect because no construction would take place.

*Conclusion:* This alternative would have no effect on aesthetics and lightscape conditions because no construction activities would occur. As such, this alternative would not contribute to any cumulative impacts to visual resources when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.10 of NPS 2006 Management Policies.

## Impacts of Alternative 2—Preferred Alternative

There would be a minor, temporary adverse effect on aesthetics caused by the exposed cut and deposition of excavated materials north of Castle Rock Cut. No recreation area resources would be

impaired. Spread evenly over the 50-acre deposition site, the depth of excavated material would be approximately 5 feet. Though these excavated materials consist primarily of the same Navajo sandstone found at the disposal site and would be placed below the OHWM, the deposits would be visible until Lake Powell returns to levels above 3,640 feet. Because the cut is likely to wholly or partially revegetate when water levels and rainfall allow, it is expected that the exposed portions of the cut, while visible, should blend reasonably well into the surrounding landscape. If excavation activities take place at night, a minor temporary impact to the level of light pollution in the area surrounding the construction area would be expected due to the use of construction lights. The light level from the use of construction lights would not be anticipated to exceed that of four houseboats anchored together.

*Cumulative Effects:* The existence of a previous cut at Castle Rock contributes to the likelihood that any future authorized cut will be located again at Castle Rock Cut because water levels and topography appear to have eliminated all other potential cut locations in this part of Lake Powell. The new disposal would not contribute to long-term adverse aesthetic impacts in this area because it would occur in a previously disturbed area and would be visually blended into its surroundings. The disposal area used for the excavation work authorized in 1992 is no longer readily identifiable.

*Conclusion:* This alternative would have a short-term minor adverse effect on the lightscape if nighttime construction occurs. Because the existence of a previous cut at Castle Rock contributes to the likelihood of future excavations at this same location, this alternative contributes to an adverse cumulative impact to visual resources when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.10 of NPS 2006 Management Policies. No recreation area resources would be impaired nor would there be any unacceptable impacts.

## Wilderness Areas

### Intensity Level Definitions

- Negligible:** Wilderness areas would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence.
- Minor:** Effects on a wilderness area would be detectable, though the effects would likely be short-term, localized, and would be small and of little consequence to the area. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Effects on a wilderness area would be readily detectable, long-term, and localized, with consequences extending beyond the area. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:** Effects on a wilderness area would be obvious and long-term and would have substantial consequences to the resource. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

**Impairment:** The impact would contribute substantially to the deterioration of the wilderness area to the extent that the park's management objectives could not be achieved, the park's purpose (Enabling Legislation, *General Management Plan, Strategic Plan*) could not be fulfilled, and the resource could not be experienced and enjoyed by future generations.

## Existing Conditions

The project is located in a national recreation area. There are 588,855 acres of proposed wilderness in the recreation area, including Antelope Island, which is adjacent to the southern project area. The Glen Canyon NRA GMP established the wilderness boundary as being above 3,620 feet elevation in this area (NPS 1979). It is NPS policy to manage these proposed areas as if they were congressionally designated wilderness areas.

## Impacts of Alternative 1—No Action Alternative

This alternative would not impact the proposed wilderness area on Antelope Island because no construction would occur.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact to the proposed wilderness area because no construction would take place.

*Conclusion:* This alternative would have no effect on the proposed wilderness area because no construction would occur. As such, this alternative would not contribute to any cumulative impacts to wilderness areas when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 6.3 of NPS 2006 Management Policies.

## Impacts of Alternative 2—Preferred Alternative

This alternative would have no direct impact on the proposed wilderness area on Antelope Island because all construction activities and disposal of excavated materials would be located north of the 3,620-foot elevation boundary (Figure 4) of this area. The south side of the cut would be a vertical wall to ensure that the project does not extend into the wilderness area. The disposal of the excavated material would be expected to have a minor indirect negative impact on the viewshed as seen from the wilderness area looking north.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact on the proposed wilderness area because all excavation and disposal would occur outside of the proposed wilderness area boundaries.



Figure 4. Aerial photograph showing proximity of the project to the proposed wilderness area.

*Conclusion:* An indirect minor adverse impact on the viewshed would be expected from this alternative because the 50-acre disposal area would be visible from the Antelope Island proposed wilderness area. This alternative would not contribute to any cumulative impacts to wilderness areas when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 6.3 of NPS 2006 Management Policies.

## Visitor Use and Experience

### Intensity Level Definitions

- Negligible:** The visitor experience, enjoyment, and use of park resources would not be affected, or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence.
- Minor:** Effects on visitors' experience, enjoyment, and use of park resources would be detectable, though the effects would likely be short-term and localized. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Effects on visitors' experience, enjoyment, and use of park resources would be readily detectable, long-term, and localized. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:** Effects on visitors' experience, enjoyment, and use of park resources would be obvious and long-term and would have substantial consequences. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.
- Impairment:** The impact would contribute substantially to the deterioration of the visitor experience, enjoyment, and use of park resources to the extent that the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and the resource could not be experienced and enjoyed by future generations.

### Existing Conditions

Lake Powell is used mainly for recreational navigation, though NPS work and emergency service boats and commercial tour boats also use the lake. In accordance with U.S. Coast Guard regulations, the NPS has marked the main channel of the Colorado River through the use of lighted buoys. When the cut was last underwater, these buoys provided lake users with a path to and from the main channel. Once the cut is deepened and is again underwater, these buoys will be reactivated.

The tour boats used by the NPS concessioner, Aramark, have a draft of approximately 7 feet, the deepest draft of boats currently in use on Lake Powell. The tour boats require approximately 8 feet of water in the channel to navigate Castle Rock Cut. Houseboats, speedboats, and most other watercraft using the lake typically have a maximum 4-foot draft and would require a maximum of

5 feet of water to traverse the cut. The 2008 Glen Canyon NRA Superintendent's Compendium limits the size of private vessels 75 feet or less in total length and 22 feet or less in total beam from entering the lake.

Since 2003, boat traffic from Wahweap Bay to uplake destinations and vice versa has been restricted to the Channel. Most of the recreational watercraft on the southwestern part of the lake, including houseboats and personal watercraft, draft a maximum of 4 feet. The larger tour boats draft approximately 7 feet and therefore need a higher water elevation before they can travel through Castle Rock Cut. Houseboats, powerboats, and personal watercraft need a minimum water level elevation of 3,620 feet for Castle Rock Cut to be operational at its current bottom elevation of 3,615 feet. The larger tour boats need a minimum water level elevation of 3,623 feet to travel through Castle Rock Cut at its current bottom elevation. Currently, boats traveling from Wahweap Bay to uplake destinations must detour via the Channel, which adds 12 miles to the journey and makes only full-day trips practicable for tour boats because of the extra time to navigate through the Channel. Opening Castle Rock Cut at lower water elevations would allow tour boats to return to half-day tours for more of the peak visitor season, even with the deeper draft requirement.

Alternate launch sites to allow visitors to launch uplake of the Channel are not readily available. The only other developed marina is Antelope Point Marina, which would still require visitors to transit the Channel.

Rainbow Bridge National Monument is the world's largest known natural bridge, a unique geological formation of Navajo sandstone 290 feet tall and spanning 275 feet across. Rainbow Bridge is located in Forbidden Canyon at buoy 49 on Lake Powell. Park visitors most often reach Rainbow Bridge, an approximately 50-mile boat trip from Wahweap Bay, by travel in a personal or rented watercraft, or by taking a concessioner-operated tour boat from Wahweap Marina.

Visitation to Rainbow Bridge has averaged fewer than 85,000 visitors annually since Castle Rock Cut closed to boat traffic. This visitation level is far below the recent peak in visitation in the mid-1990s, when as many as 346,000 visitors annually made their way to Rainbow Bridge. Since 1999, visitation to Glen Canyon and Rainbow Bridge had steadily declined. This visitation decline may be attributed to a number of factors: increased travel expenses, decreased interest in national parks, and the aftereffects of September 11, 2001, which have all played a role in affecting visitation to parks nationwide. The drop in the level of Lake Powell is a specific factor that has affected visitation to Glen Canyon and Rainbow Bridge.

**Table 4. Visitation Statistics: Glen Canyon and Rainbow Bridge**

<b>Year</b>	<b>Rainbow Bridge</b>	<b>Glen Canyon</b>
1994	298,651	2,797,734
1995	346,151	2,511,353
1996	325,562	2,505,004
1997	179,791	2,430,781
1998	195,916	2,442,990
1999	234,550	2,639,860
2000	197,614	2,568,111
2001	189,750	2,340,031
2002	167,736	2,106,896
2003	98,865	1,876,984
2004	73,675	1,841,845
2005	81,206	1,908,726
2006	87,642	1,885,378
2007	81,048	1,889,149

### **Impacts of Alternative 1–No Action Alternative**

Under Alternative 1, boat traffic would continue to pass through the Channel to travel between Wahweap Bay and uplake destinations. This passage can have rough water and high wake conditions due to the large number of boats and other watercraft that pass through. If lake levels remain below 3,620 feet and Castle Rock Cut remains closed, it is possible that more visitors would choose to drive to alternative marinas to launch boats uplake to avoid the Channel passage. If lake levels rise to 3,620 feet or above, Castle Rock Cut would open to boat traffic and an alternative to the Channel would be available; therefore, this alternative is expected to have a moderate adverse impact on transportation patterns and recreational navigation until lake levels rise sufficiently to open Castle Rock Cut.

This alternative would have no impact on visitation to Rainbow Bridge National Monument. The number of visitors to Rainbow Bridge would continue to be dependent on external factors, such as gas prices, boat rental and tour prices, general public interest in visiting the national parks, and other factors.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because transportation and navigation patterns would not alter from the current situation.

*Conclusion:* This alternative would have a long-term moderate adverse impact on transportation patterns and recreational navigation unless lake levels are above 3,620 feet because all traffic would have to travel through the Channel, resulting in high traffic volumes and high wake conditions. This alternative would have no impact on visitation to Rainbow Bridge National Monument. This alternative would not contribute to any cumulative impacts to visitor use or experience when considered with other past, present, and reasonably foreseeable future actions.

### **Impacts of Alternative 2–Preferred Alternative**

This alternative would be expected to allow more use of the navigational passage through Castle Rock Cut during the traditionally high visitor use months of June through September. By excavating Castle Rock Cut to the 3,580-foot elevation, Alternative 2 would be expected to increase the average time the cut is open by 22 days, or 18 percent, over the existing cut elevation (to 100 days, or 82 percent from 78 days, or 64 percent) during the peak boating season (June–September) and

84 days, or 23 percent (to 285 days, or 78 percent from 201 days, or 55 percent) on a year-round basis over the next 20 years compared with Alternative 1. The 150-foot width of the proposed channel is large enough to easily accommodate the side-by-side passage of two maximum-sized boats with a maximum separation of about 40 feet when the cut is at its build-out depth of 3,580 feet in elevation (Figure 5).

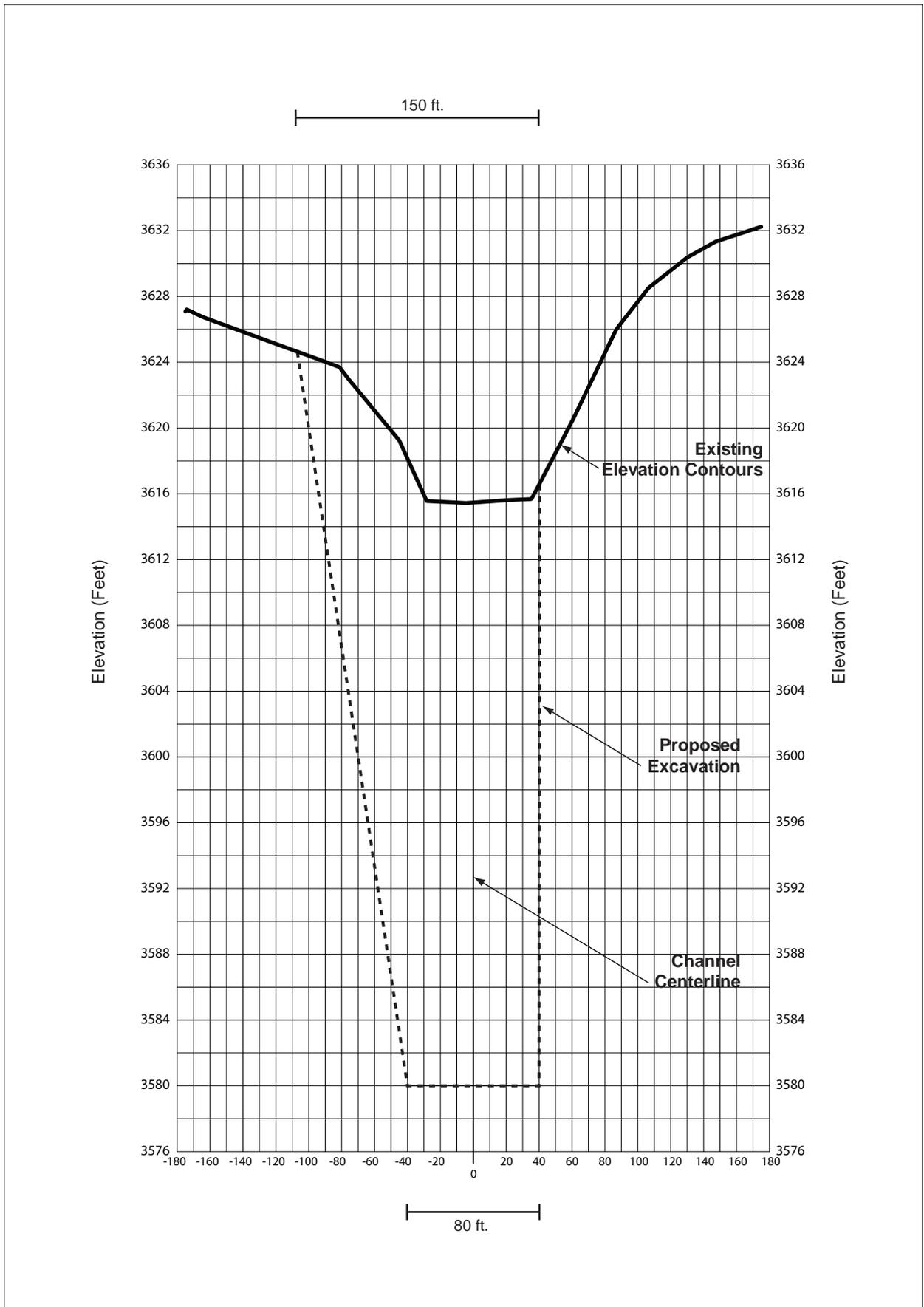
During the first phase of construction (to 3,600 feet in elevation), the maximum separation would be approximately 70 feet). Having the cut available at lower elevations and for longer time periods would alter current lake traffic patterns by allowing another access route for uplake destinations. More boats would be expected to use Castle Rock Cut over the Channel because of the benefits of shorter distance and time, decreased user costs, less dangerous wake conditions, and fewer navigational hazards due to the presence of lighted buoys and adequate passing space. Therefore, this alternative would have a moderate beneficial impact on transportation patterns.

Opening Castle Rock Cut would result in boat traffic being able to avoid the Channel to uplake destinations, saving travel time and costs, and reducing the safety concerns associated with boat traffic through the Channel. Though it is difficult to draw a direct correlation, visitation statistics (Table 4) appear to show that visitation to Rainbow Bridge dropped significantly with the closure of Castle Rock Cut to boat traffic, while overall visitation to Glen Canyon remains consistent since 2003. Given that Rainbow Bridge has experienced higher visitation in the recent past and that opening Castle Rock Cut would improve the opportunity to travel to uplake destinations, it is reasonable to assume that visitation to Rainbow Bridge would be positively affected.

Many tourists visit Rainbow Bridge on a concessioner-operated tour boat. Prior to closure of Castle Rock Cut, the tour boat concessioner was able to run half-day tours to Rainbow Bridge and reports that as many as 40,000 visitors were taking part in these tours. In 2002, the concessioner reports that just over 35,000 passengers participated in the Rainbow Bridge tour. Due to the closure of the cut, the concessioner now offers only full-day (7.5-hour) tours to Rainbow Bridge, resulting in a significant increase in travel time and a corresponding decrease in the number of tours that can be offered on an annual basis. For 2005, 2006, and 2007, the concessioner reports that only 13,300 visitors on average have participated in the Rainbow Bridge tour.

The NPS anticipates that opening the cut to private and tour boat traffic would result in a moderate increase in visitation to Rainbow Bridge.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact to navigation because boat traffic would still navigate to uplake destinations; it would just open an alternative boating route. As a secondary positive impact, visitation numbers at the Glen Canyon NRA would be expected to increase due to the opening of Castle Rock Cut, whether as a result of the preferred alternative going forward or as a result of lake levels rising to 3,620 feet or higher. A commensurate increase in the overall number of visitors to Rainbow Bridge National Monument would be expected from either of these two scenarios. In either case, visitation is not expected to exceed pre-2003 levels and would be in accordance with the terms of the 1995 PA. In addition, overall visitation to Rainbow Bridge National Monument would be limited by the availability of dock space and the walking distance from the dock to the bridge.



W07-095\NEPA\EA\Fig5

Figure 5. Typical cross-section showing depth, width, slopes, and elevations of proposed cut.

*Conclusion:* This alternative would have a moderate beneficial impact on transportation patterns and recreational navigation by providing an alternative route uplake, thus reducing traffic congestion and high wake conditions. A moderate increase in visitation to Rainbow Bridge National Monument would be expected due to overall increases in park visitation and shorter travel times, allowing half-day tours. This alternative would not contribute to any cumulative impacts to visitor use or experience when considered with other past, present, and reasonably foreseeable future actions.

## Energy Consumption or Generation

### Intensity Level Definitions

- Negligible:** No effects would occur or the effects on energy and waste minimization requirements and conservation potential would be below or at the level of detection. The effect would be slight, and no long-term effects on energy and waste minimization requirements and conservation potential would occur.
- Minor:** The effects on energy and waste minimization requirements and conservation potential would be detectable and likely short-term. Any effects would be small, and the initiatives applied or mitigation measures used would be inexpensive, simple, and successful.
- Moderate:** The effects on energy and waste minimization requirements and conservation potential would be readily apparent and likely long-term. Any effects would result in changes to energy and waste minimization requirements and conservation potential on a local scale. Initiatives applied or mitigation measures used would require funding, be relatively simple, and likely be successful.
- Major:** The effects on energy and waste minimization requirements and conservation potential would be readily apparent and long-term and would cause substantial changes to energy and waste minimization requirements and conservation potential in the region. Initiatives applied or mitigation measures used would require extensive funding and be relatively complex. Success could not be guaranteed.

### Existing Conditions

Lake Powell is used by recreation watercraft, NPS maintenance and emergency vessels, and commercial tour boats. The majority of energy consumption at Glen Canyon NRA is due to the fuel consumption by these boats navigating in Lake Powell. A hydroelectric power plant at the toe of Glen Canyon Dam uses water from Lake Powell to generate electricity.

### Impacts of Alternative 1—No Action Alternative

This alternative would result in continuing increased fuel consumption for those willing and/or required to make the trip through the Channel to reach uplake destinations. This impact would likely be long-term based on water level projections. This increased use of fuel would have a minor long-term adverse effect on fuel consumption when looking at the local area but would probably be negligible at the county, state, and national level.

*Cumulative Effects:* If visitation at Lake Powell continues to decrease due to higher fuel prices and the effects of September 11, 2001, overall energy consumption at Lake Powell would decrease as fewer boats traverse the lake. In addition, if dam operations continue to keep lake levels low and

Castle Rock Cut dry, boats would continue to travel through the Channel, increasing fuel consumption by individual boats.

*Conclusion:* This alternative would result in a minor long-term adverse effect on fuel consumption locally as traffic continues to travel the longer route through the Channel. If dam operations continue to result in low lake levels, traffic would continue to travel through the Channel and this alternative would contribute to an adverse cumulative impact to energy consumption when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 9.1.7 of NPS 2006 Management Policies.

### Impacts of Alternative 2–Preferred Alternative

This alternative would result in a short-term and negligible adverse increase of energy consumption by construction equipment and vehicles during the construction phase of the proposed activity. There would also be a minor long-term beneficial impact on energy consumption by increasing the amount of time Castle Rock Cut would be open by approximately 22 days, or 18 percent, during the peak boating season over the next 20 years. Increasing the amount of time Castle Rock Cut can be used by boaters would reduce the amount of fuel currently being expended by boats traveling between Wahweap Bay and Warm Creek Bay and other uplake destinations.

*Cumulative Effects:* This alternative would not contribute to adverse or beneficial cumulative impacts because dam operations would be less likely to affect Castle Rock Cut when it is at a lower elevation.

*Conclusion:* This alternative would result in a short-term negligible adverse increase of energy consumption during construction and a minor long-term beneficial impact on energy consumption by increasing the amount of time Castle Rock Cut is open, resulting in a shorter distance and less fuel for boats to reach uplake destinations. This alternative would not contribute to any cumulative impacts to energy consumption or generation when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 9.1.7 of NPS 2006 Management Policies.

## Safety

### Intensity Level Definitions

**Negligible:** Public health and safety would not be affected or the effects would be at low levels of detection and would not have an appreciable adverse effect on public safety.

**Minor:** Effects would be detectable and short-term but would not have an appreciable adverse effect on public safety. If mitigation were needed, it would be relatively simple and would likely be successful.

**Moderate:** The impact to visitor safety would be sufficient to cause a permanent adverse change in accident rates at existing low accident locations or create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends. Mitigation measures may be necessary and would likely be successful.

**Major:** The impact to visitor safety would be substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards.

**Impairment:** The effect use would contribute to a substantial visitor safety risk such that visitor uses and levels of visitor satisfaction identified as part of the park's purpose could no longer be provided over the long-term for future generations.

## Existing Conditions

The passage through the section of the Channel known as "the Narrows" (Figure 6) has created a high level of danger for boaters, especially those with smaller vessels (Mihata 2008). Wakes from passing boats hit the cliff walls and return undiminished into the Channel, creating rough water conditions that have the potential to cause collisions and capsizing. Lake Powell is used by novice to experienced boaters, and all levels of boaters find the conditions through the Narrows difficult to navigate. Currently, the entire width of the Channel in front of Antelope Point Marina for about ½ river mile has been classified and posted as a No Wake Zone. This area is patrolled by NPS and rangers from the Utah Department of Natural Resources during the high use season.

Exclusive use of the Channel creates a 12-mile detour and increased travel time over the use of Castle Rock Cut. This additional travel time increases emergency response time to incidents uplake of the Channel.

## Impacts of Alternative 1—No Action Alternative

This alternative would continue to route boat traffic through the Narrows until the lake level reaches 3,620 feet or higher and Castle Rock Cut can be reopened. At its current elevation, Castle Rock Cut is projected to be open 78 days, or 64 percent, of the peak boating season over the next 20 years. This alternative would not resolve the current safety issues associated with boat traffic through the Channel; therefore, it would have a minor long-term adverse impact on the safety of those using the current route uplake.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because until lake levels rise to 3,620 feet, the Channel will continue to be the only route to uplake destinations regardless of other reasonably foreseeable projects.

*Conclusion:* This alternative would have a minor long-term adverse impact on the safety of the visiting public and park and concessioner staff by continuing to divert traffic through the Channel when lake levels are less than 3,620 feet. This alternative would not contribute to any cumulative impacts to safety when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2.5 of NPS 2006 Management Policies.

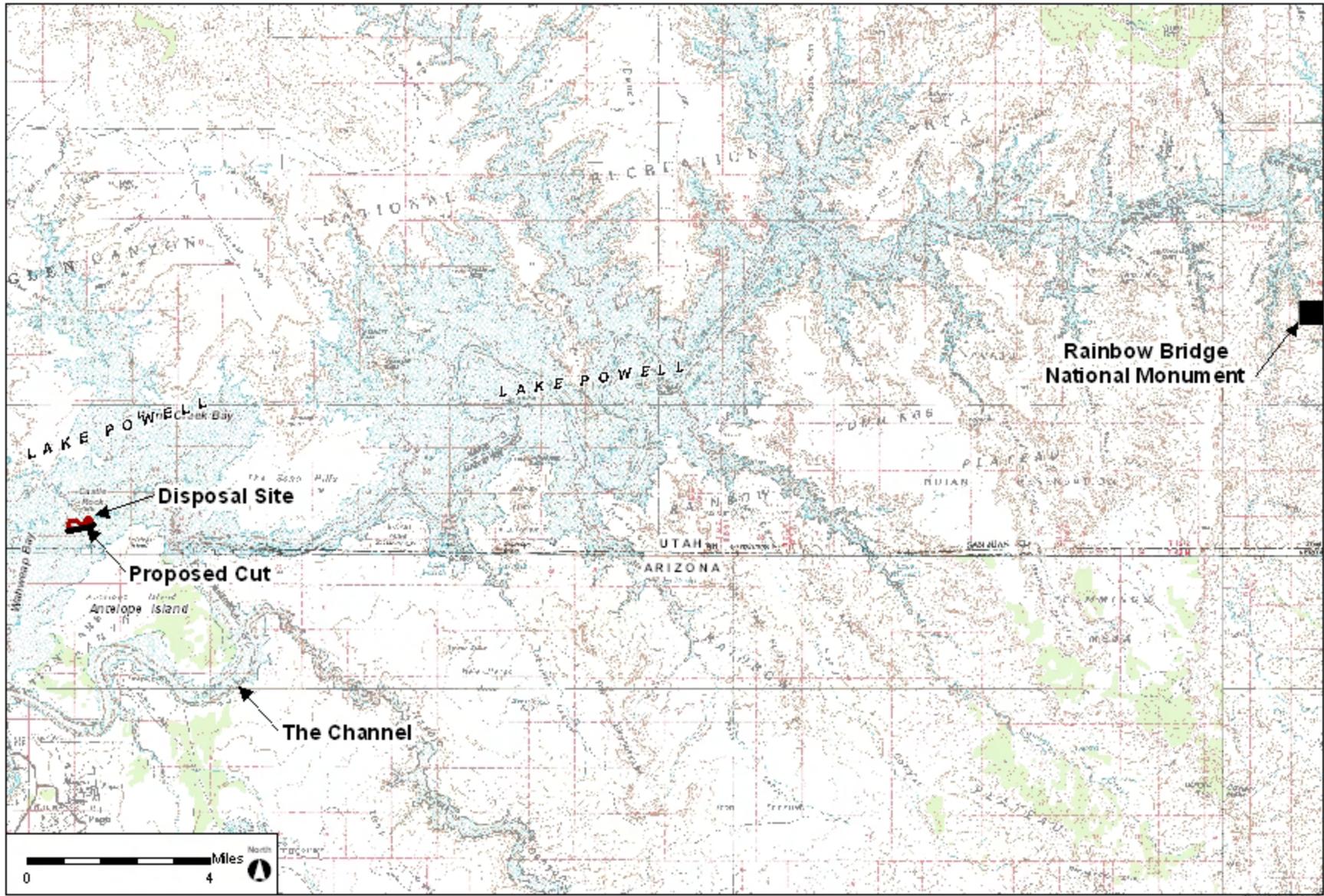


Figure 6. Regional map of the project area.

## Impacts of Alternative 2–Preferred Alternative

This alternative would open Castle Rock Cut a projected 100 days, or 82 percent, of the peak boating season recreational period over the next 20 years (Table 1), an increase of 22 days, or 18 percent. When open, Castle Rock Cut would likely be used by the majority of boaters traveling uplake because it provides a shorter route. Emergency response vessels would have a shorter route to uplake destinations, which would decrease the time lapse between an emergency call and the arrival of NPS emergency vessels. By decreasing traffic through the Narrows, the proposed action would decrease the danger for boaters traveling through the Channel. Therefore, this alternative would have a minor beneficial long-term effect on the safety of the visiting public and park and concessioner staff. Potential high-wake and rough-water conditions in the deepened Castle Rock Cut would be minimized through establishment of a posted no wake zone, strict speed limits, and a slope of 1.5:1 on the north face of the cut.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because project benefits will only be seen locally through the Channel.

*Conclusion:* This alternative would have a minor beneficial long-term impact on the safety of the visiting public and park and concessioner staff by opening a second access channel for boats to travel to uplake destinations, reducing traffic congestion and high wake conditions through the Channel. This alternative would not contribute to any cumulative impacts to threatened or endangered species when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 8.2.5 of NPS 2006 Management Policies.

## Soundscape

### Intensity Level Definitions

For the purposes of the intensity level definitions for soundscape, the following definitions apply:

- Recreation and Resource Utilization (RRU) Zone: An area in which maintenance of natural processes, while allowing to the extent possible both mining and grazing, is the management strategy.
- Development Zone: An area in which provision of visitor services and maintenance of facilities is practiced.
- Natural Zone: An area in which maintenance of isolation and natural processes, while allowing grazing, is the management strategy.

**Negligible:** In the RRU and Development zones, sound levels rarely exceed levels specified in 36 CFR 3.7. In the RRU Zone, low-level human-caused sound would occur 50 percent or less of the time during daylight hours. Human-caused noise is absent between sunset and sunrise.

In the Natural Zone, natural sounds predominate. Human-caused sound is rarely present or when present is only at low levels of intensity and duration. Little motorized noise would be heard in the Natural Zone, except in a small buffer zone immediately adjacent to the RRU Zone. Visitors have the opportunity to experience the natural soundscape free from human-caused noise all of the time in most of the areas.

**Minor:** In the RRU and Development zones, sound levels occasionally exceed levels specified in 36 CFR 3.7. During the busiest days, the RRU Zone may experience human-caused noise at moderate levels for a substantial portion of each hour during daylight hours. Human-caused noise is rarely noticeable between sunset and sunrise.

In the Natural Zone, natural sounds still predominate. Human-caused sound occurs occasionally but only at low levels of intensity and duration. Little motorized noise can be heard in the Natural Zone except in a small buffer zone immediately adjacent to an RRU Zone. Visitors have the opportunity to experience the natural soundscape free from human-caused noise most of the time in most of the areas.

**Moderate:** In the RRU and Development zones, human-caused sound is present in a majority of the area during most of the time during daylight hours. When present, noise levels can be high compared with the natural soundscape much of the time. Sound levels occasionally exceed 36 CFR 3.7 levels. During the busiest days, a majority of the RRU Zone may experience human-caused noise at moderate to high levels compared with the natural soundscape for a majority of daylight hours. Human-caused noise is infrequently noticeable between sunset and sunrise.

In the Natural Zone, natural sound often predominates. Human-caused sound is present infrequently to occasionally. When human-caused noise is present at all, it is at low to moderate levels compared with the natural soundscape, and for less than moderate durations in a majority of the area. Small portions of the Natural Zone adjacent to the RRU and Development zones may be often affected by human-caused sound. Visitors have the opportunity to experience the natural soundscape free from human-caused noise most of the time in less than a majority of the area.

**Major:** In the RRU and Development zones, human-caused sound is present in most of the area during most of the time during daylight hours. When present, noise levels can be high compared with the natural soundscape most of the time. Sound levels exceed 36 CFR 3.7 levels more than rarely. During the busiest days, most of the RRU Zone may experience human-caused noise at moderate to high levels compared with the natural soundscape for most of each hour during daylight hours. Human-caused noise is more than infrequently noticeable between sunset and sunrise.

In the Natural Zone, natural sounds are often masked by human-caused sound for extended periods of time. Human-caused sound is present more than occasionally. When human-caused noise is present, it is often at moderate or higher levels compared with the natural soundscape and for moderate duration or greater in a majority of the area. More than small portions of the Natural Zone adjacent to the RRU and Development zones may be often affected by human-caused sound. Visitors have the opportunity to experience the natural soundscape free from human-caused noise less than most of the time in a majority of the area.

**Impairment:** Noise levels change substantially and conflict with the intended use of that area, thereby precluding the enjoyment of park resources by most park visitors.

## Existing Conditions

Background noise levels in the project vicinity are primarily due to watercraft use. The area around the cut is consistently noisy due to its proximity to the Wahweap Marina area. This area is expected to have noise from watercraft and users and, therefore, is not identified as an area for solitude and quiet.

## Impacts of Alternative 1—No Action Alternative

This alternative may result in a slight decrease in noise levels at Lake Powell. If boater visitation continues to drop due to the extended and continued closure of Castle Rock Cut; this effect would be negligible. Noise levels in the Channel in front of Antelope Point Marina would continue to be higher while the cut is closed than when the cut is open because of the consolidation of traffic in Wahweap Bay. This effect would be minor, long-term, and adverse.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because no alteration in the current soundscape would occur.

*Conclusion:* This alternative would have a long-term minor adverse impact on the soundscape in Wahweap Bay and the Channel by consolidating boat traffic in these areas. This alternative would not contribute to any cumulative impacts to the soundscape when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.9 of NPS 2006 Management Policies.

## Impacts of Alternative 2—Preferred Alternative

This alternative would result in an increase in noise levels over those commonly expected due to construction activities at the project location and adjacent proposed wilderness area. This impact would be temporary and would cease once construction was completed. A minor long-term beneficial impact on noise would be expected following the opening of Castle Rock Cut as boaters would disperse more widely across the lake; however, the area around Castle Rock Cut would always be expected to have consistent noise because it would be a main thoroughfare from Wahweap Bay to Warm Creek Bay and other uplake destinations.

*Cumulative Effects:* This alternative would have a beneficial cumulative impact on the soundscape as long as Glen Canyon Dam operations kept water levels in Lake Powell high enough for Castle Rock Cut to remain open, allowing greater dispersal of boats lakewide.

*Conclusion:* This alternative would have a short-term minor increase in noise during construction activities and a long-term minor beneficial impact on noise following the opening of Castle Rock Cut by dispersing boats across the lake. If dam operations keep water levels high enough for Castle Rock Cut to remain open, this alternative would contribute to a beneficial cumulative impacts to the soundscape when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major adverse impacts to a resource or value whose

conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Section 4.9 of NPS 2006 Management Policies.

## Archaeological and Ethnographic Resources

The National Historic Preservation Act (NHPA) defines historic properties as sites, buildings, structures, districts (including landscapes), and objects included on, or eligible for inclusion on, the National Register of Historic Places (NRHP), as well as the artifacts, records, and remains related to such properties. "Traditional cultural properties" having heritage value for contemporary communities (often, but not necessarily, Native American groups) can be listed on the NRHP because of their association with historic cultural practices or beliefs that are important in maintaining the cultural identities of such communities. In accordance with NPS protocol and for the purposes of the following discussion, cultural resources include archaeological resources, historic structures (including buildings), cultural landscapes, ethnographic resources (including traditional cultural properties), and museum collections.

Section 106 of the NHPA, as amended in 1992 (16 USC 470 et seq.); NPS DO 28 *Cultural Resource Management Guideline*; and NPS 2006 Management Policies (NPS 2006) require the consideration of impacts on historic properties. The NRHP is the nation's inventory of historic places and the national repository of documentation on property types and their significance. The above-mentioned legislation and policies require federal agencies to coordinate consultation regarding the potential effects to properties listed on or eligible for the NRHP.

Regulations for *Protection of Historic Properties* (36 CFR Part 800) define a process for federal agencies to consult with the State Historic Preservation Office (SHPO); Native American groups, including Tribal Historic Preservation Officers [THPOs], where appropriate; other interested parties; and, when necessary, the Advisory Council on Historic Preservation (ACHP) to ensure that historic properties are duly considered as federal projects and are planned and implemented. The steps in the "Section 106 consultation process" involve:

- Identifying the area where a proposed undertaking could affect cultural resources—the area of potential effects (APE). (Undertakings can include approvals, funding, issuance of permits, and so forth.)
- Identifying and evaluating the eligibility for listing on the NRHP of properties that might be affected by the proposed undertaking.
- Assessing the potential effects of the undertaking on eligible properties.
- Consulting with the SHPO, Native American groups, other interested parties, and the ACHP (as appropriate) to determine ways to avoid or reduce any adverse effects (impacts) if such are anticipated.
- If necessary, providing the ACHP a reasonable opportunity to comment on the proposed undertaking and the effects on properties determined to be eligible for NRHP listing.

- Proceeding with the undertaking under the terms of a programmatic agreement, a memorandum of agreement, or in consideration of ACHP comments if required.

To be determined eligible for inclusion on the NRHP, properties must be important in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, settings, materials, workmanship, feeling, and association, and meet at least one of four criteria:

- A Are associated with events that have made a significant contribution to the broad patterns of our history.
- B Are associated with the lives of persons significant in our past.
- C Embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction.
- D Have yielded, or may be likely to yield, information important in prehistory or history (36 CFR Part 60.4).

Properties may be of local, state, or national importance. Typically, historic properties are at least 50 years old, but younger properties may be considered for listing if they are of exceptional importance.

If a federal agency decides a proposed project *is an undertaking*, it then has an obligation to determine the undertaking's effect on historic properties, and to consult with SHPO (and sometimes the ACHP) regarding that determination. There are three possible effect determinations:

- "No historic properties affected"
- "No adverse effect"
- "Adverse effect"

The NPS, as steward of many of America's most important cultural resources, is charged to preserve historic properties for the enjoyment of present and future generations. Management decisions and activities throughout the NPS must reflect awareness of the irreplaceable nature of these resources. The NPS will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in NPS 2006 Management Policies and the appropriate DOs.

## Section 106 Consultation

This EA is *not* intended to comply with the requirements of Section 106 as is sometimes done by the NPS when a combined document is used for compliance with both NEPA and the NHPA. The Glen Canyon NRA is currently conducting Section 106 consultation with regard to the proposed undertaking and will conclude that consultation after receipt of all public input, and consideration of that input, prior to project implementation.

The APE is defined to include the project area and its immediate environs as well as areas proximal to the shoreline of the uplake area, including Rainbow Bridge National Monument, because of the

potential for impacts to cultural resources that might be affected, intentionally or inadvertently, by the increase in visitation anticipated as a result of access afforded by the deepening of Castle Rock Cut (refer to *Visitor Use and Experience*).

Glen Canyon NRA has initiated consultation with the Utah and Arizona SHPOs as well as with 11 Native American tribes (including the Navajo THPO that has identified an interest in the Glen Canyon region). Tribal consultation conducted to date is detailed in *Native American Consultation*. Tribes have expressed concerns regarding the potential for impacts to Rainbow Bridge National Monument from increased visitation.

## Intensity Level Definitions

No cultural resources were identified in the project area or its immediate environs as detailed in the following section. Numerous archaeological sites are known or suspected to occur in the broader APE, however, and an ethnographic resource—Rainbow Bridge National Monument—also is present in the APE. Because none are known or suspected to occur in the APE, historic structures, cultural landscapes, and museum collections were dismissed from further consideration in *Impact Topics Dismissed from Further Analysis*. In the following section, the topics of archaeological and ethnographic resources are considered and potential impacts are assessed in consideration of the following intensity levels.

**Negligible:** There would be no direct or indirect impacts on any archaeological or ethnographic resource potentially eligible for, or listed on, the NRHP. For purposes of Section 106, the determination would be “no historic properties affected.”

**Minor:** Direct or indirect impacts to an archaeological or ethnographic resource potentially eligible for, or listed on, the NRHP are anticipated; however, these effects would be minor in number, extent, and/or duration and would not diminish the overall integrity of the resource (i.e., those characteristics of the resource that qualify it for listing on the NRHP [contribute to its significance] would not be measurably affected). The determination would be “no historic properties affected.”

**Moderate:** Direct or indirect impacts to an archaeological or ethnographic resource potentially eligible for, or listed on, the NRHP are anticipated, and these effects would be greater in number, extent, and/or duration than minor impacts, but impacts to those characteristics of the resource that qualify it for listing on the NRHP (contribute to its significance) would be treated in accordance with the Secretary of the Interior’s Standards for the Treatment of Historic Properties through preservation, rehabilitation, restoration, or reconstruction, or through beneficial practices compatible with the nature of the resource. The determination would be “no adverse effect.”

**Major:** Direct or indirect impacts to an archaeological or ethnographic resource potentially eligible for, or listed on, the NRHP are anticipated, and these effects would be more substantial in number, extent, and/or duration than moderate impacts. Major impacts would result in the alteration of some or all of the characteristics of the resource that qualify it for listing on the NRHP (contribute to its significance) and could potentially disqualify the property from listing on the NRHP. The determination would be “adverse effect.”

**Impairment:** Loss, destruction, or degradation of an archaeological or ethnographic resource potentially eligible for, or listed on, the NRHP so severe as to render the property ineligible for NRHP listing and to be directly contrary to the NPS stewardship mandate. The determination would be “adverse effect.”

## Existing Conditions

*Archaeological Resources:* In addition to the NHPA and NPS 2006 Management Policies (NPS 2006), the NPS DO 28B *Archaeology* affirms a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the NPS is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. Archaeological resources are nonrenewable and irreplaceable, so it is important that all management decisions and activities throughout the National Park System reflect a commitment to the conservation of archaeological resources as elements of our national heritage.

An intensive pedestrian survey examined the proposed cut, areas where excavated material would be disposed, the access route, and proposed construction staging areas north of Castle Rock Cut (i.e., all areas in the project limits [Schreyer and Lundin 2008]). No cultural resources were identified as a result of the survey. In the broader APE, however, are an undetermined number of archaeological sites along the shoreline of the lake.

The Glen Canyon area has been witness to approximately 11,500 years of periodic use during a variety of temporal periods, including Paleoindian, Archaic, Basketmaker, Formative, Protohistoric, and Historic. Use of the area by Paleoindian groups is evidenced by the presence of a few Clovis and Folsom style projectile points. In general, however, Paleoindian use of the area is not well represented in the recreation area (NPS 2008). The Archaic period in the region starts at about 9000 B.P., based on radiocarbon analysis conducted on samples recovered from cave deposits (Geib 1996), and ends around 400 B.C., with the beginning of the Basketmaker period around 400 B.C. Archaic site types include caves, rock shelters, lithic scatters, and rock art sites.

The Basketmaker period, which represents a transitional period between mobile and settled lifeways, lasted from about 400 B.C. to about A.D. 500 (NPS 2008). Basketmaker sites commonly feature slab-line cysts (above-ground and underground). Distinctive rock art styles are also attributable to the Basketmaker period. The Formative period lasted from the end of the Basketmaker period to about A.D. 1500 and is characterized by material culture representative of Anasazi and Fremont cultural adaptations.

The poorly understood Protohistoric period (circa A.D. 1500–1850) in the Glen Canyon region is marked by remains of Navajo, Paiute, and Hopi use of the area. Historic remains include primarily those related to Mormon settlement and mining (NPS 2008). A very recent discovery of an inscription reading “Pasa Por Aqui” (“pass by here”) followed by the year “1776” is believed to have been left during the first European incursion into Utah (the Dominguez-Escalante expedition) (Salt Lake Tribune 2008).

Not surprisingly, aboriginal remains tend to be concentrated in generally high-elevation areas (i.e., outside of canyons), offering favorable environmental attributes, including soils, a diverse biome, and relatively high precipitation amounts. According to Jennings (1966), these areas include the Kaiparowits Plateau, Paiute Mesa, Cummings Mesa, and Rainbow Plateau. As part of ongoing Section 106 analysis and consultation for this project, a review of existing archaeological records

will be conducted to better assess the potential for an increase in visitation to impact archaeological resources proximal to the shoreline in the uplake area. Glen Canyon NRA has not been entirely inventoried for archaeological resources, but broad-ranging surveys were conducted in advance of the construction of Glen Canyon Dam by the University of Utah and the Museum of Northern Arizona in the 1960s, and a number of smaller-scale studies have been conducted since then.

To date, there have been upwards of 2,000 archaeological sites recorded in Glen Canyon NRA (Geib 1996). The number of those situated near shoreline areas remains to be determined. In addition, as lake levels have dropped in recent years, sites that had previously been underwater have been exposed on the shoreline. Since 2003, an estimated 25 “new” sites have been discovered as the lake has receded. These include primarily flaked stone scatters, small campsites with rock rings and fire pits, and at least two human burials. No large habitations have been reported (Wilson 2008). Eight archaeological sites, some containing prehistoric and historic rock art inscriptions, have been recorded in the 160-acre Rainbow Bridge National Monument.

*Ethnographic Resources:* Per NPS DO 28 *Cultural Resource Management*, ethnographic resources are defined as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to DO 28 and Executive Order 13007 on sacred sites, the NPS should try to preserve and protect ethnographic resources.

In addition to the aforementioned pedestrian survey of the project area, Glen Canyon NRA initiated Section 106 consultation with Native American communities in part to identify traditional cultural properties that may be affected by the proposed undertaking (refer to *Native American Consultation*). This research identified no cultural resources in or in the vicinity of the project limits; however, the Shivwits Paiute Band of Paiute Indian Tribes of Utah expressed an interest in visiting the project area to determine whether it might contain any plants important to the tribe. Tribal consultation is ongoing.

With regard to the broader APE, Glen Canyon NRA consultation with tribal groups resulted in the recognition that the tribes may have concerns regarding possible effects to Rainbow Bridge National Monument that might result from a possible increase in visitation to uplake areas if the proposed Castle Lake Cut is opened. Rainbow Bridge National Monument is administered by Glen Canyon NRA, which forms part of its northwest boundary, approximately 27 miles east of the project area in Bridge Canyon. The 160-acre monument is surrounded on three sides by the Navajo Reservation. Rainbow Bridge National Monument contains the world’s largest natural bridge and was nominated in 1989 as a World Heritage Site. In addition to its geological significance and the presence of archaeological sites as noted above, the monument’s natural and archaeological resources have cultural significance based on their traditional and sacred values to American Indians (Sproul 2001).

The Hopi Tribe and San Juan Paiute consider Rainbow Bridge important to their origin stories, and other tribes regard the monument as an area of traditional and religious significance. Navajos have identified Rainbow Bridge as a sacred religious site integral to the story of their emergence into this world and related specifically to two of the most important figures in Navajo religion: the Hero Twins who are believed to have been raised in “the cradle of Bridge Creek” and the stone rainbow formed the protective handle of their cradle board” (Sproul 2001). On March 17, 1992, the Utah SHPO concurred with the Glen Canyon NRA’s determination that Rainbow Bridge is eligible for listing on the NRHP as a traditional cultural property (TCP). It is assumed the property is regarded as eligible under Criterion A for its association with events that have made a significant contribution to the broad patterns of Native American history, and possibly other criteria.

## Impacts of Alternative 1–No Action Alternative

Alternative 1 would not affect known historic properties because no cultural resources were identified in the project area, and there would be no change in management of uplake cultural resources in the broader APE. Impacts would be negligible.

*Cumulative Effects:* This alternative would not contribute to cumulative impacts because no construction would take place and no historic properties would be affected. Impacts would be negligible.

*Conclusion:* This alternative would have no effect on historic properties. Impacts would be negligible.

## Impacts of Alternative 2–Preferred Alternative

This alternative would not affect currently identified historic properties in the project area, but the Shivwits Paiute Band of Paiute Indian Tribes of Utah have indicated a desire to visit the project area to determine if it might contain important plants. Section 106 consultation is ongoing, and this concern would be addressed prior to project implementation. Should important plants be found, Glen Canyon NRA would work with the tribe to identify a treatment option that would result in “no adverse effect” to the resource, if possible. Impacts in such a case are anticipated to be minor to moderate.

An increase in visitation over current levels also has the potential for impacts to archaeological resources along the shoreline in the uplake area. The concern is that visitors who put in to shore may encounter sites and either inadvertently cause disturbance or engage in intentional vandalism. As part of the NPS, Glen Canyon NRA has a mandate to protect, preserve, and foster appreciation of the cultural resources in its custody through appropriate programs of research, planning, and stewardship. In 1991, Glen Canyon NRA executed a PA for compliance with Section 106 for undertakings under its purview.

Glen Canyon NRA rangers are specifically trained with regard to the protection of archaeological resources and conduct regular patrols throughout the recreation area to discourage vandalism and educate the public. When Glen Canyon NRA authorities become aware that an archaeological resource has been discovered, a professional archaeologist inspects the area, checks existing records to determine if the resource had been previously recorded, and performs new or additional recordation aimed at an assessment of the resource’s eligibility for NRHP listing. The condition of the resource is assessed and a determination is made regarding its vulnerability to future disturbance from natural forces such as erosion or intentional or unintentional human activities. In consideration of those findings, the site may be protected in place and its location obscured with sand or rocks, or, if the resource is endangered, its information content may be retrieved through a program of controlled data recovery. The latter strategy is employed sparingly because preservation is the preferred management practice.

Through continued implementation of these protective measures, Glen Canyon NRA anticipates no measurable degradation of archaeological resources in uplake areas, even with the anticipated increase in visitation numbers. Ongoing Section 106 consultation can be expected to identify any additional protective measures that might be required to arrive at a determination of “no adverse effect.” Impacts are anticipated to be moderate.

Native American communities expressed concerns about increased visitation at Rainbow Bridge National Monument, which is a TCP as well as containing archaeological sites. Visitation numbers

at the Glen Canyon NRA would be expected to increase from current levels with the opening of Castle Rock Cut, and a commensurate increase in the overall number of visitors to Rainbow Bridge National Monument would be expected, though those numbers are not expected to exceed past (1990s) levels. Actual visitation will be limited by the availability of dock space near the Rainbow Bridge site as well as the distance required for tour boat patrons and other visitors to walk from the dock to the bridge. Visitation would be limited in accordance with the 1995 PA. The 1995 PA was developed and executed to satisfy Section 106 requirements with regard to implementation of a General Management Plan/Development Concept Plan (GMP/DCP) for Rainbow Bridge National Monument (June 1993). The 1993 Finding of No Significant Impact for the EA prepared for that action concluded that “There are no *unmitigated* adverse impacts on ... sites or districts listed in, or eligible for listing in, the National Register of Historic Places.”

The 1995 PA established a standing Native American Consultation Committee (NACC) to facilitate consultation with interested tribes with regard to implementation of the GMP/DCP. The NACC meets annually at a minimum, and more frequently in response to tribal requests as detailed in *Native American Consultation*. Native Americans have unrestricted access to Rainbow Bridge National Monument to conduct traditional ceremonies. If a member of the NACC requests, Glen Canyon NRA has discretionary authority to close Rainbow Bridge National Monument to the general public on an occasional basis for the private use of Native Americans for traditional ceremonies. Glen Canyon NRA promotes public awareness of the cultural significance of Rainbow Bridge National Monument through a variety of interpretive programs and exhibits, and requires all boat tours to Rainbow Bridge National Monument to have an NPS interpreter on board. Visitor access is strictly controlled in accordance with the 1995 PA at a level not to exceed the carrying capacity. Therefore, while visitation to uplake areas overall may increase with implementation of Castle Rock Cut, visitation levels at Rainbow Bridge National Monument will be maintained in accordance with the 1995 PA, which is anticipated to result in a finding of “no adverse effect.” As noted previously, Section 106 consultation is ongoing in this regard. Impacts are anticipated to be moderate.

*Cumulative Effects:* Visitation numbers at the Glen Canyon NRA would be expected to increase from current levels with the opening of Castle Rock Cut, and a commensurate increase in the overall number of visitors to uplake areas and Rainbow Bridge National Monument would be expected. As documented in the EIS for Glen Canyon dam operations, bigger water releases coupled with climate change will result in lower lake levels and greater shoreline exposure, which may result in greater numbers of vulnerable archaeological sites being exposed. Management practices aimed at the preservation of those resources will continue; therefore, cumulative impacts are anticipated to be moderate.

*Conclusion:* This alternative is anticipated to have a moderate impact on archaeological and ethnographic resources. Section 106 consultation is ongoing.

## Socioeconomic Environment

The socioeconomic environment was given particular attention during the tribal consultation and public scoping phases of the proposed project in recognition of the government-to-government relationship between federally recognized tribes and the NPS, and due to the high level of public interest in the project as indicated by the number of responses to the scoping brochure. Topics addressed in this socioeconomic environment section include health and safety, visitor use, economics, and concessions.

## Intensity Level Definitions

- Negligible:** Park revenue and the socioeconomic environment would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to park operations or the local economy.
- Minor:** Effects on park revenue and the socioeconomic environment would be detectable, though the effects would likely be short-term, localized, small, and of little consequence to park operations and the local economy. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Effects on park revenue and the socioeconomic environment would be readily detectable, long-term, and localized, with consequences to park operations and the local economy. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
- Major:** Effects on park revenue and the socioeconomic environment would be obvious and long-term and would have substantial consequences to park operations and the local economy. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.
- Impairment:** The impact would contribute substantially to the reduction in park revenue and the socioeconomic environment to the extent that the park would no longer function and the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and the resource could not be experienced and enjoyed by future generations.

## Existing Conditions

Visitation at Glen Canyon NRA has declined 32.5 percent since 1994. This marked decrease in visitation has resulted in a lower overall economic gain for commercial interests associated with the recreation at Glen Canyon NRA. The closure of Castle Rock Cut in 2003 due to low water conditions created additional negative impacts to visitation, and consequently commercial interests in the area as a whole, and the economic well-being of the local community based on information gathered through tribal consultation and public participation.

Castle Rock Cut had previously been used as a boat passage from Wahweap Bay to Warm Creek Bay and uplake areas, including Rainbow Bridge National Monument. The existing Castle Rock Cut is open to boaters only when the elevation of Lake Powell is at 3,620 feet or higher. As a result of continuous low lake levels since 2003, the closure of Castle Rock Cut requires boaters to detour around Antelope Island via the Channel to reach Warm Creek Bay and other uplake destinations, including Rainbow Bridge National Monument. This detour has resulted in longer travel times, additional user costs, and reduced safety for visitors, concession operations, and the NPS. Visitors have been asking the NPS to re-excavate Castle Rock Cut since the time of the closure, and public support for the project is detailed in the comments received in response to the public scoping brochure, over 90 percent of which were positive.

The Antelope Point Marina concession operation was completed in 2003 and has maintained a high volume of business traffic due to its location in the Channel. However, the operator has encountered measurable unanticipated maintenance costs as a result of the damage caused to the infrastructure because all of the boats leaving Wahweap Bay must pass through the Channel. The

Antelope Point Marina operator has also received complaints from boaters whose vessels have been damaged by the turbulence caused from the wake due to the high traffic volume. There has also been a sharp rise in complaints from slip renters due to the continual rocking of houseboats during the busy visitor season. The concession operation in Wahweap Bay has incurred additional operational costs due to the additional fuel, travel, and staff time needed for the longer boat trips carrying visitors from Wahweap Bay to uplake destinations. Boat travel via the Channel is approximately 12 miles longer and requires an hour or more of additional travel time in each direction.

In addition to higher costs related to staff, travel, and other costs, including fuel, the longer travel time and distance has resulted in decreased visitor safety due to the turbulence in the Channel as well as decreased uplake emergency response times.

### **Impacts of Alternative 1—No Action Alternative**

This alternative would be expected to have a minor adverse impact on the local economy over time. Visitation to Lake Powell has decreased since Castle Rock Cut was closed to boat traffic in 2003. Though the drop in visitation is not wholly due to the closing of the cut, the effect would be expected to increase if Castle Rock Cut remains closed. In 2002, total visitation to the Glen Canyon NRA was 2,128,379. When Castle Rock Cut closed in 2003, visitation decreased to 1,896,797 and has remained under 2,000,000 in subsequent years, reaching 1,889,149 in 2007. The NPS believes the longer route through the Channel, with the associated increase in recreational and commercial boat user costs related to rising fuel costs and decrease in the perception of boating safety, is the main impetus behind the loss of visitors. With fewer visitors, there is less income to the Glen Canyon NRA, less business and revenue at the six marinas at Lake Powell, and less business and revenue for hotels, restaurants, grocery stores, tackle shops, boat rental and repair enterprises, and other tourism-associated businesses, resulting in a long-term moderate adverse impact to the local economy, including the local resident economy of the neighboring Navajo Nation. This impact should last until lake levels rise to an elevation that allows Castle Rock Cut to be opened without further deepening of the channel.

*Cumulative Effects:* If visitation continues to decrease and dam operations continue to result in low lake levels, an adverse cumulative impact to the local economy would be anticipated.

*Conclusion:* This alternative would have a long-term minor adverse impact to the local economy as visitation continues to decrease along with a decrease in tourism revenue. If dam operations continue to result in low lake levels, it would contribute to decreased visitation, and this alternative would contribute to adverse cumulative impacts to socioeconomic resources when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts.

### **Impacts of Alternative 2—Preferred Alternative**

This alternative would be expected to have a long-term moderate beneficial impact on the local economy because Castle Rock Cut would be open to boat traffic for a greater percentage of time if lake elevations reach or exceed 3,585 feet in elevation. The availability of Castle Rock Cut to reach Warm Creek Bay or uplake destinations would be expected to increase visitation at Lake

Powell to at least the levels prior to 2003. The project would have a major beneficial impact to the boat tourism business at the lake; a moderate beneficial impact on tourism in Page, Arizona; a moderate beneficial impact to the local community, including the neighboring Navajo Nation and other nearby tribal communities; a reduction in boat user costs; increased public safety; and improved efficiency and economy for the NPS. The data supporting the expected beneficial impacts to the Antelope Point, Wahweap Bay, and local community were gathered in close consultation with the concessionaires, consulting Native American tribes, and public input.

There were 721 total boat tour trips in 2002 prior to the closure of Castle Rock Cut, compared with 252 total boat tour trips in 2006. When the cut is open to boats drafting 7 feet or more, the boat tours are able to run half-day trips rather than full-day trips if required to go through the Channel. There would be a minor benefit associated with a temporary increase in construction jobs. After construction is completed, the construction benefit would cease.

Though the opening of Castle Rock Cut is expected to result in improved visitation to Rainbow Bridge National Monument via commercial boat, the NPS would continue to manage the carrying capacity within the limits established in the 1993 Rainbow Bridge General Management Plan as the visitation is restored. No Rainbow Bridge resources would be impaired. Glen Canyon NRA conducted government-to-government consultation focused specifically on potential impacts to Rainbow Bridge due to the significance of Rainbow Bridge to tribal communities and due to its status as a Traditional Cultural Property determined eligible for inclusion on the NRHP.

*Cumulative Effects:* This alternative would contribute to a beneficial cumulative impact on the local economy if reasonably foreseeable projects in the future contribute to increased visitation levels at Lake Powell over and above the increased visitation anticipated from Alternative 2.

*Conclusion:* This alternative would have a long-term moderate beneficial impact on the local economy by increasing visitation and angler use of the lake and a short-term minor benefit associated with the creation of construction jobs during excavation. If other projects contribute to increased visitation levels, this alternative would contribute to a beneficial cumulative impact to socioeconomic resources when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts.

## Environmental Justice (Title VI of the Civil Rights Act and Executive Order 12898)

### Intensity Level Definitions

**Negligible:** The effects on socioeconomic conditions would be below or at the level of detection. The effects would be slight, and no long-term effects on socioeconomic conditions would occur.

**Minor:** The effects on socioeconomic conditions would be detectable. Any effects would be small, and if mitigation is needed to offset potential adverse effects, it would be simple and successful.

**Moderate:** The effects on socioeconomic conditions would be readily apparent and likely long-term. Any effects would result in changes to socioeconomic conditions on a local scale. If mitigation is needed to offset potential adverse effects, it could be expensive but would likely be successful.

**Major:** The effects on socioeconomic conditions would be readily apparent and long-term and would cause substantial changes to socioeconomic conditions in the region. Mitigation measures to offset potential adverse effects would be expensive, and their success could not be guaranteed.

## Existing Conditions

Title VI of the Civil Rights Act of 1964 and related statutes assure that individuals are not excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity receiving federal financial assistance on the basis of race, color, national origin, age, sex, and disability. “Executive Order 12898” on environmental justice, dated February 11, 1994, directs that programs, policies, and activities not have a disproportionately high and adverse human health or environmental effect on minority and low-income populations.

The Antelope Point Marina is a joint project between the NPS, the Navajo Nation, and their business partner, contracted concessioner Antelope Point Holdings (APH). The current NPS contract runs from January 1, 2003, through December 31, 2022. The Navajo Nation agreement with APH takes the form of a business site lease for the same time period.

All NPS concession contracts require a “return to the government,” which usually takes the form of a franchise fee based on a percentage of gross revenues. The return goes to the Navajo Nation, not the NPS. The Navajo Nation receives a guaranteed minimum annual rent from APH that increases during the term of the agreement as the project is completed or “built out.” The rent is not adjusted by gross or net revenue figures but by the year of the contract. It increases but is not based on revenue. The minimum franchise fee is 3 percent of the gross revenues paid to the Navajo Nation directly, but the figure is adjustable based on the annual net operating income of APH. The minimum franchise fee is based on gross revenues, and the adjustments are based on net operating income.

## Impacts of Alternative 1—No Action Alternative

Though Castle Rock Cut has not been open since the marina was built due to low water levels, the cut was open at the time the marina prospectus was developed, and all associated financial projections assumed the cut would be open. This alternative would result in the continued, unanticipated current economic benefit to the Antelope Point Marina resulting from the increased business it derives when Castle Rock Cut is closed. This minor positive effect benefits the operators of the marina and the Navajo Nation, as outlined previously.

*Cumulative Effects:* This alternative would not contribute to an adverse or beneficial cumulative impact because no change to the current conditions would occur.

*Conclusion:* This alternative would continue the minor positive impact on the operators of Antelope Point Marina and the Navajo Nation by continuing to divert traffic through the Channel, resulting in increased revenue at Antelope Point Marina. This alternative would not contribute to any cumulative impacts to protected populations when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the

establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Executive Order 12898.

## Impacts of Alternative 2–Preferred Alternative

This alternative would potentially have a minor adverse impact on the Antelope Point Marina and the Navajo Nation by decreasing revenue due to the rerouting of some boats from the Channel to Castle Rock Cut. This effect would likely be temporary until visitation increases after reopening of the cut, when the Navajo Nation would see an associated gain in revenue due to the increase in visitation. Therefore, the long-term benefit would offset temporary revenue losses, and the proposed action would be expected to have no disproportionately high and adverse human health or environmental effect on minority and low-income populations (i.e., the Navajo Nation).

*Cumulative Effects:* This alternative would contribute to a cumulative adverse impact on Antelope Point Marina if visitation to Lake Powell continues to drop for reasons unrelated to the status of Castle Rock Cut.

*Conclusion:* This alternative would potentially have a minor adverse impact on the operators of Antelope Point Marina and the Navajo Nation by allowing traffic to split between two routes uplake, decreasing traffic volumes through the Channel and use of Antelope Point Marina. There would be no disproportionately high and adverse human health or environmental effect on minority and low-income populations. If visitation continues to drop despite opening Castle Rock Cut, this alternative would contribute to an adverse cumulative impact to protected populations when considered with other past, present, and reasonably foreseeable future actions. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values. Implementation of this alternative would not result in any unacceptable impacts and is consistent with Executive Order 12898.

## NPS Operations

### Intensity Level Definitions

- Negligible:** Park operations would not be affected or the effect would be at or below the lower levels of detection and would not have an appreciable effect on park operations.
- Minor:** The effect would be detectable and likely short-term but would be of a magnitude that would not have an appreciable effect on park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and successful.
- Moderate:** The effects would be readily apparent and long-term and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
- Major:** The effects would be readily apparent and long-term and would result in a substantial change in park operations in a manner noticeable to staff and the public

and markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

**Impairment:** The effects would be substantial and long-term and would result in a significant change in park operations noticeable to staff and the public. Mitigation measures to offset adverse effects would be cost prohibitive or technically infeasible.

## Existing Conditions

Currently, NPS-owned maintenance, police, and emergency vessels must travel through the Channel, a 12-mile detour that adds a minimum of 1 hour of travel time to reach uplake destinations from Wahweap Bay.

## Impacts of Alternative 1—No Action Alternative

This alternative would have a continuing long-term minor adverse effect on NPS operations by perpetuating the increased time necessary to travel to uplake destinations through the Channel when Castle Rock Cut is closed.

*Cumulative Effects:* This alternative would contribute to an adverse cumulative impact on NPS operations by contributing, in addition to rising fuel costs, lower lake levels, or other actions, to the difficulty in boating uplake and the associated time loss in responding to calls, taking care of park facility maintenance issues, and other concerns.

*Conclusion:* This alternative would have a long-term minor adverse effect on NPS operations by continuing to require NPS personnel to travel through the Channel, resulting in increased travel times and maintenance costs. This alternative would contribute to an adverse cumulative impact to NPS operations when considered with other past, present, and reasonably foreseeable future actions such as rising fuel costs and lower lake levels. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values.

## Impacts of Alternative 2—Preferred Alternative

This alternative would require assistance from the NPS to transport construction equipment to the project area using barges and to place and maintain navigation buoys and signs. There would be a moderate long-term positive impact by decreasing the time spent traveling uplake and associated maintenance costs by NPS-owned and operated boats.

*Cumulative Effects:* Excavation and disposal activities would contribute to the cumulative total of man-made adverse impacts to this area, though the cut already exists and has been excavated twice previously. If water levels at Lake Powell continue to drop, it is possible that the NPS will at some time request authorization for yet another deepening of Castle Rock Cut.

*Conclusion:* This alternative would have a moderate long-term positive impact on NPS operations by decreasing the time required to travel uplake and decreasing associated maintenance costs on NPS watercraft. This alternative would contribute to an adverse cumulative impact to NPS operations when considered with other past, present, and reasonably foreseeable future actions, including the previous excavations in the same area and the increased likelihood that the same area

would be chosen if future excavations are desired. Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, (2) key to the natural or cultural integrity of the park, or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of Glen Canyon NRA's resources or values.



# CONSULTATION AND COORDINATION

## External Scoping

External (public) scoping was conducted to inform various agencies and the public about the proposed deepening of Castle Rock Cut and to generate input on the preparation of this EA. This effort was initiated through the posting of the scoping flier on the Planning, Environment, and Public Comment Web site on November 2, 2007. A scoping flier was distributed on December 5, 2007, to more than 50 local businesses and non-profit organizations, and the following agencies and organizations:

### Federal Agencies

Bureau of Land Management  
U.S. Bureau of Reclamation  
U.S. Forest Service  
Department of Energy, Western Area Power  
Lake Mead National Recreation Area  
U.S. Army Corps of Engineers  
U.S. Environmental Protection Agency  
National Park Service  
U.S. Fish and Wildlife Service

### State Agencies and Individuals

Arizona Department of Environmental Quality  
Arizona Department of Transportation  
Arizona Department of Water Resources  
Arizona Game and Fish Department  
Arizona State Historic Preservation Office  
Arizona State Governor  
U.S. Senate and House representatives  
from Arizona and Utah  
Utah State Governor  
Utah Department of Wildlife Resources  
Utah Division of Water Quality  
Utah Division of Water Resources  
Utah State Parks

### Affiliated Native American Groups

Navajo Nation  
Havasupai Tribe  
Hopi Tribe  
Hualapai Tribe  
Jicarilla Apache Nation  
Kaibab Paiute Tribe  
Paiute Indian Tribe of Utah  
San Carlos Apache Tribe  
San Juan Paiute Tribe  
Southern Ute Tribe  
Tonto Apache Tribe  
Uintah and Ouray Agency  
Ute Mountain Ute Tribe  
White Mountain Apache Tribe  
Yavapai-Apache Tribe

### Local Governments

City of Page  
City of Big Water

During the 30-day scoping period, approximately 1,630 responses were received from the public through letters, e-mail, or on the PEPC Web site. Approximately 1,470 responses were in favor of the project, stating that proceeding with the project would improve boater safety, particularly when passing through the Channel; reduce fuel and boat maintenance costs; reduce emissions; reduce water and air pollution caused by boats traveling uplake via the longer route through the Channel; reduce travel time to uplake destinations; and benefit the local economy. These comments are also summarized in *Public Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*

Approximately 149 responses were opposed to the project, in general stating that the project would violate NPS mandates, favor one group of recreationists (i.e., boaters versus hikers, birdwatchers, etc.), create pollution and cause damage to the lakeshore to effect a short-term solution to a temporary drought, be a waste of taxpayer money and park economic resources,

harm threatened or endangered species and other natural resources, and negatively impact the aesthetic and backcountry values of Glen Canyon NRA. These comments are also summarized in *Public Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*.

Approximately 11 responses received were neutral toward the project and had general comments questioning the budget, the best width and depth of the cut, and the impacts on the environment, traffic, and safety. These comments are also summarized in *Public Scoping*, and substantive comments are addressed in the applicable impact topic in *Affected Environment/Environmental Consequences*.

In addition to these responses, the manager of the Antelope Point Marina responded with no concerns regarding the project; the Navajo Nation responded in opposition to the project, citing concerns regarding the economic impact to Antelope Point Marina; and the Hopi Tribe responded in opposition to the project, stating that the project serves only the “convenience of a small local interest group” and would adversely effect water resources and fish and wildlife.

## Native American Consultation

Pursuant to the 1995 PA, timely and meaningful tribal consultation was initiated during the preliminary planning and scoping phase of the proposed project in recognition of the government-to-government relationship between federally recognized tribes and the NPS due to the concerns expressed by the Rainbow Bridge Native American Consultation Committee (NACC) about potential impacts to Rainbow Bridge, and due to the high level of local interest in the project as indicated during one-on-one site visits by the Glen Canyon NRA tribal liaison to tribal offices. An overview of the government-to-government tribal consultation activities is included to document Glen Canyon NRA activities in compliance with the NHPA and NEPA, and in fulfillment of the stipulations in the 1995 PA between GLCA and signatory tribes.

Letters outlining the proposed project and requesting comments were sent to the Native American tribes that had identified an interest in the Glen Canyon region during the tribal and public scoping period (November 2–December 4, 2007) for the proposed Castle Rock Cut project. In response, Glen Canyon NRA received two letters from tribal authorities—one from the Cultural Resources Manager of the Hopi Tribe and one from the Program Manager of the Navajo Nation Historic Preservation Department–Traditional Cultural Program (HPD-TCP). The Hopi Tribe expressed concerns about completing a project that “seems to only serve as a convenience to the boating public.” The letter sent by the Navajo Nation stated that “HPD-TCP has concluded the proposed undertaking/project area will not impact any Navajo traditional cultural properties or historical properties.”

As a follow-up to the scoping notices and responses received, Glen Canyon’s Native American Liaison attended council meetings held by non-Navajo tribes (Shivwits Paiute Band of Paiute Indians, Kaibab Band of Paiute Indians) as well as meetings held by individual Navajo Nation Chapters (Navajo Mountain, Oljato). The Glen Canyon NRA Native American Liaison, acting as the designated representative of the Superintendent of GLCA, provided updated information on the project and brought back comments and concerns of the tribes (if any) during these meetings. The information, comments, and concerns gathered during these consultation meetings, if substantive and related to the project, have been incorporated into the EA. No consulting tribes identified impacts to cultural or historic resources of concern in the immediate project area. Rather, further consultations highlighted tribal concerns about potential socioeconomic impacts to the Navajo

Mountain Chapter community and potential impacts to Rainbow Bridge as a TCP determined eligible for inclusion on the NRHP.

Aside from the tribal and public scoping processes, and the focused one-on-one meetings between the Glen Canyon Native American liaison and interested tribes and Navajo Nation chapters, the park also consulted with a subset of Native American tribes through the NACC process. This committee meets once a year with NPS staff at NPS headquarters in Page, Arizona, to discuss ongoing and upcoming projects that could have an effect on Rainbow Bridge National Monument.

During the 2007 annual meeting in October, the Castle Rock Cut project was introduced. Discussion about the project was minimal, though the designated representative from the Hopi Tribe objected to the project. This objection was reflected in the letter we received from the Hopi during the public scoping period. On or about November 26, 2007, the Glen Canyon Native American liaison received a call from a representative of the Navajo Nation Historic Preservation Department requesting a meeting of the NACC to discuss concerns forwarded to them from the Navajo Mountain and Shonto chapters. On January 17, 2008, the park received a draft resolution from the Navajo Mountain Chapter opposing the EA for the project. Of particular concern were possible unidentified indirect impacts to Rainbow Bridge National Monument due to a possible increase in visitation and a possible monetary loss at Antelope Point Marina due to a decrease in visitation if the cut were reopened. An NACC meeting was held on February 6, 2008, to specifically discuss these possible impacts of the proposed Castle Rock Cut project.

Specific issues addressed included but were not limited to:

1. Who is the benefactor of the project and is the project a thinly veiled pass-through from Aramark, the park's largest concessioner?
2. Will the project cause an impact to Rainbow Bridge National Monument due to increased visitation?
3. Will the Navajo Nation lose revenue from Antelope Point Marina if the cut is opened?
4. What is the ultimate depth of the cut?

Each of these issues is summarized below and is more fully discussed in various resources topic sections in the EA.

1. The boating public was the instigator of the project and would be the main benefactor, saving time and fuel costs to reach uplake destinations. Both concessioners, Aramark and Antelope Point Marina, LLC (and as a partner with Antelope Point Marina, LLC, the western chapters of the Navajo Nation), would benefit financially if the cut helped boost visitation to the lake. The NPS would benefit by reducing staff time and fuel costs to access uplake locations. All individuals using the lake would benefit by the reduced time it took emergency services to reach uplake locations.
2. Though visitation to Glen Canyon NRA and Rainbow Bridge National Monument has been declining for a number of years, the closure of Castle Rock Cut due to low water in 2003 probably had influenced that downturn, along with rising fuel prices and other less tangible reasons. Therefore, opening the cut during times of low water, thereby increasing the number of daily boat tours, would probably result in restoration of previous visitation levels to Rainbow Bridge. Glen Canyon NRA will continue to control the number of visitors at any one time to

Rainbow Bridge through the dock system and scheduling of concession boat tours, in keeping with the 1993 Rainbow Bridge National Monument GMP. The dock and tour scheduling system are managed within the carrying capacity requirements of the 1993 Rainbow Bridge National Monument GMP and subsequent PA. As such, though the project is likely to increase the number of visitors to Rainbow Bridge National Monument compared with recent years, the visitation will be managed so that it does not exceed the "people at one time" thresholds identified in consultation with tribes and identified in the existing Rainbow Bridge National Monument GMP.

3. The manager of the Antelope Point Marina, LLC, participated in the consultation and reported that most of the revenue that Antelope Point Marina, LLC, generates is from the rental of houseboats, slips, and speedboats. Very little is gained from those passing through the Channel in front of the marina. Marina management has speculated that easing the rough water in the Channel by rerouting traffic through the cut, as well as an expected increase in general visitation to the lake due to the cut being opened, would have the effect of increasing revenue, which would increase the amount the western chapters of the tribe receive. As a result, the Navajo Mountain Chapter indicated that the chapter would revisit the resolution opposing the Castle Rock Cut project to reflect the information provided by the operator of Antelope Point Marina, LLC, a Navajo Nation enterprise.
4. The EA will allow the cut to be excavated to a level of 3,580 feet.

Following the focused discussion addressing the preceding issues, the NACC went into an executive session to further discuss the project. The consensus feedback given to the NPS at the close of the meeting indicated that the tribes did not oppose the project. The Navajo Mountain Chapter indicated that the chapter would be revisiting the resolution and official response related to the proposed project in light of the information shared at the meeting and that a favorable response was anticipated. None of the designated tribal representatives representing the consulting NACC tribes expressed disagreement with the project at the close of the meeting, with the understanding that the provisions of the 1993 Rainbow Bridge National Monument GMP and 1995 PA would continue to be met by all parties.

To date, Glen Canyon NRA has not received correspondence from the consulting tribes in follow-up to the February 6, 2008, NACC consultation. Glen Canyon NRA is committed to continuing government-to-government consultation on the proposed project, as requested, in compliance with the NHPA, NEPA, and in fulfillment of the stipulations in the 1995 PA between Glen Canyon NRA and signatory tribes. Information about future consultations, including dates, participating tribes, and data collected concerning resources of mutual interest to Glen Canyon NRA and the consulting tribes will continue to inform the planning efforts for the proposed project. As such, tribal consultation is ongoing.

## Environmental Assessment Review and List of Recipients

The EA will be released for public review in February 2008. To inform the public of the availability of the EA, the NPS will publish and distribute a letter or press release to various agencies, tribes, and members of the public on Glen Canyon NRA's mailing list. Copies of the EA will be provided to interested individuals upon request. Copies of the document will also be available for review at Glen Canyon NRA and on the Internet at <http://parkplanning.nps.gov>.

The EA is subject to a 30-day public comment period ending March 19, 2008. During this time, the public is encouraged to submit written comments to the NPS address provided at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed prior to the release of a decision document. The NPS will issue responses to substantive comments received during the public comment period and will make appropriate changes to the EA as needed.

## List of Preparers

The following individuals participated in the development of this document:

Barbara Wilson, NPS  
Kevin Schneider, NPS  
Tim Windle, NPS  
Mark Anderson, NPS  
John Spence, NPS  
Brian Sweatland, NPS  
Cheryl Eckhardt, NPS  
Christine Landrum, NPS  
Lindy Mihata, NPS  
Donald C. Smith, EcoPlan Associates, Inc.  
William Davis, EcoPlan Associates, Inc.  
J. Simon Bruder, EcoPlan Associates, Inc.  
Thomas C. Ashbeck, EcoPlan Associates, Inc.  
Michele Waltz, EcoPlan Associates, Inc.  
Tricia Balluff, EcoPlan Associates, Inc.

The following individuals and agencies provided information for use in this document:

Wayne Gustaveson, Utah Division of Wildlife Resources  
Katrina Grantz, Reclamation



## REFERENCES

- Geib, Phil R. 1996. Archaic Occupancy of the Glen Canyon Region. In *Glen Canyon Revisited*. University of Utah Anthropology Papers No. 119, Salt Lake City.
- Gustaveson, Wayne. 2007. UDWR. Provided fisheries information regarding Lake Powell. Personal communication, December 3, 2007.
- Hill, M. 2005. NPS, Glen Canyon NRA Web site. Catalog of the vascular plants of the Glen Canyon NRA, Utah and Arizona. <http://www.nps.gov/glca/naturescience/upload/VascularPlantsChecklist.pdf>. Accessed November 29, 2007.
- Jennings, Jesse D. 1966. *Glen Canyon: An Archaeological Summary*. University of Utah Press, Salt Lake City.
- Jones and DeMille Engineering. 2003. *Castle Rock Cut-off Economic Analysis Addendum*. December 2003, Richfield, Utah.
- Mihata, Lindy. 2008. NPS Law Enforcement. Provided safety information regarding the Channel. Personal communication, January 31, 2008.
- NPS. 1979. Glen Canyon NRA/Arizona–Utah Proposed General Management Plan. NPS. U.S. Department of the Interior, July 1979.
- \_\_\_\_\_. 1993. Rainbow Bridge National Monument General Management Plan.
- \_\_\_\_\_. 2003. Final Wahweap Development Concept Plan Environmental Assessment. Glen Canyon NRA, October 2003.
- \_\_\_\_\_. 2006. 2006 NPS Management Policies. <http://www.nps.gov/policy/MP2006.pdf>. Accessed February 5, 2008.
- \_\_\_\_\_. 2007a. Glen Canyon NRA Laws and Policies. <http://www.nps.gov/glca/parkmgmt/lawsandpolicies.htm>. Updated August 13, 2007. Accessed December 4, 2007.
- \_\_\_\_\_. 2007b. Checklist of Mammals found in Glen Canyon NRA. <http://www.nps.gov/glca/naturescience/upload/MammalChecklist.pdf>. Accessed November 29, 2007.
- \_\_\_\_\_. 2007c. Checklist of birds found in Glen Canyon NRA. <http://www.nps.gov/glca/naturescience/upload/bird%20checklist%20booklet.pdf>. Accessed November 30, 2007.
- \_\_\_\_\_. 2007d. Checklist of reptiles found in Glen Canyon NRA. <http://www.nps.gov/glca/naturescience/upload/ReptileChecklist.pdf>. Accessed November 30, 2007.
- \_\_\_\_\_. 2007e. Checklist of amphibians found in Glen Canyon NRA. <http://www.nps.gov/glca/naturescience/upload/AmphibianChecklist.pdf>. Accessed November 30, 2007.
- \_\_\_\_\_. 2008. <http://www.nps.gov/glca/historyculture/people.html>. Accessed February 15, 2008.

- Reclamation. 2007a. Lake Powell, Upper Colorado Region Water Operations Historic Lake Levels December 1963–November 2007. [www.usbr.gov/uc/crsp/download/feet-1196445509313.lst](http://www.usbr.gov/uc/crsp/download/feet-1196445509313.lst). Accessed November 29, 2007.
- \_\_\_\_\_. 2007b. Upper Colorado Region Water Operations: Current Status: Lake Powell. [www.usbr.gov/dataweb/dams/az10307.htm](http://www.usbr.gov/dataweb/dams/az10307.htm). Accessed November 30, 2007.
- \_\_\_\_\_. 2007c. Lake Powell Protected Elevations. Obtained December 6, 2007.
- Salt Lake Tribune. 2008. [http://www.sltrib.com/outdoors/ci\\_8043024](http://www.sltrib.com/outdoors/ci_8043024). Accessed February 15, 2008.
- Schreyer, Sarah, and Deil R. Lundin. 2008. *A Cultural Resources Survey of the Castle Rock Cut Located within Glen Canyon National Recreation Area, Kane County, Utah*. Cultural Resource Survey Report No. 07-095. EcoPlan Associates, Inc., Mesa, Arizona.
- Sproul, David Kent. 2001. *A Bridge between Cultures: An Administrative History of Rainbow Bridge National Monument*. Intermountain Region, NPS, Denver.
- Turner, R.M. 1994. Great Basin desertscrub. In *Desert Plants, Biotic Communities of the American Southwest—United States and Northwestern Mexico*, edited by D.E. Brown. 4(1–4):145–155.
- UDWR 2007a. Utah Division of Wildlife Resources Web site. Known distribution: Southwestern willow flycatcher. <http://dwr.cdc.nr.utah.gov/rsgis2/search/Map.asp/ld=262>. Accessed November 23, 2007.
- \_\_\_\_\_. 2007b. Utah Division of Wildlife Resources Web site. Known distribution: Mexican spotted owl. <http://dwr.cdc.nr.utah.gov/rsgis2/search/Map.asp/ld=413>. Accessed November 23, 2007.
- \_\_\_\_\_. 2007c. Utah Division of Wildlife Resources Web site. Known distribution: California condor. <http://dwr.cdc.nr.utah.gov/rsgis2/search/Map.asp/ld=281>. Accessed November 23, 2007.
- Wilson, Barbara. 2008. Glen Canyon NRA Environmental Specialist. Provided information on recent archaeological sites discovered along the shoreline of Lake Powell. Personal communication, February 15, 2008.