# United States Department of the Interior

NATIONAL PARK SERVICE
Glen Canyon National Recreation Area
P.O. Box 1507
Page, Arizona 86040

TAKE PRIDE IN AMERICA

Dear Interested Party:

Accompanying this letter is a copy of the Draft Uplake Development Concept Plan (DCP) / Environmental Assessment (EA) for Bullfrog, Halls Crossing and Hite development districts at Glen Canyon National Recreation Area (NRA). The National Park Service uses DCPs to plan future facilities necessary to meet the park objectives while ensuring the protection of resources, park values, and recreation opportunities consistent with the park's enabling legislation, purpose, mission, and goals. Previous plans for these uplake areas were completed in the mid-1980's and needed updating to address current and anticipated issues affecting the management for these areas. Once finalized, the DCP will guide development for approximately 15 to 20 years.

Over the last several years, Glen Canyon NRA has experienced varying numbers of visitors, drought, and unprecedented changes in lake levels. Lower lake levels have affected the location and access to water-based facilities lake wide. Effects of lower lake levels necessitates our need to evaluate the viability and location of future facilities and services, changing visitor needs and expectations, and carrying capacity issues on Lake Powell when lake conditions change.

The DCP alternatives portion of this document describes a range of actions for future development. The EA sections evaluate the alternatives in terms of potential impacts to the natural and cultural environment. Alternative A, the no-action alternative, describes current facilities and uses that have been implemented under previously approved planning and compliance. Alternative B proposes changes to the current facilities including upgrades and the establishment of development maximums for specific facilities to address future needs. Alternative C includes many of the same proposals described in Alternative B along with additionally specific improvements or changes in facility expansion limits.

We welcome your review and comments during the public comment period from July 18 through August 18, 2006. The document is available in electronic format on the internet at http://parkplanning.nps.gov or on compact disk by request. Printed copies are also available at the following public locations:

Regional Libraries: Salt Lake City Public Libraries, Washington County Public Library (St. George, UT), Kanab Public Library, Grand County Public Library (Moab, UT), San Juan County Public Libraries (Monticello & Blanding, UT), Mesa County Public Libraries (Grand Junction, CO), Wayne County Public Library (Bicknell, UT), and Page Public Library.

Other Locations: Bullfrog Visitor Center, Grand Staircase-Escalante Visitor Center (Kanab, UT), Escalante Interagency Visitor Center, Carl Hayden Visitor Center (Page, AZ), Glen Canyon NRA Headquarters (Page, AZ).

If you wish to comment on the Draft Uplake Development Concept Plan / Environmental Assessment you may mail comments to the name and address below or post comments online at *http://parkplanning.nps.gov*. The plan and environmental assessment will be on public review for approximately 30 days. Our practice is to make comments, including names, home addresses, home phone numbers, and email addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc., but if you wish us to consider withholding this information you must state this prominently at the beginning of your comments. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute a clearly unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documentable circumstances, this information will be released. We will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives of or officials of organizations or businesses, available for public inspection in their entirety.

Please address comments to Glen Canyon National Recreation Area, ATTN: GLCA Draft Uplake DCP/EA at PO Box 1507 in Page, AZ 86040. For more information about this project, please contact the park at 928-608-6200. Thank you for your time and interest in Glen Canyon National Recreation Area.

Sincerely,

Kitty L. Roberts
Superintendent

National Park Service
U.S. Department of the Interior

Glen Canyon National Recreation Area

# Draft Uplake Development Concept Plan / Environmental Assessment

## July 2006

**U.S. Department of the Interior**
**National Park Service**

# Draft Uplake Development Concept Plan / Environmental Assessment

**Glen Canyon National Recreation Area**
**Garfield, Kane, and San Juan Counties, Utah**

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## Abstract


Glen Canyon National Recreation Area (NRA) encompasses more than 1.2 million acres of land and water in northern Arizona and southeastern Utah. The principal feature of the area is Lake Powell, which was formed by construction of Glen Canyon Dam on the Colorado River in 1963. To implement development within Glen Canyon NRA, the National Park Service uses development concept plans (DCPs) to define the facilities and activities necessary to meet the general goals and objectives set forth in the general management plan. This DCP provides guidance for development for approximately 15 to 20 years. The project area covered in this planning effort includes three marinas (Bullfrog, Halls Crossing, and Hite) within Glen Canyon NRA, spanning three counties in Utah. Collectively, theses areas are referred to as the uplake area.

Subsequent to development of previous DCPs, the uplake area within Glen Canyon NRA has experienced periods of changing visitation patterns, drought, and unprecedented changes in lake levels. A general reduction in annual visitation during recent drought years, along with changes in visitor needs and expectations, contribute to the need to update long-range planning for uplake areas. Lower lake levels have affected the location and access to water-based facilities and prompted the need to evaluate future facilities and services when low water lake conditions occur. The overall purpose of the Draft Uplake Development Plan / Environmental Assessment is to evaluate a range of alternatives for the future management of the uplake marinas and associated developed areas at Bullfrog, Halls Crossing, and Hite (Uplake DCP) to ensure the protection of NRA resources and values while offering recreation opportunities as provided in Glen Canyon NRA enabling legislation, purpose, mission, and goals.

This environmental assessment evaluates three alternatives for future development in the uplake areas. Alternative A, the no-action alternative, describes and evaluates current facilities and uses that are in place or currently funded for construction based on existing approved plans and amendments. Alternative B (preferred alternative) proposes changes to current facilities to address future needs through upgrades and defined maximum expansion of specific facilities. Alternative C includes many of the same proposals described in alternative B, with additionally specific improvements or facility expansion.

Alternative B is the National Park Service proposed action and the environmentally preferred alternative. The majority of predicted adverse impacts under alternative B would result from construction of new and expanded facilities. All short-term adverse impacts are predicted to be negligible to minor and adverse.

Long-term adverse impacts would be negligible to minor for geology and soils, water resources (waters of the United States, including wetlands and floodplains), wildlife, threatened and endangered species and species of concern / designated critical habitat, visual resources, archeological resources, and ethnographic resources. Long-term minor to moderate adverse impacts would occur to air quality. Long-term adverse impacts to soundscapes would vary seasonally with levels of human-caused sound, and would range from negligible to moderate. Long-term adverse impacts to vegetation would be moderate.

Construction of new facilities or improvements to existing facilities would also result in short- and long-term beneficial impacts. Short-term beneficial impacts to socioeconomics would be minor. Long-term beneficial impacts would generally range from negligible to minor to vegetation, visual resources, park operations, public health and safety, and transportation. Long-term beneficial impacts may reach moderate levels for visitor use and experience, and socioeconomics.

## Notes to Reviewers and Respondents

If you wish to comment on the Draft Uplake Development Concept Plan / Environmental Assessment, you may mail comments to the name and address below or you may post comments online at http://parkplanning.nps.gov/. The DCP and environmental assessment will be on public review for 30 days. Our practice is to make comments, including names, home addresses, home telephone numbers, and e-mail addresses of respondents, available for public review. Individual respondents may request that we withhold their names and/or home addresses, etc.; however, if you wish us to consider withholding this information, you must state this prominently at the beginning of your comments. In addition, you must present a rationale for withholding this information. This rationale must demonstrate that disclosure would constitute a clearly unwarranted invasion of privacy. Unsupported assertions will not meet this burden. In the absence of exceptional, documentable circumstances, this information will be released. We will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

Please address comments to:

Glen Canyon National Recreation Area
ATTN: GLCA Uplake DCP/EA
PO Box 1507
Page, AZ 86040

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| amsl | Above Mean Sea Level |
| ARAMARK | ARAMARK Sports and Entertainment Services, Inc. |
| BLM | Bureau of Land Management |
| BMP | Best Management Practice |
| BAOT | Boats At One Time |
| BP | Before Present |
| CCLR | Carrying Capacity Launch Rates |
| CFR | Code of Federal Regulations |
| dB | Decibel |
| dBA | A-Weighted Decibel |
| DCP | Development Concept Plan |
| EA | Environmental Assessment |
| EPA | U.S. Environmental Protection Agency |
| GMP | Glen Canyon National Recreation Area General Management Plan and Environmental Impact Statement, 1979 |
| NAAQS | National Ambient Air Quality Standards |
| NAGPRA | Native American Graves Protection and Repatriation Act of 1990 |
| NEPA | National Environmental Policy Act of 1969 |
| NPS | National Park Service |
| NRA | National Recreation Area |
| NRHP | National Register of Historic Places |
| PL | Public Law |
| ROS | Recreational Opportunity Spectrum |
| RRU | Recreation and Resource Utilization |
| RV | Recreational Vehicle |
| SH | State Highway |
| SHPO | State Historic Preservation Office |
| Typ. | Typical |
| UDOT | Utah Department of Transportation |
| Uplake | Uplake Districts of Lake Powell |
| Uplake DCP | Uplake Districts of Lake Powell included in the Development Concept Plan |
| USACE | U.S. Army Corps of Engineers |
| USC | United States Code |
| USFWS | U.S. Fish and Wildlife Service |

# Purpose and Need

# PURPOSE AND NEED

## INTRODUCTION

Glen Canyon National Recreation Area (NRA) encompasses more than 1.2 million acres of land and water in northern Arizona and southeastern Utah. The southern boundary is contiguous with Navajo Nation lands. Other boundaries adjoin Grand Canyon National Park, Capitol Reef National Park, Canyonlands National Park, and Rainbow Bridge National Monument, all managed by the National Park Service (NPS). The recreation area also adjoins areas administered by the Bureau of Land Management (BLM), including Grand Staircase–Escalante National Monument and Vermilion Cliffs National Monument (which includes the Paria Canyon Wilderness).

The principal feature of the area is Lake Powell, which was formed by the Glen Canyon Dam on the Colorado River. At full pool, approximately 3,700 feet above mean sea level (amsl), the lake occupies approximately 163,000 surface acres, with about 1,960 miles of shoreline. The reservoir stores approximately 27 million acre-feet of water.

Glen Canyon NRA provides boating, fishing, hiking, and camping opportunities to approximately 2 million people per year. As shown in figure 1, recreational activities and supporting facilities are concentrated at six developed areas: Antelope Point, Bullfrog, Dangling Rope, Halls Crossing, Hite, and Wahweap. This development concept plan (DCP) includes proposed management actions for three of these areas: Hite, Halls Crossing, and Bullfrog (Uplake DCP).

## PURPOSE AND SIGNIFICANCE OF GLEN CANYON NATIONAL RECREATION AREA

National park system units are established by Congress to fulfill specific purposes based on the unit's unique resources. A unit's purpose, as established by Congress, is the foundation on which later management decisions are based to conserve resources while providing for the enjoyment of future generations. The purpose and significance of Glen Canyon NRA and its broad mission goals are derived from its enabling legislation and are summarized in the *Glen Canyon National Recreation Area General Management Plan and Environmental Impact Statement* (GMP) (NPS 1979) and strategic plan (NPS 2005f).

Glen Canyon NRA was established by enactment of Public Law (PL) 92-593 on October 27, 1972. The legislation defines the purposes of the recreation area: ". . .to provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto. . . and to preserve scenic, scientific, and historic features contributing to public enjoyment of the area" (NPS 1979).

The primary objective of the NRA, as established in the GMP, is ". . . to manage the recreation area so that it provides maximal recreational enjoyment to the American public and their guests" (NPS 1979).

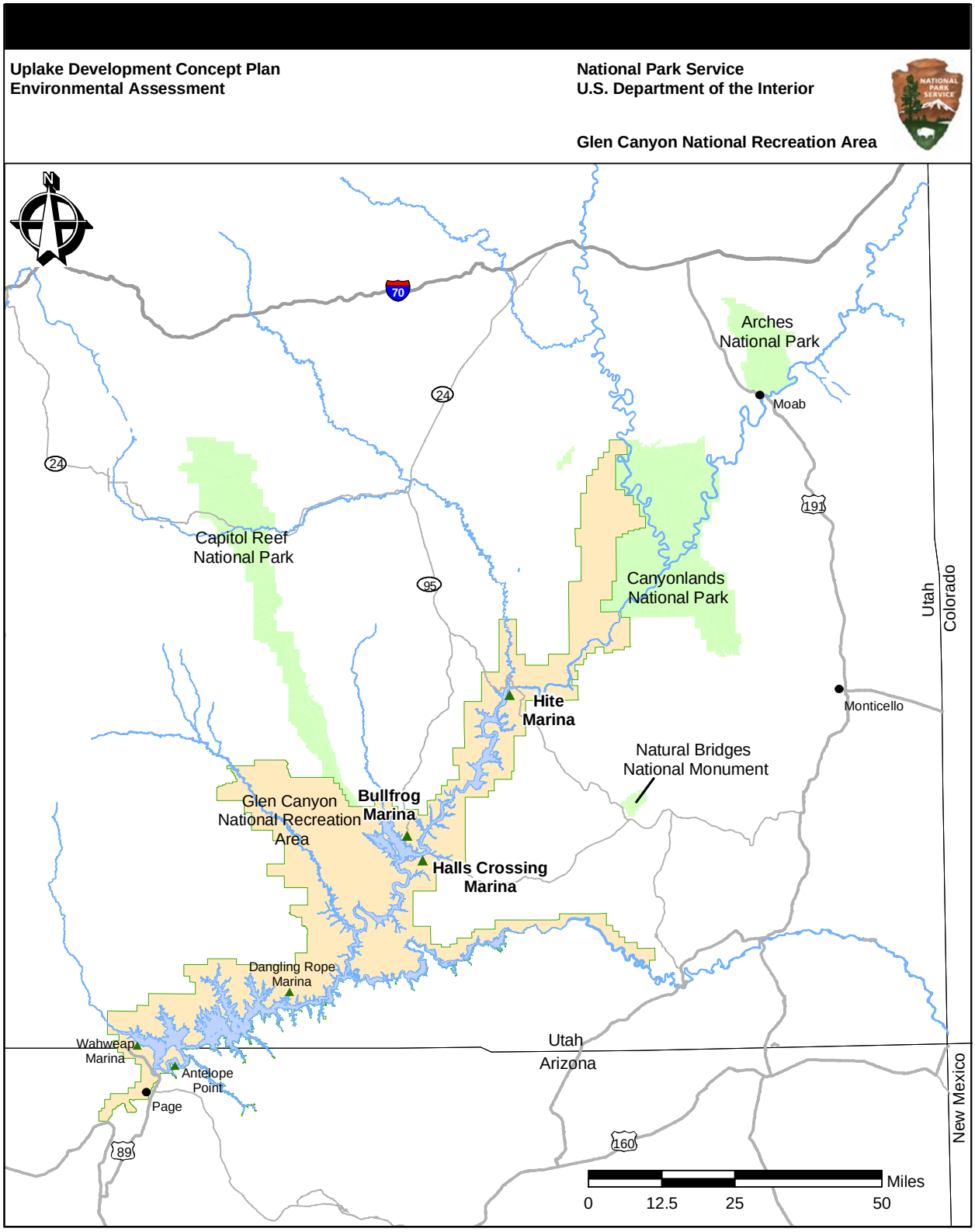



**FIGURE 1. GLEN CANYON NATIONAL RECREATION AREA**

The enabling legislation for Glen Canyon NRA states that "The Secretary shall administer, protect, and develop the recreation area in accordance with the provision of the [Organic Act]. . . and with any other statutory authority available to him for the conservation and management of natural resources" (16 *United States Code* [USC] 459f-5(a)).

This act also specifies that "nothing. . . shall affect or interfere with the authority of the Secretary. . . to operate Glen Canyon dam and reservoir" for the purposes of the Colorado River Storage Project Act, the achievement of which is the responsibility of the Bureau of Reclamation.

As stated in the GMP (NPS 1979) and strategic plan (NPS 2005f), Glen Canyon NRA is important because of the following:

- Glen Canyon NRA offers a tremendous diversity of both water- and land-based recreational opportunities.
- Glen Canyon NRA contains Lake Powell, the second-largest human-made lake in North America, which provides both a unique opportunity to recreate in a natural environment and a transportation corridor to remote backcountry areas of Glen Canyon NRA.
- Glen Canyon NRA is in the heart of the Colorado Plateau region, which offers a unique combination of water and desert environments. It offers a natural diversity of rugged water- and wind-carved canyons, buttes, mesas, and other outstanding physiographic features.
- The climate and physical features of Glen Canyon NRA have created local environments favorable to the preservation of scientifically valuable objects, sites, populations, habitats, or communities that are important in and of themselves, or provided opportunities to add to our understanding of past or ongoing events.
- Evidence of 11,000 years of human occupation and use of resources within Glen Canyon NRA provides a continuing story of prehistoric, historic, and present-day affiliation of humans and their environment.
- Glen Canyon NRA constitutes a substantial part of the outstanding public lands of the Colorado Plateau.

## PURPOSE AND NEED FOR ACTION

To implement development within Glen Canyon NRA, the National Park Service uses DCPs that build on the general goals and objectives set forth in the GMP. The DCPs provide guidance for development for an approximate 15- to 20-year period. This planning effort will guide future development of the three marinas: Bullfrog, Halls Crossing, and Hite (figure 2). Collectively, the area containing these three marinas is referred to as the uplake area.

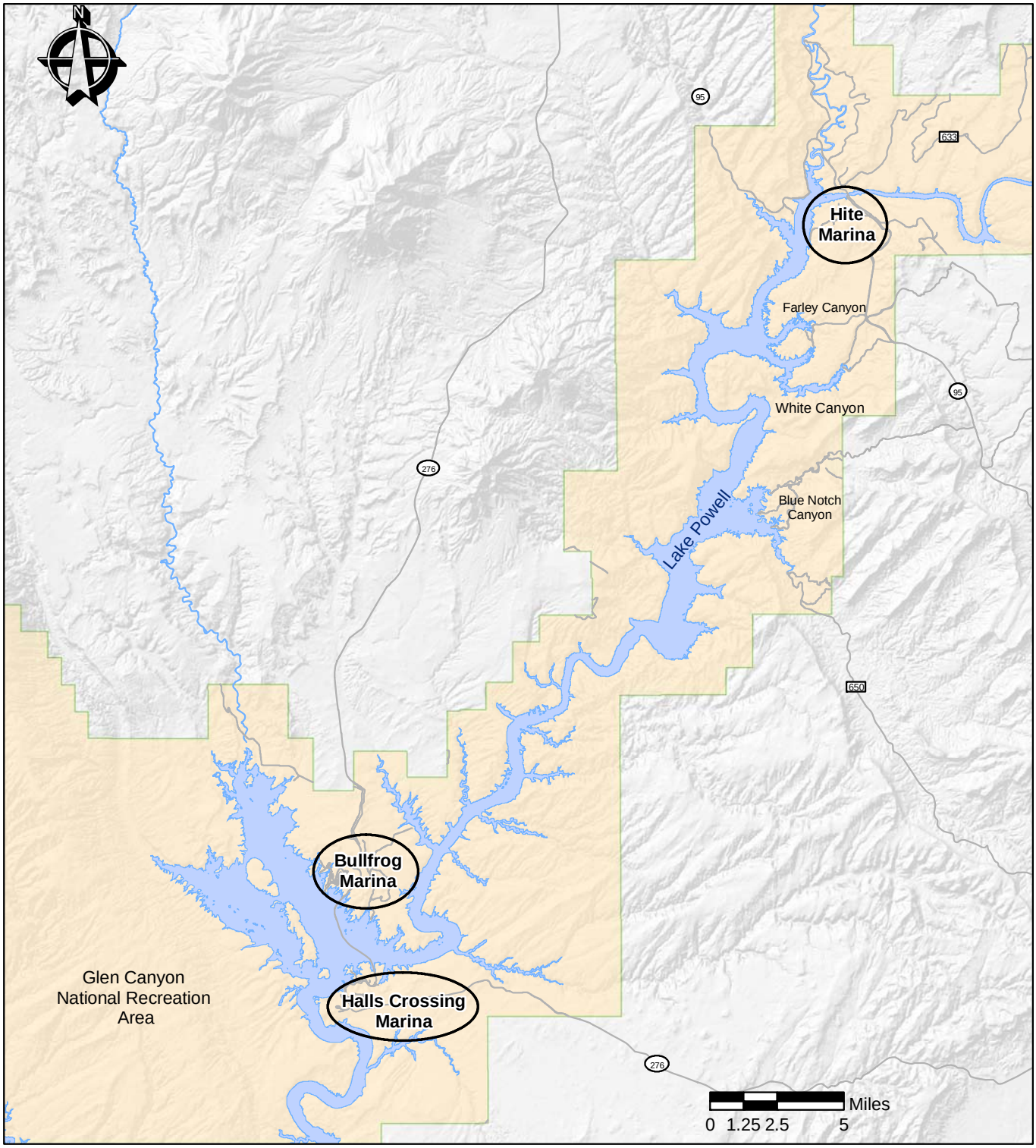



FIGURE 2. UPLAKE DEVELOPED AREAS

Previous plans have been prepared for Bullfrog, Halls Crossing, and Hite developed areas. The most recent DCP for the Hite area was completed in August 1983. A joint DCP for Bullfrog and Halls Crossing was approved in May 1985, and amended in September 1985. Minor updates have occurred since—the most recent for Bullfrog in January 1990.

Subsequent to development of the previous DCPs, the uplake areas within Glen Canyon NRA have experienced periods of increased visitation, drought, and unprecedented low lake levels. Changes in visitation and user demands, and low lake levels that affect water-based facilities, require evaluation of future service needs and anticipated physical limitations.

The Uplake DCP is needed to:

- Determine how to provide future visitor access to the uplake developed areas and tributaries at varying lake levels.
- Determine the need for and scope of additional visitor services in the uplake developed areas in order to address changes in visitation numbers and visitor expectations.
- Consider the impacts of fluctuating lake levels on visitor access and the provision of services.
- Evaluate the impacts of existing developments on the resources within the uplake developed areas.

The overall purpose of the Uplake DCP is to evaluate a range of alternatives for the future management of the uplake marinas and associated developed areas at Bullfrog, Halls Crossing, and Hite to ensure the protection of NRA resources and values while offering recreation opportunities as provided for in the NRA's enabling legislation, purpose, mission, and goals.

To address uplake needs and meet the overall purpose of the Uplake DCP, the following objectives were developed through the planning process:

- Continue to provide visitor access to the uplake areas and tributaries.
- Provide opportunities for a variety of visitor experiences at the uplake areas.
- Provide necessary and appropriate visitor services at the uplake areas, consistent with current and anticipated visitation.
- Accentuate different types of services at each developed area.
- Design facilities and services within uplake developed areas to accommodate fluctuating lake levels.
- Guide efficient and effective organization of services within uplake developed areas.

This DCP / environmental assessment (EA) is being prepared to analyze the proposed action and alternatives and their impact on the environment. The EA is incorporated into the DCP, as appropriate. The EA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), the National Historic Preservation Act of 1966, and regulations of the Council on Environmental Quality (40 *Code of Federal Regulations* [CFR] 1508.9).

## RELATIONSHIP OF THE PROPOSED ACTION TO OTHER PLANNING EFFORTS

A variety of NPS, federal, and state plans, policies, and actions influence management of the uplake developed areas and development of the DCP. The most pertinent plans and policies are summarized as follows:

**General Management Plan 1979.** The Glen Canyon NRA operates under the management goals and objectives set forth in the GMP (NPS 1979). The GMP is the foundation of previous DCPs for the uplake developed areas and will continue to be used for development of this DCP. Any proposals in this DCP must be consistent with and supported by the GMP.

**The Carrying Capacity of Lake Powell: A Management Analysis of Capacity for Boater Recreation.** The 1987 study identified carrying capacity limits on Lake Powell at full pool based on specific criteria and distribution over 13 visitor use zones. The focus of the study was to develop recommended maximum launch rates to protect lake shoreline, water quality, boater safety, and other limited resources (NPS 1987). Supplemental calculations to this study were prepared for this planning effort to evaluate Lake Powell carrying capacity in the uplake visitor use zones (6-13) at varying water levels using the same methodology as the 1987 study. These calculations provide updated recommended maximum carrying capacity launch rates when Lake Powell water levels fluctuate due to drought. Further discussion and a summary of findings are found in the "Supplemental Calculations and Analysis for Lake Powell Carrying Capacity" section.

**Bureau of Reclamation Annual Reservoir Operations Plan and Environmental Impact Statement.** Section 602 of the Colorado River Basin Project Act requires the Bureau of Reclamation to prepare an operations plan each year. Glen Canyon Dam is managed primarily to meet statutory water delivery obligations, with consideration given to maintaining or improving instream flow for aquatic resources. The annual plan, which varies according to anticipated hydrologic conditions and other factors, has a substantial influence on water levels at Lake Powell.

**Personal Watercraft Environmental Impact Statement and Rule-Making 2003.** This document concerned the use of personal watercraft at Glen Canyon NRA. The final document allows personal watercraft use in the recreation area under a special regulation with additional management restrictions.

**Environmental Assessment and Management / Development Concept Plan for Lake Powell's Accessible Shorelines, April 1988.** The accessible shorelines plan outlined shoreline recreation use areas that would be designated for day use and overnight camping and developed general and site-specific management strategies.

**Natural Resource Management Plan, June 1986.** The Natural Resource Management Plan provides an overview of strategies to manage natural resources within Glen Canyon NRA as they relate to specific projects and identified problems.

**Development Concept Plans.** In addition to the aforementioned planning efforts, the development of this document was guided by past DCPs for the three uplake developed areas. These past plans include the following documents:

- Environmental Assessment / Development Concept Plan for Hite Developed Area, November 1982
- Environmental Assessment / Development Concept Plans for Bullfrog Basin and Halls Crossing Development Zones, Rocky Mountain Region, May 1985
- Amended Development Concept Plan, Bullfrog Basin, September 1985
- Amended Development Concept Plan, Halls Crossing, September 1985
- Revision of Bullfrog Development Concept Plan, Internal Memorandum, January 1990

## PUBLIC INVOLVEMENT

NEPA requires that federal agencies make a diligent effort to involve the interested and the impacted public before making decisions affecting the environment. To inform the public, project scoping is initiated in the beginning of the planning process to solicit comments about a proposed project. The National Park Service sent out project scoping brochures to a mailing list of approximately 1,800 names comprised of individuals known to have interest in Lake Powell in general, or that use the uplake developed areas in particular. A copy of the scoping brochure is included in Appendix A: Public Involvement.

Two public scoping workshops were conducted in February 2004. One was held in Bullfrog, Utah, and the other in Grand Junction, Colorado (figure 3). These meetings were conducted in an open house format with NPS personnel available at map stations, which addressed various aspects of the planning process and gave the public an opportunity to provide input.


**FIGURE 3. GRAND JUNCTION PUBLIC MEETING**

Approximately 69 people attended the Grand Junction meeting and approximately 18 people attended the Bullfrog meeting. A total of 156 comments were received by letter, e-mail, and in person at the public workshops.

Project scoping was also conducted with affiliated tribes by the NPS American Indian liaison at monthly tribal meetings and via project correspondence. Project updates were presented at regular tribal meetings and are summarized in the "Consultation and Coordination" section of this document, along with meeting minutes in Appendix D: Consultation.


**FIGURE 4. OPEN HOUSE EVENTS AT LAKE POWELL**

A series of open house events were held in July 2004, at various locations in the Bullfrog and Halls Crossing developed areas. These informal sessions offered visitors using the uplake facilities an opportunity to look at maps, consider preliminary issues, and offer input on the effect of low water conditions on their Lake Powell experience (figure 4).

A second newsletter with updated schedule information and draft project alternatives was sent to a revised mailing list of approximately 2,400 individuals, agencies, and organizations in August 2004 (appendix A).

As a result of the public involvement process, the following issues were identified:

- access limitations to water-based facilities at variable lake levels
- long-range impacts of siltation
- extent and scale of facilities available at specific marina areas
- traffic congestion and parking limitations at all marinas
- maintenance and extension of launch ramps
- protection of water quality
- availability of water-based restroom / pump-out facilities
- separation of houseboat rentals from other boat storage

## Visitor Survey

The impact of the regional drought continues to have a fundamental effect on water-based access to developed area facilities. To understand the impacts of changing lake levels on visitors and develop supplemental calculations for the carrying capacity at lower lake levels, a visitor survey was prepared. The survey was conducted in May through June 2005. The visitor survey was sent to a random sampling of 500 persons on mailing lists comprised of boaters

who rent slips, secured storage space, or buoys; individuals on NPS or concessioner mailing lists; independent business partners with the NRA; and public information lists used for mailing information notices on past NRA planning efforts. The National Park Service received 328 responses. An excerpted summary of the 2005 visitor survey report can be found in appendix E. The complete visitor survey report is available on the National Park Service Web site at: http://park planning.nps.gov. Key points derived from the visitor survey were considered in the planning of this DCP.

- Nearly 75% of respondents indicated they would be willing to accept seeing and/or hearing more people on Lake Powell if lake access is limited. Nearly 30% of all respondents indicated they would accept seeing and/or hearing any number of visitors to continue to have lake access.
- 57% of respondents indicated that the amount of time spent waiting in line to launch a boat was a moderate or serious problem.
- Nearly 50% of respondents indicated that the level of noise on the lake was no problem.
- Over 78% of respondents indicated they would support increasing facilities on the shoreline, such as launch ramps, parking, etc.
- Nearly 70% of respondents indicated they would support increasing services on the shoreline such as fueling stations, slips, buoys, etc.
- Over 64% of respondents would support improving public access to the lake.
- Expanding the number of marina slips was supported by 45% of respondents, while only 21% would oppose such an increase.
- Approximately 70% of respondents indicated that litter on the shoreline and finding a beach campsite is a moderate or serious problem.

## ISSUES AND IMPACT TOPICS

Issues and impact topics were identified based on internal and external scoping; current management issues at Glen Canyon NRA; NPS knowledge of limited, easily impacted, or sensitive resources; federal laws, regulations, and executive orders; NPS *Management Policies 2001*; and information contained in the GMP or other NRA-specific planning documents.

Issues identified comprise the primary areas of concern for evaluation in the DCP/EA. Issues have been consolidated into several topics. Many issues presented in this DCP resemble issues studied in previous DCPs. The intent of this DCP is to evaluate the issues in light of current and predicted future conditions for the recreation area and the uplake developed areas, and to describe concurrent needs.

- There is a need to provide water access and water-based facilities that are usable at varying lake elevations—recognizing access limitation created as lake levels change.
- There is a need to provide water- and land-based facilities for visitor use that recognizes visitor needs and NPS support capabilities, while protecting natural and cultural resources in the developed areas.

- There is a need to provide maintenance and administrative facilities, utility systems, and staffing at levels commensurate with use and development of the uplake developed areas.
- There is a need to provide facilities and services to support NPS and concessioner employees and their families.

Specific impact topics were developed for discussion focus and to provide comparison of the environmental consequences of each alternative. A brief rationale for the selection of each impact topic, as well as the rationale for dismissing specific topics from further consideration, follow.

## Impact Topics Selected for Detailed Analysis

### Land Use

Bullfrog, Halls Crossing, and Hite developed areas are located in southern Utah, the uplake district of Glen Canyon NRA. These areas have been designated as developed areas under the GMP (NPS 1979). The alternatives considered in this document may affect present or future land use in the developed areas and surrounding lands. Therefore, land use will be addressed as an impact topic.

### Soils and Geology

Glen Canyon NRA and the associated uplake developed areas are in the Colorado River watershed of southeastern Utah, which is part of the larger Colorado Plateau system. Low-lying areas in the park were inundated by Lake Powell, leaving upland areas that generally consist of rock outcrops and thin soils. Because the proposed action would involve ground-disturbing activities, soils and geology will be addressed as an impact topic.

### Paleontology

Little is known about the paleontological resources of Glen Canyon NRA. Examination of the analysis area by NRA staff determined that there is a potential for paleontological resources within each of the uplake developed areas that could be impacted by development activities (Gillette 2004). Therefore, paleontology will be addressed as an impact topic.

### Air Quality

Section 118 of the 1963 Clean Air Act (42 USC 7401 *et seq.*) requires a park to meet all federal, state, and local air pollution standards. Glen Canyon NRA is designated a class II air quality area under the Clean Air Act, as amended. The Clean Air Act states that the federal land manager has an affirmative responsibility to protect recreation area air quality-related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health)

from adverse pollution impacts. Because air quality could be impacted by decisions made as part of the DCP, air quality will be addressed as an impact topic.

### Water Resources

Lake Powell's importance as a water-based resource requires that water quality be continually monitored. The Clean Water Act and supporting criteria and standards promulgated by the U.S. Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality apply to all surface waters in Glen Canyon NRA. Runoff from developed areas and other discharges are prohibited in Lake Powell to preserve lake water quality. However, changes proposed under the various alternatives could result in the potential for additional water settling areas and, if not properly implemented, could impact water quality. Therefore, water resources will be addressed as an impact topic.

### Waters of the United States, including Wetlands

The U.S. Army Corps of Engineers (USACE) has jurisdiction for the protection of waters of the United States (including wetlands) under section 404 of the Clean Water Act. Waters of the United States are defined as waters that are navigable for interstate commerce and their tributaries. The Colorado River has been identified as a navigable waterway. Additionally, wetlands are defined as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3[b]). Proposed actions that have the potential to adversely impact wetlands would be addressed in a wetlands statement of findings. The developed areas at the uplake marinas include potential wetlands areas. Therefore, waters of the United States and wetlands will be addressed as an impact topic.

### Floodplains

Executive Order 11988 (*Floodplain Management)* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practical alternative exists. Certain construction within a 100-year floodplain requires preparation of a floodplain statement of findings. The 100-year floodplain has been established at the 3,700-foot (amsl) level by the Federal Emergency Management Agency. The developed areas have temporary or portable facilities within the 100-year floodplain. Therefore, floodplains will be addressed as an impact topic.

### Vegetation

NEPA requires an examination of impacts on all components of affected ecosystems. NPS policy is to maintain all components and processes of naturally evolving recreation area ecosystems, including the natural abundance, diversity, and ecological integrity of plants and animals (NPS 2001a). Vegetation has the potential to be impacted as a result of the alternatives under consideration. Therefore, vegetation will be addressed as an impact topic.

### Wildlife

NEPA requires an examination of the impacts on all components of affected ecosystems. NPS policy is to maintain all components and processes of naturally evolving recreation area ecosystems, including the natural abundance, diversity, and ecological integrity of plants and animals (NPS 2001a). Wildlife has the potential to be impacted as a result of the alternatives under consideration. Therefore, wildlife will be addressed as an impact topic.

### Threatened and Endangered Species and Species of Concern / Designated Critical Habitat

The Endangered Species Act of 1973 requires examination of impacts on all federally listed threatened or endangered species. NPS policy also requires examination of the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species. There is habitat for threatened and endangered species within and adjacent to the uplake developed areas. In addition, there is designated critical habitat in the uplake areas. For these reasons, threatened and endangered species and species of concern / designated critical habitat will be addressed as an impact topic.

### Visual Resources

The National Park Service strives to preserve and protect visual resources to ensure a quality visitor experience. Visual resource classes and policies have been outlined by the National Park Service in the GMP (NPS 1979) and NPS *Management Policies 2001*. Alternatives could influence the visual quality and lightscapes of the immediate Bullfrog, Halls Crossing, and Hite developed areas. Therefore, visual resources will be addressed as an impact topic.

### Soundscapes

NPS *Management Policies 2001* (section 4.9) require the agency to preserve, to the greatest extent possible, the natural soundscapes of park units. Directors Order – 47: *Soundscape Preservation and Noise Management* (NPS 2000a) defines appropriate and inappropriate sound. Although most sound-producing activities defined in the alternatives would be consistent with the enabling legislation, the proposed relocation and construction activities could cause impacts. Therefore, soundscapes will be addressed as an impact topic.

### Archeological Resources

The National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*); NEPA; NPS Director's Order – 28: *Cultural Resource Management Guideline* (NPS 1998a); NPS *Management Policies 2001* (NPS 2001a); and Director's Order – 12: *Conservation Planning, Environmental Impact Analysis and Decision-making* (NPS 2001b) require the consideration of impacts on cultural resources either listed or eligible for listing on the National Register of Historic Places (NRHP).

There are archeological resources present within and in close proximity to the developed areas evaluated in this DCP/EA. Therefore, archeological resources will be addressed as an impact topic.

The actions described in this document are subject to section 106 of the National Historic Preservation Act, under the terms of both the 1991 programmatic agreement between the National Park Service and the Advisory Council on Historic Preservation, and the 1995 servicewide programmatic agreement (NPS 1995) between the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. This document would be submitted to the Utah state historic preservation office (SHPO) for review and comment.

### Ethnographic Resources

The National Park Service defines ethnographic resources 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* (Director's Order – 28: *Cultural Resource Management Guideline*, p.191).

Many Glen Canyon NRA resources are considered sacred by American Indians. An area in the vicinity of Halls Crossing has been designated as a traditional cultural property. Because ethnographic resources are known to exist at or in proximity to the analysis area, ethnographic resources will be addressed as an impact topic.

### Visitor Use and Experience

The Glen Canyon NRA receives approximately 2 million visitors per year, with peak visitation occurring during the months of June, July, and August. Visitation and the visitor experience are affected by changing lake elevations and by changes in visitor facilities. Because facility expansion and upgrades included in the alternatives under consideration are intended to improve visitor use and experience at varying lake levels, the topic of visitor use and experience will be addressed as an impact topic.

### Socioeconomic Environment

Activities associated with the alternatives relating to visitor services improvements and operations could directly affect the socioeconomics of the developed areas and surrounding region, including the demand for services in the developed areas, the profitability of commercial services contracts within the recreation area, the demand for services, and economic effects of tourism in adjacent communities. Thus, the socioeconomic environment will be addressed as an impact topic.

### Park Operations

Park operations would be influenced by future development and visitation as a result of implementation of any of the alternatives. Therefore, park operations will be addressed as an impact topic.

### Public Health and Safety

NPS *Management Policies 2001* state that the National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy park units. Further, the National Park Service will strive to protect human life and provide a safe visit (NPS 2001a). Based on the potential for health and safety impacts as a result of activities associated with the alternatives at Bullfrog, Halls Crossing, and Hite developed areas, public health and safety will be addressed as an impact topic.

### Transportation

NPS *Management Policies 2001* (section 9.2) establish guidelines for development, operation, and maintenance of roadways and trails on NPS-managed lands. The alternatives under consideration could impact transportation and change visitor travel and distribution; therefore, transportation will be addressed as an impact topic.

## Impact Topics Dismissed from Further Analysis

### Historic Structures

The National Historic Preservation Act (16 USC 470 *et seq.*), NEPA, the NPS Organic Act, NPS *Management Policies 2001*, Director's Order – 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (2001), and Director's Order – 28: *Cultural Resources Management Guideline* require the consideration of impacts on cultural resources, including historic structures either listed or eligible to be listed on the NRHP. For the purposes of analysis in this DCP/EA, historic resources are those human-made sites, structures, features, or objects that date from the time of the arrival of European Americans in approximately 1850, up to the middle of the 20th century (i.e., at least 50 years of age). Historic sites, by definition, can be of American Indian association, but are most often associated with European American use and occupation.

Glen Canyon NRA's historic resources include historic structures, trails, cultural landscapes, and archeological sites. The following NRHP-eligible historic properties and districts are located in the NRA: Wahweap Employee Trailer Village Cabins, Lonely Dell Ranch National Historic District, Defiance House Ruin, Hole-In-The-Rock, and the Davis Pictograph Panel. Glen Canyon NRA contains no national historic landscapes. There are no known historic structures within the areas potentially affected by the Uplake DCP. Therefore, historic structures were dismissed from detailed analysis.

### Cultural Landscapes

A cultural landscape is defined by the National Park Service as ". . .a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values." Cultural landscapes may be expressed in a variety of ways such as patterns of settlement or land use, buildings and structures, systems of circulation and transportation, or parks and open spaces, or any related combination thereof. There is a potential cultural landscape along Hole-in-the-Rock trail outside of the project areas, which may be evaluated in the future for cultural landscape significance. The uplake development areas covered under this DCP/EA do not contain any known cultural landscapes; therefore, this topic was dismissed from detailed analysis.

### Museum Collections

The actions described in this DCP / EA are subject to Director's Order – 24: *NPS Museum Collections Management* (NPS 2000b). Museum collections are exhibited at the visitor centers at the developed areas; however, the visitor centers are not proposed for change under the DCP. Therefore, museum collections were dismissed from detailed analysis.

### Wild and Scenic Rivers, Other Unique Natural Areas

The areas of Glen Canyon NRA that would be affected by alternatives considered in this DCP/EA do not contain wild and scenic rivers or other unique natural areas as referenced in 40 CFR 1508.27. Therefore, this topic was dismissed from detailed analysis.

### Prime and Unique Farmlands

In August 1980, the Council on Environmental Quality directed that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture, Natural Resource Conservation Service, as prime or unique. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other lands, except urban built-up land or water). Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. The soils in the analysis area have not been classified as prime or unique farmlands by the Natural Resource Conservation Service (see discussion under "Soils and Geology"). Thus, the topic of prime and unique farmlands was dismissed from detailed analysis.

### Environmental Justice

Presidential Executive Order 12898 (*General Actions to Address Environmental Justice in Minority Populations and Low-income Populations*) requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their

programs and policies on minorities and low-income populations and communities. According to the EPA, environmental justice is the

> *. . . fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.*

The goal of "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts.

The area surrounding Glen Canyon NRA contains both minority and low-income populations and communities. As a whole, these communities would not be disproportionately and/or adversely affected by the alternatives considered in this plan. Potential impacts to these communities do include socioeconomic opportunities generated by employment and potential business opportunities. These impacts are discussed in the "Socioeconomic Environment" impact section.

The alternatives do not result in any identifiable adverse human health effects or impact the natural environment that would disproportionately affect any minority or low-income population or community because all of the proposed actions fall within the boundary of the NRA. Therefore, environmental justice was dismissed from detailed analysis.

### Indian Trust Resources

Indian trust resources are assets that the United States holds and administers for Indian tribes. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources within Glen Canyon NRA. Therefore, Indian trust resources was dismissed from detailed analysis.

# Alternatives

# ALTERNATIVES

## INTRODUCTION

The "Alternatives" section describes several future development scenarios for the Bullfrog, Halls Crossing, and Hite developed areas. These alternatives were developed to consider a range of management actions for the uplake areas that would address changes in visitation numbers, visitor expectations, and evaluate facilities and operations as lake levels fluctuate due to drought.

Alternative A (the no-action alternative) describes a management action that would continue the present level of facilities and operations to maintain the status quo. The no-action alternative provides a basis for comparing changes in management actions and evaluating the consequences for each alternative. Should the no-action alternative be selected, the National Park Service would continue to manage the facilities and operations as they currently exist, with the exception of construction projects that are actively in progress that were based on decisions approved in previous planning.

Alternatives B and C consider a range of options and changes to the existing facilities and services at Bullfrog, Halls Crossing, and Hite. Alternative B proposes changes to current facilities through upgrades and defined maximum expansion of specific facilities to address future needs. Alternative C includes many of the same proposals described in alternative B with additionally specific improvements or facility expansion.

Table 1 provides a snapshot of most of the components or actions in the alternatives. The river runner takeout and uplake airstrips are described in the no-action alternative narrative following the tables. All other components have expanded descriptions after the tables for further explanation of existing conditions and proposed changes.

Six project objectives are defined under the purpose and need for this project. Table 5 evaluates all three of the project alternatives against these six objectives, providing a rationale for whether each meets, partially meets, or does not meet the objectives. Alternatives B and C have both been determined to meet all six project objectives. Alternative B is the environmentally preferred alternative, as it best meets the six NEPA criteria as illustrated in table 6. Because alternative B meets all six project objectives and is the environmentally preferred alternative, it has been identified as the NPS preferred alternative (and is the proposed action for section 106 compliance). The preferred alternative defines the rationale for the action in terms of resource protection and management, visitor and operational use, costs, and other applicable factors. All actions described in the preferred alternative are consistent with the approved 1979 GMP and related recreation area documents.

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Employee, Concessioner, Partner Housing** | Maintain employee, concessioner, and partner housing at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: 25 NPS units, 173 concessioner units, 8 partner units, 11 concessioner recreational vehicle (RV) sites<br>- Halls Crossing: 8 NPS units, 42 concessioner units<br>- Hite: 6 NPS units, 10 concessioner units, 3 employee RV sites | Upgrade employee, concessioner, and partner housing at Bullfrog, Halls Crossing, and Hite. Provide housing for temporary employees through RV spaces. Improve support facilities.<br>- Bullfrog: Increase up to 4 NPS units (29 total), up to 6 partner units (14 total), up to 24 concessioner units (197 total), up to 13 RV sites (24 total)<br>- Halls Crossing: Increase up to 2 NPS units (10 total), up to 4 concessioner units (46 total), up to 12 RV sites<br>- Hite: No change in numbers | Same as alternative B |
| **Visitor Overnight Accommodations** | Maintain lodge at Bullfrog and family rental units at all uplake developed areas.<br>- Bullfrog: 48-room lodge, 8 family rental units<br>- Halls Crossing: 20 family rental units<br>- Hite: 5 family rental units | Upgrade and increase inventory of lodge and family rental units.<br>- Bullfrog: increase up to 94 visitor accommodation units (150 total)<br>- Halls Crossing: Increase up to 40 family rental units (60 total)<br>- Hite: Increase up to 15 family rental units (20 total) | Same as alternative B |
| **Visitor Camping** | Maintain existing visitor camping at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: 24 RV sites, 78 developed campsites, approximately 88 sites at overflow campground, primitive camping at North and South Bullfrog and Stanton Creek<br>- Halls Crossing: 64 developed campsites, 32 RV sites<br>- Hite: Approximately 25 sites at primitive campground loop, primitive camping along shoreline of the Colorado and Dirty Devil rivers and Farley Canyon on the lake | Increase number of sites and upgrade developed campgrounds. Improve support facilities.<br>- Bullfrog: Increase up to 128 sites (total of 230), consolidate RV and campground in campground location, add support facilities<br>- Halls Crossing: Increase up to 8 RV sites (40 total)<br>- Hite: Convert 25 primitive sites to developed sites, primitive camping along shoreline of the Colorado and Dirty Devil rivers, and Farley Canyon on the lake | - Bullfrog: Same as alternative B<br>- Halls Crossing: Consolidate Halls Crossing RV and campground sites at campground location, add campground amphitheater<br>- Hite: Same as alternative B |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Shower and Laundry Facilities** | Maintain existing shower and laundry facilities at Bullfrog and Halls Crossing.<br>- Bullfrog: Combined visitor and employee facility available<br>- Halls Crossing: Combined visitor and employee facility available, shower facilities for visitor use, laundromat for employees<br>- Hite: No facilities | Upgrade shower and laundry facilities.<br>- Bullfrog: Relocate shower and laundry facilities<br>- Halls Crossing: Relocate all visitor shower and laundry facilities to Village Center<br>- Hite: Add combined visitor and employee shower and laundry facility | - Bullfrog: Same as alternative B<br>- Halls Crossing: Relocate all visitor shower and laundry facilities to campground<br>- Hite: Same as alternative B |
| **Land-Based Stores** | Maintain existing land-based stores at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: Village Center store with snack food, sundries, fuel, and automotive repair<br>- Halls Crossing: Village Center store with snack food, sundries, fuel<br>- Hite: Store with snack food, sundries, fuel, and RV waste disposal station | Upgrade store facilities.<br>- Bullfrog: Upgrade Village Center store, add campground store<br>- Halls Crossing: Upgrade Village Center store<br>- Hite: Upgrade store | Same as alternative B |
| **Land-Based Food Service** | Maintain existing land-based food service at Bullfrog.<br>- Bullfrog: 180-seat restaurant<br>- Halls Crossing: No land-based food service<br>- Hite: No land-based food service | Expand and upgrade land-based food service.<br>- Bullfrog: Increase seating up to 70 (250 total), add second land-based food service facility<br>- Halls Crossing: Add land-based food service<br>- Hite: Add land-based food service at store | Same as alternative B |
| **Day-Use Facilities (picnic areas, restrooms, and shade shelters not designed for overnight camping)** | Maintain existing day-use facilities at Bullfrog and Halls Crossing.<br>- Bullfrog: Day-use facilities located at boat ready area<br>- Halls Crossing: Day-use facilities adjacent to marina, parking area with picnic facilities near ferry access road<br>- Hite: No day-use facilities | Add additional day-use facilities at Halls Crossing and add new facilities to Hite.<br>- Bullfrog: Same as alternative A<br>- Halls Crossing: Add second day-use area<br>- Hite: Add day-use facility, develop partnership with Utah Department of Transportation (UDOT) for upgrades to State Highway (SH) 95 overlook | Same as alternative B |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Ranger Station / Visitor Contact Station and Emergency Facilities** | Maintain existing ranger / visitor contact station and emergency facilities at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: Visitor contact / ranger station / medical clinic, emergency support equipment, and fire station<br>- Halls Crossing: Floating visitor contact / ranger station and first-aid station, temporary helipad, emergency support equipment<br>- Hite: Visitor contact / ranger station, first-aid station, emergency support equipment | Maintain existing facilities with minimal upgrades.<br>- Bullfrog: Same as alternative A<br>- Halls Crossing: Same as alternative A with upgrade to existing helipad<br>- Hite: Same as alternative A | - Bullfrog: Same as alternative B<br>- Halls Crossing: Upgrade existing floating ranger / visitor contact station and emergency facilities and add a land-based visitor / ranger contact station, combine land-based facility with emergency facilities building<br>- Hite: Same as alternative B |
| **Concessioner Boat Maintenance and Repair and Property Maintenance Facilities** | Maintain existing boat maintenance / repair and property maintenance facilities at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: Boat maintenance and repair, warehouse, indoor and outdoor storage, boat wash down, concessioner administration<br>- Halls Crossing: Automotive repair, boat maintenance and repair, warehouse, indoor and outdoor storage, floating boat repair facility<br>- Hite: Boat maintenance and repair, warehouse, indoor and outdoor storage | Relocate and upgrade boat maintenance / repair and property maintenance facilities at Bullfrog and Halls Crossing.<br>- Bullfrog: Relocate boat maintenance and repair and concessioner property maintenance facilities<br>- Halls Crossing: Relocate boat maintenance and repair and concessioner property maintenance facilities<br>- Hite: Same as alternative A | Same as alternative B |
| **Park Service Maintenance Facilities** | Maintain existing NPS maintenance facilities at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: Warehouse building, indoor and outdoor storage<br>- Halls Crossing: Warehouse building, indoor and outdoor storage<br>- Hite: Warehouse building, indoor and outdoor storage | Same as alternative A | - Bullfrog: Relocate maintenance facilities<br>- Halls Crossing: Same as alternative A<br>- Hite: Same as alternative A |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Secured Storage** | Maintain existing secured storage location and size at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: up to 750 outdoor spaces<br>- Halls Crossing: up to 230 outdoor spaces<br>- Hite: up to 107 outdoor spaces | Upgrade secured storage at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: Expand up to 250 spaces (total of 1000), add enclosed facility<br>- Halls Crossing: Relocate secured storage and expand up to 170 spaces (total of 500), add enclosed facility<br>- Hite: Expand up to 53 spaces (total of 160) | Same as alternative B |
| **Utility Systems** | Maintain existing utility systems at Bullfrog, Halls Crossing, and Hite.<br>- Bullfrog: 3 diesel electrical generators and distribution system, 3 water wells and 2 storage tanks with distribution system, water collection and treatment system, propane storage tanks with distribution tanks<br>- Halls Crossing: 3 diesel electric generators with distribution system, 2 water wells and storage tank with distribution system, water treatment and collection system, propane storage tank with distribution system<br>- Hite: 1 diesel generator with distribution system, 1 water well and lake intake system with distribution, water treatment and collection system, propane storage tank with distribution system | Expand utility systems as needed to meet code and demands of new development, supplement power systems with solar, fuel-cell, or alternative power technology, as appropriate.<br>- Bullfrog: Expand as needed<br>- Halls Crossing: Expand as needed<br>- Hite: Expand as needed, replace aboveground water storage tank with below-ground water storage tank | Same as alternative B |
| **Roads and Parking** | Maintain existing access and parking areas at Bullfrog, Halls Crossing, and Hite. | Improve/add roads and parking areas at Bullfrog, Halls Crossing, and Hite as needed to accommodate added or relocated facilities.<br>- Bullfrog: Same as alternative A<br>- Halls Crossing: Improved road to relocated secured storage / property maintenance area<br>- Hite: Unimproved road to primitive shoreline camping | Same as alternative B |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Fee Collection** | Maintain existing fee collection at Bullfrog, Halls Crossing, and Hite.<br><br>- Bullfrog: Fee collection booths, automated fee collection station<br>- Halls Crossing: Fee collection booth, automated fee collection station<br>- Hite: Automated fee collection station | - Bullfrog: Upgrade fee collection booths for accessibility and administrative services<br>- Halls Crossing: Same as alternative A<br>- Hite: Same as alternative A | Same as alternative B |
| **School** | Maintain existing school at Bullfrog. | Upgrade school at Bullfrog to include library building. | Same as alternative B |
| **Boat Wash-Down Area** | Maintain existing boat wash-down areas.<br><br>- Bullfrog: Concessioner boat wash-down area, no public access<br>- Halls Crossing: Concessioner boat wash-down area, no public access<br>- Hite: No boat wash-down area | Upgrade and expand boat wash-down areas.<br><br>- Bullfrog: Add public boat wash-down area<br>- Halls Crossing: Add public boat wash-down area<br>- Hite: Add public boat wash-down area | Same as alternative B |
| **Marina Facilities** | Maintain existing marina facilities at Bullfrog, Halls Crossing, and Hite. Total combined uplake wet moorage up to 1,090 spaces. Total existing rental fleet of 173 boats (runabout/houseboat/personal watercraft).<br><br>- Bullfrog: Wet moorage (slips and buoys) of 672 spaces for rental operations, overnight and courtesy slips, and executive services, slips for concessioner operations, 134 rental boats<br>- Halls Crossing: Wet moorage (slips and buoys) of 418 for rental operations, overnight and courtesy slips, and slips for concessioner operations, 3 rental boats<br>- Hite: Above lake elevation 3,620, courtesy docks, below 3,620, no water-based facilities available at Hite | Expand existing marina facilities at Bullfrog and Halls Crossing. Increase combined uplake wet moorage up to 1,145 spaces, including 16 existing NPS slips. Increase rental boat fleet up to 580 boats (combined runabout/houseboat/personal watercraft).<br><br>Distribution of wet moorage/fleet to be managed between Bullfrog and Halls Crossing as needed for management flexibility and lake level changes.<br><br>- Bullfrog/Halls Crossing: Add up to 55 buoys<br>- Bullfrog/Halls Crossing: Add up to 407 rental boats<br>- Halls Crossing: Add a fishing dock<br>- Hite: Same as alternative A | Expand existing marina facilities at Bullfrog and Halls Crossing. Increase combined uplake wet moorage up to 1,201 spaces, including 16 existing NPS slips. Increase rental boat fleet up to 580 boats (combined runabout/houseboat/ personal watercraft).<br><br>Distribution of wet moorage/fleet to be managed between Bullfrog and Halls Crossing as needed for management flexibility and lake level changes.<br><br>- Bullfrog/Halls Crossing: Add up to 55 buoys and 56 slips<br>- Halls Crossing: Same as alternative B<br>- Hite: Same as alternative A |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Water-Based Food Service** | Maintain existing water-based food service.<br><br>- Bullfrog: No water-based food service available<br>- Halls Crossing: Snack bar<br>- Hite: No water-based food service available | Upgrade/expand water-based food services at Bullfrog and Halls Crossing.<br><br>- Bullfrog: Add water-based food service facility<br>- Halls Crossing: Add water-based food service facility<br>- Hite: No water-based food service | Same as alternative B |
| **Launch Ramps** | Maintain existing launch ramp facilities. (elevations in feet amsl, typ.)<br><br>- Bullfrog: Main ramp: (paved) 150-foot-wide ramp from 3,700 to 3,605, 80-foot-wide ramp from 3,605 to 3,580, and 50-foot-wide old road surface from 3,580<br>- North ramp: (paved) 50-foot-wide section from 3,580 to 3,557<br>- Halls Crossing: (paved) 110-foot-wide section from 3,700 to 3,550<br>- Hite: (paved) 110-foot-wide section from 3,700 to 3,640, and (unpaved) 30-foot-wide section from 3,640 to 3,620; below 3,620 unimproved gravel/dirt route to Colorado River shoreline. | Extend launch ramps to access lower lake levels at Bullfrog and Halls Crossing.<br><br>- Bullfrog: Extend 80-foot width at main ramp to access lower lake levels as needed until topography limits are exceeded<br>- Halls Crossing: same as alternative A: allow unimproved ramp launching "at own risk" until topography limits are exceeded<br>- Bullfrog/Halls Crossing: Add launch ramps and access road when main ramps no longer function, potential expansion areas along shoreline toward main channel (where shown on alternatives maps)<br>- Hite: Same as alternative A | Extend or add launch ramps to access lower lake levels at Bullfrog and Halls Crossing.<br><br>- Bullfrog: Extend 110-foot width at main ramp to access lower lake levels as needed until topography limits exceeded<br>- Halls Crossing: Same as alternative B<br>- Hite: Same as alternative A |
| **Launch Ramp Support** | Maintain existing launch ramp support facilities.<br><br>- Bullfrog: Parking, boat ready area, restrooms, fish cleaning station, staging lane, trash disposal, waste disposal station, shade shelters, weather station, and information kiosk<br>- Halls Crossing: Parking, restrooms, fish cleaning station<br>- Hite: Parking, restrooms, fish cleaning station, porta-potty waste disposal, shade shelter | Same as alternative A | - Bullfrog: Same as alternative A<br>- Halls Crossing: Same as alternative A<br>- Hite: Expand to include land-based pump-out facilities |

**TABLE 1. SUMMARY OF ALTERNATIVES**

| Designation | Alternative A : No-Action Alternative | Alternative B: Preferred Alternative | Alternative C |
|---|---|---|---|
| **Ferry Service** | Maintain existing ferry service/ramps at Bullfrog and Halls Crossing as long as ferry operates (elevations in feet amsl, typ.).<br>- Bullfrog: Main ferry service/ramp from 3,700 to 3,600, temporary ramp area service below 3,600<br>- Halls Crossing: Main ferry service/ramp from 3,700 to 3,580, use main launch ramp from 3,580 to 3,550 | Extend or add ferry service/ramps to access lower lake levels at Bullfrog and Halls Crossing.<br>- Bullfrog: Same as alternative A, adjust docking wedge to accommodate lower lake levels<br>- Halls Crossing: Add ferry service/ramp and access when main ramps no longer function below 3,550, combine with main ramp development along shoreline toward main channel (where shown) | Same as alternative B |

This section includes a discussion of other alternatives considered and dismissed from detailed analysis, a summary table comparing the alternatives to planning objectives, possible mitigation measures for various alternatives, a summary table comparing the environmental consequences of each alternative, and an explanation of the application of the updated analysis for Lake Powell carrying capacity issues considered in this DCP/EA.

## DISTURBED AREA CALCULATIONS

Table 2 outlines the estimated acreage for new development by alternative. Acreage of existing development was calculated using aerial photos. In cases where new development is anticipated (such as an increase in the number of housing units) the acreage of the existing facilities were used to calculate an approximate size for expansion. Site-specific design will guide actual sizes as the final plan is implemented.

In some cases, facilities that may be moved or eliminated from an existing site will show a portion of the land as restored (reclaimed and revegetated). The total development acreage reflects that reduction in disturbed area. In a few plan components development is to be relocated and new structures are proposed in that previously disturbed area. This condition is shown as zero additional disturbance.

Restored acreage in most cases would be reclaimed with native landscaping or revegetated with native seed mixtures from the approved plant materials specific to this park unit.

## ALTERNATIVE A (NO ACTION)

The no-action alternative would allow the continuation of current uses. The no-action alternative describes the existing condition of developed areas at Bullfrog, Halls Crossing, and Hite. Future actions that are currently funded or with a reasonable potential for future funding from the approved DCPs and amendments or other approved directives or construction activities could take place under the no-action alternative. However, the no-action alternative does not include these possible future developments as part of the existing condition. Alternative A does not include operational activities and construction needed to accommodate water levels below 3,550 feet in elevation. These activities would continue to be reviewed on an individual basis, including preparation of the appropriate environmental compliance documents. Elements of the no-action alternative are included on figures 5, 6, and 7 for Bullfrog, Halls Crossing, and Hite, respectively. Table 1 contains a synopsis of the no-action alternative with complete descriptions in the following discussion.

**TABLE 2. CHANGES AND COMPARISONS IN DEVELOPMENT/DISTURBED AREA ACREAGES**

| Area or Facility | Alternative A (No Action) Disturbance (in acres) | Alternative B Disturbance | | | Alternative C Disturbance | | | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| | | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | |
| **BULLFROG** | | | | | | | | |
| Bullfrog School | 12.8 | 12.8 | 0.0 | 0.0 | 12.8 | 0.0 | 0.0 | The proposed library would be added within the existing disturbed area. |
| Bullfrog NPS Maintenance Area | 2.6 | 2.6 | 0.0 | 2.6 | 2.6 | 0.0 | 2.6 | Under alternative C, the NPS maintenance area would be moved to the relocated concessioner housing area. |
| Bullfrog Concessioner Maintenance Area | 2.7 | 3.2 | 2.2 | .7 | 3.2 | 2.2 | .7 | A portion of the area used for alternative A, concessioner maintenance would be reclaimed. The remaining area would be redeveloped for expansion of the boat wash-down facility and expansion of the Village Center. |
| Bullfrog Village Center | 2.0 | 3.0 | 0.0 | 0.0 | 3.0 | 0.0 | 0.0 | Expansion area created from previous concessioner maintenance area. |
| Bullfrog Concessioner Housing and RV Park | 10.6 | 0.0 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 | A portion of the area used for alternative A concessioner housing / RV park would be redeveloped for family rental units and a portion reclaimed. Under alternative C, NPS maintenance area would be relocated in this area. |
| Bullfrog Family Rental Units | 3.3 | 9.9 | 0.0 | 0.0 | 9.9 | 0.0 | 0.0 | Expansion area from previous concessioner housing / RV park area. |
| Bullfrog Lodge and Parking Area | 0.4 | 0.8 | 0.4 | 0.0 | 0.8 | 0.4 | 0.0 | Expansion into new area adjacent to existing facilities |
| Bullfrog Campground | 86.2 | 86.2 | 0.0 | 0.0 | 86.2 | 0.0 | 0.0 | The existing campground includes developed and primitive loops. Alternative B and alternative C would upgrade within this existing area. |
| Bullfrog Employee Housing | 2.7 | 30 | 27.3 | 0.0 | 30 | 27.3 | 0.0 | Consolidation of employee housing would expand into new area adjacent to existing housing. |
| Bullfrog RV Park | 3.8 | 4.2 | 0.4 | 0.0 | 4.2 | 0.4 | 0.0 | Consolidation of campground services to include RV hookup sites would require expansion into new area adjacent to existing campground. |
| Bullfrog Seasonal Housing | 9.7 | 12.2 | 2.5 | 0.0 | 12.2 | 2.5 | 0.0 | Expansion into new area adjacent to existing seasonal housing facilities. |

**TABLE 2. CHANGES AND COMPARISONS IN DEVELOPMENT/DISTURBED AREA ACREAGES**

| Area or Facility | Alternative A (No Action) Disturbance (in acres) | Alternative B Disturbance | | | Alternative C Disturbance | | | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| | | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | |
| Bullfrog Secured Storage | 16.4 | 22.4 | 6.0 | 0.0 | 22.4 | 6.0 | 0.0 | Expansion into new area adjacent to existing secured storage facilities. |
| **Bullfrog Totals** | **153.2** | **187.3** | **38.8** | **4.7** | **187.3** | **38.8** | **4.7** | |
| | | | | | | | | |
| **HALLS CROSSING** | | | | | | | | |
| Halls Crossing NPS Maintenance | 2.3 | 2.3 | 0.0 | 0.0 | 2.3 | 0.0 | 0.0 | No changes. |
| Halls Crossing Employee Housing Area | 16.5 | 20 | 3.5 | 0.0 | 20 | 3.5 | 0.0 | Expansion into new area adjacent to existing housing to consolidate facilities. |
| Halls Crossing Family Rental Units | 2.9 | 8.7 | 5.8 | 0.0 | 8.7 | 2.7 | 0.0 | Alternative B, expansion into new area adjacent to existing family rental units. Alternative C, a portion of expansion into new area and partial redevelopment of existing RV park. |
| Halls Crossing Village Center | 1.4 | 1.8 | 0.4 | 0.0 | 2.0 | 0.6 | 0.0 | Alternative B, expansion into new area adjacent to existing Village Center to consolidate facilities. Alternative C, expansion into new area adjacent to add visitor center and emergency services building. |
| Halls Crossing RV Park | 3.1 | 3.9 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | Alternative B, expansion into new area adjacent to existing RV park. Alternative C, expansion within existing family rental unit site. |
| Halls Crossing Campground | 6.9 | 6.9 | 0.0 | 0.0 | 10 | 3.1 | 0.0 | Alternative B, no change. Alternative C, consolidation of campground services to include RV hookup sites would require expansion into new area adjacent to existing campground. |
| Halls Crossing Secured Storage / Concessioner Maintenance / Boat Wash-Down Facility | 11.2 | 25.5 | 25 | 10.7 | 25.5 | 25 | 10.7 | Alternatives B and C, expansion into new area adjacent to existing secured storage for concessioner maintenance relocation. Portion is previously disturbed area to be reclaimed/revegetated. Remaining area to be redeveloped into boat wash-down facility. |

**TABLE 2. CHANGES AND COMPARISONS IN DEVELOPMENT/DISTURBED AREA ACREAGES**

| Area or Facility | Alternative A (No Action) Disturbance (in acres) | Alternative B Disturbance | | | Alternative C Disturbance | | | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| | | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | Proposed Area (acres) | Additional Disturbed Area (acres) | Restored Area (acres) | |
| Halls Crossing Roads and Parking | 0.0 | 2.1 | 2.1 | 0.0 | 2.1 | 2.1 | 0.0 | Alternatives B and C, expansion to provide access to new access road to secured storage. |
| **Halls Crossing Totals** | **44.3** | **71.2** | **37.6** | **10.7** | **70.6** | **37.0** | **10.7** | |
| | | | | | | | | |
| **HITE** | | | | | | | | |
| Hite Campground | 0.7 | 0.7 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | Alternatives B and C, site improvements within the disturbed area. |
| Hite Employee Housing / Family Rental Unit Area | 6.0 | 9.8 | 3.8 | 0.0 | 9.8 | 3.8 | 0.0 | Alternatives B and C, expansion into new area adjacent to existing housing. |
| Hite Secured Storage | 3.5 | 5.2 | 1.7 | 0.0 | 5.2 | 1.7 | 0.0 | Alternatives B and C, expansion into new area adjacent to existing secured storage. |
| Hite Roads and Parking | 0.0 | 2.0 | 2.0 | 0.0 | 2.0 | 2.0 | 0.0 | Alternatives B and C, expansion to provide access to shoreline camping at low lake levels. |
| Hite Underground 100,000-gallon Potable Water Tank | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | Alternatives B and C, replacement of water tank with 100,000-gallon underground potable water tank. Existing tank mounted on a frame structure with minimal existing ground disturbance. Permanent disturbance with the new tank may result from manholes to access the tank; therefore, disturbance would be roughly the same. |
| **Hite Totals** | **10.3** | **17.8** | **7.5** | **0.0** | **17.8** | **7.5** | **0.0** | |

Alternative B would result in an increase of 83.9 developed acres, and 15.4 acres of previously disturbed area being restored/revegetated.
Alternative C would result in an increase of 83.3 developed acres, and 15.4 acres of previously disturbed area being restored/revegetated.

## Employee, Concessioner, and Partner Housing

Employee housing is provided within Glen Canyon NRA at Bullfrog, Halls Crossing, and Hite. There are a variety of types and locations for housing in each area to accommodate permanent and seasonal employees of the National Park Service, concessioners, and "partner" agencies such as state of Utah local representatives (Division of Wildlife Resources, Utah Division of Parks and Recreation), medical clinic staff, tri-county sheriff, and Kane County school employees. Providing housing is essential to uplake operations because of the remote nature of the location, utilization of seasonal employees, and that little or no private housing is available for rent outside the recreation area. All available permanent housing is typically occupied, and seasonal housing is fully occupied during the summer months.

Housing types at Bullfrog consist of individual and multiple or plex-style houses, trailer units (both single-family units and multiple-occupancy units), and dormitory units (figures 5 and 6). Housing is established in several locations as shown on figure 11. Single-family housing is located east of the visitor center (figure 8), concessioner trailer housing (figure 6) is located adjacent to the family rental units and shower and laundry facilities, and seasonal dormitory housing is located between the visitor RV park and the secured storage area. A concessioner employee RV park with 11 hookups for power is also available adjacent to the concessioner trailer housing. The existing Bullfrog housing inventory consists of 25 NPS units, 8 partner units, 77 concessioner units, and 96 concessioner seasonal employee dormitory units.

Housing types at Halls Crossing consists of individual manufactured homes, multiple or plex-style houses, and trailer units (both single-family units and multiple-occupancy units). Housing units are located southwest of the Village Center store and RV park. Existing housing inventory includes 8 NPS units and 42 concessioner units.

**Figure 5. Concessioner Housing Units at Bullfrog**

**Figure 6. Concessioner Trailer Housing Units at Bullfrog**

Housing types at Hite consist of manufactured homes, multiple or plex-style houses, and trailer units (both single-family units and multiple-occupancy units). Housing is located south

of the main access road and east of the existing secured storage area. Three employee RV sites with hookups for power are also available and located within the employee housing area. Existing housing includes 6 NPS units and 10 concessioner units.

Under the no-action alternative, the current inventory of NPS and concessioner employee housing, along with existing partner housing at Bullfrog, Halls Crossing, and Hite, would be maintained at the current number, location, and type. These units would be maintained at the existing location with no major upgrades, although general maintenance would occur, as necessary, to permit continued use.

## Overnight Accommodations

Uplake overnight accommodations consist of Defiance House Lodge (figure 7) and family rental units (figure 8). Defiance House Lodge is located on a hilltop overlooking the launch ramp and marina facilities at Bullfrog (figure 7). The lodge contains 48 motel units. Under the no-action alternative, the lodge would be maintained at the existing location with no major upgrades, although general maintenance would occur, as necessary, to permit continued use.

FIGURE 7. DEFIANCE HOUSE LODGE

FIGURE 8. TYPICAL FAMILY RENTAL UNITS

Family rental units are available at Bullfrog, Halls Crossing, and Hite. Each family rental unit contains a living area, kitchen, three bedrooms, and two bathrooms. There are eight family rental units at Bullfrog located adjacent to the concessioner employee housing and shower and laundry facilities, 20 family rental units at Halls Crossing are located adjacent to the store and RV park, and five family rental units at Hite located adjacent to the employee housing area (figure 8).

Under the no-action alternative, there would be no change to the location and variety of visitor overnight accommodations at Bullfrog, Halls Crossing, and Hite. Existing accommodations would continue to receive routine maintenance; however, there would be no change to the general condition of the facilities.

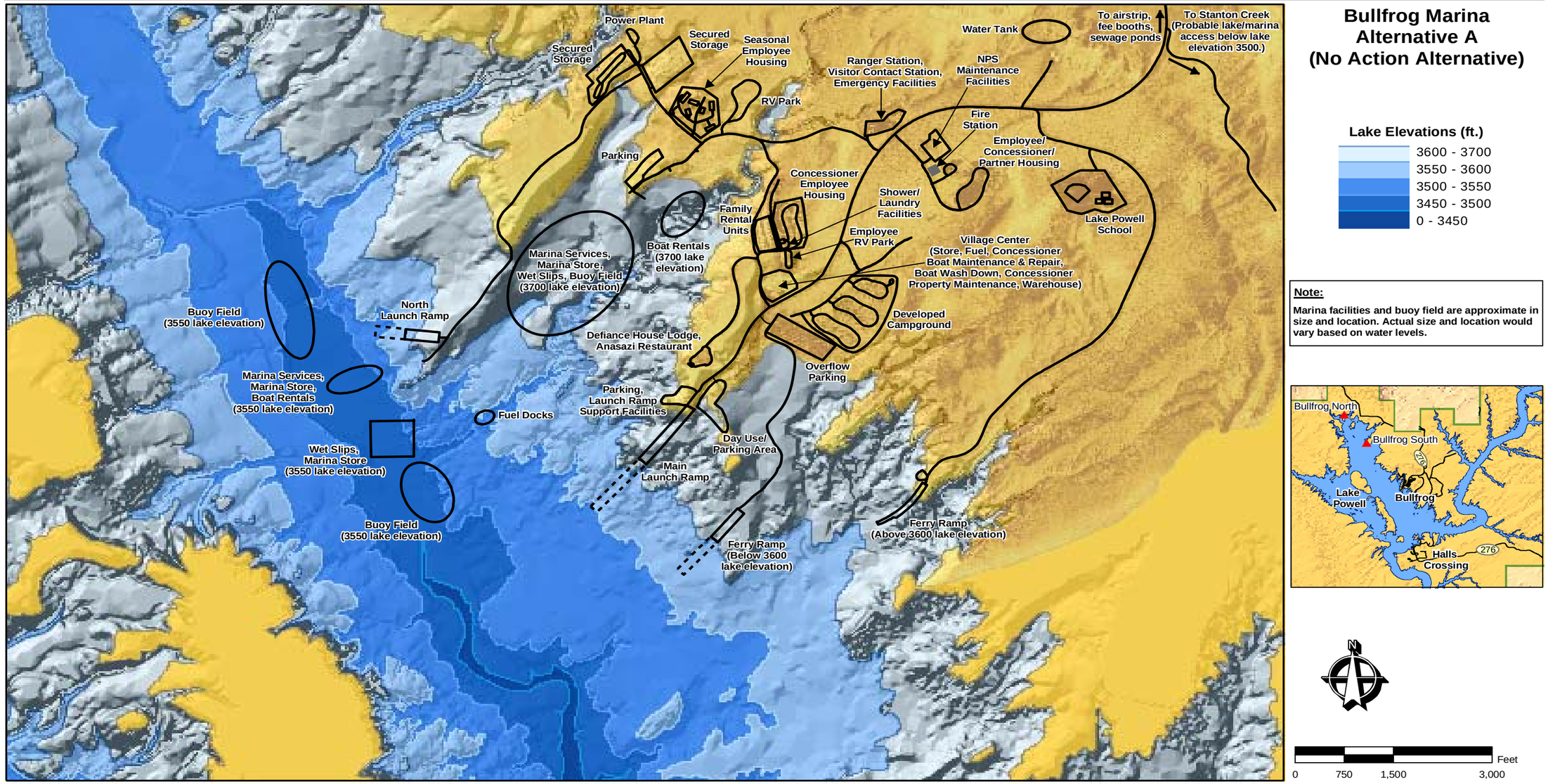



FIGURE 9. BULLFROG MARINA, ALTERNATIVE A: NO-ACTION ALTERNATIVE

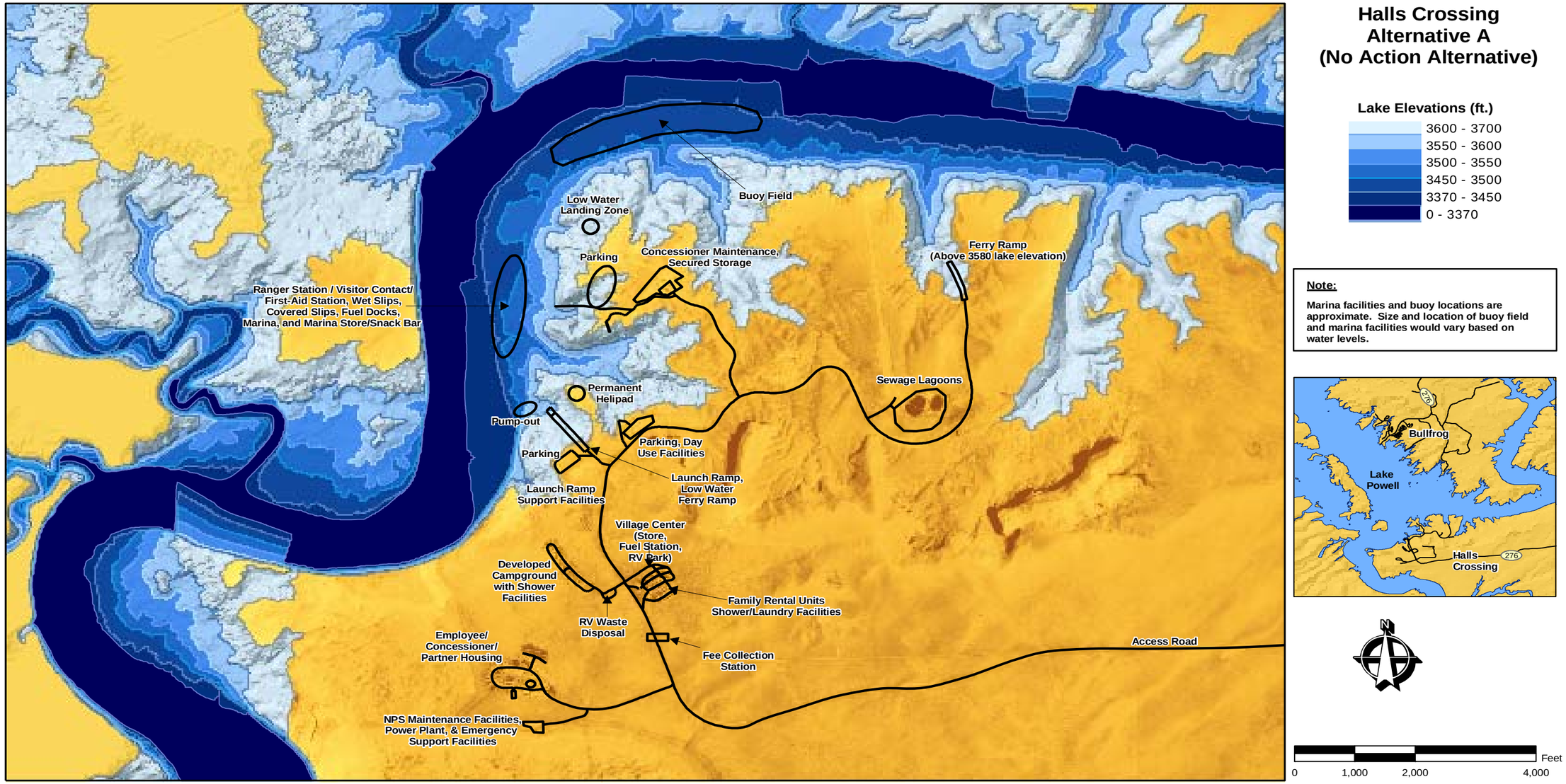



FIGURE 10. HALLS CROSSING MARINA, ALTERNATIVE A: NO-ACTION ALTERNATIVE

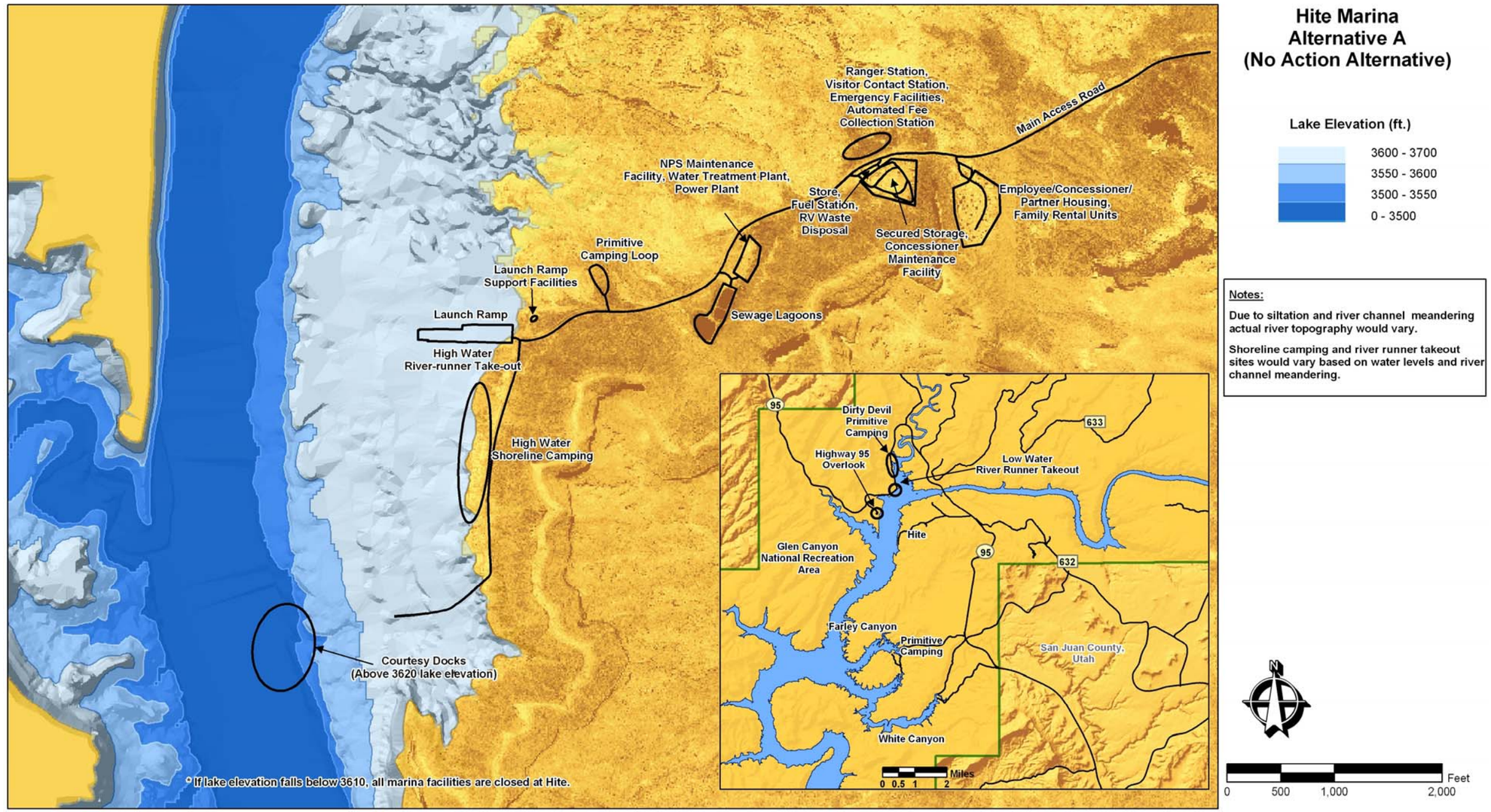



FIGURE 11. HITE MARINA, ALTERNATIVE A: NO-ACTION ALTERNATIVE

## Visitor Camping

The Bullfrog campground is located east of the Village Center and currently consists of 78 developed camping sites with paved parking areas, designated tent pads, fire rings, grills, and picnic tables (see figure 11 and figure 12).

FIGURE 12. BULLFROG CAMPGROUND

There is a primitive loop for overflow camping to the north of the existing developed campground. The overflow loop contains approximately 88 sites with no amenities. The concession-operated Bullfrog RV park is located adjacent to the seasonal employee housing dormitories. The RV park consists of 24 sites: 20 pull-through and 4 back-in spaces that can accommodate RVs up to 50 feet in length (ARAMARK 2006). Sites include gravel turnouts, electrical hookup boxes offering 30-amp service, grills, and picnic tables.

Bullfrog also has primitive camping at North and South Bullfrog and Stanton Creek. The primitive camping does not include defined campsites or offer any amenities such as picnic tables or grills; however, restrooms are available at these locations on a seasonal basis. There is no designated group camping available in the uplake district (figure 12).

The Halls Crossing campground is located west of the store and RV park and currently consists of 64 developed camping sites with parking areas, picnic tables, and grills (see figure 10). The campground includes restroom and shower facilities with a waste disposal station located on the access road to the campground.

In addition to the Halls Crossing campground, there is an existing RV park located adjacent to the store and family rental units (figure 13). The RV park consists of 32 sites and includes gravel turnouts, electrical hookup boxes offering 30-amp service, grills, and picnic tables.

Camping at Hite is within the primitive camping area east of the public launch ramp (see figure 11). The Hite campground currently consists of an unpaved loop where camping is permitted, with space for approximately 25 undesignated sites. The camping is primitive, with limited site development and no water or restroom facilities. In addition to the campground loop, at high water there is shoreline camping adjacent to the public launch ramp. There are no facilities or designated camping areas associated with shoreline camping. Primitive car camping also occurs on the shoreline of the Dirty Devil River and Farley Canyon in the vicinity of Hite.
No changes or improvements would be made to camping facilities or locations at Bullfrog, Halls Crossing, and Hite under the no-action alternative. Routine maintenance, as required, would occur.

## Shower and Laundry Facilities

FIGURE 13. HALLS CROSSING RV PARK

Shower and laundry facilities are available at Bullfrog and Halls Crossing; there are no shower or laundry facilities at Hite. Shower and laundry facilities at Bullfrog are located adjacent to the family rental units and concessioner housing and are used by visitors and employees. Shower and laundry facilities at Halls Crossing are located at the east end of the RV park and family rental unit area (see figure 13) and are used by visitors and employees. Additional shower facilities are located in the campground area used primarily by visitors. An employee laundromat facility is located in the employee housing area.

Under the no-action alternative, the shower and laundry facilities at Bullfrog and Halls Crossing would be maintained at their current size and locations. No shower or laundry facilities would be constructed at Hite.

## Land-Based Stores

A land-based store is defined as a store that is located and designed to service vehicle and foot traffic and is not specifically located or designed to handle boat traffic. Land-based stores exist at all three uplake developed areas. The land-based store at Bullfrog is located at the Village Center, south of the concessioner housing area and family rental units (figure 11 and figure 14). The existing Village Center store complex includes a fuel station, small convenience store, automotive repair shop, gift shop, and the concessioner administrative offices. The Village Center store complex is attached to the concessioner boat maintenance and repair facility.

The land-based store at Halls Crossing is located in the Village Center adjacent to the RV park and family rental units (figure 10). The land-based store includes a fuel station and small convenience store.

The land-based store at Hite is located on the main access road across from the ranger station and visitor contact station (figure 11). The land-based store includes a fuel station and small convenience store (figure 15). The RV waste disposal station is also located at the store.

Under the no-action alternative, the land-based stores at Bullfrog, Halls Crossing, and Hite would be maintained as existing facilities with no new additions or changes. Routine maintenance would occur, as necessary.

FIGURE 14. BULLFROG VILLAGE CENTER

FIGURE 15. HITE STORE

## Land-Based Food Service

In the uplake district, land-based food service is available only at Bullfrog. The Anasazi Restaurant is a sit-down facility with 180-seat capacity located in the Defiance House Lodge (see figure 7). The restaurant is open for breakfast, lunch, and dinner. Under the no-action alternative, the Anasazi Restaurant would continue as currently operated without expansion or relocation.

## Day-Use Facilities

Day-use facilities are designed for use by visitors for picnicking and relaxing. Day-use areas are distinct from camping or overnight-use areas. Facilities at day-use areas at Glen Canyon NRA typically include picnic tables, shade shelters, and restrooms. There are two designated day-use facilities in the uplake district: one located at Bullfrog and the other at Halls Crossing. There are no day-use facilities at Hite. The existing Bullfrog day-use facility is located at the top of the main launch ramp and is known as the boat-ready area. The day-use area contains picnic tables, restroom facilities, a fish cleaning station, waste disposal facilities (both trash and dump stations), and parking. The day-use facility also provides overflow parking for vehicles and trailers after boat launching. The Halls Crossing day-use facility is located adjacent to Halls Crossing Marina and contains picnic facilities. Under the no-action alternative, the existing day-use facilities would be maintained as they now exist, with no new improvements.

## Ranger Station / Visitor Contact Station and Emergency Facilities

Ranger stations and visitor contact stations are available at all three uplake developed areas. The existing ranger station and visitor contact station at Bullfrog is located on the main access route to Bullfrog Village in the first building on the south side of the road after the entrance station. The facilities include a visitor center with exhibits and a small bookstore and ranger facilities with offices for rangers, maintenance, concession, interpretive, and other staff. The emergency facilities are within this building and include a small medical clinic (staffed in the

summer season only), emergency helipad, and emergency medical technicians and paramedic vehicles and facilities. Emergency facilities also include holding cells and a communication station. The fire station, located near the employee housing area, is also part of the emergency facilities. Search and rescue equipment is stored at the fire station.

The existing ranger station and visitor contact station at Halls Crossing is located on the water at the marina. The facilities include a small area for displays and brochures and ranger facilities, as well as a first-aid station. There are no designated emergency facilities at Halls Crossing. Emergency response equipment is housed in various locations. The fire engine is parked in the NPS maintenance building and the ambulance is parked outside in the NPS maintenance building yard. Equipment storage for search and rescue and fire fighting is located in a trailer in the NPS maintenance yard as well. A primitive emergency helipad area is designated within the Halls Crossing developed area, dependent on water levels.

The existing ranger station and visitor contact station at Hite is located on the main access road across from the store. The facilities include a small area for displays and brochures and ranger facilities. The emergency facilities at Hite are located at the ranger station and visitor contact station and include fire fighting and search and rescue equipment storage, and a helipad.

The ranger station / visitor contact station and emergency facilities at Bullfrog, Halls Crossing, and Hite would be maintained as they currently exist under the no-action alternative.

### Concessioner Boat Maintenance and Repair and Property Maintenance Facilities

The concessioner-run boat maintenance and repair facilities and the concessioner property maintenance offices at Bullfrog are located at the Village Center adjacent to the Village Center store. The boat maintenance and repair facility is fenced with a 6-foot chain-link fence and includes a boat repair facility, boat painting facility, concessioner warehouse and maintenance building, and indoor and outdoor storage (figure 16). The concessioner offices are located above the Village Center gift store. A concessioner boat wash-down area is also located within this facility.

The concessioner-run boat maintenance and repair facilities and the concessioner property maintenance offices at Halls Crossing are located at the secured storage area, which is located northeast of the main launch ramp. The boat maintenance and repair facility is fenced with a 6-foot chain-link fence and facilities include a boat repair facility, a boat painting facility, concessioner warehouse and maintenance building, and indoor and outdoor storage. A small area for automobile repair is also included in this facility. There is also a concessioner-run floating boat maintenance facility at the Halls Crossing Marina.

FIGURE 16. BOAT MAINTENANCE AND REPAIR AND CONCESSIONER MAINTENANCE AREA AT BULLFROG

At Hite, the concessioner runs a limited boat maintenance and repair shop at the secured storage area located off the main access road, southwest of the store. The boat maintenance and repair facility is fenced with a 6-foot chain-link fence and facilities include a small boat repair facility, concessioner warehouse and maintenance building, and indoor and outdoor storage.

The concessioner boat maintenance and repair and property maintenance facilities at Bullfrog, Halls Crossing, and Hite would be maintained as they exist under the no-action alternative.

## National Park Service Maintenance Facilities

The National Park Service has existing maintenance facilities at all three uplake developed areas. The existing maintenance area at Bullfrog is located east of the ranger station / visitor contact station / emergency facilities. The maintenance facility includes a maintenance building and storage yard surrounded by a 6-foot chain-link fence.

The Halls Crossing maintenance area is located south of the employee housing area. The maintenance facility includes a maintenance building and storage yard surrounded by a 6-foot chain-link fence. Fire fighting and search and rescue equipment is also stored in this area.

The Hite maintenance area is located at the water treatment plant facility, east of the ranger station / visitor contact station / emergency facilities. The maintenance facility includes a maintenance building, storage yard, the water treatment plant, and generator building.

The NPS maintenance areas at Bullfrog, Halls Crossing, and Hite would be maintained in their current location and general condition under the no-action alternative.

## Secured Storage

The secured storage at Bullfrog is located northwest of the seasonal employee housing area and currently provides 750 outdoor spaces for storage of boats, personal watercraft, and RVs in a large fenced area (figure 17). The secured storage at Halls Crossing is located northeast of the main launch ramp and currently provides 230 outdoor spaces for storage of boats, personal watercraft, and RVs in a large fenced area. The secured storage at Hite is located adjacent to the Hite store and currently provides 107 outdoor spaces for storage of boats, personal watercraft, and RVs in a small fenced area.


**FIGURE 17. AERIAL VIEW OF HALLS CROSSING SECURED STORAGE AND CONSTRUCTION OF NEW ACCESS TO MARINA FACILITIES**

Under the no-action alternative, the existing secured storage areas at Bullfrog, Halls Crossing, and Hite would be maintained in their current location and condition, with routine maintenance.

## Utility Systems

The existing utility systems at Bullfrog include a power supply and distribution system, a water supply and distribution system, a wastewater removal and treatment system, and propane tanks. Three diesel generators located adjacent to the secured storage area supply power to Bullfrog. Power is distributed to various facilities by underground lines. The existing water supply consists of three wells and two 500,000-gallon storage tanks. The water is treated for drinking, primarily through the addition of chlorine, and is piped through buried pipelines for use at various facilities. The existing tank farm located in the NPS maintenance area stores 17,800 gallons of propane for distribution to the housing area.

Wastewater is carried from buildings and restroom facilities as well as from the RV disposal station and floating waste disposal stations. A number of lift stations are required to carry the wastewater uphill to the wastewater treatment plant. The wastewater treatment system, which includes the sewage lagoons, is located to the east of the entrance station. The wastewater

treatment system is currently in a multi-phased upgrade that would continue through to completion under the no-action alternative.

The existing utility systems at Halls Crossing include a power supply and distribution system, a water supply and distribution system, a wastewater removal and treatment system, and propane tanks. The power at Halls Crossing is supplied by three diesel generators located adjacent to the NPS maintenance area. Power is distributed through underground lines to various facilities at Halls Crossing. The existing water supply consists of two wells and a 360,000-gallon storage tank. Water is treated with a chlorination system and is then piped, primarily through buried pipelines, for use at various facilities.

Wastewater is carried from buildings and restroom facilities, as well as from the RV disposal station and floating waste disposal stations. A number of lift stations are required to carry the wastewater uphill to the wastewater treatment ponds. The wastewater treatment ponds comprise 6.41 acres and are located to the east of the main ferry launch ramp. There is also a propane tank farm at Halls Crossing located behind the store and operated by ARAMARK, with storage capacity for 10,000 gallons. Propane serves as the major heat source for the housing area.

At Bullfrog and Halls Crossing, as water levels recede, utility distribution lines below the full pool lake elevation of 3,700 feet are extended aboveground to the floating marina facilities. Under the no-action alternative, the power and water supply systems and wastewater removal systems would remain the same, as would the powerlines and water distribution pipelines, except in areas where water-based facilities are being relocated. In these areas, utility distribution lines would continue to be laid on the ground surface, typically following access routes to the relocated facilities. The wastewater removal systems would continue to be extended as water levels recede and water-based facilities move farther out into the lake. Additional lift stations may also be required to carry the wastewater uphill from the relocated facilities.

The existing utility systems at Hite include a power supply and distribution system, a water supply and distribution system, a wastewater removal and treatment system with sewage lagoons, and propane storage tanks. The power at Hite is supplied by a diesel generator located in the NPS maintenance area. Power is distributed through underground lines to various facilities at Hite. The water supply at Hite is obtained from a river intake pipe when the lake elevation is above 3,620 feet, and from a water well when lake elevation drops below 3,620 feet. The water is piped to a water treatment plant and then into a 100,000-gallon aboveground tank. The existing propane tank farm is operated by ARAMARK, has storage capacity of 17,500 gallons, and is located in the housing area and at the store.

Under the no-action alternative, the existing utility systems at Bullfrog, Halls Crossing, and Hite would not change, although maintenance and repairs would continue.

## Roads and Parking

Existing paved roads and parking areas in the Bullfrog developed area are shown on figure 9. Roads are continually being extended to reach floating and shoreline facilities as water levels recede. These road extensions have dirt or gravel surfaces below the full pool lake elevation of 3,700 feet. Unpaved parking areas are also being created as the marina facilities are relocated due to decreasing water levels. These roads and parking areas will be covered as water levels rise.

Existing paved roads and parking areas in the Halls Crossing developed area are shown on figure 10. A new gravel access road and parking area have been constructed to access the relocated Halls Crossing water-based facilities in the main channel. The new gravel access road and parking area are located to the west of the secured storage area and the road continues west to the relocated docks and marina facilities (figure 10). Additional new roads and parking areas would continue to be constructed to maintain lake access.

Existing paved roads and parking areas in the Hite developed area are shown on figure 9. No changes to the existing Hite paved road system would occur under the no-action alternative.

## Fee Collection System

The two existing staffed fee collection kiosks are located along the main access road into Bullfrog. An automated fee collection system is located at the fee collection kiosk for use when the fee collection booths are unmanned. There are both fee collection kiosks and an automated fee collection system at Halls Crossing, located on the main access road south of the store. There is an automated fee collection system at Hite located at the visitor contact station parking area. No changes to the fee collection systems or facilities would occur in the uplake developed areas under the no-action alternative.

## School

The Lake Powell School, located in the Bullfrog development, is administrated by Kane County and serves children in kindergarten through grade 12 from Bullfrog, Halls Crossing, and surrounding communities. The school is located east of the combined employee housing area. Children are bussed in from surrounding communities. Under the no-action alternative, the Lake Powell School would be maintained, as necessary, with no upgraded amenities.

### Airstrip

An asphalt airstrip is maintained at Bullfrog with shuttle service from the airstrip to Bullfrog facilities. The airstrip is available for use both day and night, although night landings are for emergencies only. The airstrip is located north and west of the main entrance station for Bullfrog. There is no airstrip located within NRA boundaries at Halls Crossing. A private airstrip is maintained outside of the NRA. There is an existing packed gravel airstrip at Hite with a gravel parking area. There would be no change under the no-action alternative to the uplake district airstrips.

## Boat Wash-Down Area

The only existing boat wash-down facility uplake (to prevent the spread of aquatic nuisance species by washing boats prior to entry into Lake Powell) is at Bullfrog; there are no boat wash-down areas at Halls Crossing or Hite. The boat wash-down facility is located in the concessioner maintenance area in the Village Center and is not available for use by the general public. Under the no-action alternative, there would be no change to the Bullfrog boat wash-down area, and no wash-down areas would be constructed in the other uplake developed areas.

## Marina Facilities

The existing water-based facilities at Bullfrog include rental facilities and associated services, courtesy docks, executive services (boat cleaning and preparation), boat tours, wet moorage (buoy field and wet slips), fuel docks, two-cycle engine oil dispensing system, and pump-out docks (figure 18). The Bullfrog, Halls Crossing, and Hite DCPs from 1985 established maximum numbers for wet moorage. Those figures were used to establish maximums for the lifespan of the current concession contract. Full implementation of those numbers has not occurred. Table 3 outlines these numbers for comparison of wet moorage. The NPS slips at Bullfrog and Halls Crossing, combined total of 16 slips, are included in the total wet moorage numbers shown in the table.

**FIGURE 18. AERIAL VIEW OF WET SLIPS AND WATER-BASED STORES AT BULLFROG**

**TABLE 3. WET MOORAGE SUMMARY**

| | Moorage Numbers (permitted in 1985 DCPs) | Moorage Numbers (permitted under current concession contract) | Current Moorage Numbers Implemented |
|---|---|---|---|
| **Bullfrog** | | | |
| Slips | 400 | 400 | 440 |
| Buoys | 200 | 200 | 220 |
| Total | 600 | 600 | 660 |
| NPS Slips | | | 12 |
| **Halls Crossing** | | | |
| Slips | 240 | 240 | 180 |
| Buoys | 150 | 150 | 234 |
| Total | 390 | 390 | 414 |
| NPS Slips | | | 4 |
| **Hite** | | | |
| Buoys | N/A | 54 | 0* |
| Concessioner Wet Moorage – All Lake Elevations | | 1,044 | 1,074 |
| **Total Wet Moorage (concessioner & NPS)** | | | **1,090** |

*Hite buoys were permanently relocated to Bullfrog and Halls Crossing.

There are up to 440 moorings currently available for rental slips, overnight slips, courtesy slips, executive services, and the rental fleet boats. Of this number, 40 are for overnight and courtesy slips. An additional 220 moorings are available in the buoy fields (figure 22). An additional 12 slips are available for NPS operations for a total of 672 wet moorings. There are 134 boats available for rent at Bullfrog.

The existing water-based facilities at Halls Crossing include courtesy docks, executive services (boat cleaning and preparation), wet moorage (buoy field and wet slips), fuel docks, floating private boat repair, pump-out docks, and floating restrooms. There are up to 180 moorings currently available for rental slips, overnight slips, courtesy slips, and executive services. Of this number, 6 of the slips are for overnight and courtesy slips. An additional 234 moorings are available in the buoy fields. An additional 4 slips are available for NPS operations for a total of 418 wet moorings. There are 3 boats available for rent at Halls Crossing. Under the no-action alternative, the existing marina facilities at Bullfrog and Halls Crossing would be maintained in their current location and at their current level of service. The location for the marina facilities at Bullfrog would vary based on water levels. Several potential locations for the Bullfrog Marina, based on lake elevation, are shown on figure 9.

In the past, water-based marina facilities at Hite included a small rental fleet and wet moorage consisting of 54 buoys and associated services, courtesy docks, fuel docks, a floating minor boat repair facility, boat pump-out docks, and a floating store. Declining lake levels due to drought between the years 1999 and 2004, resulted in the closure of water-based facilities at

Hite (figure 19) and permanent relocation of the infrastructure to Bullfrog and Halls Crossing. Under the no-action alternative, there are no water-based facilities at Hite.

FIGURE 19. HITE LAUNCH RAMP AT LOW WATER

## Water-Based Stores

There are currently two floating stores at Bullfrog: one store located at the rental docks (referred to as the Boat-N-Go) and the other located at the wet slips (referred to as the Dock and Stock). There is a floating store at the main marina at Halls Crossing. Under the no-action alternative, there would be no changes to the existing water-based stores at Bullfrog and Halls Crossing and no floating store at Hite.

## Water-Based Food Service

Under existing conditions at Bullfrog, there are no water-based food service facilities. The water-based store at Halls Crossing includes a water-based snack bar offering a limited menu. There is no water-based food service facility at Hite. Under the no-action alternative, there would be no changes to the existing water-based food service offered at Halls Crossing, nor would water-based food services be added to any of the uplake developed areas.

## Public Boat Launch Capabilities

There are two public boat launch ramps at Bullfrog. The main public launch ramp is located adjacent to the day-use area. A 150-foot-wide paved launch ramp is available to a lake elevation of 3,605 feet, with the ramp narrowing to an 80-foot-wide paved ramp between the lake elevations of 3,605 and 3,580 feet (figure 20). Below a 3,580-foot lake elevation, near the main launch ramp, there is an old access road surfaced with cold mix asphalt that is available for use as a launch ramp. A second launch ramp was constructed as shown in figure 9 and is called the north launch ramp. This ramp is a paved 50-foot-wide launch ramp operational between lake elevations of 3,583 and 3,557.

There is one public launch ramp at Halls Crossing. The main public launch ramp is located west of the marina facilities. The 110-foot-wide paved launch ramp is available to a lake elevation of 3,550.

**FIGURE 20. MAIN LAUNCH RAMP AT BULLFROG DEVELOPED AREA**

The public launch ramp at Hite is paved to a 110-foot width down to a lake elevation of 3,640 feet. The ramp continues as a 30-foot-wide unpaved ramp between the lake elevations of 3,640 and 3,620. Below a lake elevation of 3,620, the ramp is gravel and dirt, and is not maintained, but is available for launching at Hite at the boaters' own risk.

The supplemental calculations to the 1987 Carrying Capacity Study calculated the capacity of public launch facilities in the uplake district to launch boats on a 24-hour basis, assuming 12 hours each for launch and retrieval. The exact volume of existing launches is not known; however, NPS staff has determined that the maximum capacity of the launch ramp is not fully utilized based on field observations of typical launch days over a 24-hour period.

Launch ramps would be maintained in the existing condition under the no-action alternative, with maintenance as needed.

**TABLE 4. LAUNCH RAMPS**

| Developed Area | Name | Status |
|---|---|---|
| Hite | Public Launch Ramp | Paved at 110-foot width to 3,640 feet<br>Unpaved at 30-foot width to 3,620 feet<br>Unimproved gravel/dirt route to Colorado River shoreline |
| Bullfrog | Main Public Launch Ramp | Paved at 150-foot width to 3,605 feet<br>Paved at 75-foot width to 3,580 feet<br>Hardened surface at 50-foot width below 3,580 feet<br>Bullfrog Bay becomes unusable near 3,500 feet and new ramp location would be required |
| | North Public Launch Ramp | Paved at 80-foot width to 3,557 feet |
| | Ferry Ramp | Usable to 3,600 feet<br>Alternate ramp usable to 3,555 feet or lower |
| Halls Crossing | Main Public Launch Ramp | Paved at 110-foot width to 3,572 feet<br>Paved at 80-foot width to 3,550 feet |
| | Ferry Ramp | Usable to 3,580 feet<br>Alternate ramp (main public launch ramp) usable to 3,550 feet |

## Launch Ramp Support Facilities

Existing launch ramp support facilities at Bullfrog and Halls Crossing are located at the top of the launch ramp and include parking for vehicles and boat trailers, restrooms, a fish cleaning station, and the boat ready area that also functions as a day-use area. At Bullfrog, there is a small turnout at the top of the launch ramp to allow derigging and trash disposal. The launch ramp support facilities at Hite are also located at the top of the launch ramp, and include restrooms, a fish cleaning station, porta-potty waste disposal station, parking area for vehicles and boat trailers, and a shade shelter with wayside exhibit. There would be no change to the existing launch ramp support facilities at Bullfrog, Halls Crossing, and Hite under the no-action alternative.

## Ferry Service Facilities

Ferry services operated by UDOT are currently available between Bullfrog and Halls Crossing. Ferry service is offered from several separate launch ramp locations in both Bullfrog and Halls Crossing areas, depending on water level. At Bullfrog, the main ferry ramp is operational at lake elevations above 3,600 feet. The Halls Crossing ferry service facilities include the main ferry ramp that is operational at lake elevations above 3,580 feet. As shown on figure 10, the ferry launch ramp at Halls Crossing is at the public launch ramp below a lake elevation of 3,580 feet. The National Park Service maintains the ferry ramps, but is not involved in ferry operations.

As shown in figure 9, below a lake elevation of 3,600 feet, the ferry launch ramp at Bullfrog is accessed by a gravel road located adjacent to the overflow parking area. No changes to the Bullfrog or Halls Crossing ferry service facilities would occur under the no-action alternative.

### River Runner Takeout

The Hite public launch ramp serves as the take-out point for rafters on the Colorado River at the inlet to Lake Powell. The launch ramp takeout is usable between 3,700 to 3,620 feet lake levels. Below that elevation, the river runner takeout is relocated to a temporary location upstream and across from the Hite launch ramp. The current river takeout location is shown on figure 9. Under the no-action alternative, Glen Canyon NRA would continue to maintain a takeout at Hite. Because the river channel is subject to meandering and movement, the low water takeout may not always function due to changes in topography, shoreline access, and siltation patterns. If conditions occur that the low water takeout or the Hite ramp no longer function for this use, additional site investigation, compliance, and U.S. Fish and Wildlife Service (USFWS) consultation would be required to relocate this facility to another place along the river channel.

## ALTERNATIVE B (PREFERRED ALTERNATIVE)

Alternative B is the preferred alternative. The preferred alternative is the NPS preferred alternative (and is the proposed action for section 106 compliance) and defines the rationale for the action in terms of resource protection and management, visitor and operational use, costs, and other applicable factors. All actions described in the preferred alternative are consistent with the approved 1979 GMP and related recreation area documents.

Alternative B represents changes to current facilities in the form of facility upgrades, expansion, or improvements generally keeping with approved plans and anticipated future needs including increases to employee, concessioner, and visitor services, and paving launch ramps. This alternative also reorganizes and relocates some marina services among the three marinas. The location of facilities under alternative B for Bullfrog, Halls Crossing, and Hite are shown in figures 21, 22, and 23, respectively. Table 1 contains a summary of the changes under alternative B, as well as a comparison with alternatives A and C. Table 2 contains changes in disturbed area acreages as a result of alternatives A, B, and C. Table 5 provides a comparison of the alternatives with the project objectives. Facilities that would not change from the existing condition as a result of alternative B are not discussed in detail in the following sections. Those facilities that would remain unchanged from the existing condition, except for routine maintenance and repairs, would include the following:

- Bullfrog day-use facilities
- Bullfrog and Hite visitor contact / ranger station and emergency facilities
- concessioner boat maintenance and repair and property maintenance facility at Hite
- NPS maintenance facilities at Halls Crossing and Hite
- Halls Crossing and Hite fee collection systems

- airstrips at Bullfrog and Hite
- Hite Marina facilities
- water-based stores at Bullfrog, Halls Crossing, and Hite
- Hite launch ramp
- launch ramp support at Bullfrog and Halls Crossing
- river runner takeout at Hite

## Employee, Concessioner, and Partner Housing

At Bullfrog, under alternative B, all long-term employee trailer housing would be consolidated into one area northeast of the Bullfrog campground. Trailer housing would be replaced with permanent housing comprised of single-family homes, duplex, and multiplex unites. Seasonal employee housing would be upgraded and expanded at the existing site southwest of secured storage (figure 21). The current concessioner trailer housing area would be reclaimed.

Increased visitation is anticipated in the future and additional staff would be needed to operate facilities and visitor services. Privately owned housing for rent or purchase outside the NRA is nonexistent. Up to 4 additional NPS housing units (for a total of up to 29 units), up to 24 additional concessioner housing units (for a total of up to 197), and up to 6 additional partner housing units (for a total of 14) would be added at Bullfrog to serve the school and provide staff for interagency law enforcement. The 24 additional concessioner housing units would consist of construction of an additional dormitory or efficiency unit building within the seasonal housing area shown on figure 21.

The existing public RV park at Bullfrog would be upgraded and converted to an employee RV park with the number of sites remaining at 24. A building with shower and laundry facilities would be added in the vicinity of the seasonal housing and employee RV park. Some seasonal and concession employees are retired and work seasonally, living out of their RVs. An employee RV park provides efficient and economical housing options for some seasonal employees. The existing concessioner RV park, adjacent to the existing concessioner housing area, would be removed and revegetated with native plants.

The existing employee trailer housing units at Halls Crossing and Hite would be replaced with new housing units. Up to 2 additional permanent NPS housing units (for a total of up to 10 units) and up to 4 additional concessioner units (for a total of up to 46 units) would be added at Halls Crossing. An employee RV park providing housing for temporary employees would be constructed at Halls Crossing for up to 12 RV sites.

No additional housing would be added at Hite; however, the existing housing would be replaced with new housing units.

## Overnight Accommodations

Under alternative B, Defiance House Lodge and family rental units at Bullfrog would be expanded so that up to a total of 94 units would be added (for a total of up to 150 units). The allocation of lodge units versus family rental units would be determined by the National Park Service in conjunction with the concessioner. The Defiance House Lodge facilities would be upgraded. At Halls Crossing, up to an additional 40 family rental units (for a total of up to 60 units) would be constructed. The existing family rental unit trailers at Bullfrog and Halls Crossing would be replaced with new units (figure 22).

The number of family rental units available at Hite would be increased by up to 15 units (for a total of up to 20 units), and would be located in the same area as the existing units (in the same area as the employee and concessioner housing as shown on figure 23). The existing family rental trailer units would be replaced with new units.

## Visitor Camping

Under alternative B, the developed campground at Bullfrog and the Bullfrog RV park would be consolidated in the existing campground location (figure 21). Anticipated increases in visitation in the future would result in increased demand for visitor camping. The combined campground and RV park would be expanded by up to 128 sites (for a total of up to 230 sites), with approximately two-thirds of the new sites offering hookups with 50-amp electrical service, and nonhookup sites. The balance of the nonhookup sites would be divided between a designated group camping area and walk-in tent sites. The new group camping area is envisioned to consist of a "pod" of 6 sites, each of which could accommodate up to 8 tents and 15 people per site. A site analysis and design concept plan was developed for the Bullfrog campground (NPS 1998b). The proposed increases in numbers of campsites represent the maximum number of campsites that could be expected with full development of the area designated for camping. The proposed campsites would be developed to accommodate a variety of camping vehicle sizes, circulation patterns, and visitor camping experiences.

A small store, shower and laundry facility, and amphitheater would be added. The RV waste disposal station would be upgraded at the Bullfrog campground. Consolidation of these services at the campground location would improve the efficiency of operation of the Bullfrog development. No improvements would be made to primitive camping at North and South Bullfrog and Stanton Creek.

The Halls Crossing campground would be upgraded in the current location, including site upgrades and upgrades to the restroom facilities. The RV waste disposal station would also be upgraded in the current location. At the RV park, hookups would be upgraded to include 50-amp electrical service, and up to 8 additional RV sites would be added (for a total of up to 40 sites). Increased demand for RV sites would be expected with upgrading of available service. The proposed increases in numbers of campsites represent the maximum number of campsites that could be expected with full development of the area designated for camping.

The existing primitive campground would be upgraded at Hite. Upgrades would include defining up to 25 nonhookup sites in the campground loop (figure 23) to include campsites,

picnic tables, fire rings, and grills. A centralized water source would be installed at the campground and restroom facilities would be added.

Under alternative B, there would be no change to shoreline camping at Hite for lake elevations above approximately 3,620 feet. Primitive camping would be available along the shoreline, the Dirty Devil River, and at Farley Canyon. Below a lake elevation of approximately 3,620 feet, shoreline camping would be permitted on the Colorado River at designated camping sites. This area would be upstream of the Hite launch ramp as shown in figure 23. Micro flush toilets would be installed if determined necessary based on campsite use.

### Shower and Laundry Facilities

Under alternative B, the existing shower and laundry facilities at Bullfrog would be removed and new shower and laundry facilities would be constructed at the campground, primarily for visitor use. The existing shower facilities at the campground and at the RV park at Halls Crossing would be removed. The Village Center at Halls Crossing would be upgraded to include shower and laundry facilities for employees and visitors. The land-based store at Hite would be expanded to include visitor and employee shower and laundry facilities.

### Land-Based Stores

Under alternative B, the store at the Village Center at Bullfrog would be expanded to provide a greater supply of items and food service. The warehouse and boat maintenance and repair facility would be moved, allowing the store to expand into this area. A campground store would be added at the Bullfrog campground to increase the variety of items offered and expand use of the facilities.

The Village Center store at Halls Crossing would be upgraded by replacing it with a larger building. The new building would provide adequate storage for supplies, land-based food service, and shower and laundry facilities. The fuel station area would be regraded and the pavement replaced to eliminate uneven areas.

Under alternative B, the land-based store at Hite would be upgraded and expanded to include shower and laundry facilities and to provide a potential food service facility. The building would undergo aesthetic improvements such as painting and the addition of a shade cover. The concrete pad around the fueling area would be replaced and extended. The concessioner secured storage and maintenance area adjacent to the store would be visually screened from the store. The RV waste disposal station would be upgraded with a new pump-out and containment pad.

### Land-Based Food Service

Under alternative B, the Anasazi Restaurant at Bullfrog would be expanded by up to 70 seats (for a total of up to 250 seats). An additional food service facility would be added at the expanded Village Center store.

At Halls Crossing, a food service facility would be added to the expanded Village Center store. The store at Hite would be expanded to provide a potential food service facility in the form of a small snack bar operated seasonally or as demand warrants.

### Day-Use Facilities

Under alternative B, a second day-use facility would be constructed at Halls Crossing (as shown on figure 22) to include picnic tables, shade shelters, and restroom facilities. A day-use facility would be constructed at Hite at the top of the launch ramp. A partnership with UDOT would be developed for the purpose of pursuing upgrades to the SH 95 overlook to include a defined day-use area with picnic tables, shade shelters, and micro-flush toilets.

### Ranger Station / Visitor Contact Station and Emergency Facilities

Under alternative B, the permanent helipad would remain at Halls Crossing. The helipad site would be upgraded to include a hardened, painted surface for landing, and a wind sock. The low water landing location for helicopters at Halls Crossing would be the parking lot adjacent to the marina.

### Concessioner Boat Maintenance and Repair and Property Maintenance Facilities

The concessioner rental boat maintenance and repair facilities and property maintenance facilities at Bullfrog would be moved from the existing location adjacent the Village Center to the secured storage area, northwest of the employee RV park. Visual screening would be enhanced at the new location to conceal the repair and storage areas from the general public. Space vacated at the Village Center would be used to expand the Village Center store and food service.

The secured storage area at Halls Crossing, including the boat maintenance and repair and property maintenance facilities, would be relocated to the old airstrip area, which is less visible from all points at Halls Crossing.

### Secured Storage

Under alternative B, the secured storage area at Bullfrog would be expanded by up to 250 spaces (for a total of up to 1,000 spaces). An enclosed storage building with screening would be constructed and stacked storage would be used, if feasible. The facility screening would be improved to provide some mitigation for the visual impacts of the storage area.

The secured storage area at Halls Crossing would be relocated to a less visible location as shown in figure 22, which is an area already disturbed by an old airstrip. The new secured storage area would include an addition of up to 170 spaces (for a total of up to 500 spaces), an enclosed storage facility, and visual screening, as well as being surrounded by a 6-foot chain-link fence and locking gate. Covered storage would be made available.

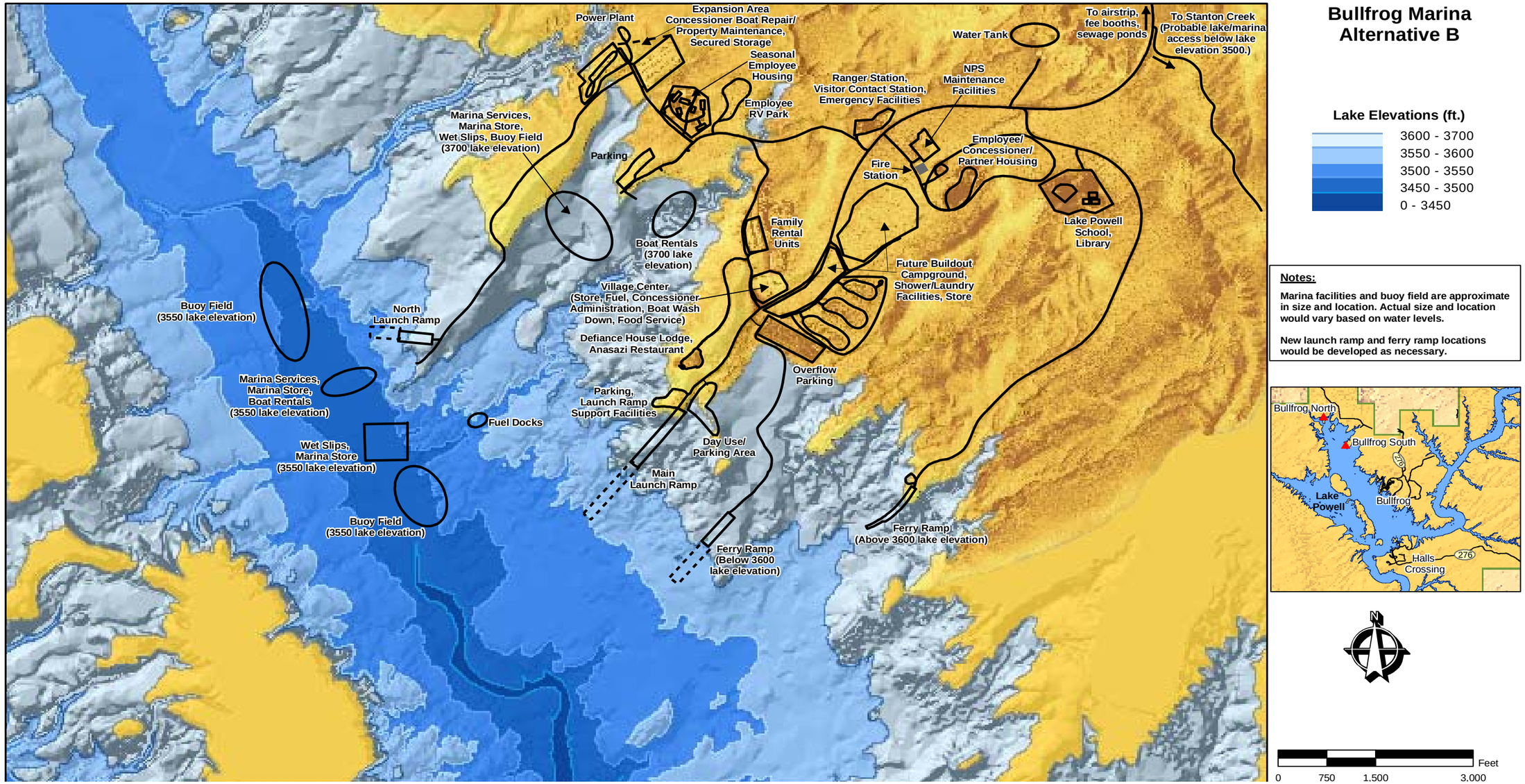



FIGURE 21. BULLFROG MARINA: ALTERNATIVE B

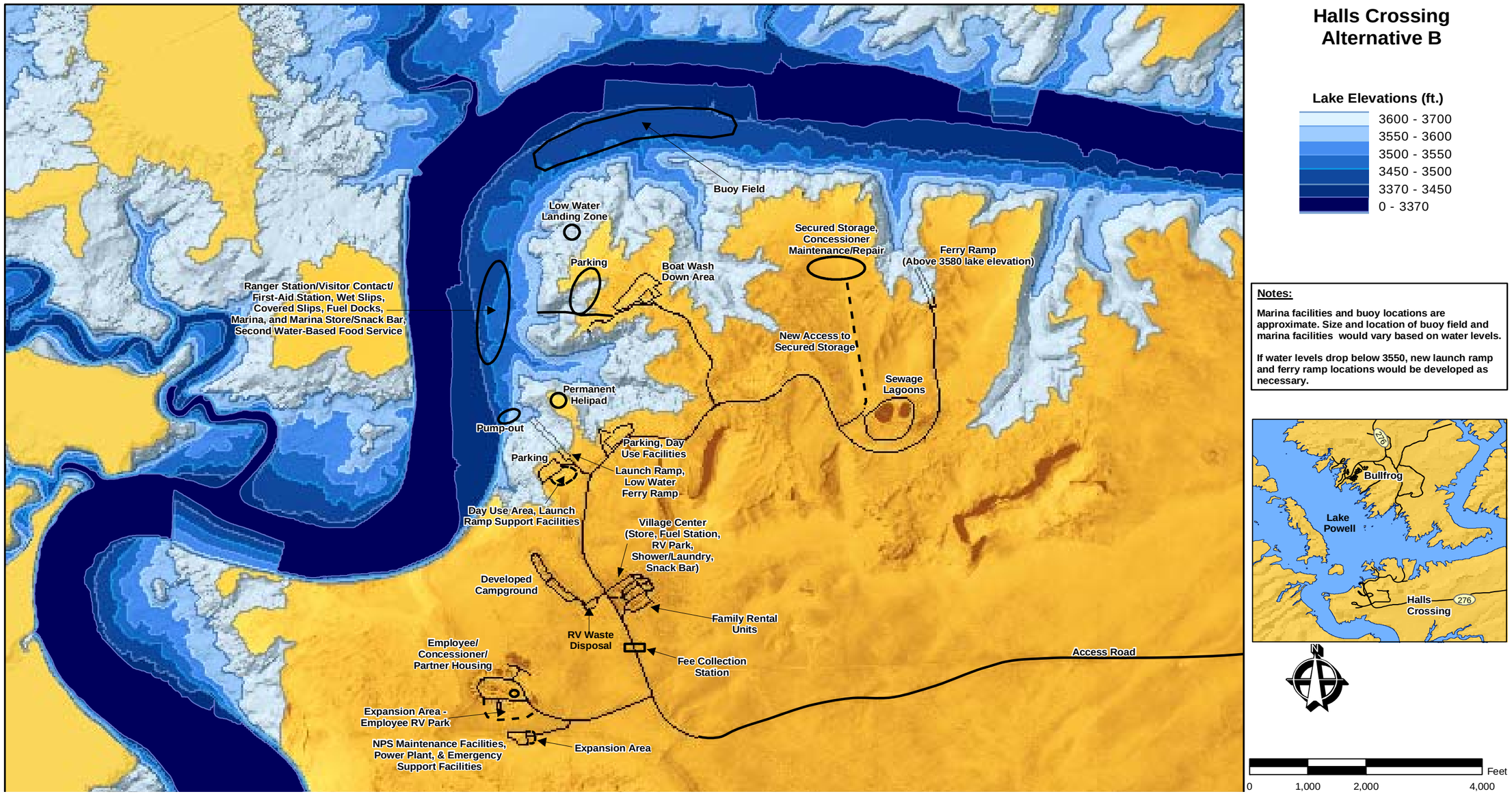



FIGURE 22. HALLS CROSSING MARINA: ALTERNATIVE B

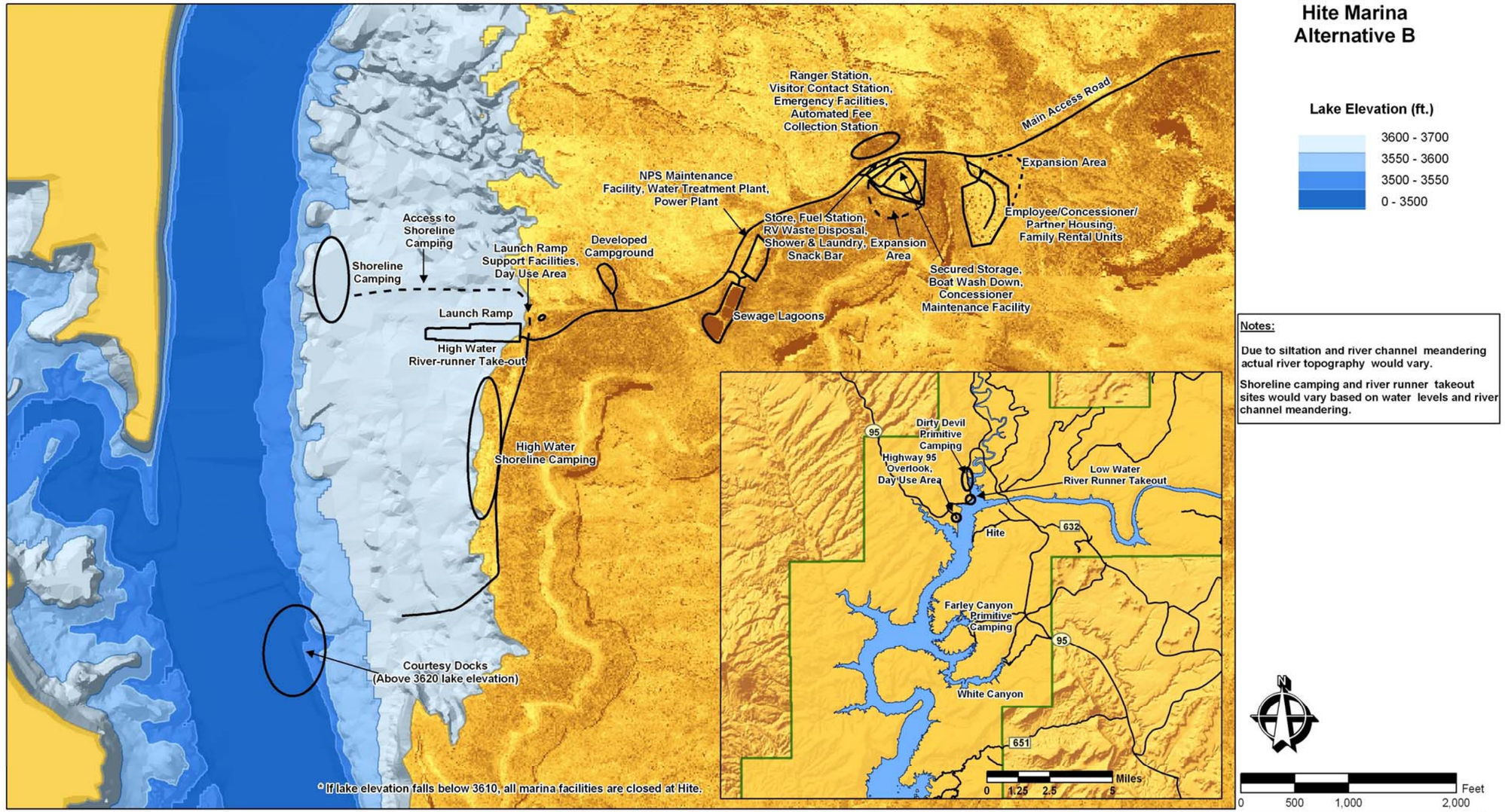



FIGURE 23. HITE MARINA: ALTERNATIVE B

The secured storage area at Hite would be expanded by up to 53 spaces (for a total of up to 160 spaces), and include construction of a boat wash-down facility for visitor and concessioner use.

### Utility Systems

Under alternative B, the existing utility supply and distribution systems at Bullfrog, Halls Crossing, and Hite would be expanded as needed to provide adequate service for increased development. At Hite, a 100,000-gallon underground water storage tank for potable water would replace the existing aboveground water storage tank in the same general location. Because soils in this area are shallow, blasting may be required to bury the underground tank. Any blasting would conform to specifications in NPS 65, *Explosives Use and Blasting Program* (1991). All blasting would use the minimum amount of explosives necessary to accomplish the task. Upon completion of installation of the water tank, the area would be covered with conserved topsoil, regraded to match natural contours, and revegetated.

### Roads and Parking

Under alternative B, at Halls Crossing, a new road would be constructed to access the relocated secured storage. At Hite, an unimproved road would provide access to primitive low-water designated shoreline camping.

### Fee Collection System

Under alternative B, the existing fee collection booth at Bullfrog would be upgraded for accessibility and administrative services.

### School

Under alternative B, the Lake Powell School would be expanded to include a library building.

### Boat Wash-Down Area

Under alternative B, the boat wash-down facility at Bullfrog would be expanded to provide additional wash-down facilities in the same location (at the former concessioner maintenance area at the Village Center) for public access. Boat wash-down facilities would be constructed at Halls Crossing in the old secured storage area and at Hite at the concessioner maintenance facility.

### Marina Facilities

Under alternative B, wet moorage (wet slip and buoy field moorings) would be managed jointly between Halls Crossing and Bullfrog. Buoy field moorings would be increased by up to 55

spaces, for a combined total of 1,145, including visitor, concessioner, and NPS wet mooring spaces for Bullfrog and Halls Crossing. The rental boat fleet would be allowed to expand up to a combined total of 580 boats. The concessioner, in conjunction with the National Park Service, would determine how to allocate this total between the two sites based on customer preference, season, water level, and other factors. The existing water-based facilities at Halls Crossing would be upgraded under alternative B to include a fishing dock. The balance of marina facilities at Bullfrog and Halls Crossing would be the same as presented under alternative A.

### Water-Based Food Service

Under alternative B, an 80-seat water-based restaurant would be provided at the Bullfrog Marina. An additional water-based food service facility would be added at Halls Crossing.

### Public Boat Launch Capabilities

Under alternative B, the existing Bullfrog launch ramp would be maintained at its current width (ranging from 80- to 150-feet wide). Any new additional lengths needed to reach lower water levels would be constructed at a maximum of 80-feet wide. If the existing launch ramp becomes unusable due to extreme low water, a new launch ramp no more than 80-feet wide would be constructed within the developed area (see figure 21), which would require additional environmental evaluation and consultation at that time. The environmental consequences of construction of a new launch ramp in a new location will not be evaluated as part of this DCP. The existing launch ramp at Halls Crossing would be maintained at its current configuration. Any additional length necessary to reach low water would be 80 feet in width. As no other launch sites are available at Halls Crossing once the water level recedes below an elevation of 3,550 feet, launching would revert to “ramp closed—launch at your own risk.”

### Ferry Service Facilities

Under alternative B, ferry services at Bullfrog would continue to be provided by a docking wedge and associated access. The docking wedge would continue to be moved within the developed area (figure 21) to accommodate lower water levels. At Halls Crossing, the ferry would either be launched at its current location or moved to the main launch ramp as the water level recedes. Once the water level has receded lower than 3,550 feet and the main launch ramp is closed, a new primitive site, which includes the use of a wedge and gravel access road (similar to Bullfrog), would be located within the developed area (figure 22).

## ALTERNATIVE C

Alternative C retains many of the components of alternative B, with some additional changes in location, type, or size of facilities, as well as some improvements and upgrades. Changes under alternative C include consolidation of the Halls Crossing campground and RV park, addition

of an amphitheater in the consolidated campground, relocation of shower and laundry facilities to the campground, addition of a combined land-based visitor contact / ranger station and emergency facilities building at Halls Crossing, relocation of the Bullfrog NPS maintenance facility, an increase in wet moorage, expansion of launch ramps, and supplementation of electric power with solar or fuel-cell technology.

The following sections describe in detail the changes proposed under alternative C that are both different from alternative A and different from alternative B. The location of facilities under alternative C for Bullfrog, Halls Crossing, and Hite are included in figures 24, 25, and 26, respectively. Table 1 contains a summary of the changes under alternative C. Table 2 contains changes in disturbed area acreages as a result of alternatives A, B, and C. Table 5 provides a comparison of the alternatives with the project objectives.

Facilities that would not change from existing conditions as a result of alternative C are not discussed in detail in the following sections. Those facilities that would remain unchanged from existing conditions (no-action alternative), including routine maintenance and repairs, are as follows:

- Bullfrog day-use facilities
- Bullfrog and Hite visitor contact / ranger station and emergency facilities
- concessioner boat maintenance and repair and property maintenance facility at Hite
- NPS maintenance facilities at Halls Crossing and Hite
- Halls Crossing and Hite fee collection systems
- airstrips at Bullfrog and Hite
- Hite Marina facilities
- water-based stores at Bullfrog, Halls Crossing, and Hite
- Hite launch ramp
- launch ramp support at Bullfrog and Halls Crossing
- river runner takeout at Hite

In addition, a number of items in alternative B are also common to alternative C. Those items common to alternatives B and C include the following:

- employee, concessioner, and partner housing at Bullfrog, Halls Crossing, and Hite
- visitor overnight accommodations at Bullfrog, Halls Crossing, and Hite
- Bullfrog and Hite visitor camping
- Bullfrog and Hite shower and laundry facilities
- land-based store at Bullfrog and Hite
- land-based food service at Bullfrog, Halls Crossing, and Hite
- day-use facilities at Bullfrog, Halls Crossing, and Hite
- visitor contact / ranger station and emergency facilities at Bullfrog and Hite

- concessioner boat maintenance and repair and property maintenance facilities at Bullfrog, Halls Crossing, and Hite
- secured storage at Bullfrog, Halls Crossing, and Hite
- utility systems at Bullfrog, Halls Crossing, and Hite
- roads and parking at Bullfrog, Halls Crossing, and Hite
- fee collection at Bullfrog
- Bullfrog school
- public boat wash-down areas at Bullfrog. Halls Crossing, and Hite
- water-based food service at Bullfrog and Halls Crossing
- ferry service at Bullfrog and Halls Crossing

### Visitor Camping

Under alternative C, the developed campground and RV park at Halls Crossing would be consolidated in the existing campground location. The combined campground and RV park would be expanded from 64 sites to up to 80 total sites with both hookup and nonhookup sites. A shower and laundry facility and amphitheater would be added. The RV waste disposal station would be upgraded.

### Shower and Laundry Facilities

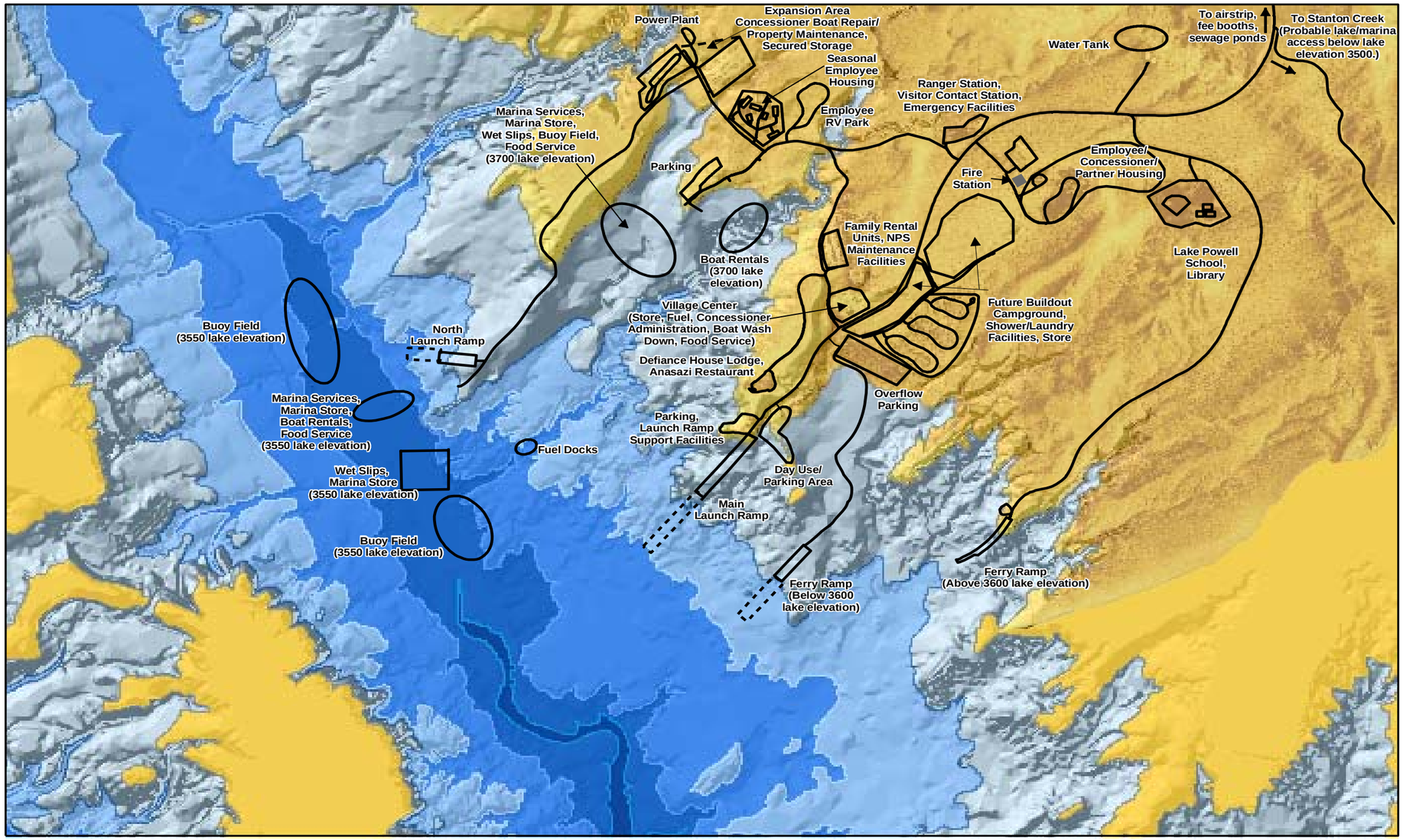
The existing shower facilities at the campground at Halls Crossing would be upgraded to include shower and laundry facilities and the shower and laundry facilities at the Village Center would be eliminated.

### Land-Based Stores

The land-based store at Halls Crossing would be upgraded by replacing it with a larger building. The new building would provide adequate storage for supplies. A small café or snack bar would also be added in the expanded building. The fuel station area would be regraded and the pavement replaced to eliminate uneven areas.

### Ranger Station / Visitor Contact Station and Emergency Facilities

A land-based combined visitor services / ranger station and emergency services building would be constructed at Halls Crossing, in association with the campground or Village Center that would serve as a visitor center, fire station, provide storage for emergency service and search and rescue equipment, and include several ranger offices.




# Bullfrog Marina Alternative C

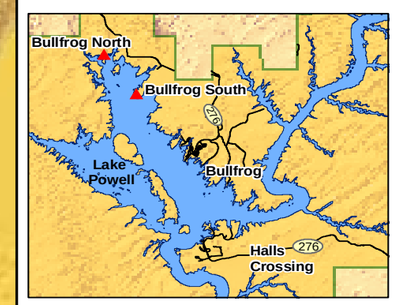
**Lake Elevations (ft.)**

- 3600 - 3700
- 3550 - 3600
- 3500 - 3550
- 3450 - 3500
- 0 - 3450

**Notes:**

Marina facilities and buoy field are approximate in size and location. Actual size and location would vary based on water levels.

New launch ramp and ferry ramp locations would be developed as necessary.




N

0 750 1,500 3,000 Feet

FIGURE 24. BULLFROG MARINA: ALTERNATIVE C

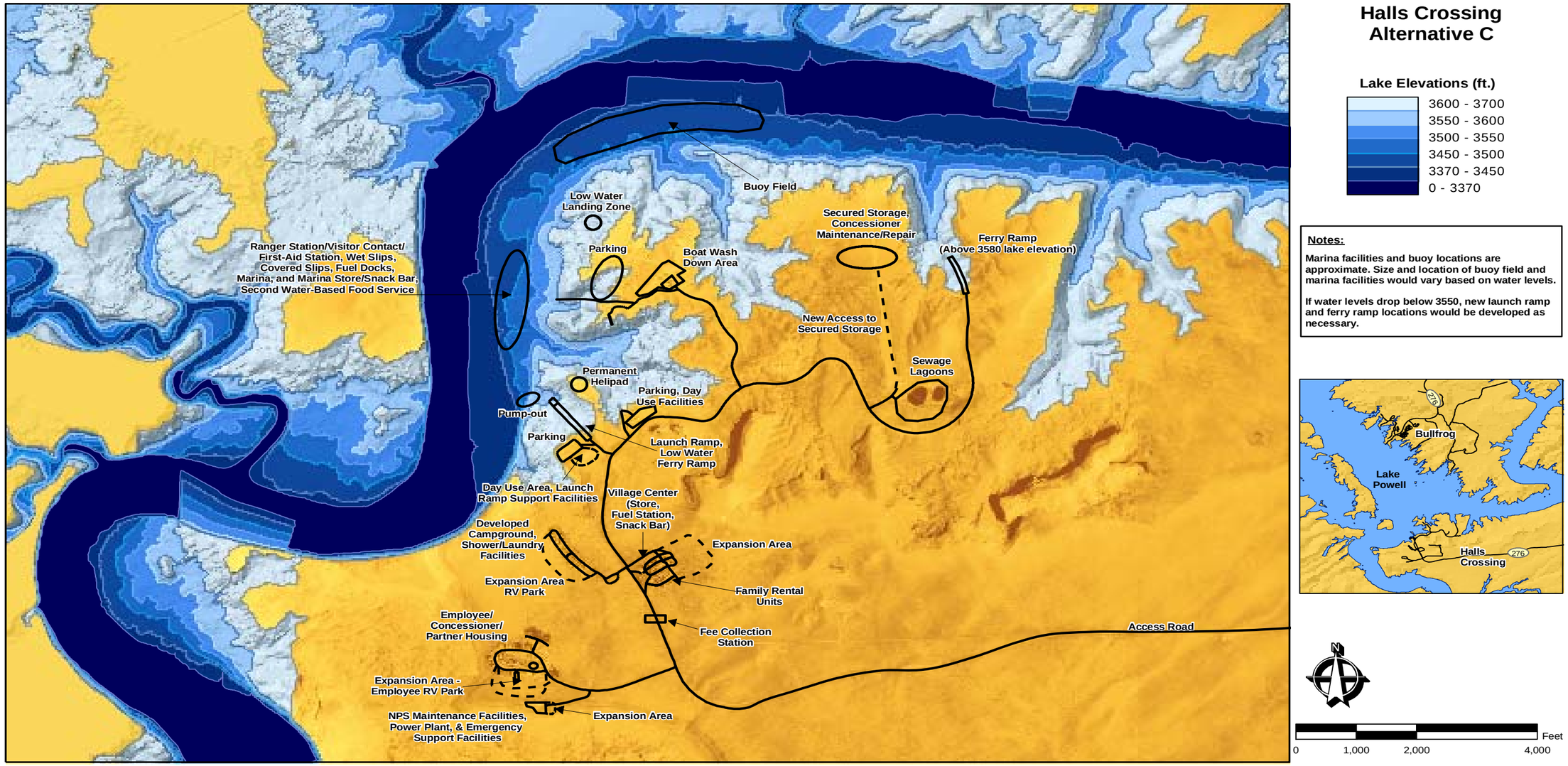



FIGURE 25. HALLS CROSSING MARINA: ALTERNATIVE C

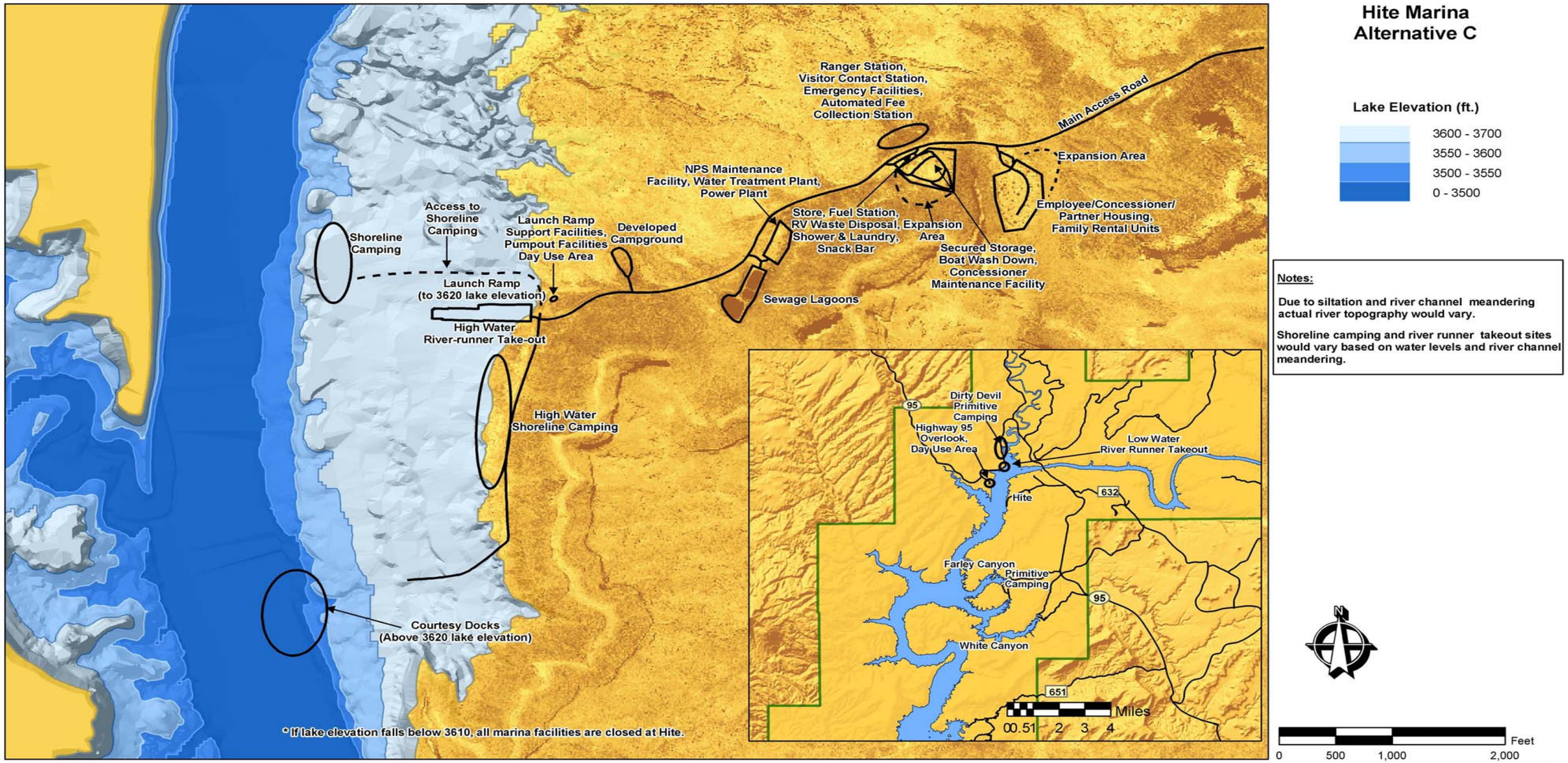



FIGURE 26. HITE MARINA: ALTERNATIVE C

### National Park Service Maintenance Facilities

Under alternative C, the NPS maintenance area at Bullfrog would be moved to a less visible location behind the family rental units. Construction would include screening to improve the visual aesthetics of the maintenance facilities.

### Marina Facilities

Under alternative C, the total combined moorage for Bullfrog and Halls Crossing would increase from the existing 1,090 spaces, up to 1,201 spaces. Additional spaces would be available for up to a 55-mooring buoy field and up to a 56-mooring slip area. The rental boat fleet would be allowed to expand up to a combined total of 580 boats. The concessioner, in conjunction with the National Park Service, would determine how to allocate this total between the two sites based on customer preference, season, water level, navigation impediments, and other factors. The existing water-based facilities at Halls Crossing would be upgraded under alternative C to include a fishing dock. There would be no change to the other marina services at Bullfrog and Halls Crossing under alternative C. The marina facilities would continue to be relocated within the development boundary, as necessary, in response to changing water levels.

### Public Boat Launch Capabilities

Under alternative C, the National Park Service would continue to respond to changing water levels, as necessary, to maintain launching at Bullfrog and Halls Crossing. Under alternative C, the existing Bullfrog launch ramp would be maintained at its current width (ranging from 80- to 150-feet wide). Any new additional length needed to reach lower water levels would be constructed up to 150-feet wide, based on layout and landform constraints. If the existing launch ramp becomes unusable due to extreme low water, a new launch ramp of no more than 150-feet wide would be constructed within the developed area (figure 24), which would require additional environmental evaluation at that time. The existing launch ramp at Halls Crossing would be maintained at its current configuration. Any additional length necessary to reach low water would be up to 110 feet in width, based on layout and landform constraints.

### Launch Ramp Support Facilities

Under alternative C, all launch ramp support facilities would be the same as the existing facilities, except at Hite a land-based boat pump-out facility would be constructed at the top of the launch ramp in the area of the fish cleaning station and shade shelter.

## COMPARISON TO PROJECT OBJECTIVES

Six project objectives outlined in the purpose and need section of this document provide benchmarks for measuring the ability of each alternative to meet the purpose and need of the

project. Alternatives B (the preferred alternative) and C would achieve the six project objectives, while alternative A would not completely meet all six project objectives. A comparison of alternatives and planning objectives is illustrated in table 5.

## ENVIRONMENTALLY PREFERRED ALTERNATIVE

In accordance with Director's Order – 12, the National Park Service is required to identify the "environmentally preferred alternative" in all environmental documents, including environmental assessments. The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which is guided by the Council on Environmental Quality. The Council on Environmental Quality provides direction that "[t]he environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed in section 101 of NEPA, which considers the following criteria:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of non-renewable resources" (NEPA, section 101).

Alternative A (no-action alternative) represents the current status of the uplake developed areas and would permit no modification from the existing conditions to address anticipated changes in visitor numbers and expectations, or relocation of facilities to accommodate changing lake elevations. In addition, existing facilities in less-than-ideal locations would continue to adversely affect the visitor experience, operational efficiency, and overall visual quality. Alternative A (no-action alternative) meets criterion 1 because it would not result in any expansion that could degrade the environment. Criteria 2 and 3 are not met by alternative A (no-action alternative) because locations of existing developments adversely impact overall visual quality. Because no expansion would be provided under alternative A (no-action alternative), criterion 4 is met because natural and cultural resources would not be adversely impacted by lack of action and would continue to be preserved. Criterion 5 would not be met by alternative A (no-action alternative) because visitation is projected to return to pre-drought levels (if not increase above them), further impacting congested facilities and limiting the variety of services offered. Criterion 6 would also not be met by alternative A (no-action alternative) because there are no provisions under this alternative for expanded use of technology to enhance the quality of renewable resources.

**TABLE 5. COMPARISON WITH PROJECT OBJECTIVES**

| Project Objectives | Alternative A (no action) | Alternative B (preferred alternative) | Alternative C |
|---|---|---|---|
| 1. Continue to provide visitor access to the uplake areas and tributaries. | **Partially Meets Objectives.** The existing launch ramps provide limited access, and in some cases, do not provide access to the lake at lower lake elevations. | **Meets Objectives.** Launch ramps would be lengthened, and in some cases, constructed in new locations in order to provide access to the lake at lower lake elevations. | **Meets Objectives.** Launch ramps would be constructed at maximum widths, in addition to being lengthened, and in some cases, constructed in new locations in order to provide access to the lake at lower lake elevations. |
| 2. Provide opportunities for a variety of visitor experiences at the uplake areas. | **Partially Meets Objectives.** Campgrounds, restaurants, and stores would remain in their present configurations and locations. Some variety in terms of stores and restaurants is available. Campgrounds offer limited experiences as campgrounds cannot accommodate a variety of sizes of vehicles and there are no group camping facilities. Day-use facilities are limited. | **Meets Objectives.** Stores and restaurants would be expanded and/or new facilities constructed, increasing the variety of experience available to visitors. Campgrounds would be expanded to accommodate a variety of vehicles and offer a variety of camping experiences including group camping. The number of day-use facilities would be increased. | **Meets Objectives**. Same as alternative B. |
| 3. Provide necessary and appropriate visitor services at the uplake areas, consistent with current and anticipated visitation. | **Partially Meets Objectives.** Occupancy rates for some facilities in some locations demonstrate that use of certain facilities is already maximized at reduced visitation levels. | **Meets Objectives.** Visitor services (numbers of buoys, lodging units, stores, restaurants, secured storage spaces, boat wash-down areas, and campsites with and without hookups) would be expanded to provide increased levels and expanded variety of necessary and appropriate services at the uplake areas. | **Meets Objectives.** Visitor services, in addition to those listed under alternative B (numbers of slips, land base pumpouts, amphitheaters, and ranger contact stations), would be expanded to provide increased levels and expanded variety of necessary and appropriate services at the uplake areas. |
| 4. Accentuate different types of services at each developed area. | **Does Not Meet Objectives.** All developments would continue to offer similar services. | **Meets Objectives.** Development in the Hite area would focus more on river runner and backcountry use, and less on water-based services. Allocation of slip, buoy, and boat rental between Bullfrog and Halls Crossing would be flexible. | **Meets Objectives.** Same as alternative B. |
| 5. Design facilities and services within uplake developed areas to accommodate fluctuating lake levels. | **Partially Meets Objectives.** Existing facilities (such as launch ramps, parking areas, and roads) have been extended to accommodate lower lake levels, but may not fully accommodate future lake level fluctuations. | **Meets Objectives.** Launch ramps, roads, and parking areas would continue to be extended, and sometimes constructed in new locations to provide visitor access at lower lake levels. | **Meets Objectives.** Same as alternative B. |
| 6. Guide efficient and effective organization within uplake developed areas. | **Does Not Meet Objectives.** No changes would be made to current organization or location of facilities within the uplake developed areas. | **Meets Objectives.** Like uses would be consolidated in one location and facilities relocated to allow for effective and efficient organization. | **Meets Objectives.** Same as alternative B. |

Alternative B (preferred alternative) represents the environmentally preferred alternative. Criteria 1 and 4 would be met under alternative B through mitigation measures that would reduce or eliminate environmental impacts resulting from increased development. Alternative B would relocate facilities to improve the visitor experience, operational efficiency, and visual quality, which would meet criteria 2 and 3. Additional visitor facilities such as visitor accommodations, camping facilities, food service facilities, visitor use areas, and marina facilities would also improve the visitor experience, meeting criterion 3. Alternative B would meet criterion 5 by increasing the amenities available to visitors while protecting the environment. Alternative B would also meet criterion 6 through expanded use of renewable energy sources for the uplake developed areas.

Alternative C includes many of the same elements as alternative B, but provides some additional changes and relocations. Changes and relocations under alternative C include consolidating the Halls Crossing RV park and campground sites at the campground location, addition of a land-based visitor / ranger contact station, and relocation of NPS maintenance facilities at Bullfrog to a less congested and visible location. These changes would improve the visitor experience, operational efficiency, and visual quality resulting in criteria 1, 3, and 4 being met. However, many of the changes would use limited resources without realizing the maximum attainable recycling and reuse. This would result in criteria 2 and 6 only partially being met under alternative C. Alternative C would not maximize the balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities because of the scale of the increased development, resulting in criterion 5 only partially being met. By making some of the changes in alternative C, such as moving the NPS maintenance facility, the resources used outweigh the benefits of the move.

Table 6 summarizes fulfillment of NEPA criteria for the environmentally preferred alternative for each alternative.

**TABLE 6. COMPARISON OF ABILITY TO MEET NEPA CRITERIA FOR EACH ALTERNATIVE**

| Criteria | Alternative A (no action) | Alternative B (preferred alternative) | Alternative C |
|---|---|---|---|
| 1 | Yes | Yes | Yes |
| 2 | No | Yes | Partially |
| 3 | No | Yes | Yes |
| 4 | Yes | Yes | Yes |
| 5 | No | Yes | Partially |
| 6 | No | Yes | Partially |

## ALTERNATIVES CONSIDERED BUT DISMISSED

Several combinations of alternatives were considered and dismissed. At Hite, various alternatives for continuing to launch boats at lower water levels were examined, including dredging a channel to provide boat access to the river channel or lake, hoisting large boats into the river channel, and establishing a launch ramp at Blue Notch, Farley Canyon, or White Canyon to access the upper reaches of the lake. All of these alternatives were considered cost prohibitive and would result in unacceptable impacts to natural resources.

Alternatives to the locations for various facilities were evaluated in all uplake developed areas; however, the facility locations presented in the action alternatives represent optimization of operational efficiencies. Alternatives to the size of various facilities were also evaluated; however, the facility sizes presented in the action alternatives represent the balance between providing adequate visitor services based on current and expected future visitation, and protecting natural and cultural resources.

## COSTS OF ALTERNATIVES

A cost comparison in the form of a class C cost estimate of each of the action alternatives is included as appendix B. Industry refers to these estimates as conceptual or order-of-magnitude estimates. A class C estimate is a conceptual cost estimate based on square-foot cost of similar construction. These estimates are generally prepared without a fully defined scope of work and have an accuracy range of -30% to +50%.

## MITIGATION MEASURES

To minimize resource impacts, the following mitigation measures would be followed during implementation of either action alternative. These mitigation measures are included in the analysis of impacts for each action alternative. The mitigation measures were developed to lessen potential adverse effects of the action.

### General Considerations

- The National Park Service project manager would ensure that each project remains confined within the parameters established in the compliance documents and that mitigation measures are properly implemented.

- Construction zones would be identified and flagged before beginning the activity, and all disturbance would be confined to the flagged areas. All project personnel would be instructed that their activities must be confined to locations within flagged areas. Disturbance beyond the actual construction zone would be prohibited.

**TABLE 7. SUMMARY AND COMPARISON OF POTENTIAL ENVIRONMENTAL CONSEQUENCES**

| Impact Topic | Alternative A (no action) | Alternative B (preferred alternative) | Alternative C |
|---|---|---|---|
| Land Use | Because the existing uses conform to the land-use descriptions, and no changes would be made under the no-action alternative, there would be no impacts to land use under alternative A. | All proposed expansion and development would be consistent with the land-use descriptions in the 1979 GMP; therefore, there would be no impacts to land use. | |
| Soils and Geology | There would be no impacts to geology. The impacts to soils would continue to be long term, minor, and adverse. | Impacts to geology would be localized, short and long term, minor, and adverse. Overall impacts to soils would be long term, minor, and adverse. | |
| Paleontology | There would be no impacts to paleontology. | Impacts to paleontology would be localized, long term, negligible to minor, and adverse. | |
| Air Quality | The impacts to air quality would continue to be short and long term, minor, and adverse. | Impacts to air quality would be short term, minor, and adverse, and long term, minor to moderate, and adverse. | The use of supplemental power systems with solar or fuel-cell technology under alternative C would decrease in air emissions resulting in short-term, minor, and adverse, and long-term, negligible to minor, adverse impacts to air quality. |
| Water Resources | Overall water quality in the developed areas is adequately controlled through existing facilities and programs. As a result, the no-action alternative would continue to result in long-term negligible impacts to water quality. | Impacts to water quality would be short term, negligible, and adverse from runoff during construction. Long-term, minor, adverse impacts on surface water quality would occur from continued recreational uses, including potential leaks and spillage of boat fuels and continued use of watercraft. No violations of water quality standards would be expected. | |
| Waters of the U.S. including Wetlands | There would be no changes to existing conditions under the no-action alternative and therefore no impacts to wetlands. | Impacts to waters of the United States would be expected to be short and long term, negligible, and adverse. There would only be negligible impacts to wetlands. | |
| Floodplains | Under the no-action alternative, there would be no impacts to floodplains because new construction or expansion of existing operations would not occur. | Impacts to floodplains would be expected to be short and long term, negligible, and adverse. | |
| Vegetation | Overall impacts to vegetation of the uplake developed areas under the no-action alternative would be long term, minor to moderate, and adverse, resulting from facility and infrastructure maintenance, increased visitation, and introductions of nonnative plant species. | Overall impacts to vegetation would be long term, moderate, and adverse, resulting primarily from facility and infrastructure construction, more intense development of primitive campsites, and long term, negligible, and beneficial due to restoration of previously disturbed plant communities. | |

**TABLE 7. SUMMARY AND COMPARISON OF POTENTIAL ENVIRONMENTAL CONSEQUENCES**

| Impact Topic | Alternative A (no action) | Alternative B (preferred alternative) | Alternative C |
|---|---|---|---|
| Wildlife | Existing impacts to wildlife in the developed areas are long term, minor, and adverse. | Impacts to wildlife species and habitat would be short and long term, minor, and adverse. | |
| Threatened and Endangered Species and Species of Concern / Designated Critical Habitat | Impacts from the no-action alternative would continue to be long term, localized, minor, and adverse. | The short- and long-term impacts would be minor and adverse. | |
| Visual Resources | Existing impacts to visual resources from facilities that visually detract from busy visitor use areas would continue to be long term, minor, and adverse. | Short-term, negligible to minor, adverse impacts to visual resources would result from construction activities. Overall long-term impacts under this alternative would be minor and beneficial due to the positive effects of relocating certain facilities outside visitor viewscapes and reclaiming previously developed areas. | |
| Soundscapes | Impacts would vary seasonally and would be long term, localized, and adverse, and range from negligible to minor depending on the season of activity. | The short-term impacts to soundscapes from construction activities as a result of implementation of the alternative would be negligible to moderate and adverse. The long-term impacts to soundscapes as a result of human-caused sound from the implementation of the alternative would vary seasonally and be negligible to moderate and adverse. | |
| Archeological Resources | Localized archeological resource impacts from visitor use and NRA operations would be long term, adverse, and range from negligible to minor. | Archeological resource impacts would be long term, adverse, and range from negligible to minor. | |
| Ethnographic Resources | Ethnographic resource impacts related to visitor use would be long term, adverse, and negligible to minor in the developed areas. Impacts from NRA operations would have long-term, minor, adverse impacts. | With mitigation, impacts to ethnographic resources would be resource-specific and long term and would range from negligible to minor. | |
| Visitor Use and Experience | Overall impacts to visitor use and experience from the no-action alternative would be long term, minor to moderate, and adverse, and result from the lack of increases in visitor services as visitor numbers increase, and the aging of visitor accommodations. | Short-term impacts to visitor use and experience as a result of activities associated with expansion, relocation, or construction of facilities at the uplake areas would be minor and adverse. Long-term impacts to visitor use and experience would be minor and beneficial. | Short-term impacts to visitor use and experience as a result of activities associated with expansion, relocation, or construction of facilities at the uplake areas would be minor and adverse. Long-term impacts to visitor use and experience would be minor to moderate and beneficial. |

**TABLE 7. SUMMARY AND COMPARISON OF POTENTIAL ENVIRONMENTAL CONSEQUENCES**

| Impact Topic | Alternative A (no action) | Alternative B (preferred alternative) | Alternative C |
|---|---|---|---|
| Socioeconomic Environment | Under alternative A, impacts to the economy and local government fiscal conditions in towns near the uplake developed areas and associated counties would be negligible to minor, long term, and adverse. Where effects to visitor use are greatest, impacts to the economy and to local government fiscal conditions would be long term, minor, and adverse. | Impacts to socioeconomics from planned construction projects as part of the alternatives would be short term, minor, and beneficial. The benefits to concessioners and to visitor-related business and public revenue would be long term, minor to moderate, and beneficial. | |
| Park Operations | Overall impacts to NRA operations from alternative A would be long term, minor, and adverse from meeting the ongoing maintenance needs of aging facilities and increased demands as a result of increased visitation. | Overall short-term, negligible to minor, adverse impacts would occur to NRA operations from construction activities; long-term, minor, and adverse impacts would result from increased operational demands from facility expansion; and long-term, minor, beneficial impacts to NRA operations would result from reduced maintenance and repair requirements for upgraded facilities. | |
| Public Health and Safety | Because no changes would occur to existing facilities at the uplake developed areas under the no-action alternative, there would be no impacts to health and safety. | Impacts to health and safety would be short term, negligible, and adverse, and long term, negligible to minor, and beneficial. | Impacts to health and safety would be short term, negligible, and adverse, and long-term, minor, and beneficial. |
| Transportation | Because no changes would be made under the no-action alternative, there would be no impacts to transportation under alternative A. | The overall impacts to transportation would be short term, minor, and adverse resulting from increased traffic and congestion during construction periods; and long-term, minor, and beneficial impacts resulting from consolidation of like activities, centrally locating facilities to reduce traffic, and improved circulation patterns. | |

- All protection measures would be clearly stated in the construction specifications and workers would be instructed to avoid conducting activities beyond the construction zone, as defined by the construction zone flagging. This does not exclude necessary temporary structures such as erosion-control fencing.

- All tools, equipment, barricades, signs, and surplus materials would be removed from the project work limits upon project completion. Rubbish would be routinely removed from the project site. Any asphalt or concrete surfaces damaged due to work on the project would be repaired to original condition. All demolition debris would be removed from the project site.

- Staging for a construction office, construction vehicles and equipment, and materials storage would be located in previously disturbed areas, outside of high visitor use areas, and would be clearly identified in advance. All staging areas would be returned to pre-construction conditions once construction is complete.

- Contractors would be given orientation concerning proper conduct of operations. This orientation is provided in both written form and verbally at a preconstruction meeting. Orientation topics would include (and not limited to) the following:

  - Wildlife should not be approached or fed.
  - Collecting any park resources, including plants, animals, and historic or prehistoric materials, is prohibited.
  - Contractor must have a safety policy in place and follow it.
  - A vehicle fuel leakage and spill plan would be developed and implemented for the project prior to construction.
  - Other environmental concerns and requirements discussed elsewhere in this EA would be addressed, including relevant mitigation measures listed below.

## Sediment Control

- Utah Department of Environmental Quality requirements, industry standards, and best management practices (BMPs) for drainage and sediment control would be implemented to prevent and/or control nonpoint source discharge to minimize soil loss and sedimentation in drainage areas. Use of BMPs for drainage area protection would include all or some of the following actions, depending on site-specific requirements:

  - Keep disturbed areas as small as practical to minimize exposed soil and the potential for erosion.
  - Locate waste and excess excavated materials outside of drainages to avoid sedimentation.
  - Install silt fences, temporary earthen berms, water bars, sediment traps, check dams, or other equivalent measures to control runoff, as necessary, prior to construction.

  - Conduct regular site inspections during the construction period to ensure that erosion-control measures are properly installed and are functioning effectively.
  - Store, use, and dispose of chemicals, fuels, and other toxic materials in the required and appropriate manner.
  - Revegetate disturbed areas as soon as possible after construction is completed.

### Soils

- Trenching grading operations using manual or heavy equipment would follow industry standard stabilization methods. After trenching and grading is completed, backfill, compaction and regrading operations would be initiated as soon as possible to establish and maintain stable soil surfaces. Soil surfaces would be treated and restoration within approved NPS guidelines and specifications would be performed.

- Vehicle or equipment tracks would be eradicated and "raked out" after construction activities to reduce visual impact and reduce the possibility of visitors driving through soil-disturbed areas.

- Dust and soil control measures, including surface water spraying and revegetation using hydro mulch, would be incorporated into construction activities to reduce soil loss from wind erosion.

### Paleontology

If previously unknown paleontological resources are discovered during construction activities, all work in the immediate area of the discovery would cease until the resources could be identified and documented. If paleontological sites are discovered and cannot be avoided, the resource would be recorded and recovered using required compliance processes.

### Air Quality

- To reduce dust and fine particles from becoming airborne during construction activities, truck beds would be covered with tarps.

- To reduce tailpipe emissions, construction equipment would not be left idling any longer than is required for safety and mechanical operations.

- To reduce short-term construction dust, water sprinkling would be applied to problem areas. Construction limits would be established to minimize soil disturbance and blowing dust.

- Landscaping and revegetation would control long-term soil erosion and blowing dust. Mulch and plants would be used to stabilize the soil and reduce wind impacts across open areas where required.

## Water Resources

- A stormwater management plan would be developed in compliance with Utah Department of Environmental Quality requirements. Additional permitting would be managed to comply with mitigation measures required by state and federal water quality and pollution prevention regulations.
- All activities and projects that occur below 3,700 feet (amsl) would adhere to the requirements of the USACE general lakewide permit, as required by section 404 of the Clean Water Act, and section 10 of the Rivers and Harbor Act.
- Measures from a hazardous spill plan would be in place and dictate preventive measures and required actions taken in the case of a hazardous materials spill.
- All equipment used within the NRA for operations and construction would be maintained in a clean and well-functioning condition to avoid leaks and contamination of resources from mechanical and automotive fluids.

## Floodplains

Appropriate state and federal regulatory permits and protection measures would be established prior to the start of any new construction projects.

## Vegetation

- In an effort to avoid introduction of nonnative/noxious plant species, imported topsoil would be certified free of weed seed contaminants.
- Most areas of new disturbance would be returned to native vegetation through revegetation or seeding. Natural restoration may be used, when appropriate and viable, based on seasonal rain patterns.
- Reclaimed areas would be monitored after construction to determine if revegetation efforts are successful with follow-up actions, as needed.
- Reclamation measures may include installation of erosion-control structures and reseeding with hydro-mulch stabilization.
- To avoid the introduction of nonnative plant species, hay bales would be limited in use because they often contain seeds of undesirable or harmful alien plant species. Straw wattles of appropriate plant species would be used to control soil erosion wherever possible. Application of NPS guidelines for noxious weed control measures would be incorporated into construction activities.

- Undesirable plant species would be controlled, as necessary. To prevent the introduction and minimize the spread of nonnative vegetation and noxious weeds, the following measures would be implemented during construction:
  - Minimize soil disturbance.
  - Pressure wash and/or steam clean all construction equipment to ensure that all equipment, machinery, rocks, gravel, or other materials are cleaned and weed free before entering Glen Canyon NRA.
  - Cover all haul trucks bringing asphalt or other fill materials from outside the recreation area to prevent seed transport.
  - Limit vehicle parking to existing disturbed areas where possible.
  - Obtain all fill, rock, or additional topsoil from the project area, if possible. If not possible, obtaining weed-free sources from NPS-approved sources outside the recreation area, as required.
  - Initiate restoration of disturbed sites immediately following construction activities.
  - Monitor disturbed areas following construction to identify growth of noxious weeds or nonnative vegetation. Treatment of nonnative vegetation would be completed in accordance with NPS – 13, *Integrated Pest Management Guidelines* and/or the Glen Canyon Integrated Pest Management Plan, which will be competed in 2006.

### Threatened and Endangered Species / State Species of Concern

Mitigation for impacts to threatened and endangered species and their designated critical habitat is based on consultation with the USFWS under section 7 of the Endangered Species Act, and includes:

- Access road, restroom placement, and any other incidental actions needed to develop the Hite shoreline camping area would occur outside the southwestern willow flycatcher breeding season.

- Use of the camping area would be restricted to the nonbreeding season for the southwestern willow flycatcher during low lake levels. These restrictions would be lifted should lake levels increase and inundate the habitat area. As the water rises and falls, the shoreline camping area would be adjusted accordingly.

Mitigation measures for Utah state species of concern would include:

- Mitigate for any impacts to bat species – all impacted buildings would be surveyed for bats prior to demolition or construction. Any bats found would be relocated per Utah Department of Natural Resource guidelines.

- Mitigation for the chuckwalla and the glossy snake would consist of surveys for species presence prior to disturbance, which may include relocation of detected individuals

per Utah Department of Natural Resource guidelines, to prevent direct impacts from construction.

- Burrowing owl surveys would be completed and if found, will be relocated to artificial burrows away from construction areas.

## Visual Resources

Trenching for underground utilities would be limited to a 10-foot-wide fenced construction zone, if possible.

- All new construction would be consistent with established architectural themes and construction materials would complement natural colors and textures.

- The new stacked storage unit proposed for the Bullfrog secured storage area would be located outside the primary viewshed and would blend into the natural landscape.

- Overall, muted natural colors would be used to blend any human-made surfaces with the landscape.

## Soundscapes

- Contractors would be required to properly maintain construction equipment (i.e., mufflers) to minimize noise.

- Noise-generating construction activities would be limited to approved hours of operation to minimize visitor impacts.

## Archeological Resources

- Prior to implementation of any undertakings (actions), a SHPO file search would be conducted to determine the location of any existing historic or prehistoric resources. As necessary, an appropriate level of survey and/or data recovery would be completed before work begins. In the unlikely event that unknown archeological resources would be uncovered during construction, work would be halted in the discovery area, the site secured, and Glen Canyon NRA staff experts would consult according to 36 CFR 800.13 and, as appropriate, provisions of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA).

- In compliance with NAGPRA, the National Park Service would notify and consult concerned American Indian tribal representatives for the proper treatment of human remains, funerary, and sacred objects should these be discovered during the project.

- Archeological monitoring would be established on-site during any ground-disturbing activities in areas identified as culturally sensitive.

- Archeological specimens found within the construction area would only be removed by NPS archeologists or their designated representatives.

## Visitor Use and Experience

- The recreation area may restrict construction activities during peak use hours/days, such as holidays and weekends, to minimize disruption to visitors.

- Facilities that are relocated or are temporarily closed due to construction work would be signed with information on the location of the nearest similar facility or location for assistance.

- Unless otherwise approved by the National Park Service, construction operations would be restricted to the hours of 8:00 a.m. to 6:00 p.m. during the summer (May 1 through September 30), and 9:00 a.m. to 5:00 p.m. during the rest of the year to reduce visitor impacts.

- Information regarding construction projects or activities would be shared with the public upon entrance into the recreation area, or through other methods of informational distribution such as informational brochures, flyers, press releases, mailings, and Web sites.

- Management strategies to address carrying capacity issues at various water levels would target better distribution of launch activities throughout a 24-hour day. Methods to reduce launch backup may include broadcasts of real-time launch ramp conditions using the recreation area information radio system, on-site NPS staff visitor contacts, Web site postings, or a launch-time reservation system.

- Methods to allocate visitor use of shoreline campsites may include a camping reservation system to reduce impacts to specific visitor use zones and coordinate length of stay to further address carrying capacity issues.

- The existing "trash tracker" program is well established and incorporates volunteer houseboat trips to clean up beaches. Additionally, visitor education promoting responsible behavior and awareness of water quality and pollution issues are offered through NPS and concessioner visitor contacts, brochures, on-site programs, and Web site information. Trash bags are also made available to visitors at no charge in support of the "pack it in / pack it out" program. These combined mitigations substantially reduce the adverse impacts of litter on beaches and in the lake.

## Park Operations

- Concessions would be notified at least 24 hours in advance of temporary utility outages and construction work within their land assignments.

- Whenever possible, length of outages would be kept to a minimum and scheduled on nonpeak usage hours to reduce economic impacts on concessions and visitor inconvenience.

### Public Health and Safety

A safety plan for project work in drainages and washes would be formulated and implemented to protect public health and safety should these activities take place during the rainy season. Whenever possible, construction in floodplains and washes would be avoided during the rainy season.

- All construction work in visitor use areas (parking lots, campgrounds, launch ramps, etc.) would be barricaded and signed in order to keep visitors at a safe distance from the construction zone.

- Based on the Occupational Safety and Health Administration (OSHA) and NPS patrol and construction management monitoring systems for land- and water-based safety, some construction areas in flash flood-prone areas may be closed to reduce public health and safety risks.

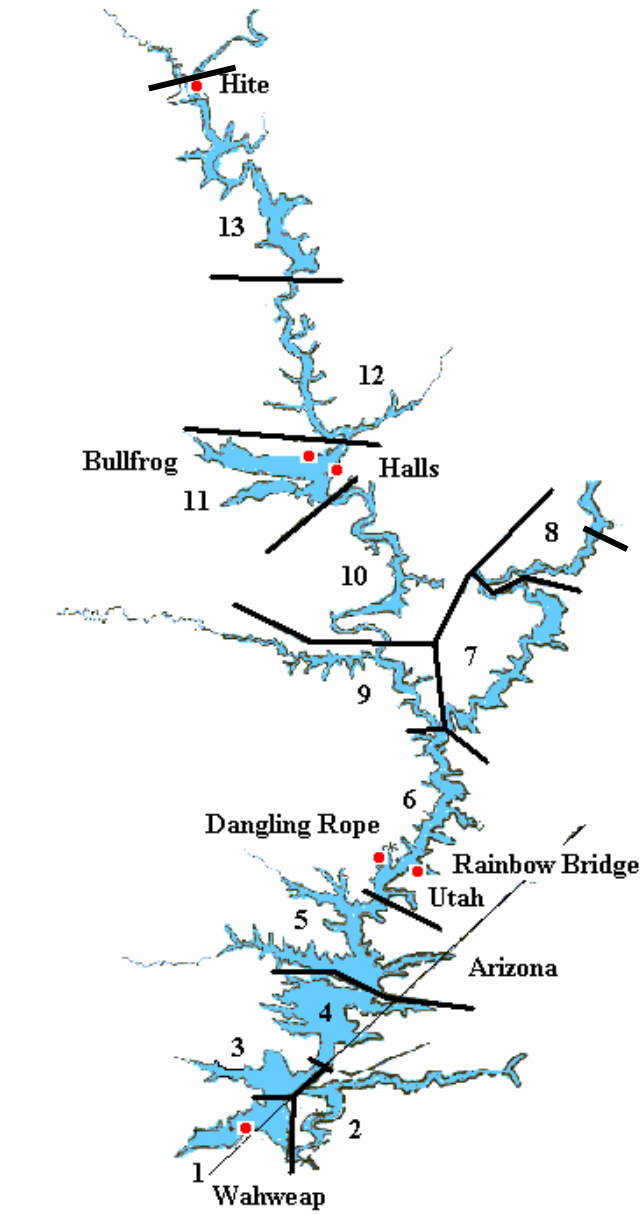
- Water activities on Lake Powell are regulated by U.S. Coast Guard and NPS regulations. Measures to manage concentrated visitor boating may include increased water patrols and designation of wakeless zones based on water surface reduction at lower lake levels. These measures would mitigate adverse impacts of increased boat density in specific visitor use zones.

### Transportation

Traffic in any one direction would not be stopped for more than 20 minutes to minimize disruption of traffic flow.

## SUPPLEMENTAL CALCULATIONS AND ANALYSIS FOR LAKE POWELL CARRYING CAPACITY

In 1987, a carrying capacity study was developed to quantify resource impacts and visitor distribution on Lake Powell during full pool conditions (+/- 3,680 to 3,700 feet amsl). For purposes of the study, Lake Powell was divided into 13 visitor use zones, which are identified in the GMP (figure 27). Impact factors were used to evaluate the relationship between visitor use areas and environmental impacts, such as shoreline pollution, water quality, availability of usable shoreline for recreation, boating safety, and visitor experience qualities, that contribute to recreational opportunities.




(zones 6 through 13 considered uplake area)

**FIGURE 27. VISITOR USE ZONES**

Due to ongoing drought conditions that have impacted lake levels at Lake Powell, the DCP planning process prompted the need to prepare supplemental calculations and analyze carrying capacity for lower lake levels in the uplake areas. To accomplish this effort, updated data from ongoing resource monitoring projects and recent visitor surveys were input into carrying capacity calculations using the same methodology as the 1987 study.

Two limiting factors from the 1987 study were eliminated from the supplemental calculations: water quality and shoreline impacts. These factors were not considered in the updated calculations due to successful mitigation measures implemented since the original study, resulting in reduced impacts. The remaining factors used to calculate new numbers for carrying capacity were applied to the physical capacity (shoreline availability), safety (density/distribution of boats on lake surface), and recreational quality (measuring visitor experience) while visiting Lake Powell.

A detailed summary of calculations and findings for the supplemental analysis are available on request from Glen Canyon NRA. Additional analysis of the supplemental carrying capacity calculations and a description of impacts that relate to the DCP/EA can be found in the "Environmental Consequences" section of this document.

## Analysis of Carrying Capacity for Lake Powell

The concept of analyzing impacts based on limiting factors is flexible and can be used to produce quantifiable results to consider resource impacts, their causes, and potential management strategies for mitigation. Limiting factors serve as a screen to determine the most constraining issue to trigger management changes.

The limiting factors at each lake elevation interval under consideration in the supplemental calculations are presented in tables 8 through 11. Maximum boats-at-one-time (BAOT) indicates the maximum number of boats at one time in that particular zone to meet the limitation of that particular limiting factor.

The shaded blocks with numbers in brackets indicate the limiting factor that is the controlling consideration for each zone. As previously discussed, water quality has been determined to be nonlimiting based on water quality. Data evaluated since 1998, indicate that water quality is not a limiting factor due to education, monitoring studies, and practices implemented to control human waste.

**TABLE 8. 2005 LIMITING FACTOR MATRIX LAKE ELEVATION 3,500**

(Maximum Boats-At-One-Time)

| Visitor Use Zone | Physical | Safety | Recreational Quality (Social) | | |
|---|---|---|---|---|---|
| | | | Semi-Primitive | Rural / Natural | Urban / Natural |
| 6 | 1,456 | 612 | [459] | 612 | 612 |
| 7 | 1,025 | 471 | [353] | 471 | N/A |
| 9 | 784 | 265 | [199] | 265 | N/A |
| 10 | 596 | 615 | [461] | 615 | N/A |
| 11 | 417 | 256 | N/A | [192] | 256 |
| 12 | 679 | 438 | [329] | 438 | N/A |
| 13 | 2,285 | 675 | [506] | 675 | N/A |

NA = The Recreational Opportunity Spectrum or ROS designation used in the 1987 study does not apply to this zone due to the concentration of marina facilities.
Shaded and bracketed numbers indicate the limiting factor for that particular zone at specific lake elevation.

**TABLE 9. 2005 LIMITING FACTOR MATRIX LAKE ELEVATION 3,550**

(Maximum Boats-At-One-Time)

| Visitor Use Zone | Physical | Safety | Recreational Quality (Social) | | |
|---|---|---|---|---|---|
| | | | Semi-Primitive | Rural / Natural | Urban / Natural |
| 6 | 1,465 | 753 | [565] | 753 | 753 |
| 7 | 595 | 614 | [460] | 614 | N/A |
| 9 | 334 | 349 | [261] | 349 | N/A |
| 10 | [394] | 729 | 547 | 729 | N/A |
| 11 | 593 | 437 | N/A | [328] | 437 |
| 12 | 854 | 525 | [394] | 525 | N/A |
| 13 | 2,191 | 963 | [722] | 963 | N/A |

NA = The Recreational Opportunity Spectrum or ROS designation used in the 1987 study does not apply to this zone due to the concentration of marina facilities.
Shaded and bracketed numbers indicate the limiting factor for that particular zone at specific lake elevation.

**TABLE 10. 2005 LIMITING FACTOR MATRIX LAKE ELEVATION 3,600**

(Maximum Boats-At-One-Time)

| Visitor Use Zone | Physical | Safety | Recreational Quality (Social) | | |
|---|---|---|---|---|---|
| | | | Semi-Primitive | Rural / Natural | Urban/ Natural |
| 6 | 1,812 | 946 | [710] | 946 | 946 |
| 7 | [537] | 745 | 558 | 745 | N/A |
| 9 | 475 | 459 | [344] | 459 | N/A |
| 10 | 640 | 851 | [639] | 851 | N/A |
| 11 | 685 | 764 | N/A | [573] | 764 |
| 12 | 499 | 619 | [465] | 619 | N/A |
| 13 | 1,852 | 1,273 | [955] | 1,273 | N/A |

NA = The Recreational Opportunity Spectrum or ROS designation used in the 1987 study does not apply to this zone due to the concentration of marina facilities.
Shaded and bracketed numbers indicate the limiting factor for that particular zone at specific lake elevation.

**TABLE 11. 2005 LIMITING FACTOR MATRIX LAKE ELEVATION 3,700**

(Maximum Boats-At-One-Time)

| Visitor Use Zone | Physical | Safety | Recreational Quality (Social) | | |
|---|---|---|---|---|---|
| | | | Semi-Primitive | Rural / Natural | Urban / Natural |
| 6 | 2,589 | 1,394 | [1,045] | 1,394 | 1,394 |
| 7 | [779] | 1,045 | 784 | 1,045 | N/A |
| 9 | 990 | 726 | [544] | 726 | N/A |
| 10 | 1,082 | 1,127 | [846] | 1,127 | N/A |
| 11 | 1,528 | 1,942 | N/A | [1,456] | 1,942 |
| 12 | 1,215 | 915 | [686] | 915 | N/A |
| 13 | 2,802 | 1,948 | [1,461] | 1,948 | N/A |

NA = The Recreational Opportunity Spectrum or ROS designation used in the 1987 study does not apply to this zone due to the concentration of marina facilities.
Shaded and bracketed numbers indicate the limiting factor for that particular zone at specific lake elevation.

The supplemental calculations in table 12 provide updated carrying capacity launch rates (CCLRs) at varying lake levels, and compare them with the existing capacity of launch and marina facilities to launch boats onto the lake.

Table 13 provides a comparison of 2005 carrying capacity launch rates with current capacity of existing marinas and launch ramps to distribute boats onto the lake. Columns of information should be compared between those with the same lake elevations. Shaded blocks with bracketed numbers in the current capacity columns indicate when the capacity exceeds the recommended CCLR for that lake elevation.

As shown in table 12, the carrying capacity limits for combined Bullfrog and Halls Crossing areas may be exceeded based on limiting factors if maximum launch rates and boats from marinas put on the water at one time at the full pool lake elevation of 3,700. In addition, Halls Crossing existing carrying capacity may be exceeded at lake elevations of 3,550, 3,600, and 3,700 if maximum launch rates and boats from marinas put on the water at the same time.

The 1987 carrying capacity study and supplemental calculations assumed that 20% of boats in marina facilities would be out on the lake at any one time. Under alternative B, increases in wet moorage would increase total launches by 11 launches per day, and increases in rental boat fleets would increase total launches by 116 launches per day. Under alternative C, increases in wet moorage would increase total launches by 22 launches per day, and increases in rental boat fleets would increase total launches by 116 launches per day.

**TABLE 12. CARRYING CAPACITY LAUNCH RATES / CURRENT CAPACITY COMPARISON TABLE**

| Updated Carrying Capacity Launch Rate (calculated using 1987 methodology and updated data to evaluate varying lake levels) | | | | | Current Capacity (combines 20% of existing buoy moorage and ramp capacity at each lake level) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **3,500 CCLR** | **3,550 CCLR** | **3,600 CCLR** | **3,700 CCLR** | **3,500** | **3,550** | **◆3,557–3,583** | **3,600** | **3,700** |
| **Bullfrog** | 310 | 375 | 524 | 463 | 246 | 246 | 343 | 305 | 437 |
| **Halls Crossing** | 121 | 160 | 217 | 179 | Unknown* | [223] | 223 | [275] | [266] |
| **Bullfrog/Halls Crossing Combined** | 431 | 535 | 741 | 642 | Unknown | 469 | 566 | 580 | [703] |
| **Hite** | 0 | 0 | 0 | 377 | N/A | N/A | N/A | N/A | 210 |

* There is no launch capacity at the existing Halls Crossing launch ramp below 3,550 lake elevation.
**Numbers reflect a factor increase due to length of stay estimates from visitor survey information. Survey data suggests visitors stay twice as long at higher lake levels then at 3,600 and below lake levels.
◆ 3,557–3,583 lake levels shown due to launch capability of Bullfrog north ramp at those lake elevations.
For this planning effort, Bullfrog and Halls Crossing numbers are shown combined due to proximity of marinas within visitor use zone 11.

Table 13 compares updated carrying capacity launch rates with projected capacity to launch boats resulting from the implementation of alternative B. Varying lake level shoreline capacity, safety, and recreational quality factors are included in the updated carrying capacity launch rates. Alternative B adds 20% of proposed buoy moorage and increased rental boat fleet to the launch ramp capacity numbers. Shaded boxes with bracketed numbers highlight lake level projected capacities that may exceed carrying capacity if maximum numbers of launches occur within 24 hours.

The 1987 carrying capacity study and supplemental calculations assumed that 20% of boats in marina facilities would be out on the lake at any one time.

**TABLE 13. CARRYING CAPACITY LAUNCH RATES (UPDATED CARRYING CAPACITY LIMITS COMPARED TO ALTERNATIVE B)**

| Updated Carrying Capacity Launch Rate (calculated using 1987 methodology and updated data to evaluate varying lake levels) | | | | | Alternative B Projected Capacity (combines 20% of increased buoy moorage, rental boats and ramp capacity at each lake level) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **3,500 CCLR** | **3,550 CCLR** | **3,600 CCLR** | **3,700** CCLR** | **3,500** | **3,550** | **◆3,557–3,583** | **3,600** | **3,700** |
| **Bullfrog** | 310 | 385 | 524 | 469 | 286 | 286 | 383 | 345 | 479 |
| **Halls Crossing** | 121 | 171 | 217 | 179 | Unknown* | [274] | [274] | [326] | [326] |
| **Bullfrog/Halls Crossing Combined** | 431 | 556 | 741 | 648 | Unknown | 560 | 657 | 671 | [805] |
| **Hite** | 0 | 0 | 0 | 377 | N/A | N/A | N/A | N/A | 219 |

* There is no launch capacity at the existing Halls Crossing launch ramp below 3,550 lake elevation.
**Numbers reflect a factor increase due to length of stay estimates from visitor survey information. Survey data suggests visitors stay twice as long at higher lake levels then at 3,600 and below lake levels.
◆ 3,557–3,583 lake levels shown due to launch capability of Bullfrog north ramp at those lake elevations.
For this planning effort, Bullfrog and Halls Crossing numbers are shown combined due to proximity of marinas within visitor use zone 11.

Table 14 compares updated carrying capacity launch rates with projected capacity resulting from the implementation of alternative C. Varying lake level shoreline capacity, safety, and recreational quality factors are included in the updated carrying capacity launch rates. Alternative C adds 20% of proposed wet slips, buoy moorage, and rental boat fleet increases into the launch ramp capacity numbers. Shaded boxes highlight lake levels and launch rates that may exceed carrying capacity if maximum numbers of launches occur within 24 hours.

**TABLE 14. CARRYING CAPACITY LAUNCH RATES, UPDATED CARRYING CAPACITY COMPARED TO ALTERNATIVE C**

| Updated Carrying Capacity Launch Rate (calculated using 1987 methodology and updated data to evaluate varying lake levels) | | | | | Alternative C Projected Capacity (combines 20% of increased buoy moorage & slip expansion, rental boats, and ramp capacity at each lake level) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **3,500 CCLR** | **3,550 CCLR** | **3,600 CCLR** | **3,700 CCLR** | **3,500** | **3,550** | **◆3,557–3,583** | **3,600** | **3,700** |
| **Bullfrog** | 310 | 385 | 524 | 469 | 297 | 297 | 394 | 356 | 490 |
| **Halls Crossing** | 121 | 171 | 217 | 179 | Unknown* | [274] | [274] | [326] | [326] |

**TABLE 14. CARRYING CAPACITY LAUNCH RATES, UPDATED CARRYING CAPACITY COMPARED TO ALTERNATIVE C**

| Updated Carrying Capacity Launch Rate (calculated using 1987 methodology and updated data to evaluate varying lake levels) | | | | | Alternative C Projected Capacity (combines 20% of increased buoy moorage & slip expansion, rental boats, and ramp capacity at each lake level) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3,500 CCLR | 3,550 CCLR | 3,600 CCLR | 3,700 CCLR | 3,500 | 3,550 | ◆3,557–3,583 | 3,600 | 3,700 |
| **Bullfrog / Halls Crossing Combined** | 431 | 556 | 741 | 648 | Unknown | [571 | 668 | 682 | [816] |
| **Hite** | 0 | 0 | 0 | 377 | N/A | N/A | N/A | N/A | 219 |

* There is no launch capacity at the existing Halls Crossing launch ramp below 3,550 lake elevation.
**Numbers reflect a factor increase due to length of stay estimates from visitor survey information. Survey data suggests visitors stay twice as long at higher lake levels then at 3,600 and below lake levels.
◆ 3,557–3,583 lake levels shown due to launch capability of Bullfrog north ramp at those lake elevations.
For this planning effort, Bullfrog and Halls Crossing numbers are shown combined due to proximity of marinas within visitor use zone 11.

Widening the existing launch ramp sections to a maximum of 150-feet wide and construction of any future launch ramp sections to a maximum of 150-feet wide under alternative C would result in increased launch capacity at lower lake levels. Assumptions used in the supplemental calculations to the 1987 carrying capacity study included 24-hour ramp availability for launching/retrieving, 25-foot-wide launch lanes, and 15 minutes cycle time per launch. Using these assumptions, the capacity of the ramp to launch boats would increase by 134 launches per day at lake elevation 3,600, and 193 launches per day at lake elevations 3,550 and 3,500.

The updated calculations show management strategies may be needed to mitigate the resulting carrying capacity issues to address “physical capacity” and “recreational quality” factors. Some management actions that could mitigate the physical capacity issue include a reservation or permitting system to manage camping allocation in different zones, or regulating launch times and volume during peak demand.

Approaches to managing recreational quality factors may include providing information to visitors, prior to boating, about the characteristics and popularity of different visitor use zones to increase distribution and support a range of visitor experience opportunities as part of the Lake Powell recreational experience.

# Affected Environment

# AFFECTED ENVIRONMENT

## INTRODUCTION

This section describes the affected environment or physical and social conditions currently present within the analysis area, which includes the uplake developed areas (Bullfrog, Halls Crossing, and Hite marinas). The analysis area for the affected environment and environmental consequences discussions includes the developed areas plus a 500-foot buffer as shown in the figures depicting the alternatives.

## GENERAL DESCRIPTION

Glen Canyon NRA is on the Colorado Plateau and extends more than 200 miles from the Green River in southern Utah downstream to Lees Ferry in Arizona (see figure 1). Lake Powell was formed by the construction of Glen Canyon Dam between 1956 and 1964. Congress authorized the dam construction in the Colorado River Storage Project Act of 1956 (PL 84-485). The primary objectives were to prevent flooding on the Colorado River, create a reservoir to meet downstream water demand, and generate hydroelectric power.

Glen Canyon Dam is managed by the Bureau of Reclamation. It was designed to accommodate lake levels ranging from approximately 3,490 feet to approximately 3,700 feet amsl. As the water level changes, the surface of Lake Powell varies in size from 52,000 acres to 163,000 acres, and the shoreline fluctuates from 990 miles to 1,960 miles in length. Annual fluctuations in lake levels typically are about 25 vertical feet.

The lake level rises in the spring as water from snowmelt runoff and spring storms collects behind the dam. The lake level then declines throughout the rest of the year, particularly during summer and early fall as water is released for electrical power generation and irrigation. In recent years, low snowmelt runoff and decreased rainfall from spring storms have resulted in a decreased lake water surface. By the end of 2006, water levels are predicted to be at an elevation of approximately 3,613 feet (USBR 2006).

In 1972, Congress established Glen Canyon NRA (PL 92-593) to provide public recreation on Lake Powell and adjacent lands. The National Park Service is responsible for managing all federal lands and waters within Glen Canyon NRA. Access to Lake Powell within Glen Canyon NRA is provided at five developed marinas (Bullfrog, Halls Crossing, Hite, Antelope Point, and Wahweap [see figure 2]). The recreation area includes approximately 1,254,306 acres of land and water. At full pool, the water surface of Lake Powell encompasses approximately 13% of the total lands of Glen Canyon NRA; however, the lake and associated marinas and developed areas are the most extensively used portion of the recreation area.

## LAND USE

In the 1979 GMP, land use was defined through the creation of four distinct land management zones within the boundaries of Glen Canyon NRA. These zones were designated as natural, recreation and resource utilization, development, and cultural.

The developed areas at Bullfrog, Halls Crossing, and Hite fall into the development zone. The development zone designation allows development of more permanent and elaborate structures to support recreational activities. All types of visitor activities are permitted in this zone, with certain restrictions determined during management planning. Within the defined boundaries for this zone, all types of construction to support visitor services would be acceptable.

## SOILS

Soils in the uplake area consist primarily of alluvial or colluvial soils derived from water and wind erosion of the surrounding bedrock. As shown in figure 28, much of Bullfrog lies within the Moffat loamy fine sand and Monue loamy fine sand soils types. Figure 29 shows the soils at Halls Crossing, which include primarily the Moenkopi M warm complex and Bluechief L-N complex soils with minor incursions of the Piute-S rock complex soils. The Hite area includes soils from the Moenkopi rock outcrop and Moenkopi-M warm complex (figure 30). Soils descriptions for each soils type are as follows:

### *Monue Series*

The Monue series soils consist of very deep, well-drained, moderately rapidly permeable soils on alluvial terraces and eolian deposits on structural benches. These soils form from the erosion of sandstone. Soils are loamy fine sand. Slopes range from 1% to 12%. These soils are typically deeper then 60 inches, but may have bedrock at depths of 40 to 60 inches. Soils are typically used for rangeland.

### *Bluechief Series*

The Bluechief series consists of moderately deep, well-drained, moderately to rapidly permeable soils that formed in sandy eolian deposits and alluvium derived from sandstone. These soils are on benches and fan terraces. Soils are fine sandy loam. Slopes range from 1% to 15%. Soil depths are typically 30 to 40 inches, but bedrock can occur at 20 inches. Soils in this series are typically used for rangeland, wildlife habitat, and recreation.

### *Moenkopi Series*

The Moenkopi series consists of very shallow and shallow, well-drained, moderate to moderately to rapidly permeable soils that formed in alluvium and residuum from sandstone and shale. Moenkopi soils are on mesas, hillslopes on structural benches and plateaus. Soils are loamy sand. Slopes are 1% to 30%. Soil depths are typically 9 to 12 inches, but can range from 4 to 20 inches. Soils in this series are typically used for livestock grazing and wildlife habitat.

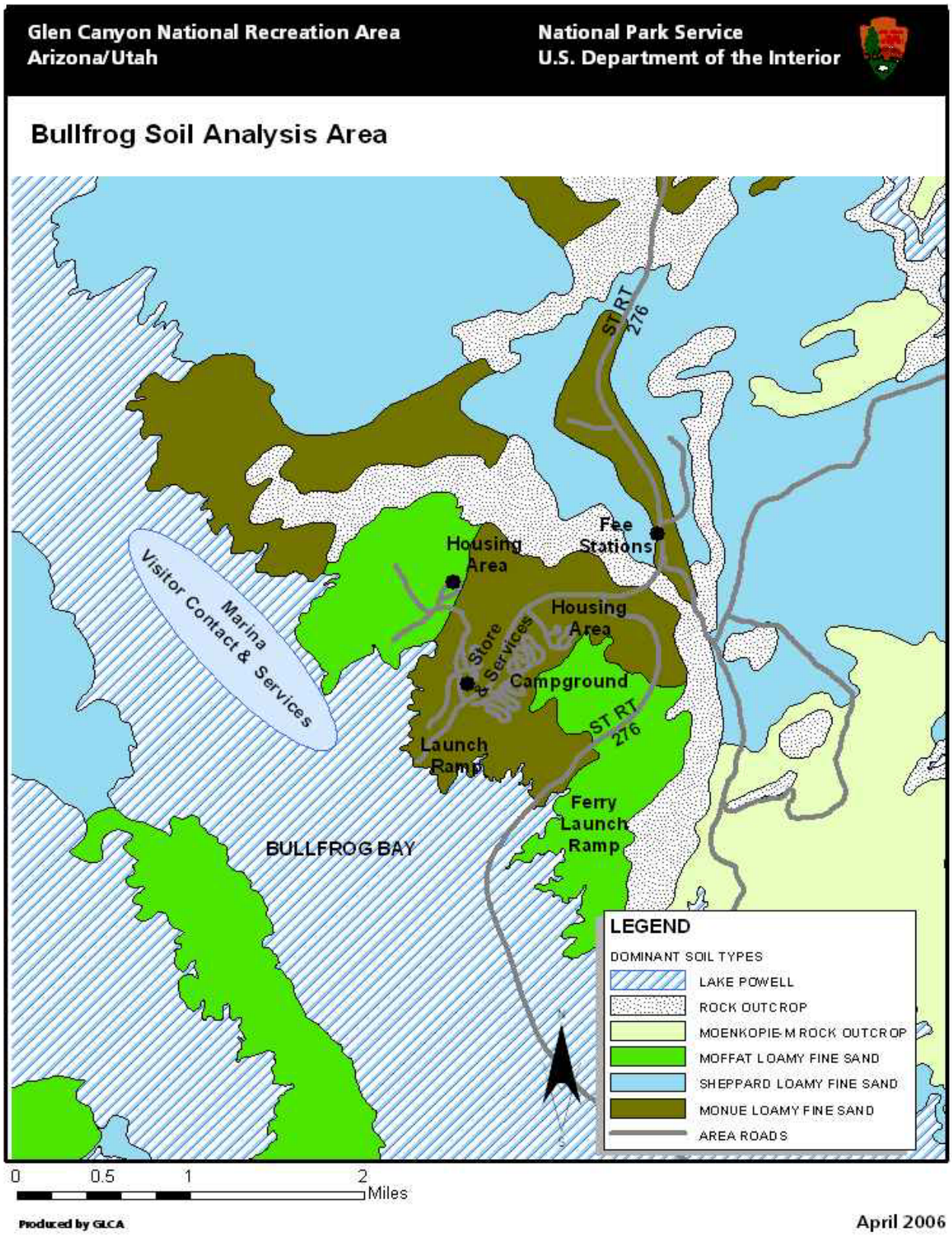



**FIGURE 28. SOILS OF BULLFROG DEVELOPED AREA**

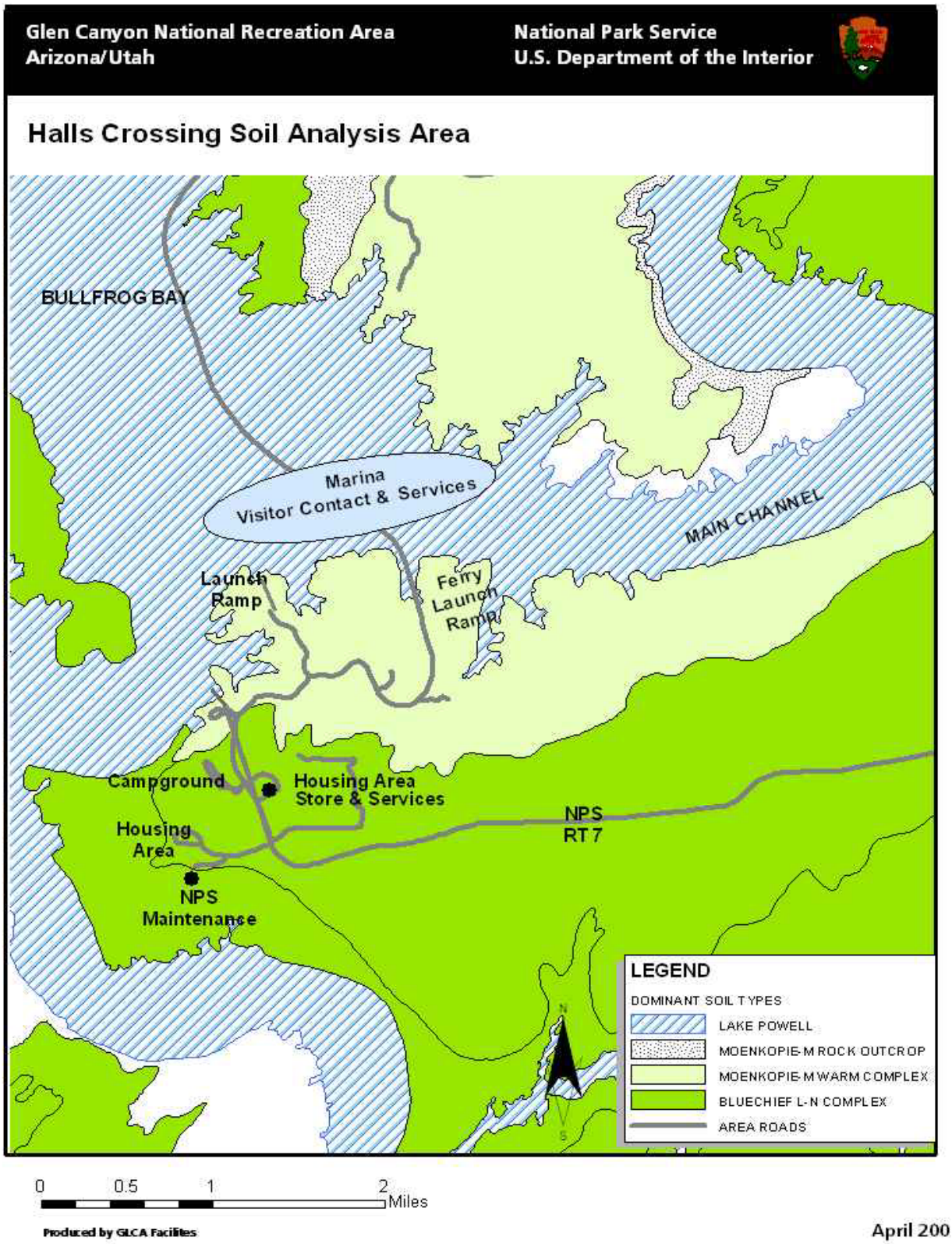



**FIGURE 29. SOILS OF HALLS CROSSING DEVELOPED AREA**

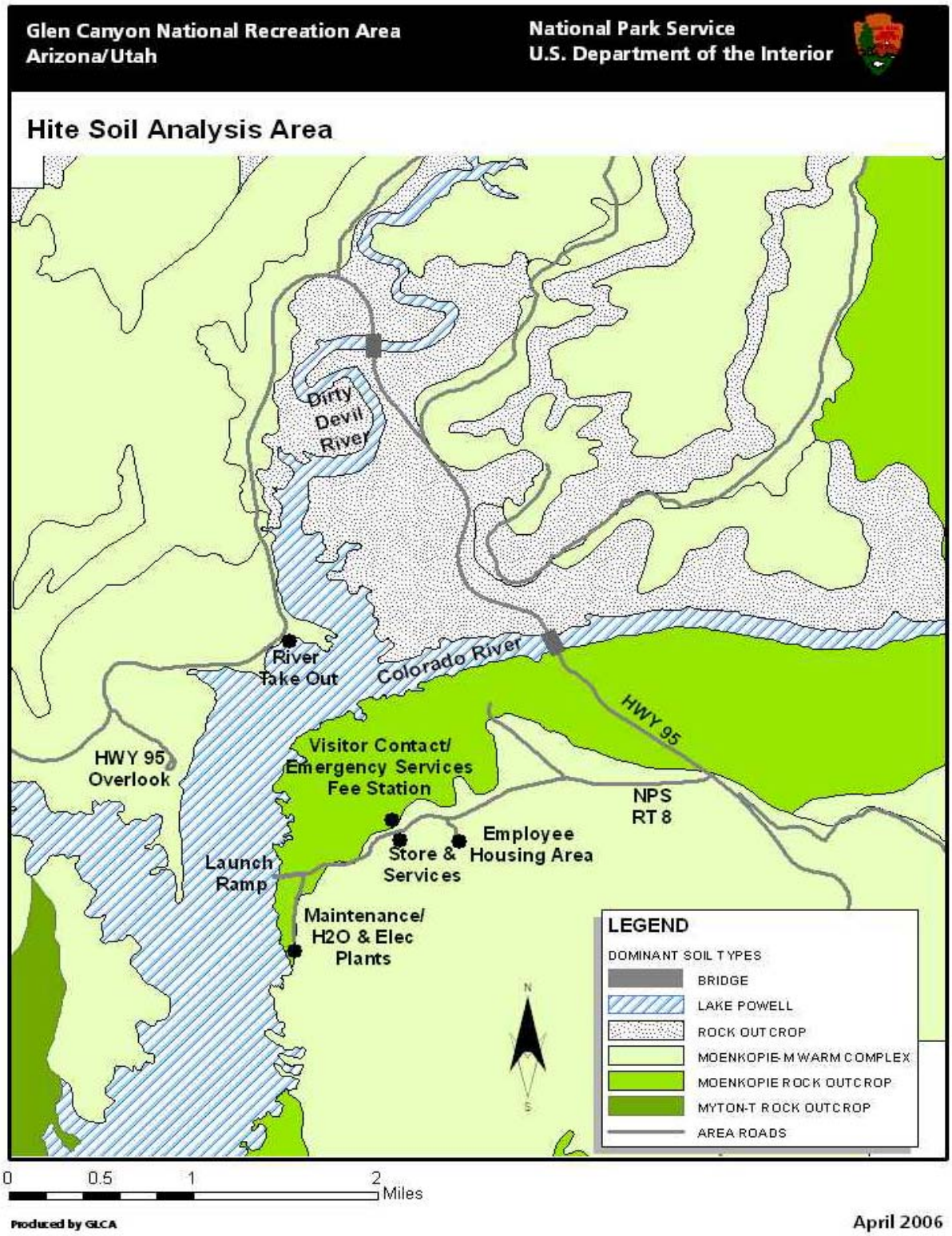



**FIGURE 30. SOILS OF HITE DEVELOPED AREA**

#### *Moffat Series*

The Moffat series consists of very deep, well-drained, moderately rapidly permeable soils that formed in eolian and alluvial sediments. These soils are on plains, plains on structural benches, and alluvial fans, and have slopes ranging from 1% to 25%. Soils are gravelly fine sand. Soil depths are typically 40 to 60 inches. Soils are typically used for rangeland.

## GEOLOGY

### Geology of the Bullfrog Area

Upper Jurassic formation rocks dominate the landscape at Bullfrog. During the Jurassic period approximately 180 million years ago, ancient oceans began to retreat. The Carmel formation is present at Bullfrog in lower areas closer to the lake. The Carmel formation was deposited under shallow marine conditions and consists of beds of limestone and sandy limestone. Above the Carmel formation lies the Kayenta formation. Streams flowing into the shallow oceans deposited the limey, thinly layered sandstone of the Kayenta formation. The cliffs and ledges are present in the elevated segments of the developed area. At the highest points of the developed area, the Summerville formation may be exposed. The Summerville formation contains sedimentary rocks deposited primarily by river flows, with some thin layers that may have been deposited by wind. Rocks are typically thinly bedded siltstones and mudstones with occasional thin beds of white sandstone. Holocene gravels, dunes, and soils are scattered in the area (Gillette 2004).

### Geology of the Halls Crossing Area

The geology of Halls Crossing and surrounding areas is dominated by Upper Jurassic age sandstones. Navajo sandstone resulted from a period of time when a massive windswept dunefield covered what is now the Colorado Plateau. Navajo sandstone is a colorful unit of red, orange, and white sandstone that can be as thick as 2,400 feet. At Halls Crossing, the Navajo sandstone is believed to be approximately 1,200-feet thick, but not all of the formation is exposed. Navajo sandstone forms the lowest lying rocks in the area. Page sandstone may lie above the Navajo sandstone; however, this unit is difficult to distinguish because it is similar to Navajo sandstone. When Page sandstone is difficult to distinguish, geologists generally map this unit as part of the Navajo sandstone. The Navajo/Page sandstone layer can be found above the Carmel formation previously described, but it has limited exposure. Entrada sandstone lies above the Carmel formation. Like Navajo sandstone, the Entrada formation is a wind-driven deposit. However, the Entrada sandstone generally forms a thinner layer than the Navajo sandstone, and is typically a white or off-white to cream color. Above the Entrada sandstone lie Quaternary sediments consisting of unconsolidated silts and sands deposited mainly by wind (Gillette 2004).

### Geology of the Hite Area

The rocks in the Hite area are older than the rocks at Bullfrog and Halls Crossing. The geology at Hite is dominated by rocks of Permian and early Triassic age. Cedar Mesa sandstone is the lowest formation present in the area. Cedar Mesa sandstone accumulated in a coastal dune system, which was periodically inundated by water. The Organ Rock formation overlies the Cedar Mesa sandstone and consists of shale, silt, and sand deposited by rivers with occasional dry land sand deposits. White Rim sandstone forms the vertical cliffs in the area and is sandstone derived from both ocean and dry land wind deposits. The highest formation is the Moenkopi. This formation caps the exposures in the Hite vicinity. The Moenkopi formation is comprised of mudstones from a riverine environment (Gillette 2004).

## PALEONTOLOGY

In accordance with NPS *Management Policies 2001*, section 4.8.2.1, *Paleontological Resources and Their Contexts*, paleontological resources in national parks "will be protected, preserved, and managed for public education, interpretation, and scientific research." The paleontological resources at the three uplake developed areas were evaluated as part of an initial site survey that provided a general overview of geologic formations in the analysis area and research into the paleontological resources that might be present in each formation. The following discussions describe the findings for each developed area (Gillette 2004).

### Potential Paleontological Resources at Bullfrog

Three formations are exposed at Bullfrog. The potential for paleontological resources at each site is described as follows:

- While fossils (mostly invertebrates) are occasionally found in the Carmel formation, finding any fossil in this formation is considered rare. The upper layers of the Entrada sandstone preserve abundant dinosaur tracks. Prior to the time of deposition of the Entrada sandstone, sauropod (long-neck) dinosaurs were absent in North America. There is some evidence in the Entrada sandstone track record that sauropod populations expanded from Asia to North America at this time, setting the stage for the spectacular evolution of dinosaurs found in great abundance in the Morrison formation.

- The Summerville formation seldom produces fossils; however, because of its stratigraphic position, it may contain fossils at Bullfrog.

### Potential Paleontological Resources at Halls Crossing

Five formations are exposed at Halls Crossing. The potential for paleontological resources in each formation is described as follows:

- The Navajo sandstone has extensive, but poorly recorded dinosaur tracks on horizontal bedding planes that represent ancient stabilized dune surfaces, perhaps temporary wet ground that would form shallow interdune lakes under the right climatic conditions. Some beds of very local extent in the Navajo sandstone have impressive petrified logs, occasionally associated with dinosaur tracks, under conditions generally interpreted as oasis deposits. The petrified logs can be substantial in size, but are likely to be broken and difficult to recognize where erosional effects caused by fluctuations of the lake have produced wave action and otherwise left the logs exposed.

- The Page sandstone has a poor fossil record, if any.

- The Carmel formation fossils are generally marine invertebrates with spotty distribution. Vertebrate fossils and plants are possible and, if found, would be considered rare.

- The uppermost beds of Entrada sandstone occasionally yield exceptional dinosaur footprints, in some places by the millions (e.g., in the vicinity of Arches National Park). These sites have been called dinosaur freeways and probably represent north-south migratory routes for herding species.

- Eolian Quaternary sediments, on rare occasion, yield extinct flora and fauna in association with early human occupation (e.g., Clovis and Folsom technologies), overlapping with archeological resources.

### Potential Paleontological Resources at Hite

Four formations are exposed at Hite. The potential for paleontological resources at each site is described as follows:

- Fossils are not common in the Cedar Mesa formation, but this formation has yielded critically important plant fossils that provide details of terrestrial plant species that existed here prior to the catastrophic extinction event at the end of the Permian period.

- The Organ Rock formation represents terrestrial conditions where Permian reptiles dominated the landscape and may contain reptile or reptile-related fossils.

- White Rim sandstone in the Hite area forms nearly vertical cliffs that are difficult to examine and are not likely to be disturbed during any construction.

- The Moenkopi formation contains the earliest record of Triassic fauna and flora of the southern Colorado Plateau. The fossil record represents the recovery stage following the catastrophic end-Permian extinction event that nearly extinguished all life on earth. Reptilian ancestors to dinosaurs and all other reptiles are contained in the Moenkopi formation. There is some evidence that the oldest dinosaurs in the world occur in this formation.

## AIR QUALITY

The EPA and the Utah Department of Environmental Quality regulate air quality in Utah through implementation of the Clean Air Act. The Clean Air Act is a federal air quality law that is intended to protect human health and the environment by reducing emissions of specified pollutants at their source. In accordance with this law, permits are required for any stationary facility that qualifies as a "major source." Further, the Clean Air Act outlines three types of airshed classification areas: class I, II, and III. Glen Canyon NRA is located within a class II airshed in which the demonstrated impact of a new stationary source facility may emit no more than 100 tons of a regulated pollutant annually before needing a permit.

The EPA has established primary and secondary National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, particulate matter, ozone, sulfur dioxide, and lead. Primary standards are adopted to protect public health, while secondary standards are adopted to protect public welfare. Air quality data for four of the six criteria pollutants that are regulated by the EPA are measured and recorded by the Salt River Project at Glen Canyon Dam next to the Carl Hayden Visitor Center. There are no air quality monitoring sites at or near the uplake developed areas. No data is available for carbon monoxide or lead within Glen Canyon NRA as these pollutants are not monitored due to historically low concentrations in the area—no exceedances have been recorded for the last five years. Ambient air quality data at the downlake monitoring site for Glen Canyon NRA from 1996 through 2001, when compared to the federal standards for those pollutants, indicate that all pollutants monitored are well below established standards.

## WATER RESOURCES

### Introduction

Although Lake Powell reached full capacity at an elevation of approximately 3,700 feet on June 22, 1980, the average lake elevation for 1980 was approximately 3,680 feet amsl (figure 31). At full capacity, Lake Powell extends 186 miles up the Colorado River from the dam, and 75 miles up the San Juan River from its confluence with the Colorado. The design surface area at full capacity is 251.2-square miles with 1,960 miles of shoreline (USBR 1988). The lower Colorado River watershed, including the analysis area, has experienced a severe drought six of the last ten years. The lake level dropped to its lowest annual average elevation (since reaching full capacity in 1980) in 2005. The projected water level for Lake Powell at the end of water year 2006 is 3,618 feet. At 3,618 feet lake elevation, the surface area is 140.7-square miles. Predictions of elevation provided by the Bureau of Reclamation are based on factors related to snowpack, melt rate, contributing rain, and releases from Glen Canyon Dam. Predictions are updated monthly and will likely change slightly during the preparation of this report.

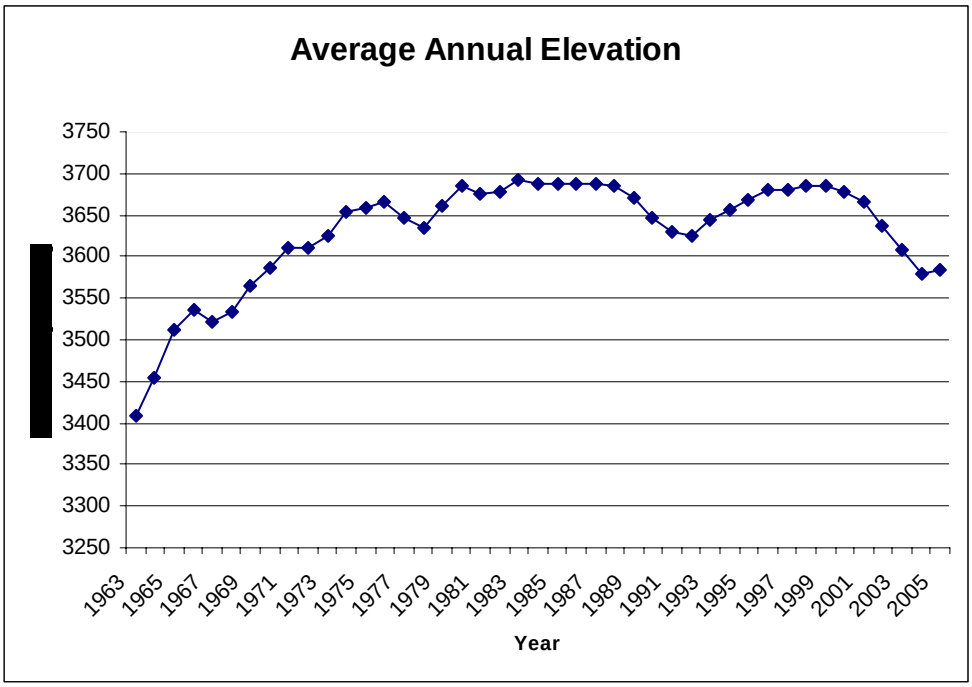



**FIGURE 31. ANNUAL ELEVATION**

The Bureau of Reclamation manages water levels in Lake Powell within the constraints of supply provided through precipitation and runoff. The National Park Service manages the recreational facilities within and surrounding Lake Powell. The uplake developed areas of Bullfrog, Halls Crossing, and Hite have modified available services in response to the decrease in water levels. Boat ramps have been extended or relocated and moorings at wet slips and buoy fields have been moved. These circumstances have been aggravated at Hite by the increased levels of sediment. Hite marina facilities were permanently relocated to Bullfrog and Halls Crossing in 2004.

The Uplake DCP provides an evaluation of potential changes to the uplake developed areas to accommodate future use. Water supply, distribution, and treatment are components of the planning for development changes. The EPA, State of Utah, and Glen Canyon NRA do not allow discharges from surface facilities into the lake. Impacts from recreational users are managed to maximize water quality.

Bullfrog is located near the inlet of Bullfrog Creek. Halls Crossing is south of Bullfrog on the south shore of the Colorado River, north and upstream of Lake Canyon, and west and downstream of Moqui Canyon. Hite is located downstream of Dirty Devil Canyon and slightly north of the confluence of North Wash and the Colorado River.

Lake Powell has a contributing watershed of 107,700-square miles. The major tributaries to Lake Powell are the Colorado, San Juan, Dirty Devil, and Escalante rivers. Lake Powell is part of the Colorado River Storage Project, a federal program designed to store seasonal flood waters for beneficial water uses at later periods. The project has a storage capacity of 34 million acre-feet of water (USBR 2006) in Lake Powell, Flaming Gorge Reservoir on the Green River

in Utah, Navajo Reservoir on the San Juan River in New Mexico, and Blue Mesa Reservoir on the Gunnison River in Colorado. Lake Powell serves as a recreation destination for boaters, nature lovers, and fishermen, and also produces hydroelectric power.

Lake Powell was filled using upper basin flows over a 21-year period. During this time, outflows to downstream water rights holders averaged 12.07 million acre-feet per year and inflows averaged 15.18 million acre-feet per year. Storage stayed within 94% of the full capacity of 23.35 million acre-feet for the six-year period from 1984 through 1989, before larger fluctuations based on annual inflows began. Inflow matched or exceeded outflow until 2000, when the minimum outflow obligation exceeded the inflow. If the annual amount of water flowing into the lake is less than that lost to dam releases (and evaporation), the reservoir surface elevation drops.

Water obligations to Lower Colorado basin states and Mexico are 8.23 million acre-feet per year, and discharges from Glen Canyon Dam have averaged 13.75 million acre-feet in the last 10 years. The Bureau of Reclamation prepares an annual operating plan at the end of every water year for consultation and consensus by Upper Colorado River basin states, Lower Colorado River basin states, American Indian tribes, water delivery contractors, contractors for the purchase of federal power, appropriate federal agencies, and others with interests in Colorado River operations. The annual operating plan for 2006 (USBR 2005) couples a 24-month water supply forecast with the operating criteria developed by the secretary of the interior entitled "Criteria for Coordinated Long Range Operation of Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968." In 2004, the *Interim 602(a) Storage Guideline* was adopted, which sets the minimum storage of Lake Powell at 14.85 million acre-feet. This operating protocol will guide releases from Lake Powell during the 2006 water year. In the event that the capacity of Lake Powell exceeds this value, storage equalization criteria between the active storage volumes in Lake Mead and Lake Powell will control releases for the year.

## Lake Level Analysis

Six years of drought, coupled with anticipated inlet sedimentation have resulted in new challenges for recreation management at Lake Powell. Between 1999 and 2004, the average annual water level dropped over 100 feet, modifying the perimeter, area, and elevation of Lake Powell. The reservoir surface area at 3,600 feet of 149-square miles is 40% less than the area at 3,700 feet (full capacity) of 251-square miles. A drop in the elevation of Lake Powell another 20 feet to 3,580 feet would decrease the reservoir surface area to 133-square miles. This dramatic decrease in surface area as the lake elevation drops has substantial implications for the lake's recreational carrying capacity.

Normal average annual variation has been approximately 25 feet, with the highest levels occurring in July following snowmelt runoff, and the lowest levels occurring in April, after the winter, but prior to high-country runoff. The Bureau of Reclamation predicts that the water level will rise to its highest point for 2006 (3,624 feet) in July.

## Water Quality

Inflow water quality near Hite was measured prior to the construction of Glen Canyon Dam. Assuming no changes in the intervening year, the water at Hite was characterized as hard (average calcium carbonate hardness of 420 mg/l), moderately alkaline (pH ranging from 7.1 to 8.2, and averaging 7.77), and with an average salinity (specific conductance ranging from 399 mg/l to 2060 mg/l) (USGS 2006). The water quality of Lake Powell varies seasonally. The Grand Canyon Monitoring and Research Center performs quarterly water quality assessments at as many as 15 stations on the main channel of the Colorado River. Elevated spring runoff and large upstream storm events bring in elevated sediment concentrations as well as higher levels of dissolved oxygen. Lake Powell also exhibits traditional thermal stratification with some mixing in the fall as the water surface cools and in the spring when large inflows occur. Water quality varies with distance from Glen Canyon Dam and water depth.

Lake Powell is located on the boundary between Arizona and Utah, and consequently both states regulate water quality. However, Lake Powell waters within the analysis area are within Utah and are thus regulated by Utah state standards. Utah's antidegradation policy is included in the Utah Administrative Code, Rule R317-2, *Standards of Quality for the State*. The policy establishes a plan to maintain and improve the quality of state 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. Glen Canyon NRA water quality management objectives are focused toward this central premise.

Human waste is a potential threat to recreation area resources because it can be a source of pathogens in water. Lake Powell water quality has been monitored for human waste since 1988. The monitoring periodically shows high concentrations of fecal coliform bacteria, which indicate the presence of untreated sewage. In the early 1990s, several beaches were temporarily closed because of high fecal coliform bacteria levels. There were 12 beach closures for the same reason in 1995. In response to these conditions, the National Park Service has addressed sanitation issues by implementing the Strategic Plan to Protect Water Quality in Lake Powell (NPS 2005f). With implementation of the Strategic Plan to Protect Water Quality in Lake Powell, beach closures due to high concentration of fecal coliform bacteria were reduced to three in 1996, and one in 1999.

Glen Canyon NRA continues to actively perform a beach monitoring program and implement management actions to protect water quality in an effort to exceed levels recommended by the State of Utah. Since 2002, all monitoring of fecal bacterial pollution has used the *Escherichia coli* bacteria Coliert system to protect public health. Data was collected in six uplake zones, including Bullfrog and Halls Crossing located in zone 11, and Hite located in zone 13. Zone 11, near Bullfrog and Halls Crossing, had several instances of high levels of fecal bacterial pollution in 1997 and 1998. *E. coli* levels in zone 11 peaked in 1998, but have dropped since that time. A similar pattern is seen for zone 13 (Hite), which had several instances of high levels of fecal bacterial pollution in 1998, but levels have subsequently dropped. Improvements in water quality may be a result of implementation of the aforementioned Strategic Plan to Protect Water Quality in Lake Powell.

## Other Water Resources

Other water resources that occur in or adjacent to the analysis area for Glen Canyon NRA include ephemeral washes, intermittent streams, springs, tinajas, and groundwater. Ephemeral washes are fed by the limited precipitation events that occur in or upstream of the NRA. Intermittent streams are fed both by very limited precipitation events and by flow from spring sources within or upstream of the NRA. Tinajas are created when precipitation is captured in depressions on the surface of rock formations within the NRA. These features are intermittent and may contain unique and diverse assemblages of plant and animal life. Groundwater resources of the analysis area may typically be found at varying depths within sandstone formations or in alluvial deposits associated with the Colorado River or its tributaries. The degree to which these hydrologic features may be impacted by proposed development is unknown at this time and would require survey data to adequately define the quantity, quality, and location of these resources relative to the analysis areas.

Implementation of standard NPS BMPs for control of sedimentation (as specified in the mitigation measures located in the "Alternatives" section) would mitigate adverse effects to these water resources.

## Siltation

Rivers move weathered sediments during high flows. These form deltas at the inlets of lakes and reservoirs when the velocity of the river decreases. Several estimates of sedimentation have been prepared over the years of operation of Glen Canyon Dam. The most thorough study to date, a 1986 Bureau of Reclamation survey, concluded that 868,231 acre-feet of sediment had been deposited in Lake Powell between March 1963 and September 1986, or 36,946 acre-feet per year, with 54% derived from the Colorado River arm. This would suggest that on average 19,951 acre-feet of sediment per year would enter the reservoir near Hite. A smaller study of the Hite area in June 2001 estimated that 183,400 acre-feet of sediment entered the Colorado River arm between 1986 and 2001, with an average sedimentation rate of 12,200 acre-feet per year (Mussetter 2001). Sediment depth measurements in the Hite vicinity suggest that the lake bottom has risen at an average rate of 4 feet per year over the life of the reservoir (Mussetter 2001).

Sediment deposition will continue to play a role in the use of uplake facilities at Hite. At water levels near full pool, the sediment deposited in the vicinity of Hite could eventually reach a high enough elevation to cause concern for the long-term use of Hite. During lower lake levels, sediment deposition occurs at the lake inlet downstream of Hite, and some cutting by the river and flood flows moves previously deposited sediment downstream. Currently, Hite is basically silted in.

## Effects of Sedimentation

Sediment carried by the rivers emptying into Lake Powell is deposited on the lake bottom and along the shoreline. The effects of sedimentation relative to these supplemental calculations are most noticeable in zone 13. In figure 32, the red lines indicate approximate locations where

the free-flowing river ends and the pooling of water begins at various elevations. The figure also displays estimates of sediment deposits in zone 13. These estimates were prepared based on a sedimentation study of Lake Powell (Mussetter 2001). It should be noted that sedimentation is an ongoing process, and its effects will vary over time; therefore, the effects described for zone 13 are only estimates.

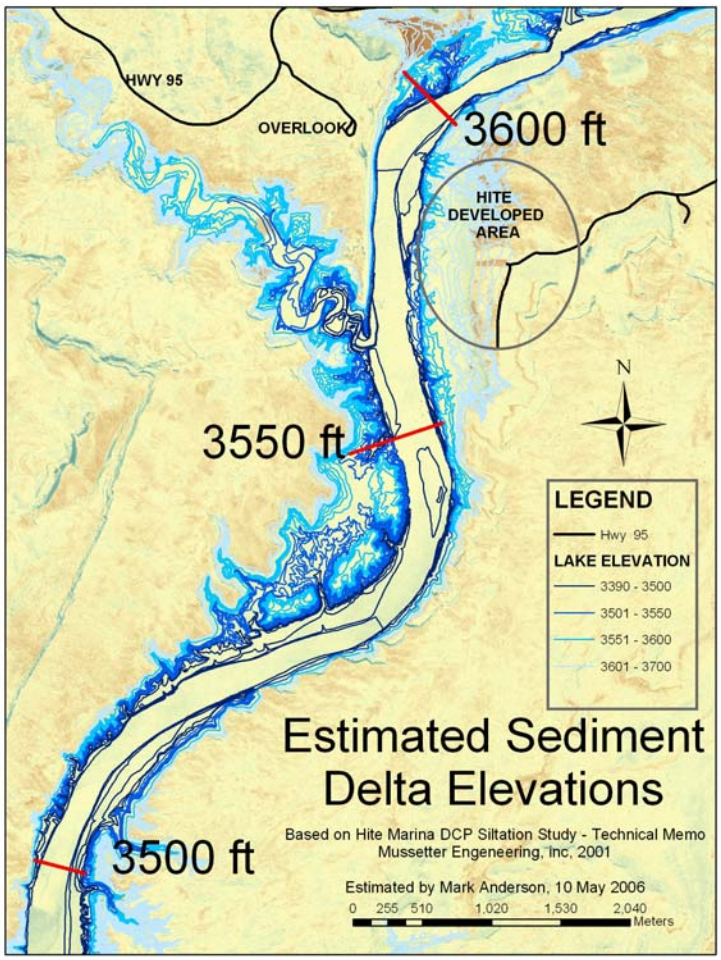



**FIGURE 32. ESTIMATE OF SEDIMENT**

Sediment deposits will reduce the amount of accessible shoreline and surface area of the lake in zone 13, particularly between lake elevations 3,500 and 3,550. Figure 32 provides a visual representation of the estimates. The impacts of sedimentation are not numerically factored into the supplemental calculations presented in this document.

## FLOODPLAINS

The 100-year floodplain has been established at the 3,700-foot elevation by the Federal Emergency Management Agency. Additionally, small areas of floodplain occur at the deltas of tributaries to the lake. The elevation of these floodplains is determined by the elevation level of the lake during the flood event. The principle tributaries within or adjacent to the developed areas include the Dirty Devil River, North Wash, Bullfrog Creek, Halls Creek, and Stanton Creek. All of these enter the lake and deposit sediments at this interface. NPS policy requires that permanently occupied structures should not be located in a floodplain. Additionally, any facilities (temporarily occupied structures, e.g., water-based stores, or nonoccupied structures, e.g., ramps, roads, parking lots) that are located within floodplain areas should be designed and/or located adequately to protect them during flood events.

## WATERS OF THE UNITED STATES, INCLUDING WETLANDS

The USACE has jurisdiction over protecting waters of the United States, including wetlands under section 404 of the Clean Water Act. Waters of the United States are defined as waters that are navigable for interstate commerce and their tributaries. The Colorado River has been identified as a navigable waterway. Additionally, wetlands are defined as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3[b]). Wetlands have three diagnostic characteristics: (1) over 50% of the dominant species present must be classified as obligate, facultative wetlands, or facultative; (2) the soils must be classified as hydric; and (3) the area is either permanently or seasonally inundated (USACE 1987).

The National Park Service classifies, delineates, and maps wetlands using the USFWS's Cowardin classification system (USFWS 1979). This system is based on the more inclusive definition, e.g., "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." Under this classification, wetlands must have one or more of the following characteristics: (1) the land supports, at least periodically, predominantly hydrophytes (i.e., plants adapted to growing in water or in saturated soils that are oxygen deficient), (2) the substrate is comprised of predominantly undrained hydric (anaerobic) soils, and (3) the substrate is saturated with water or covered by shallow water at some time during the growing season of each year (USFWS 1979).

Both wetlands definitions and classification systems (USFWS and USACE) recognize three parameters: hydrophytic vegetation, hydric soil, and wetlands hydrology, but differ from each other in how much habitat is considered wetlands. The Cowardin system defines more habitat types as wetlands and also recognizes many unvegetated sites such as mudflats, or areas without soil such as rocky or sandy banks, stream shallows, saline lakeshores, playas, and deepwater or sites lacking soil.

The jurisdictional limits of waters of the United States have been established by the USACE as occurring at the 3,700-foot elevation along the shoreline of Lake Powell. Due to fluctuating water input, the actual level of the water is oftentimes much lower. A variety of mostly nonnative noxious weeds typically grow in this band of soil between 3,700 feet and the actual waterline. These plants are generally not recognized as wetlands plants and this area does not contain appropriate hydric soils. While there may be some inundation during certain times of the year, this area does not meet the definition of a wetlands by either the USACE or USFWS standards and therefore is only protected as waters of the United States, not as "wetlands." Small areas of wetlands do occur within the footprint of Bullfrog and Halls Crossing. Additionally, wetlands may also occur along the banks of the Colorado River in the Hite area.

## VEGETATION

### Introduction

Glen Canyon NRA and Lake Powell lie within the Colorado Plateau Semidesert province (Bailey 1995). The Colorado Plateau Semidesert province includes tablelands with moderate to considerable topographic relief in the vicinity of Glen Canyon NRA. Elevations range from 3,100 feet in the deeper canyons up to 7,500 feet on canyon rims and mesa tops. Generally, four vegetation zones can be used to describe regional flora and wildlife habitats of the Glen Canyon NRA region. They are (1) arid grassland, (2) xeric shrublands, (3) woodlands, and (4) montane communities (Bailey 1995). Of these zones only arid grasslands and xeric shrublands occur in the analysis area. Arid grasslands are composed of sod-forming grasses and bunch-grasses that are typically widely spaced, with open areas often covered by a well-developed cryptobiotic crust between grass patches and shrubs. Xeric shrublands can grow in open stands within arid grassland communities, but may also form extensive, sparse to moderately dense shrublands on appropriate habitats. In addition to these two major community types, riparian vegetation occurs in washes and along the banks of creeks and rivers throughout the NRA and in the analysis area.

In 1988, a report on the vegetation and relict communities of Glen Canyon NRA was completed (Tuhy and MacMahon 1988) (figures 33, 34, and 35). The 1988 report used existing regional information sources along with field observations and limited data collection. The report classified, described, and delineated 21 vegetation cover types in Glen Canyon NRA. Major types are illustrated in figure 33. Fourteen of the cover types likely occur in the analysis area of this DCP/EA:

1. *Stipa [Achnatherum, Hesperostipa] – Hilaria* [*Pleuraphis*] Grassland (Indian ricegrass, Needle-and-thread – Galleta) community type
2. Sand-shrub community type
3. *Coleogyne ramosissima* (Blackbrush) cover type
   - *Coleogyne ramosissima* / *Stipa* [*Achnatherum] hymenoides* (Blackbrush / Indian ricegrass) community type
   - *Coleogyne ramosissima* / *Hilaria* [*Pleuraphis] jamesii* (Blackbrush / James' Galleta) community type

4. *Atriplex confertifolia* (Shadscale) cover type
   - *Atriplex confertifolia* / *Hilaria* [*Pleuraphis] jamesii* – *Stipa* [*Achnatherum] hymenoides* (Shadscale / James' Galleta – Indian ricegrass) community type
   - *Atriplex confertifolia / Hilaria [Pleuraphis] jamesii* (Shadscale / James' Galleta) community type
5. *Atriplex gardneri* var. *cuneata* (Gardner saltbush) cover type
6. *Atriplex corrugata* (Mat saltbush) cover type
7. *Ceratoides* [*Krascheninnikovia] lanata* (Winterfat) cover type
8. Talus slopes with mixed shrubs, below piñon -juniper zone
9. Hanging gardens
10. Perennial riparian
11. Ephemeral washes and higher terraces
12. *Sarcobatus vermiculatus* (Black greasewood) cover type
13. *Atriplex canescens* (Four-wing saltbush) cover type
14. *Artemisia tridentata* ssp. *tridentata* (Basin big sagebrush) cover type

## Analysis Area Vegetation

Plant communities that have become established in the analysis area consist of seral communities of disturbed sites, introduced landscape species, and climax native communities of more stable wetlands and upland sites. Disturbed sites include those that are subject to foot traffic and vehicle access and those of the Lake Powell low-water zone. Plant species typically present on high-traffic recreation sites include purple threeawn (*Aristida purpurea*), cheatgrass (*Bromus tectorum*), Bermuda grass (*Cynodon dactylon*), witchgrass (*Panicum capillare*), storksbill (*Erodium cicutarium*), knotweed (*Polygonum aviculare*), Russian thistle (*Salsola iberica*), purslane (*Portulaca oleracea*), prostrate vervain (*Verbena bracteata*), and puncture vine (*Tribulus terrestris*). Native and nonnative landscape plantings have been introduced or otherwise became established in campgrounds, around marinas, and elsewhere in the developed portion of the recreation area. Landscape shade trees include Fremont cottonwood (*Populus fremontii*), Gooddings willow (*Salix gooddingii*), box-elder (*Acer negundo*), hackberry (*Celtis* sp.), juniper (*Juniperus* sp.), Russian-olive (*Elaeagnus angustifolia*), ash (*Fraxinus* sp.), elm (*Ulmus* sp.), western redbud (*Cercis occidentalis*), pinyon pine, Utah juniper, and sycamore (*Platanus* sp.).

Much of the analysis area that occurs below the ordinary high water line of Lake Powell has been inundated historically and reexposed as water levels have receded in the past decade. This exposed shoreline habitat often supports both native and nonnative annual and perennial plant species that grow in distinct bands relative to soil moisture and include cocklebur (*Xanthium strumarium*), horseweed (*Conyza canadensis*), curly gumweed (*Grindelia squarrosa*), Fremont and narrowleaf goosefoot (*Chenopodium fremontii* and *C. leptophyllum*), yellow and white sweetclover (*Melilotus officianalis* and *M. alba*), tumble

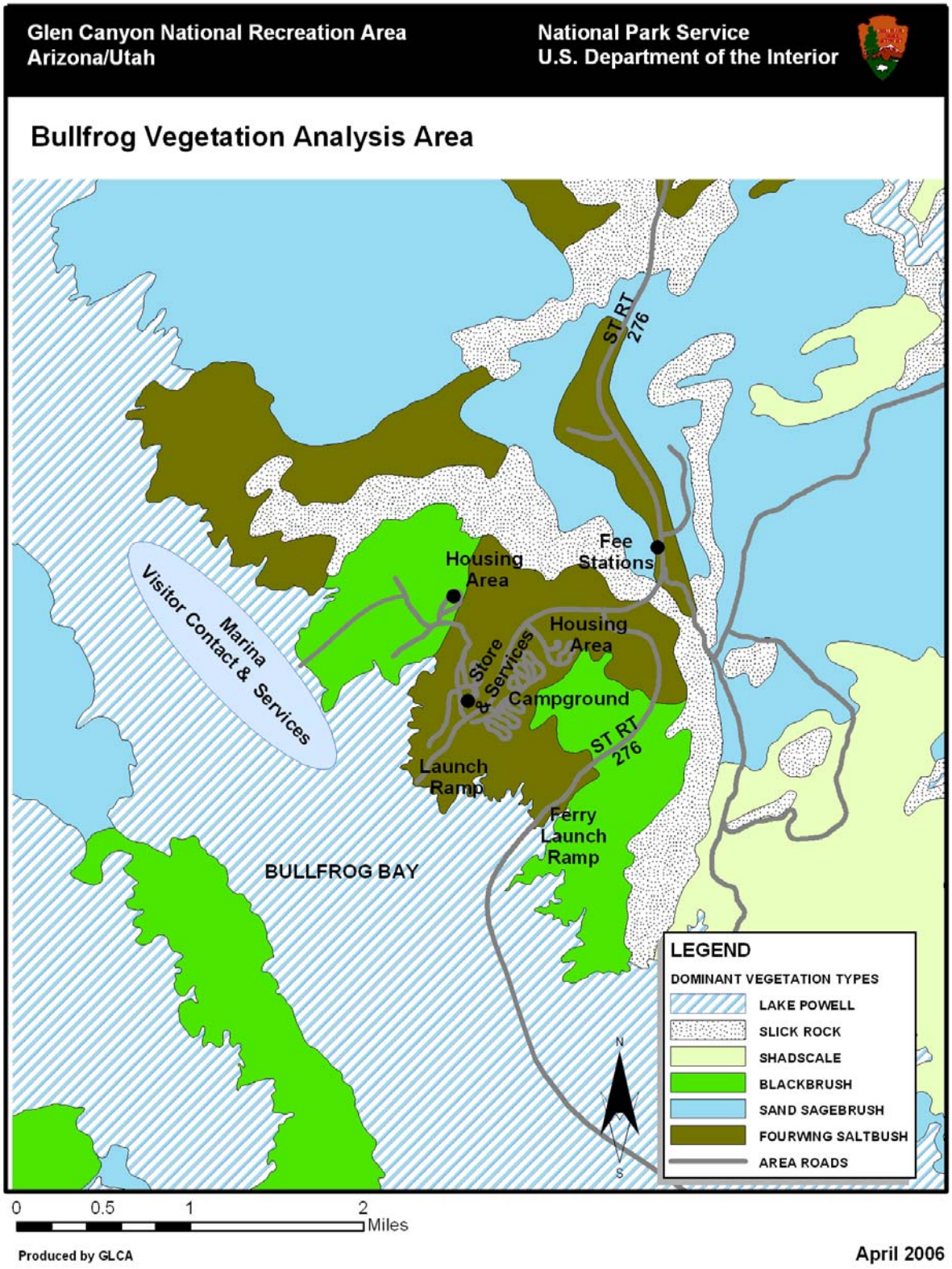



**FIGURE 33. VEGETATION OF BULLFROG DEVELOPED AREA**

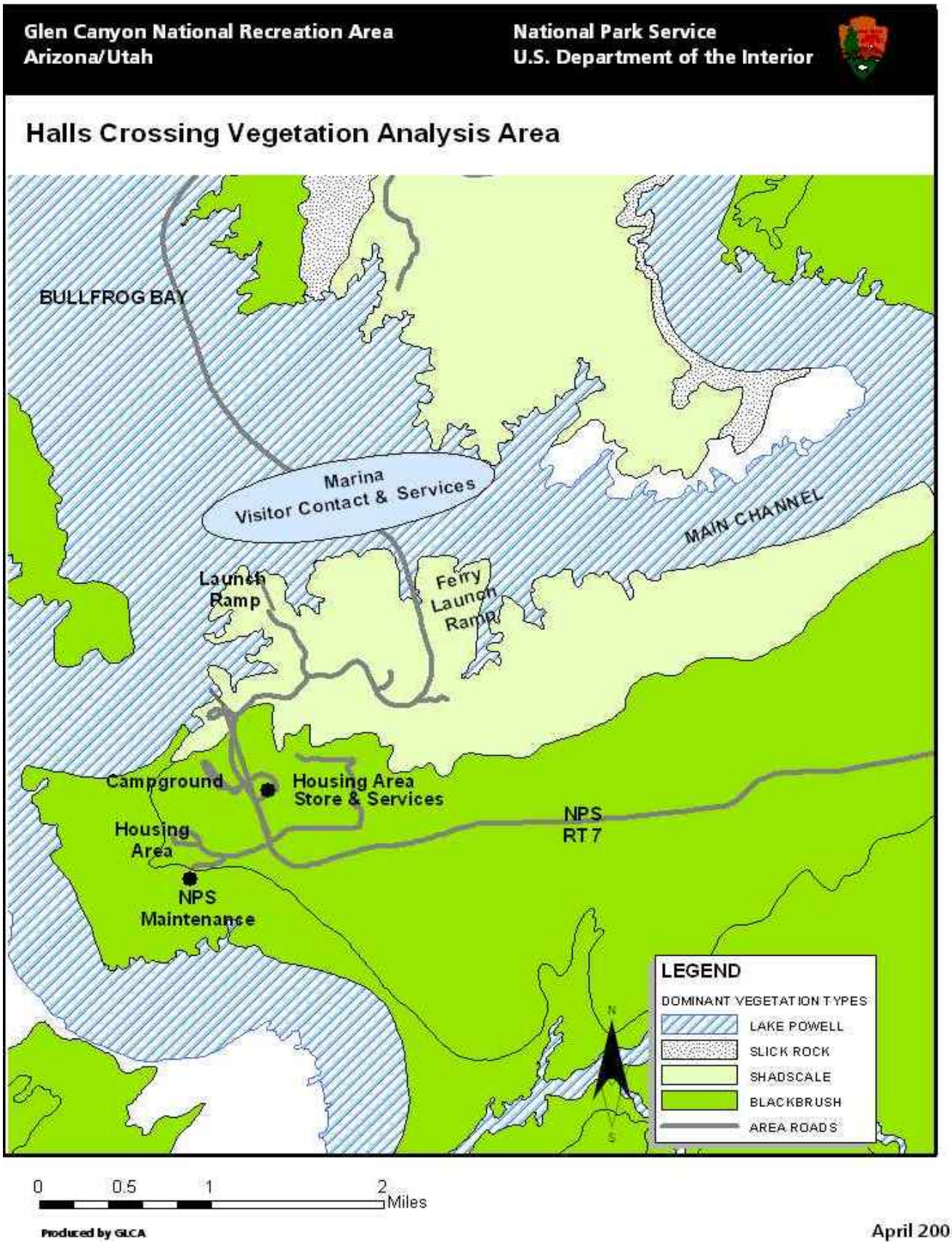



**FIGURE 34. VEGETATION OF HALLS CROSSING DEVELOPED AREA**

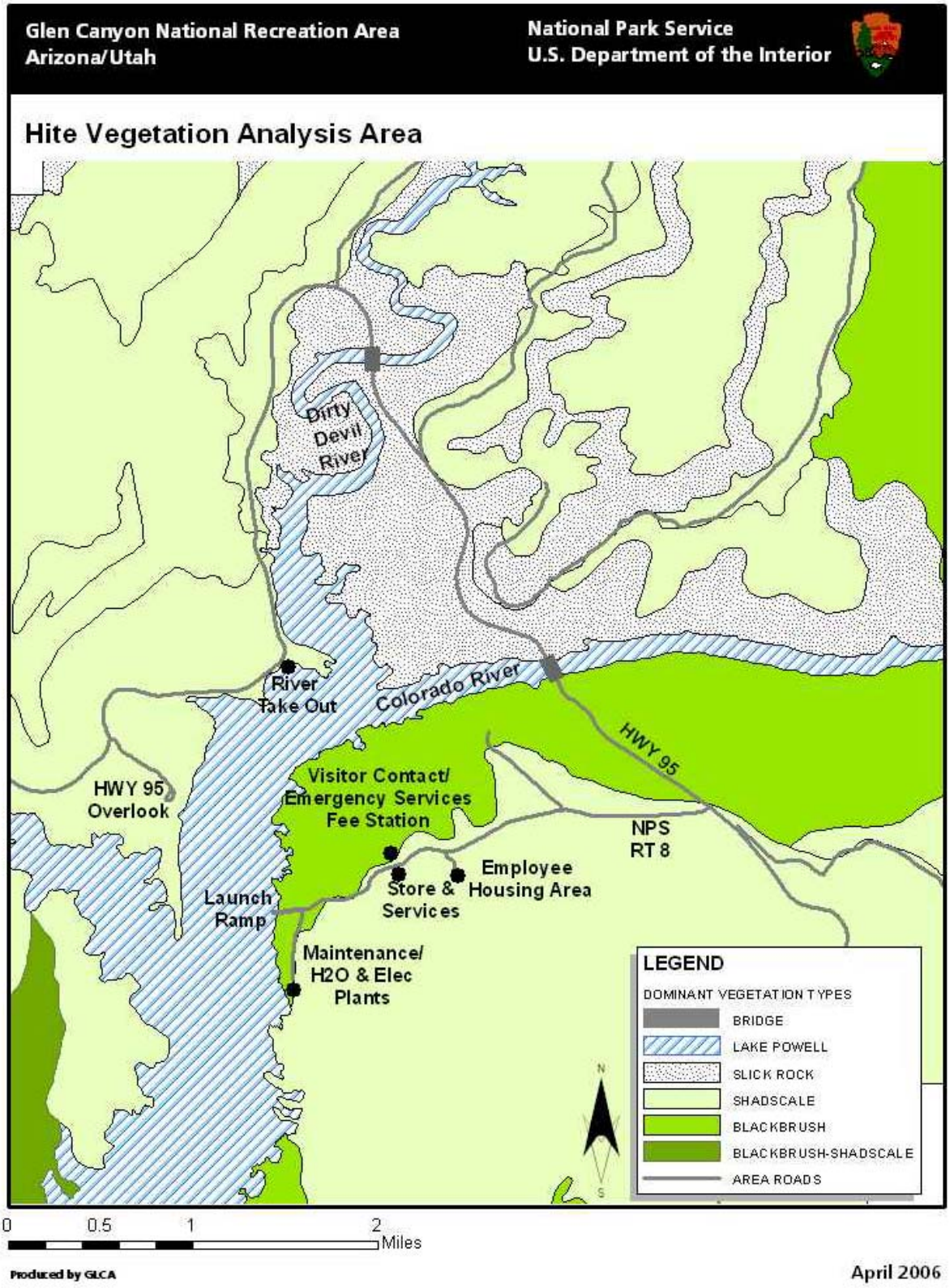



**FIGURE 35. VEGETATION OF HITE DEVELOPED AREA**

mustard (*Sisymbrium altissimum*), Russian thistle, tumbling orach (*Atriplex rosea*), bassia (*Bassia hyssopifolia*), tarragon (*Artemisia dracunculus*), common sunflower (*Helianthus annuus*), poverty-weed (*Iva axillaris*), dropseeds (*Sprobolus* spp.), and redroot, and prostrate pigweed (*Amaranthus retroflexus* and *A. blitoides*). On more mesic shoreline sites, stands of nonnative tamarisk (*Tamarix chinensis*) and native seepwillows (*Baccharis* spp.) become established (Waring 1993).

## WILDLIFE

Glen Canyon NRA supports a surprisingly diverse number of wildlife species, which is partly due to the presence of Lake Powell. Within the boundaries of the recreation area, 438 wildlife species have been identified including 311 species of birds, 64 species of mammals, 27 species of fish, 29 species of reptiles, and 7 species of amphibians (NPS 2005j). Threatened and endangered species and state species of concern that may be affected by the proposed projects will be discussed in a later section.

### Mammals

The areas that surround the marinas provide limited habitat to the large, mobile mammals of the recreation area. These areas may be briefly used by species that are searching for food and water while they are moving through the area. These species include the desert bighorn sheep (*Ovis canadensis*) and mule deer (*Odocoileus hemionus*). Predators are prevalent in all of the vegetation communities where abundant prey is available and include the bobcat (*Felis rufus*), mountain lion (*Felix concolor*), gray fox (*Urocyon cinereoargenteus*), badger (*Spilogale gracilis*), kit fox (*Vulpes velox*), and coyote (*Canis latrans*) (NPS 2003a).

The riparian areas of the analysis area provide sufficient forage and shelter for a diverse population of rodents. A survey of shoreline salt cedar (*Tamarix chinensis*) shrublands noted the following rodents: deer mouse (*Peromyscus maniculatus*), Ord's kangaroo rat (*Dipodomys ordii*), little pocket mouse (*Perognathus longimembrus*), long-tailed pocket mouse (*Chaetodipus formosus*), western harvest mouse (*Reithrodontomys megalotis),* canyon mouse (*Peromyscus crinitus*), brush mouse (*Peromyscus boylii*), piñon mouse (*Peromyscus truei*), northern grasshopper mouse (*Onychomys leucogaster*), and desert woodrat (*Neotoma lepida*) (NPS 2003a).

Desert shrublands and herbaceous communities are found inland from the riparian areas and provide a diversity of vegetation for habitat and forage. Mule deer and pronghorn browse on the shrubs, forbs, and grasses present in these desert communities. Shrublands and herbaceous communities include a variety of small mammals such as Ord's kangaroo rat, deer mouse, piñon mouse, northern grasshopper mouse, white-tailed antelope squirrel (*Ammospermophilus leucurus*), and desert woodrat (Rosenstock 1996). Rabbits are common and include the desert cottontail (*Sylvilagus audubonii*) and the black-tailed jackrabbit (*Lepus californicus*). Several species of bats use these areas to forage at night including several *Myotis* sp., western pipistrelle (*Pipistrellus hesperus*), big brown bat (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), and pallid bat (*Antrozous pallidus*) (NPS 2004b).

## Birds

The majority of wildlife species found within Glen Canyon NRA are birds. Shorebirds, waterfowl, and other water-associated bird species frequently use Lake Powell for resting, security, and foraging purposes, and constitute 101 of the 311 bird species found in Glen Canyon (Spence et al. 2006). Species commonly observed along the shoreline and on the lake include grebes, cormorants, herons, egrets, coots, and ducks. These species concentrate at Lake Powell during the winter and during the peak migration months of late fall, winter, and early spring, especially at bays such as Bullfrog Bay (Spence 1998, Spence & Bobowski 2003).

Birds also use the dense shrublands of the riparian zones during both migration and breeding for shelter, food, and reproduction. During a survey of salt-cedar stands within the recreation area, the following birds were observed: the horned lark (*Eremophila alpestris*), common raven (*Corvus corax*), mourning dove (*Zenaida macroura*), yellow warbler (*Dendroica petechia*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and the house finch (*Carpodacus mexicanus*). Songbird density, abundance, and species richness increased toward the northern portion of Lake Powell where Bullfrog, Halls Crossing, and Hite marinas are located (Spence et al. 2006).

Desert shrub and grassland communities host a variety of wintering, migrant, and resident bird species including the house finch, northern mocking bird (*Mimus polyglottos*), lesser nighthawk (*Chordeiles acutipennis*), Say's phoebe (*Sayornis saya*), the white-crowned sparrow (*Zonotrichia leucophrys*), rock wren (*Salpinctes obsoletus*), and the black-throated sparrow (*Amphispiza bilineata*), which is the characteristic breeding bird of Glen Canyon NRA (LaRue and Spence 2001). Several permanent residents of these areas include the common raven, loggerhead shrike (*Lanius ludovicianus*), and the canyon wren (*Catherpes mexicanus*) (Spence et al. 2006). Most of these species can be seen in the vegetation found in and around the analysis area.

The diversity of small rodents, songbirds, fish, and reptiles, combined with the proximity of nesting cliffs, explains the large diverse number of raptors in the analysis area. Species include the osprey (*Pandion haliaetus)*, northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), and the peregrine falcon (*Falco peregrinus*) (NPS 2003a).

## Reptiles and Amphibians

Systematic surveys of reptile and amphibian species have not been conducted since the creation of Glen Canyon Dam (Plattenberg et al. 2003). However, reptiles and amphibians have been observed and recorded in the ecological systems found within the analysis area. During a survey of salt-cedar (tamarisk) stands, seven species of reptiles and amphibians were documented including the orangehead spiny lizard (*Sceloporus magister cephaloflavus*), side-blotched lizard (*Uta stansburiana stejnegeri*), desert short-horned lizard (*Phrynosoma platyrhinos calidiarum*), western whiptail (*Cnemidophorus tigris septentrionalis*), western rattlesnake (*Crotalus viridis*), longnose leopard lizard (*Gambelia wislizenii*), and the Glen Canyon chuckwalla (*Sauromalus obesus multiforaminatus*) (Platenberg et al. 2003). Additionally, Arizona glossy snake (*Arizona elegans*) was observed in the Bullfrog area in 2005.

In the analysis area, desert shrublands and grasslands host a diverse population of small rodents and other reptile prey species. Within the analysis area, the following reptiles may be present including the yellowhead collared lizard (*Cyotaphytus collaris auriceps*), longnose leopard lizard, side-blotched lizard, California king snake (*Lampropeltis getula californiae*), western whiptail, western rattlesnake, and the Great Basin gopher snake (*Pituophis catenifer deserticola*) (NPS 2004b). The Great Basin spadefoot toad (*Spea hammondi intermountana*) has been found in temporary pools within washes that may occur in the analysis area (NPS 2004b). Other species that may be found in temporary pools and scattered springs include the leopard frog (*Rana pipiens*), red-spotted toad (*Bufo punctatus*), Woodhouse's toad (*Bufo woodhousii*), and the canyon treefrog (*Hyla arenicolor*) (NPS 2003a).

## Fish

Glen Canyon NRA hosts fish that are adapted to either lakes or flowing rivers. Before the creation of the dam, the free-flowing Colorado River hosted a number of species that have not been able to adapt to the recent lacustrine environment and the invasion of introduced species. Several native species have been extirpated, but other native species such as the Colorado pikeminnow (*Ptychocheilus lucius*), flannelmouth sucker (*Catostomus latipinnis*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus*), bluehead sucker (*Catostomus discobolus*), and roundtail chub (*Gila robusta*) still occur in extremely reduced populations within the Colorado River, its tributaries, and its interface with Lake Powell (NPS 2003a). Threatened and endangered species that may be affected by the proposed projects will be discussed in the threatened and endangered species section.

Since the creation of Lake Powell, a large sport fishing industry has taken advantage of the excellent quality of the lake's fishery. Introduced species that are adapted to the lacustrine environment are the backbone of this industry. Striped bass (*Morone saxatilis*) and smallmouth bass (*Micropterus dolomieui*) comprise the majority of the annual game fish harvest, but largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), crappie (*Promoxis nigromaculatus*), and bluegill (*Lepomis macrochirus*) are also present. Important nongame fish species include the common carp (*Cyprinus carpio*), red shiner (*Cyprinella lutrensis*), and threadfin shad (*Dorosoma petenense*) (NPS 2003a).

## Invertebrates

Along the shoreline of Lake Powell, aquatic invertebrate density and richness is low due to the fluctuating water levels of the reservoir. These fluctuations reduce or eliminate food and/or shelter available to aquatic invertebrates. Invertebrate species that do exist along the shoreline habitat include Asiatic clam (*Corbicula fluminea)* and crayfish, (*Orconectes virilis*), both of which are introduced (NPS 2003a).

Riparian communities and desert shrub communities provide ample food and shelter for a variety of invertebrates that range from microscopic protozoans and nematodes to mites, mollusks, and insects. Insects include various grasshoppers, cicadas, and seed-eating harvester ants.

## THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN / DESIGNATED CRITICAL HABITAT

### Federally Listed Species Known to Occur in Analysis Area

In accordance with threatened or endangered species consultation and coordination activities, the USFWS identified 19 listed and 1 candidate species for portions of Garfield, Kane, and San Juan counties, Utah (USFWS 2002). Within the analysis area, suitable habitat for one federally listed endangered species (southwestern willow flycatcher) and one federally listed threatened species (bald eagle) occurs (table 15). Species or potentially suitable habitat likely to be present within this analysis area are identified and discussed further. Species listed by the USFWS for which suitable habitat is not present within the analysis area are eliminated from further discussion.

### Presence of Designated Critical Habitat for Federally Listed Species

Provisions of the Endangered Species Act require consideration of both species populations and designated critical habitat for species listed or proposed for listing. Critical habitat is defined as a specific geographic area that is essential for conservation of an endangered or threatened species, and is designated as such in the recovery plan for that species, or in subsequent legislation.

Glen Canyon NRA supports designated critical habitat for four endangered fish species (NPS 2003a). These are the razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and the bonytail chub (*Gila elegans*). Designated critical habitat for these fish occurs in portions of the Colorado, Dirty Devil, and San Juan rivers, including their 100-year floodplains up to the full pool elevation of Lake Powell (50 CFR Part 17, 1994) (table 16) and North Wash. Some of this habitat occurs in the Hite area. The bonytail is no longer present in the upper basin of the Colorado River and is believed to be the most endangered of these four native fish species. Prior to 1996, fewer than 10 bonytails were captured in Lake Powell. At the lowest projected lake level, critical habitat in areas that were previously submerged may increase in the Hite area as the water level lowers and the silt level rises. Within the analysis area, designated critical habitat exists for only two of these fish: the Colorado pikeminnow and the razorback sucker.

**TABLE 15. FEDERAL THREATENED, ENDANGERED, OR CANDIDATE SPECIES OF GARFIELD, KANE, AND SAN JUAN COUNTIES, UTAH**

| Species | County | Status | Habitat | Comments | Species Considered? | Reason for Exclusion / Inclusion |
|---|---|---|---|---|---|---|
| Aquarius paintbrush<br>*Castilleja aquariensis* | Garfield | Candidate | Subalpine sagebrush-grass meadows and openings in spruce communities. Rocky/gravelly soils. 9,100–11,960 ft elevation. | Known only from Fremont, Escalante, and East Fork Sevier drainages. | No | No known populations or habitat in analysis area. |
| Autumn buttercup<br>*Ranunculus aestivalis* | Garfield | Endangered | Hummocks or raised dry areas associated with marshes/bogs along Sevier River. | Known only from west slope of Sevier River valley. | No | No known populations or habitat in analysis area. |
| Jones cycladenia<br>*Cycladenia humilis* var. *jonesii* | Garfield, Kane | Threatened | Salt clay and gypsum soils at 4,400 to 6,000 feet elevation. Communities include mixed desert scrub, juniper, or wild buckwheat-Mormon tea. | This species occurs within the NRA west of the Waterpocket Fold. | No | No known populations or habitat in analysis area. |
| Maguire daisy<br>*Erigeron maguirei* | Garfield | Threatened | Exposed mesas; steep, narrow canyons cut into Navajo sandstone; cool, shaded, mesic sites in crevices that collect soil and organic matter; less frequently along canyon bottom washes. 5,250–7,120 ft elevation. | Known from San Rafael, Muddy and Fremont drainages. | No | No known populations or habitat in analysis area. |
| Ute ladies'-tresses<br>*Spiranthes diluvialis* | Garfield | Threatened | Moist to very wet meadows along streams or in abandoned stream meanders that still retain ample groundwater; also near 4,265–5,250 ft elevation. | In southeastern Utah, known only from upper reaches of the Escalante watershed. | No | No known populations or habitat in analysis area. |
| Navajo sedge<br>*Carex specuicola* | Kane, San Juan | Threatened | Moist, sandy to silty soils of shady seep-spring pockets or alcoves with somewhat limited soil development. 5,700–6,000 ft elevation. | Endemic to the Navajo Nation, Coconino County, Arizona, and San Juan County, Utah; Chinle and Lower San Juan watersheds. | No | No known populations or habitat in analysis area. |
| Siler pincushion cactus<br>*Pediocactus sileri* | Kane | Threatened | Limited to southwestern Utah and northwestern Arizona, where it is ecologically restricted to a specific gypsum and salt-rich soil. | Known from the St. George area of Utah. | No | No known populations or habitat in analysis area. |
| Welsh's milkweed [4]<br>*Asclepias welshii* | Kane | Threatened | Crest and lee slopes of Coral Pink Sand Dunes in sagebrush, juniper, and ponderosa pine communities at 5,580–6,230 ft. | Known from area south and west of the analysis area (Paria and Chinle watersheds). | No | No known populations or habitat in analysis area. |

**TABLE 15. FEDERAL THREATENED, ENDANGERED, OR CANDIDATE SPECIES OF GARFIELD, KANE, AND SAN JUAN COUNTIES, UTAH**

| Species | County | Status | Habitat | Comments | Species Considered? | Reason for Exclusion / Inclusion |
|---|---|---|---|---|---|---|
| Kodachrome bladderpod<br>*Lesquerella tumulosa* | Kane | Endangered | Extremely dry, sparsely vegetated, white shale knolls with thin soils derived from the Windsor Member of the Carmel formation. Associated with scattered Utah juniper within a *Bouteloua* grassland. | Known from a single population scattered over an area about 2.5 miles wide in western Kane County, Utah (in the Paria watershed). | No | No known populations or habitat in analysis area. |
| Kanab ambersnail [5]<br>*Oxyloma haydeni kanabensis* | Kane | Endangered | Springs and seeps at base of sandstone or limestone cliffs. Associated with perennially wet surface soil or shallow standing water. | Known only from Kanab drainage in western Kane County and from Grand Canyon National Park in Arizona. | No | No known populations or habitat in analysis area. |
| Coral pink sand dunes tiger beetle<br>*Cincindela limbata albissima* | Kane | Candidate | Interdunal swales and dune slopes in Coral Pink Sand Dunes near Kanab. | Known only from a small area in Coral Pink Sand Dunes State Park, and a BLM parcel approximately 3 miles northeast of that park. | No | No known populations or habitat in analysis area. |
| Bonytail chub[4, 10]<br>*Gila elegans* | Garfield, San Juan | Endangered | In or near deep, swift water in main stream of mid-sized to large rivers; in flowing pools and backwaters, over mud or rocks; also in reservoirs. | Restricted to the Colorado River system, where only a few scattered remnant populations remain; critical habitat designated in Glen Canyon in upstream portions of tributaries to Lake Powell. | No | Species is extirpated from Lake Powell. Critical habitat designated in park is located a considerable distance upstream of the analysis area. No suitable habitat within analysis area. |
| Colorado pikeminnow [4, 10]<br>*Ptychocheilus lucius* | Garfield, Kane, San Juan | Endangered | Medium to large rivers; young prefer small, quiet backwaters; adults use deep, turbid, strongly flowing water, eddies, runs, flooded bottoms, or backwaters; lowlands inundated during spring high flow appear to be important. | Critical habitat designated in Glen Canyon. | No | Species is extirpated from Lake Powell. Critical habitat in analysis area adjacent to Hite developed area only. There is no suitable habitat at or adjacent to proposed development sites. |
| Humpback chub [4, 10]<br>*Gila cypha* | Garfield, San Juan | Endangered | Adults use variety of habitats in large rivers; young usually in eddies and runs. | Critical habitat designated in Glen Canyon below the confluence of the Colorado River with the Paria River, below Glen Canyon Dam. | No | Critical habitat designated in the NRA is located on the Colorado River below Glen Canyon Dam, almost 180 miles south of analysis area. There is no suitable habitat in the analysis area. |

**TABLE 15. FEDERAL THREATENED, ENDANGERED, OR CANDIDATE SPECIES OF GARFIELD, KANE, AND SAN JUAN COUNTIES, UTAH**

| Species | County | Status | Habitat | Comments | Species Considered? | Reason for Exclusion / Inclusion |
|---|---|---|---|---|---|---|
| Razorback sucker [4, 10]<br>*Xyrauchen texanus* | Garfield, Kane, San Juan | Endangered | Slow areas, backwaters, and eddies of medium to large rivers. | Critical habitat designated in Glen Canyon in upstream portions of the tributaries to Lake Powell. | No | Species is extirpated from Lake Powell. Critical habitat in analysis area adjacent to Hite developed area only. There is no suitable habitat at or adjacent to proposed development sites. |
| Bald eagle [3]<br>*Haliaeetus leucocephalus* | Garfield, Kane, San Juan | Threatened | Cliffs, forests, and woodlands with snags and close to open water. | Winter resident only. Common on Lake Powell from November to March. Avoids areas with nearby human activity. | Yes | Migratory winter habitat occurs in or proximal to analysis area. Both adult and immature bald eagles have been seen foraging in Bullfrog Bay and have also been seen roosting on sandstone hilltops north and south of the Bullfrog developed area and north and south of the Hite developed area. |
| California condor [7]<br>*Gymnogyps californianus* | Garfield, Kane, San Juan | Endangered | Mountainous country, low to moderate elevations, especially rocky and brushy areas with cliffs available for nest sites, foraging also in grasslands, oak savanna, mountain plateaus, ridges, and canyons. | Extirpated from the wild by late 1980s; reintroductions began in 1996, and wild condors hatched in northern Arizona in 2003 and 2004. The population in Arizona is nonessential experimental. | No | Sightings in NRA since reintroduction in Arizona have been limited to the area south of U.S. 89 approx. 180 miles south of the analysis area. |
| Mexican spotted owl [1, 4]<br>*Strix occidentalis lucida* | Garfield, Kane, San Juan | Threatened | In southern Utah - mesa tops, benches and warm slopes above canyons in fall and winter; relatively cool canyons in summer. | In Utah and Colorado, most nests are in caves or on cliff ledges in steep-walled canyons. | No | While designated critical habitat crosses the analysis area, the nearest suitable habitat is located approx. 25 miles across Lake Powell from Bullfrog and Halls Crossing, and more than 70 miles from Hite. |

**TABLE 15. FEDERAL THREATENED, ENDANGERED, OR CANDIDATE SPECIES OF GARFIELD, KANE, AND SAN JUAN COUNTIES, UTAH**

| Species | County | Status | Habitat | Comments | Species Considered? | Reason for Exclusion / Inclusion |
|---|---|---|---|---|---|---|
| Southwestern willow flycatcher *Empidonax traillii extimus* | Garfield, Kane, San Juan | Endangered | Thickets, scrubby and brushy areas, open second growth, swamps, and open woodland. | No confirmed nesting or breeding in Glen Canyon. The proposed critical habitat for this species has been vacated due to court action; therefore, there is currently no proposed or assigned critical habitat for this species. The one sighting for this species occurred below the dam—not anywhere near the analysis area. However, due to extreme low water at Hite, there is now increasing suitable habitat for this species along the riverbanks at Hite. | Yes | While this species has not been seen in the analysis area, changes in the water level have favored the growth of suitable habitat in and adjacent to Hite. |
| Yellow-billed cuckoo [11] *Coccyzus americanus* | Garfield, Kane, San Juan | Candidate | Riparian forests with multiple vegetation layers. | Has been observed near Lees Ferry below Glen Canyon Dam, and at Clay Hills Crossing on the upper San Juan River. This species has only been seen below the dam—far outside the project or analysis area. There is no suitable habitat for this species within or near the analysis area. | No | No suitable habitat within the analysis area. |
| Gunnison sage grouse *Centrocercus minimus* | San Juan | Candidate | Upland to mesic habitats, all with sagebrush, esp. *L. tridentata* (big sage brush). | Known only from extreme eastern Utah. | No | No known populations or habitat in analysis area. |
| Black-footed Ferret [6] *Mustela nigripes* | San Juan | Endangered | Open habitat of grasslands, steppe, and shrub steppe; prairie dog towns. | Extirpated from the wild by 1987; reintroduced in an experimental area of northwestern Colorado and eastern Utah in 1999. | No | No known populations or habit in analysis area. |

**TABLE 15. FEDERAL THREATENED, ENDANGERED, OR CANDIDATE SPECIES OF GARFIELD, KANE, AND SAN JUAN COUNTIES, UTAH**

| Species | County | Status | Habitat | Comments | Species Considered? | Reason for Exclusion / Inclusion |
|---|---|---|---|---|---|---|
| Utah prairie dog<br>*Cynomys parvidens* | Garfield, Kane | Threatened | Grasslands, in level mountain valleys, in areas with deep well-drained soil and vegetation that prairie dogs can see over or through. | Occurs in western parts of Garfield and Kane counties. | No | No known populations or habitat in analysis area. |

[1] Nests in this county of Utah.
[3] Wintering populations (only four known nesting pairs in Utah).
[4] Critical habitat designated in this county.
[5] Critical habitat proposed in this county.
[6] Historical range.
[7] Experimental nonessential population.
[10] Water depletions from any portion of the occupied drainage basin are considered to adversely affect or adversely modify the critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.
[11] "Western" yellow-billed cuckoo = distinct population segment in Utah.

**TABLE 16. LOCATION OF ENDANGERED FISH SPECIES CRITICAL HABITAT**

| Species | Critical Habitat Location |
|---|---|
| Colorado pikeminnow | Glen Canyon NRA Colorado pikeminnow habitat includes the 100-year floodplain of the Colorado River extending to Lake Powell's full pool elevation, Lake Powell's arm of the Dirty Devil River extending upstream of North Wash, and the San Juan River's 100-year floodplain extending to Lake Powell's full pool elevation near Neskahi Canyon. Specific locations are as follows:<br><br>Grand, San Juan, Wayne, and Garfield counties, the Colorado River and its 100-year floodplain from the Colorado River bridge at exit 90, north off Interstate 70 in T6S, R93W, sec. 16 (6th Principal Meridian) to North Wash including the Dirty Devil arm of Lake Powell up to the full pool elevation in T33S, R14E, sec. 29 (Salt Lake Meridian). San Juan County, the San Juan River and its 100-year floodplain from SH 371 bridge in T29N, R13W, sec. 17 (New Mexico Meridian) to Neskahi Canyon in the San Juan arm of Lake Powell in T41S, R11E, sec. 26 (Salt Lake Meridian) up to the full pool elevation. |
| Razorback sucker | Glen Canyon NRA razorback sucker habitat includes the 100-year floodplain of the Colorado River extending to Lake Powell's full pool elevation, Lake Powell's arm of the Dirty Devil River extending upstream of North Wash, and the San Juan River's 100-year floodplain extending to Lake Powell's full pool elevation near Neskahi Canyon. Specific locations are as follows:<br><br>Grand, San Juan, Wayne, and Garfield counties, the Colorado River and its 100-year floodplain from Westwater Canyon in T20S, R25E, sec. 12 (Salt Lake Meridian) to full pool elevation, upstream of North Wash and including the Dirty Devil arm of Lake Powell in T33S, R14E, sec. 29 (Salt Lake Meridian). San Juan County, the San Juan River and its 100-year floodplain from the Hogback diversion in T29N, R16W, sec. 9 (New Mexico Meridian) to the full pool elevation at the mouth of Neskahi Canyon on the San Juan arm of Lake Powell in T41S, R11E, sec. 26 (Salt Lake Meridian). |
| Humpback chub | Glen Canyon NRA humpback chub habitat includes the 100-year floodplain of the Colorado River along the rapids in Cataract Canyon upstream of Gypsum Canyon. Specific locations are as follows:<br><br>Garfield and San Juan counties, the Colorado River from Brown Betty Rapid in T30S, R18E, sec. 34 (Salt Lake Meridian) to Imperial Canyon in T31S, R17E, sec. 28 (Salt Lake Meridian). |
| Bonytail | Glen Canyon NRA bonytail habitat includes the 100-year floodplain of the Colorado River along the rapids in Cataract Canyon upstream of Gypsum Canyon. Specific locations are as follows:<br><br>Garfield and San Juan counties, the Colorado River from Brown Betty Rapid in T30S, R18E, sec. 34 (Salt Lake Meridian) to Imperial Canyon in T31S, R17E, sec. 28 (Salt Lake Meridian). |

Source: *Federal Register* 50 CFR Part 17, Monday, March 21, 1994

## Species-Specific Information

Information relevant to the assessment of any potential effect on species considered in detail in this analysis is as follows:

**Southwestern Willow Flycatcher** (*Empidonax traillii extimus*) is associated with low elevation dense willow, cottonwood, and salt-cedar communities along streams and rivers. This species was observed and recorded about 30 miles from Lake Powell, up the Escalante River, and along the San Juan River near Clay Hills Crossing, but there is no confirmed nesting or breeding habitat present in the recreation area (NPS 2003a). In Arizona, more than 110 pairs of southwestern willow flycatchers occupy 160 territories, including breeding territory along the Colorado River. Smaller populations are known to exist in Utah. Adjacent to the recreation area, breeding habitat typically is present along the larger rivers and lake shorelines at low elevations in areas of dense willow, cottonwood, and salt-cedar (tamarisk), or other woodlands along streams and rivers. Loss of native riparian habitat, combined with predation and brown-headed cowbird nest parasitism, has reduced the species' populations. Due to lowering water levels, the mouth of the Colorado River has moved downstream past the Hite area. This has resulted in increased siltation that has narrowed and moved the active water channel to the western bank and resulted in rapid growth of riparian vegetation (primarily salt-cedar and willow) that may be suitable habitat for this species. Surveys have not been completed for this species in the Hite area, and there is no suitable habitat for this species in or near Halls Crossing or Bullfrog.

**Bald Eagle** (*Haliaeetus leucocephalus*) habitat is present along the larger rivers in southern Utah. In the recreation area, this includes the San Juan River and the main lake channel upstream from Bullfrog. No nest sites have been observed or recorded along the Lake Powell shorelines.

Bald eagles are present between the months of September to March, in small numbers throughout the Lake Powell area. Observations recorded principally during the November-to-February time periods for the years 1991 through 2002 are summarized in appendix C. Areas of Lake Powell and Glen Canyon NRA that consistently provide suitable wintering habitat include Antelope Island, Bullfrog, Cataract Canyon, Good Hope Bay, Halls Creek, Hite, Wahweap, and Warm Creek; however, there are no known consistently used winter roosts within the recreation area. Bald eagles have been observed feeding at Antelope Island and other portions of Lake Powell (Spence et al. 2002, NPS 2002).

Prior to 1995, 131 bald eagle sightings had been recorded, but recordkeeping was inconsistent (Spence 2002). Annual surveys conducted by the National Park Service report that 18 to 20 bald eagles typically winter in the recreation area and as many as 70 seasonal observations of over-wintering bald eagles have been recorded in recent years. The results recorded during 10 seasons of observations within the recreation area are presented in appendix C (Spence 2002). Potentially favorable bald eagle roosting sites along the rivers and shorelines of reservoirs like Lake Powell are monitored (Spence et al. 2002, NPS 2003a).

## Utah State Wildlife Species of Concern

The following species are included on the State of Utah, Department of Natural Resources Division of Wildlife Resources, Utah Sensitive Species List dated May 12, 2006. This list has been prepared pursuant to Utah Division of Wildlife Resources Administrative Rule R657-48. By rule, wildlife species that are federally listed, candidates for federal listing, or for which a conservation agreement is in place automatically qualify for the Utah Sensitive Species List. The additional species on the Utah Sensitive Species List, "wildlife species of concern," are those species for which there is credible scientific evidence to substantiate a threat to continued population viability. It is anticipated that wildlife species of concern designations will identify species for which conservation actions are needed, and that timely and appropriate conservation actions implemented on their behalf will preclude the need to list these species under the provisions of the federal Endangered Species Act (Utah Division of Wildlife Resources 2006a).

**Burrowing Owl** (*Athene cunicularia*) breeds in southwestern Canada, the western United States and Florida, northern Mexico, and parts of the West Indies. It winters from the southwestern United States to Honduras, northern populations being migratory. In Utah, it is uncommon during summer in native habitat throughout the state. Burrowing owl habitats comprise open grassland and prairies, but it also uses other open areas such as golf courses, cemeteries, and airports. Its diet consists of terrestrial invertebrates, and also integrates a variety of small vertebrates including small mammals, birds, frogs, toads, lizards, and snakes (Utah Division of Wildlife Resources 2006b).

Burrowing owl nests are found in mammal burrows, usually that of a prairie dog, ground squirrel, badger, or armadillo. If a mammal burrow is not available, the owls will sometimes excavate their own nest burrow. Three to 11 (usually 5 to 9) eggs are incubated by the female, who is fed by the male for 27 to 30 days. The young are tended by both parents and fledge after about 40 to 45 days (Utah Division of Wildlife Resources 2006b).

Burrowing owls are known to nest adjacent to the airstrip that serves Bullfrog. The airstrip is not included in the analysis area for this DCP/EA.

**Common Chuckwalla** (*Sauromalus ater*) is a fairly large lizard, sometimes reaching over 8 inches in length, not including the tail. Chuckwallas are predominantly found near cliffs, boulders, or rocky slopes where they use rocks as basking sites and rock crevices for shelter. Chuckwallas are primarily herbivorous, although insects are also consumed. Female chuckwallas lay one clutch of 5 to 15 eggs during the summer months. In Utah, the species occurs only in the southern portion of the state. It is included on the Utah Sensitive Species List because of habitat modification and other threats (Utah Division of Wildlife Resources 2006b).

**Glossy Snake** (*Arizona elegans*) can be found in a variety of habitats throughout its range, but it seems to prefer areas of barren open ground in deserts, sagebrush, and brushy grasslands, usually on sand, loam, or rocks. This snake is especially wary, burrowing in the ground during the day and becoming active at night. Females lay a clutch of 3 to 23 eggs during the summer. The glossy snake typically eats lizards, other snakes, and small mammals. The glossy snake is

often referred to as the "faded snake," due to the faded appearance of its coloration, which can be light brown to light gray with dull blotches of tan or gray (Utah Division of Wildlife Resources 2006b).

Two subspecies of the glossy snake can be found in Utah. The desert glossy snake (*Arizona elegans eburnata*) occurs in extreme southwestern Utah, while the Painted Desert glossy snake (*Arizona elegans philipi*) occurs in southeastern Utah (Utah Division of Wildlife Resources 2006b).

**Big Free-tailed Bat** (*Nyctinomops macrotis*) occurs in the western United States and in much of Latin America. The species is rare in Utah, occurring primarily in the southern half of the state and occasionally in northern Utah (Utah Division of Wildlife Resources 2006a).

The big free-tailed bat prefers rocky and woodland habitats where roosting occurs in caves, mines, old buildings, and rock crevices. The species is typically active year-round, spending summers in temperate North America and migrating to warmer areas in North America and South America for the winter. Big free-tailed bats eat insects, primarily moths. Females may give birth to a single offspring each year during late spring or early summer (Utah Division of Wildlife Resources 2006b).

**Fringed Myotis** (*Myotis thysanodes*) is a small bat that occurs in most of the western United States, as well as in much of Mexico and parts of southwestern Canada. The species is widely distributed throughout Utah, but is not common in the state. The fringed myotis inhabits caves, mines, and buildings, most often in desert and woodland areas. The species commonly occurs in colonies of several hundred individuals (Utah Division of Wildlife Resources 2006b).

Females generally give birth to a single offspring during the summer. Beetles, which are plucked from vegetation or the ground, are the major prey item of the fringed myotis. Because the fringed myotis flies so close to rocks and thick vegetation, its wings are particularly strong and puncture resistant. The species is nocturnal, and individuals hibernate during the cold winter months. The fringed myotis is brown in color, with a characteristic fringe of stiff hairs along the edge of the tail membrane (Utah Division of Wildlife Resources 2006).

**Townsend's Big-eared Bat** (*Corynorhinus townsendii*) occurs in western North America, from southwestern Canada to Mexico. Isolated populations of the species also occur in areas of the central and eastern United States. The species occurs statewide in Utah at elevations below 9,000 feet; however, Towsend's big-eared bat populations in Utah are thought to be declining (Utah Division of Wildlife Resources 2006).

Townsend's big-eared bat can occur in many habitat types, but is often found near forested areas. Caves, mines, and buildings are used for day roosting and winter hibernation. Consequently, human disturbances of caves and the closures of abandoned mines may constitute threats to the species (Utah Division of Wildlife Resources 2006).
Females congregate in nursery colonies and typically give birth to one young each year. Townsend's big-eared bats eat flying insects, particularly moths, and individuals are often seen foraging near trees. The species is nocturnal and typically does not leave the roost until well after sunset (Utah Division of Wildlife Resources 2006).

## VISUAL RESOURCES

Visual resources include the natural and human-made physical features that give a particular landscape its character and quality. Landscapes are not static, but are always undergoing change as a result of natural environmental processes or external modification. Underlying the character and condition of a landscape are the geological conditions and processes under which the landscape has evolved. These factors, in combination with climate, influence the type and condition of soils and vegetative cover, the type and abundance of wildlife, and the way in which people make use of the land. The resulting landscape character, together with our individual experience and expectations, determine the meaning we attach to the landscape.

The Bullfrog, Halls Crossing, and Hite developed areas are all located along the lakeshore and are characterized by stunning natural landscapes interspersed with human-made structures. The developed areas are comprised of marinas, campgrounds, housing areas, floating marina facilities, and launch ramps, which contrast with the natural environment.

At Bullfrog, the lodge is the largest human-made feature. It was constructed in the southwestern architectural style, which harmonizes well with the desert landscape. This architectural theme is carried out in other land-based facilities including the ranger station / emergency facilities / visitor contact station. Recently constructed facilities (restrooms and showers) in the day-use area are architecturally similar. The government employee housing area's numerous structures also reflect southwestern design. The older structures are of a more traditional design and appearance. Water-based development, floating stores, wet slips, buoy fields, gas docks, and boat rental facilities, however, have a contemporary nautical appearance.

Land-based facilities at Halls Crossing, primarily government facilities including maintenance facilities and NPS and concessioner employee housing, are not as visible, with the possible exception of the dry boat storage area. Much of Halls Crossing construction is older and of a more traditional style—not designed to blend with the natural landscape. As with Bullfrog, the water-based facilities (floating marina store, wet slips, buoy field, and ranger offices) have a contemporary nautical appearance.

Both Halls Crossing and Bullfrog exhibit the results of the recent construction of roads, launch ramps (or extensions), and parking areas. Such construction has disturbed vegetation, however, much of the disturbance would be below the high water line if the lake was at full capacity.

Land-based facilities at Hite are on the south side of the access road in a concentrated area and are generally older that at Bullfrog or Halls Crossing. The newer ranger station / visitor contact station is designed to harmonize with the surrounding landscape. No marina facilities are currently located at Hite.

Although Bullfrog, Halls Crossing, and Hite developed areas contain contrasting elements with the lake and desert landscape, the visual intrusions are mitigated by the fact that Glen Canyon is a national recreation area and visitors expect development and service facilities that will

support their recreational activities. Therefore, facilities that contrast with the natural scenic landscape and create a visual intrusion are expected and accepted in this environment.

## SOUNDSCAPES

Preservation of natural soundscapes is an important mission of the National Park Service. Natural soundscapes are defined in NPS *Management Policies 2001* as a combination of all the natural sounds that occur in a park, together with the physical capacity for transmitting natural sounds. Director's Order – 47: *Soundscape Preservation and Noise Management* (NPS 2000a) states that the natural ambient sound level of a park is the basis for determining the affected environment in environmental impact statements and other documents prepared for NEPA compliance.

Natural sounds occur within and beyond the range of sound that humans can perceive, and can be transmitted through air, water, or solid materials. Natural soundscapes would include all naturally occurring sounds such as waves on the shoreline, birds calling, wind blowing, or the sound of thunder. It would also include "natural quiet" that occurs in the absence of natural or human-generated sound. The opportunity to experience natural sounds is an enjoyable part of the experience for some visitors to Glen Canyon NRA.

Human-caused sounds at Glen Canyon NRA include all types of watercraft, automobiles, aircraft, and electronic devices such as radios and horns. Engines are the primary source of human-caused sound at Glen Canyon NRA. Human sounds are not unexpected or necessarily inappropriate at the developed areas, but are part of the overall soundscape in an area where water activities, picnicking, camping, sightseeing, and other recreational uses are part of the activity of the recreation area. Evaluation of the appropriateness of human sounds is evaluated by considering visitor expectation, management guidelines, resource sensitivity, and recreation area purpose.

Noise is generally defined as an unwanted or intrusive sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them. Sound is measured in a logarithmic unit called a decibel (dB). Because the human ear is more sensitive to middle and high-frequency sounds than to low-frequency sounds, sound levels are weighted to reflect human perceptions more closely. These "A-weighted" sounds are identified by the symbol "dBA."

For the average human, a 10-dBA increase in the measured sound level is subjectively perceived as being twice as loud, and a 10-dBA decrease is perceived as half as loud. The decibel change at which the average human would indicate that the sound is just perceptibly louder or perceptibly quieter is 3-dBA. There is generally a 6-dBA reduction in sound level for each doubling of distance from a sound source due to spherical spreading loss (e.g., if the sound level at 25 feet from a boat was 86 dBA, the sound level at 50 feet would be expected to be 80 dBA, at 100 feet 74 dBA, etc.). Noise levels from typical construction efforts may reach as high as 89 dBA 50 feet from the source, which would drop off 6 dBA per doubling of distance. So at 100 feet from the sound source the noise level would be 83 dBA and at 200 feet it would

be 77 dBA; this would continue until the sound became indistinguishable from the natural, or ambient noise, whichever is greater (NPS 2003b).

The GMP (NPS 1979) divided Glen Canyon NRA into four management zones. The Bullfrog, Halls Crossing, and Hite developed areas are located in the development zone. Noise from vessels is consistent with the purpose and management direction of the development zone where these areas are located.

Watercraft-generated noise levels vary from vessel to vessel. Noise limits established by the National Park Service require vessels to operate at less than 82 dBA at 82 feet (25 meters) from the vessel (36 CFR 3.7).

## ARCHEOLOGICAL RESOURCES

Humans have occupied the Glen Canyon region for at least 11,000 years, spanning four cultural periods, or stages. These include the Paleo-Indian period (11,000 before present [BP] – 9,500 BP), which was dominated by a dispersed mobile hunter-gatherer population that left little evidence in the Glen Canyon area, and the Archaic period (9,500 BP – 1,800 BP), when hunting was supplemented by the collection of a broad spectrum of wild plant and animal foods. As populations adopted the cultivation of squash and maize and settled into somewhat sedentary village life, the Formative period (1,800 BP – 700 BP) began. Regionally, early Formative period residents, also known as Ancestral Puebloans, exploited wild animal and plant food in addition to practicing agriculture. Approximately 700 years ago, the Ancestral Puebloans and their neighbors to the north, the Fremont, abandoned southern Utah and, it is presumed, joined the general Puebloan population living in larger villages in New Mexico and Arizona. This exodus marks the beginning of the Protohistoric period (700 BP – 250 BP) in which the Paiute, Ute, and Navajo peoples occupied the area.

The majority of the prehistoric sites recorded within Glen Canyon date to the Formative period, although evidence for Paleo-Indian and Archaic period occupations have been observed in limited sections of the recreation area. A small number of protohistoric remains are also present, characterized mostly by ephemeral open sherd and lithic scatters, brush shelters, and diagnostic rock art panels. Historic cultural resources are also present in relatively small numbers. Site densities of all site types tend to be relatively low. Approximately 2% of Glen Canyon NRA has been intensively surveyed or tested for cultural resources. As one would expect, the developed areas have received the most attention. Studies have been completed at Hite (Kay 1974, Goetze 1995, Zeir et al. 2002), Halls Crossing (Fowler et al. 1959b, Kay 1974, Tipps 1979, Schroedl 1981, Hurst 1984, Goetze 1995, Neal and Wenker 1997, Tipps and Warburton 2000), and Bullfrog (Fowler et al. 1959a; Kay 1974; Geib 1989; Lefree 1993; Goetze 1995; Neal and Wenker 1997; Huber and Bradley 1998, 1999).

The aggregate of the acreages intensively surveyed indicates that each of the developed areas of concern have had extensive intensive surveys completed, some relatively recently. Two surveys are of particular use in the current planning process: the 1997 surveys of the Halls Crossing and Bullfrog areas (Neal and Wenker 1997) and the 2001 survey of Hite (Zeir et al.

2002). These surveys included the entire area within the boundaries of the current development planning process.

The Glen Canyon project archeologists (noted in textual references as Fowler et al. 1959a and 1959b) surveyed up to the 3,700-foot flood level, where accessible. They did not provide specifics as to which areas were not surveyed and which were. Almost all the subsequent surveys were conducted to the water level, which varied from year to year.

As previously discussed, the Bullfrog, Halls Crossing, and Hite areas have undergone numerous archeological surveys over the years. The most extensive and recent survey at Hite was conducted in support of the development planning process between March 28 and April 1, 2001. The survey encompassed 1,480 acres and was bound on the north and west sides by Lake Powell, on the south by the foot of Brown's Rim, and on the east and northeast by SH 95. Eleven prehistoric sites and 24 isolated finds were recorded (including three previously recorded by Kay in 1974). No historic sites were noted. Sites consisted of lithic scatters (4), lithic scatter/procurement (5), sandstone slab feature / possible pit (1), and a rock shelter with lithic scatter (1). All sites occurred north of the Hite Marina access road. Seven of the sites are considered eligible for the NRHP (42SA3954–3956, 42SA24694–24697). Isolated finds included individual or small clusters of lithic artifacts in a variety of physiographic settings (Zeir et al. 2002).

A recent survey (1997), initiated because of anticipated development projects at Bullfrog and Halls Crossing, identified 25 sites at Halls Crossing. Seven had been previously recorded (three of these were completely rerecorded and three were updated). Of the sites recorded at Halls Crossing, nine (all lithic scatters) were considered NRHP-eligible (42SA3708, 42SA3941, 42SA3952–3953, and 42SA23087–23090). Seventy-two isolated finds were also noted (Neal and Wenker 1997). The same survey located 14 sites at Bullfrog. Four had been previously recorded. Of the sites recorded at Bullfrog, eight (all lithic scatters) are considered NRHP-eligible (42KA2382, 42KA4294, 42KA3467, 42KA4316–4317, 42KA4319, 42KA4321, and 42KA4323). Seventeen isolated finds were also located (Neal and Wenker 1997).

It is expected that because of the level of previous survey and the flexibility of site development that avoidance of known sites would be possible. Surveys would be completed only if undisturbed (and unsurveyed) areas are expected to be affected by development.

## ETHNOGRAPHIC RESOURCES

Many Glen Canyon NRA resources are considered sacred by American Indians. These include, but are not limited to, the Colorado and San Juan rivers, their side canyons, and the landscapes in which they occur. Five contemporary American Indian tribes are associated with Glen Canyon: the Hopi, Kaibab Paiute, Navajo, San Juan Southern Paiute, and Ute Mountain Ute. Other groups that have an ethnographic interest in the NRA include the Kanosh and Koosharem bands of the Paiute Indian Tribe of Utah, the Havasupai Tribe, and Hualapai Tribe.

Surveys for, and evaluations of, archeological (prehistoric and/or historic) resources and traditional cultural properties were conducted in August and October 1995 (Goetze 1995). The project was initiated by the anticipated construction of fee stations and associated housing at 13 different locations throughout Glen Canyon. The entire Halls Crossing developed area was declared a traditional cultural property based on consultation and ethnographic evidence (Goetze 1995).

## VISITOR USE AND EXPERIENCE

Glen Canyon NRA is one of the premier water-based recreation areas in the country. Lake Powell, its 96 major side canyons, and related natural, cultural, and geologic resources are the primary recreation features of Glen Canyon NRA.

A variety of recreational opportunities exist on and around Lake Powell. Power boating, use of houseboats and personal watercraft, waterskiing, fishing, boat tours, and kayaking are among the many water sports visitors enjoy. Opportunities also exist for hiking in the surrounding canyon areas, many of which are accessible only by water for most visitors. Visitors can also see archeologically and culturally important sites throughout the NRA. Visitors to Lake Powell are primarily interested in water-based activities. The 2005 visitor survey found that 94% of survey respondents participated in motor boating, 57% in fishing, and 51% participated in water sports. Popular land-based activities include hiking (65%) and camping (42%) (NPS 2005g).

Glen Canyon NRA experiences visitation year-round. The peak visitor season is from May 15 to Labor Day. During the "shoulder" seasons, from March 1 to May 15 and from Labor Day through Thanksgiving, the recreation area sees substantial visitation, but not at the levels experienced during the peak season. Total visitation at Glen Canyon NRA in 2005 was 1,928,274. Visitation for the uplake areas within Glen Canyon NRA for the 10-year period from 1995 to 2005 is presented in table 17.

**TABLE 17. UPLAKE VISITATION 1995–2005**

| Year | Bullfrog | Halls Crossing | Hite | Total | % Change from Previous Year |
|---|---|---|---|---|---|
| **1995** | 263,966 | 65,370 | 133,117 | 462,453 | |
| **1996** | 239,275 | 59,648 | 133,302 | 432,225 | -6.54% |
| **1997** | 248,041 | 64,708 | 127,540 | 440,289 | 1.87% |
| **1998** | 274,120 | 56,696 | 132,084 | 462,900 | 5.14% |
| **1999** | 256,875 | 86,503 | 154,107 | 497,485 | 7.47% |
| **2000** | 275,919 | 86,741 | 147,694 | 510,354 | 2.59% |
| **2001** | 272,195 | 75,198 | 143,108 | 490,501 | -3.89% |

**TABLE 17. UPLAKE VISITATION 1995–2005**

| Year | Bullfrog | Halls Crossing | Hite | Total | % Change from Previous Year |
|---|---|---|---|---|---|
| **2002** | 257,708 | 62,163 | 110,065 | 429,936 | -12.35% |
| **2003** | 214,406 | 72,579 | 62,442 | 349,427 | -18.73% |
| **2004** | 197,928 | 49,447 | 50,772 | 298,147 | -14.68% |
| **2005** | 216,663 | 58,845 | 59,405 | 334,913 | 12.33% |

Source: National Park Service Public Use Statistics Office: http://www2.nature.nps.gov/mpur/Reports/viewreport.cfm

After 1996 and prior to the onset of drought in 2001, uplake visitation showed a trend of steady increases.

Visitors can enjoy camping opportunities ranging from remote and undeveloped campsites to fully developed campgrounds (hardened campsites with picnic tables, fire grates, and available restroom facilities) managed by Glen Canyon NRA.

## SOCIOECONOMIC ENVIRONMENT

The existing and proposed development associated with the alternatives is located in Kane and Garfield counties, Utah (location of Bullfrog), and San Juan County, Utah (location of Halls Crossing and Hite). However, the affected environment for socioeconomics includes a larger analysis area that may experience direct and indirect socioeconomic change from the proposed alternatives. Socioeconomic effects include those related to visitors traveling to and from the region, those recreating in the area, and the activities of the National Park Service, its concessioner, and NPS and concessioner employees.

In addition to portions of Kane, Garfield, and San Juan counties, the socioeconomic analysis area boundary comprises parts of Wayne County in Utah because of effects to employment, income, and local government revenues, as well as potential indirect effects if prevailing trends in visitation change.

The Kane and San Juan counties school districts are in the analysis area for potential changes to tax revenue and enrollment at the Lake Powell School, which is in Kane County, but operates under an agreement to serve students from both Bullfrog in Kane County and Halls Crossing in San Juan County. Utah state government and the National Park Service at the federal government level are areas for analysis of potential tax and commercial services revenue effects.

## Affected Counties

The potentially affected counties each cover thousands of square miles and possess extensive open space; they are some of the most sparsely populated parts of Utah and the United States. Average population density ranges from less than two persons per square mile in San Juan and Kane counties, to one person per square mile or less in Wayne and Garfield counties. Utah's average population density is nine persons per square mile (U.S. Census Bureau 2004a).

Population rose by 5.3% overall in Utah from 2000 to 2003, but fell in the potentially affected counties over the same period. Estimated population in 2003 was 6,039 for Kane County, down 0.1% from 2000, and 13,901 for San Juan County, down 3.6%. Garfield and Wayne counties experienced population declines of 4.1% and 2.2% (table 18).

**TABLE 18. DEMOGRAPHIC PROFILE OF THE STATE OF UTAH AND POTENTIALLY AFFECTED COUNTIES**

| Counties | | | | | |
|---|---|---|---|---|---|
| | **Utah** | **Garfield** | **Kane** | **San Juan** | **Wayne** |
| **Population 2003 (July 1)** | 2,351,467 | 4,542 | 6,039 | 13,901 | 2,454 |
| **Population 2000 (April 1)** | 2,233,169 | 4,735 | 6,046 | 14,413 | 2,509 |
| **Population 1990 (April 1)** | 1,722,850 | 3,980 | 5,169 | 12,621 | 2,177 |
| **Percent change 2000 to 2003** | 5.3% | -4.1% | -0.1% | -3.6% | -2.2% |
| **Percent change 1990 to 2000** | 29.6% | 19.0% | 17.0% | 14.2% | 15.3% |
| **Race and Ethnicity 2000** | | | | | |
| **White** | 89.2% | 95.0% | 96.0% | 40.8% | 97.3% |
| **American Indian** | 1.3% | 1.8% | 1.6% | 55.7% | 0.4% |
| **Other races** | 9.5% | 3.2% | 2.4% | 3.5% | 2.3% |
| | | | | | |
| **Hispanic/Latino (any race)** | 9.0% | 2.9% | 2.3% | 3.7% | 2.0% |

Source: U.S. Census Bureau 2004a

Roughly 56% of the population of San Juan County is American Indian (table 18). This group is mostly Navajos and a smaller number of Utes. This reflects the fact that about 23% of the land area of San Juan County is in either the Navajo Nation or Ute Indian reservations.

American Indians are less than 2% of the population in Garfield, Kane, and Wayne counties, and are 1.3% of the state population. Other minority races make up 3.5% or less of the population in the four counties, compared to a 9.5% share in the state. People of Hispanic or Latino heritage are 3.7% or less of the county populations, compared to 9% of the state.

Considerable open space in the analysis area is devoted to agriculture. Farm jobs were almost 15% of the estimated 2002 total employment of 1,640 in Wayne County, 11.5% of 3,008 total

jobs in Garfield County, 5.3% of 5,520 jobs in San Juan County, and 4.3% of 3,826 jobs in Kane County (table 19). Farm jobs averaged only 1.4% of total employment in Utah in 2002.

**TABLE 19. ECONOMIC PROFILE OF THE STATE OF UTAH AND POTENTIALLY AFFECTED COUNTIES**

| | Counties | | | | |
|---|---|---|---|---|---|
| | **Utah** | **Garfield** | **Kane** | **San Juan** | **Wayne** |
| Total jobs in region 2002(1) | 1,395,229 | 3,008 | 3,826 | 5,520 | 1,640 |
| Agricultural | 1.4% | 11.5% | 4.3% | 5.3% | 14.8% |
| Trade, transportation, and utilities (estimated) | 18.4% | 10.0% | 13.2% | 12.3% | 12.0% |
| Leisure and hospitality (estimated) | 8.5% | 26.3% | 22.5% | 10.6% | 11.0% |
| State and federal government | 7.1% | 8.2% | 4.5% | 9.8% | 7.7% |
| Per capita income 2002(2) | $24,649 | $19,688 | $23,513 | $14,297 | $19,788 |
| Median household income 1999(3) | $45,726 | $35,180 | $34,247 | $28,137 | $32,000 |
| Persons below poverty line 1999(4) | 9.4% | 8.1% | 7.9% | 31.4% | 15.4% |
| Civilian labor force 2003(5) | 1,184,400 | 2,806 | 2,857 | 4,644 | 1,504 |
| As percent of population | 50.4% | 45.4% | 47.3% | 33.4% | 61.3% |
| Unemployment rate 2003(6) | 5.6% | 10.8% | 4.6% | 10.2% | 7.2% |
| Gross taxable sales per capita 2003(7) | $13,846 | $14,478 | $15,926 | $6,132 | $10,844 |
| Value of all building permits 2003 (000s)(8) | $4,560,852.6 | $10,302.8 | $13,088.3 | $8,180.3 | $4,440.8 |

Note: Some employment sectors are estimated from state data because federal data are undisclosed for certain sectors in small counties.
Sources: U.S. Bureau of Economic Analysis 2004 (1,2); U.S. Census Bureau 2004a (3,4); Utah Department of Workforce Services 2004 (1,5,6,7,8)

However, even in Wayne County, the most agricultural of the four counties, the economic base of the analysis area has shifted away from dependence on agriculture and mining to heavy reliance on tourism and recreation. This distinguishes the area from Utah as a whole, which is still one of the most industrially diversified states in the country. The importance of tourism and recreation in the analysis area is reflected in the importance of jobs in the leisure and hospitality sectors, which comprises from 11% to 26% of county employment in the analysis area, compared to less than 9% in Utah as a whole (table 19).

After years of economic stagnation, tourism and social services jobs have stimulated recent growth in population, home construction, and wages in Wayne County. Garfield County depends more on tourism and recreation for employment than any other county in Utah. Bryce Canyon National Park and Lake Powell are the chief attractions. Kane County also relies heavily on tourism. Lake Powell and Grand Staircase-Escalante National Monument are major attractions.

Kane County has the highest job growth rate in the state since 1997, in part because of growth in tourism and recreation. Similarly, in Garfield County, tourism has resulted in new economic

development, but the county also experiences high unemployment rates because of tourism seasonality. San Juan County's economic base derives its impetus from government, trade, and occasional mining projects in addition to tourism and recreation (Utah Department of Workforce Services 2004).

In 2002, estimated per capita income in San Juan County was $14,297, or 42% lower than the Utah average of $24,649. Other indicators of recent economic difficulty in San Juan County are a 2003 unemployment rate of 10.2% in 2003, compared to the state average of 5.6%; labor force participation of 33.4%, compared to 50.4% statewide; and 31.4% of the population below the poverty line in 1999, compared to the state average of 9.4%.

Table 19 shows lower-than-average median household income in 1999 in all four counties, ranging from about 77% of the state average in Garfield County to about 62% in San Juan County. Among the four counties, Garfield and Kane counties have higher than average taxable sales per capita, which may reflect sales to nonresidents, including tourist and recreation visitors.

Lower income levels in the region are partly the effect of the large American Indian populations in San Juan County and elsewhere. This occurs because of the disproportionately high unemployment and low labor force participation that affects some tribes. At the same time, reservations such as the Navajo Nation, which covers much of the southern part of San Juan County, are a source of federally funded government employment (Utah Department of Workforce Services 2004).

## Gateway Communities

The town of Hanksville (Wayne County), the city of Blanding (San Juan County), and Ticaboo Resort (unincorporated Garfield County) are gateways to Bullfrog, Halls Crossing, and Hite.

The economy of Hanksville depends heavily on mining, ranching, and visitation to Lake Powell. The town, with an estimated population of 206 in 2002 (U.S. Census Bureau 2003), has some lodging, restaurants, and a small store. Hanksville is 45 road miles north of Hite, 68 miles north of Bullfrog, and 70 miles north of Halls Crossing.

Blanding, with an estimated population of 3,004 in 2002 (U.S. Census Bureau 2003), depends economically on tourism and on government institutions, including the state-operated College of Eastern Utah. Because it is located near Lake Powell and many other attractions (e.g., Natural Bridges and Hovenweep national monuments, Goosenecks and Edge of the Cedars state parks, and Monument Valley Navajo Tribal Park), Blanding has a range of lodging, restaurants, and other visitor-oriented business establishments. Blanding's location 80 to 85 miles east of Halls Crossing and Hite enables it to provide medical services for the two developed areas.

Ticaboo Resort, 13 miles north of Bullfrog on SH 276, has a motel, campground, restaurants, and incidental boating services. The population in and around Ticaboo was 73 in 2000 (U.S. Census Bureau 2004b).

## Business Activity

Business activity at Lake Powell is driven by tourist and recreation visitation to Glen Canyon NRA. The Lake Powell developed areas are the most heavily visited areas of Glen Canyon NRA. Use is concentrated in the spring, summer, and fall months, and when water levels are highest. Fluctuations in seasonal use affect business activity at the developed areas and NPS and concessioner employment.

One of the primary concessioners at Glen Canyon NRA is ARAMARK Sports and Entertainment Services, Inc. (ARAMARK). Commercial services offered by ARAMARK in the uplake areas include lodging, slip, buoy, and secured storage space rental; a restaurant; snack bars; a liquor store; marina stores and gift shops; water-based fuel stations; land-based fuel stations; boat maintenance and repairs; and boat tours.

ARAMARK operates rental fleets based at each of the three uplake marinas. At low water levels, all rental operations move to Bullfrog. Incidental commercial services (e.g., boat caretaking, repairs, launch and retrieval, fishing guides, and hiking services) are provided by about 130 holders of independent business permits.

ARAMARK operates Bullfrog as a full-service resort, provides a less comprehensive level of service at Halls Crossing, and offers limited visitor services at Hite.

Trends for major commercial services provided by the concessioner were analyzed by looking at activity levels for fleet rentals, lodging, and campsite rentals at the uplake developed areas. Concessioner facility use and visitor trends from 1997 to 2005 show a diverging pattern based on examination of the annual account reports. Both increases and decreases in visitor use, and types of use have affected concessioner receipts and profits. Social, economic, and environmental factors such as a declining economic outlook, decreasing domestic and international travel, the effects of a regional drought, and increasing gasoline prices have decreased the concessioners' ability to make a profit. Specifically, after modest revenue increases occurred from 1997 through 2000, concessioner profits turned downward by almost 2% from 2000 to 2001. Profits continued to drop between 2001 to 2004. However, in 2005 a revenue upswing of about 2% is evident. This modest increase is encouraging, but insufficient to base a long-term projection on the profitability needed to expand facilities and services in the future.

River trips on the Colorado River end at the river takeout at Hite. Commercial outfitters provide a large share of these river trips. National Park Service data indicates a decline in active companies, trips, and visitors. Between the 2000 and 2003 seasons, the number of active companies providing river trips declined, the number of trips declined by 22%, and the number of visitors declined by 27%.

Peak season activity may be an indicator of the adequacy of facilities to meet current and projected future visitor needs.

Table 20 demonstrates that demand for lodge rooms peaked in 1999, prior to several years of severe drought that resulted in record low lake levels. Demand for lodge rooms in 2005 showed a slight increase, possibly resulting from increased lake levels over those of the

previous four years. Prior to the onset of drought and decreasing lake levels, almost all lodge rooms were occupied during the peak month. Even during drought conditions, 90% of lodge rooms were filled during the peak month.

**TABLE 20. LODGE ROOM AND PEAK OCCUPANCY**

| Year | Peak Season[1] Average Occupancy | Peak Month[2] | Peak Month Occupancy Percentage |
|---|---|---|---|
| 2005 | 77% | July | 89% |
| 2003 | 75% | July | 90% |
| 1999 | 89% | August | 96% |
| 1997 | 86% | August | 96% |

[1]Peak season for these calculations is defined as May through September.

[2]Peak month is the month with the greatest percentage of occupancy.

The occupancy rates in table 21 may indicate that occupancy rates during the peak season dropped in response to the severe drought that resulted in record low lake levels. At Bullfrog, the occupancy rate for family rental units in the peak month was still nearly 90% during the year with the lowest occupancy rate for the peak season. It would appear demand for family rental units at Bullfrog continued to be high despite drought and low lake level conditions.

**TABLE 21. HOUSEKEEPING (FAMILY RENTAL) UNIT PEAK OCCUPANCY**

| Year | No. Unit Nights Available Peak Season | Peak Season[1] Average Occupancy | Peak Month[2] | Peak Month Occupancy (%) |
|---|---|---|---|---|
| **Bullfrog** | | | | |
| 2005 | 1,232 | 73% | July | 89% |
| 2003 – Low[3] | 1,288 | 69% | August | 87% |
| 2000 – High[4] | 1,250 | 80% | July | 100% |
| **Halls Crossing** | | | | |
| 2005 | 3,080 | 41% | July | 52% |
| 2004 - Low | 3,080 | 36% | July | 48% |
| 2000 - High | 3,080 | 71% | August | 89% |
| **Hite** | | | | |
| 2005 - Low | 770 | 2% | July | 5% |
| 2000 - High | 770 | 75% | July | 88% |

1. Peak season for these calculations is defined as May through September.
2. Peak month is the month with the greatest percentage of occupancy.
3. Low: The year with the lowest percentage of occupancy for the peak season.
4. High: The year with the highest percentage of occupancy for the peak season.

Campground occupancy has decreased over time. At Bullfrog, occupancy peaked at 65% in mid-summer in the early 1990s, then declined through the late 1990s, then dropped sharply during recent drought years. At Halls Crossing, the occupancy percentage during the peak season was in the mid-30% range consistently in the late 1990s leading up to the drought years, and then dropped precipitously. Occupancy at Halls Crossing peaked around 40% in the early 1990s. However, the campgrounds in the uplake area are antiquated because the electrical amperage provided is below the demands of modern RVs, and sites in both the existing campgrounds and RV parks will not accommodate larger RVs. No commercial RV parks are available close to the NRA perimeter because of the remote location of the uplake area.

Peak season (May through September) activity may be an indicator of the adequacy of facilities to meet current and projected future visitor needs. Occupancy of lodge rooms peaked in 1999, with an average peak season occupancy rate of 89%, then declined to a low of 75% in 2003. Despite persistent drought and record low lake levels from 2000 to 2004, lodge room occupancy was nearly 100% in some summer months.

Family rental unit occupancy shows trends similar to that of lodge rooms. Occupancy of family rental units during the peak season reached all-time highs in 2000, and declined through the subsequent drought years. Yet, occupancy of family rental units continued to reach nearly 90% during some summer months, particularly at Bullfrog. Occupancy at Halls Crossing showed the greatest decline with peak occupancy of only 48% in August of 2004.

Slips and buoys available for long-term rental are fully rented. There are waiting lists for both slips and buoys, with names of customers interested in long-term rentals should any vacancies occur.

Occupancy of houseboat rentals peaked in 2000. In the month of August, occupancy peaked at 97.5%. Overall occupancy for 2000 was 39.3%. Rental houseboat occupancy declined to an overall low of 23.3% in 2004, with just 64.9% in August. In 2005, occupancy rates for rental houseboats increased to an overall rate of 29.2%, with 81.6% of rental houseboats occupied in July.

## Lake Powell School

Children of families living in housing at Bullfrog and Halls Crossing attend the Lake Powell School at Bullfrog, which is operated by the Kane County School District.

## Tax Revenue

Facilities and activities at the uplake developed areas generate tax revenues for the State of Utah and for local governments. All sales and watercraft and lodging rentals at Bullfrog, Halls Crossing, and Hite are taxed. Revenues go to the State of Utah and to Kane and San Juan counties. The county sales tax includes a special levy for county hospital services.

Local governments also levy a property tax or a privilege tax on facilities, fleet, and equipment at each developed area. Taxable property located at the developed areas includes federal

property used for business by the concessioner, and private boats moored or stored at the lake, but it excludes federal property used by NPS personnel. Property and privilege tax revenues go to Kane County and San Juan County governments and school districts. Other revenue generated by business activity at the uplake developed areas comes from state taxes on fuels and special Kane County excise taxes for tourism promotion levied on lodging rentals and food service sales.

Visitors going to and from Lake Powell also generate tax revenue for state and local government. Purchases of fuel, food, lodging, and other goods and services in the gateway communities of Hanksville, Blanding, and Ticaboo yield sales and excise taxes for the State of Utah; Wayne, San Juan, and Garfield counties; the town of Hanksville; and the city of Blanding. The State of Utah also earns revenues from sales tax on purchases of commercial river trips and from a special tax on rental cars.

### Fee Revenue

The National Park Service charges entrance and any applicable enhanced amenity fees (e.g., camping, boating) including concessioner franchise fees at Lake Powell. The NPS Recreation Fee Program allows Glen Canyon NRA to retain 80% of the total revenue collected. These revenues from cost-of-collection and franchise fees are used for projects that enhance visitor enjoyment of Lake Powell.

## PARK OPERATIONS

Glen Canyon NRA staff provide the full scope of functions and activities to accomplish management objectives and meet requirements of law enforcement, emergency services, public health and safety, science, resource protection and management, visitor services, interpretation and education, community services, utilities, housing, and fee collection. Management of the recreation area requires the participation of seven recreation area divisions. They include the superintendent's office, administration, visitor protection, interpretation, maintenance, concessions, and resource management.

The superintendent is responsible for the full scope of managing the area; its staff and residents; all of its programs; and its regulations with persons, agencies, and organizations interested in Glen Canyon NRA. The division of administration provides management, services, and technical expertise in all areas of administrative support. The superintendent's office and the administration division do not expend resources directly to manage park unit operations and resources. Instead, they provide support for the other divisions in their management of the recreation area.

The visitor protection division normally employs permanent rangers who patrol; enforce boating laws, including personal watercraft regulations; provide emergency medical services; and conduct search and rescue operations. In addition, during high visitor use periods, the NRA typically hires seasonal employees to support existing enforcement staff.

Development and dissemination of materials related to Glen Canyon NRA resources, visitor activities, and visitor safety and conflict is provided by the interpretive division. Information pertaining to Glen Canyon NRA resources and visitor activities also is available through nonpersonal media such as Glen Canyon NRA newspapers and brochures. These are available to visitors at all entry points and at developed sites throughout Glen Canyon NRA.

Maintenance employees perform a variety of services related to recreational use including, but not limited to, facilities and infrastructure upkeep and repair, sign construction and repair, dock repair, maintenance and placement of navigational devices such as buoys according to changes in lake levels, and sanitation services. NRA maintenance operations are responsible for water supply and wastewater treatment systems operations and maintenance.

The business division manages the concessions program, including concessions contracts, special-use permits, right-of-way permits, and commercial-use authorizations and fee remittances at Glen Canyon NRA.

The resource management division protects and manages natural and cultural resources. Its staff includes terrestrial and aquatic biologists, archeologists, and geographic information system specialists. Among other responsibilities, this staff provides monitoring, evaluation, and planning to ensure the protection of NRA resources for future generations.

A primary concessioner, ARAMARK, employs staff providing visitor service and operational support for services such as boat rentals, overnight accommodations, food service, fueling stations, and boat maintenance and repair.

Glen Canyon NRA staff manages housing in conjunction with the concessioner. Per the NPS Housing Management Plan (a management action common to all alternatives), the current direction is to provide only the minimum number of housing units necessary to support the mission of the National Park Service. To comply with this policy, the National Park Service is currently evaluating existing housing and providing recommendations for the appropriate amount and types of housing.

The concessioner is responsible for power generation and maintenance of the power facilities at the uplake developed areas. The NPS maintenance staff is responsible for water supply, treatment, and distribution systems, and maintenance of wastewater treatment systems. The National Park Service, in conjunction with the concessioner, is responsible for the wastewater collection system.

Glen Canyon NRA operations have been particularly stressed during the last several years of low water levels. The decrease in water elevation has resulted in changes to many water-based services and facilities. NPS maintenance staff have been responsible for ensuring that the public launch ramps are extended and that ferry launch ramps are maintained. The ferry service is operated by UDOT. The National Park Service has worked closely with the concessioner to relocate water-based facilities such as the wet slips and buoy fields, to ensure that these remain in operation. Construction of new parking areas and access roads have been the result of a collaborative effort between NPS maintenance staff and the concessioner.

## PUBLIC HEALTH AND SAFETY

Public health and safety facilities in the area are located at Bullfrog, Halls Crossing, and Hite. The uplake district ranger's office at Bullfrog coordinates law enforcement and emergency response, fire protection, and visitor information for all three developed areas. Ranger staff are assigned to Bullfrog, Halls Crossing, and Hite subdistricts. Jurisdiction for handling public safety issues (i.e., law enforcement) generally lies with NPS rangers, although other law enforcement entities may also respond. The medical clinic at Bullfrog provides emergency medical care through a staff of physician's assistants and ranger staff with varying levels of medical certification ranging from first responders to emergency medical technicians and paramedics.

Boating safety requirements are enforced by several agencies including the National Park Service, U.S. Coast Guard, Utah State Parks and Recreation, and the Utah Department of Natural Resources. Glen Canyon NRA normally employs between 25 and 30 permanent rangers who patrol and enforce boating laws. The distribution of enforcement staff is based on levels of visitor use and the frequency of problems. About 50% of the law enforcement staff is assigned to the uplake district, which accounts for slightly less than 25% of watercraft use at Lake Powell (NPS 2003b).

Typically during the summer months, approximately nine NPS law enforcement officers are assigned to the Bullfrog area, four to Halls Crossing, and two to Hite. NPS rangers are responsible for ensuring the safety of visitors and for protecting NRA resources on both land and water. This presents a challenge because most visitor activity is water-based, while about 85% of the recreation area is dry land. Land-based areas of concentrated visitor activity such as the boat launches and campgrounds require disproportionate commitments of NPS law enforcement staff (NPS 2003a).

**TABLE 22. RESOURCE AND VISITOR PROTECTION ACTIVITY IN GLCA NRA 2005**

| Activity | Level |
|---|---|
| Law Enforcement | |
| Part I Offenses Investigated | 54 |
| Part II Offenses Reported | 2711 |
| Emergency Medical Services | |
| Total Medical Incidents | 371 |
| Deaths (accidental) | 9 |
| Search and Rescue Incidents | 77 |

Source: NPS 2005k

Appropriate state and federal regulatory permits would be obtained prior to the start of any new construction projects.

## TRANSPORTATION

The main entrance to Bullfrog is via SH 276, entering the recreation area from SH 95, approximately 70 miles south of Hanksville, Utah. The Bullfrog area has a well-developed road system. Once inside the recreation area entrance, most secondary roads at Bullfrog are paved roads. Some of the newer roads created to maintain access to the lake under current low water conditions are packed dirt or gravel. In addition, access roads to shoreline camping areas at North and South Bullfrog and Stanton Creek are dirt roads.

Bullfrog can also be accessed by The Notom – Bullfrog Road, which is paved for approximately 25 miles north of Bullfrog and is dirt northward from the intersection with SH 24. The Burr Trail Road from Boulder, Utah, intersects the Notom – Bullfrog Road as well.

The main entrance to Halls Crossing is via SH 276, entering the recreation area from SH 95, west of Natural Bridges National Monument, and approximately 45 miles west of Blanding, Utah. Most of the secondary access roads at Halls Crossing are paved roads. Some of the newer roads created to maintain access to the lake under current low water conditions are packed dirt or gravel.

A Utah state-owned toll ferry provides access between Bullfrog and Halls Crossing, and alternate entrances to both marinas. The ferry can accommodate most vehicles and runs every other hour from each location (i.e., even hours from Halls Crossing and odd hours from Bullfrog). Hours of operation vary from winter to summer with winter hours being more restricted. The ferry is also used to transport school children to the Lake Powell School at Bullfrog. A school bus picks up the children on the Bullfrog side and transports them to the school building.

Hite is accessed from SH 95. The main access to Hite is a paved road that runs from SH 95 to the main launch ramp. Most of the secondary roads are paved roads. Some shoreline camping accesses are packed dirt.

# Environmental Consequences

# ENVIRONMENTAL CONSEQUENCES

## INTRODUCTION

This section describes the environmental consequences of the three alternatives. First, methods for assessing environmental consequences are discussed. NEPA requires consideration of context, intensity, and duration of impacts, cumulative impacts, and measures to mitigate impacts. Next, an explanation of resource impairment is assessed by alternative, in accordance with NPS policy. Table 1 provides a summary of alternatives by impact topic.

## METHODOLOGY

Overall, the National Park Service based these impact analyses and conclusions on a review of existing literature and Glen Canyon NRA studies, information provided by experts within Glen Canyon NRA and other agencies, professional judgments and NRA staff insights, interested local American Indian tribes, and public input.

The following definitions were used to evaluate the context, intensity, type, duration, and cumulative nature of impacts associated with project alternatives:

- *Context.* Context is the setting within which an impact is analyzed such as local, parkwide, or regional. The Council on Environmental Quality requires that impact analysis include discussions of context.

- *Impact Intensity*. Impact intensity is the degree to which a resource would be beneficially or adversely affected. The criteria that were used to rate the intensity of the impacts for each resource topic are presented under each impact topic discussion.

- *Type of Impact*. Impacts can be beneficial or adverse. Beneficial impacts would improve resource conditions while adverse impacts would deplete or negatively alter resources.

- *Duration.* The duration of the impacts in the analysis is defined as short term or long term. A definition of the time frame that constitutes short term and long term is included under each impact topic discussion.

- *Direct versus indirect impacts.* A direct impact is an effect that is caused by an action and occurs at the same time and place. An indirect impact is an effect that is caused by an action, but is later in time or farther removed in distance, but still reasonably foreseeable.

For each impact topic, the analysis includes a description of the affected environment and an analysis of the environmental consequences using the methods and terms presented in this section. The impact analysis involved the following steps:

- Identify the area that could be affected.
- Compare the area of potential effect with the resources that are present as compared to the baseline (alternative A).
- Identify the intensity, context, duration (short or long term) and type (direct or indirect) of effect, both as a result of this action and from a cumulative effects perspective.

## CUMULATIVE EFFECTS ANALYSIS METHOD

Council on Environmental Quality regulations, which implement NEPA, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7).

Cumulative effects were determined by combining the effects of the alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify these actions at Bullfrog, Halls Crossing, and Hite; within Glen Canyon NRA; and in the surrounding region. Other actions that have the potential to have a cumulative effect in conjunction with the proposed action include the following:

### Actions That Make Up the Cumulative Impacts Scenario

#### Road and Highway Improvements

- The Burr Trail is a historic road that begins at Boulder, Utah, terminating at SH 276, north of the Bullfrog developed area within Glen Canyon NRA. The Burr Trail connects to Utah SH 24 to the north via Notom Road. The Burr Trail has been upgraded on BLM lands, and where the counties have jurisdiction, improvements have been made to the Burr Trail and Notom Road in areas outside of Capitol Reef National Park. The National Park Service has released a draft environmental impact statement proposing a range of modifications to the Burr Trail within Capitol Reef National Park (NPS 2005a). Collectively, the past and proposed improvements and modifications to the Burr Trail could make an attractive alternative route for visitors traveling from points in northern Utah via SH 24, and from Boulder, Utah.
- SH 24 is a primary route of access for visitors to the uplake developed areas within Glen Canyon NRA traveling from points north and west. UDOT has undertaken complete reconstruction of SH 24 between Lyman and Bicknell, Utah. Work on this project is anticipated to continue through September 2006 (UDOT 2005).

- UDOT has no major reconstruction projects planned for highways in the area of the uplake district of Glen Canyon NRA. Future projects include chip sealing and overlay, with each project estimated to be three to five days in duration. These projects would result in some minor traffic delays due to one-lane traffic during construction (Lee 2005).

**Proposed Petroleum Exploration Well in Glen Canyon NRA.** The National Park Service and the BLM are in the process of preparing an environmental assessment for a proposed petroleum exploration well within Glen Canyon NRA. The well would be drilled in the Circle Cliffs area. Access to the 2-acre well site would be over several miles of paved or graded dirt roads in the NRA and over existing roads in Grand Staircase – Escalante National Monument (NPS 2005b).

**Canyonlands National Park River Management Plan.** Visitors and commercial operators recreating on the Colorado River through Canyonlands National Park takeout from the river at Hite. Canyonlands manages the use of the Colorado River through Canyonlands and into Glen Canyon NRA under a river management plan that was implemented in the early 1980s. Canyonlands has initiated a process to update the river management plan and anticipates issuance of a draft plan for review in the spring or summer of 2006 (Cowan 2005). Changes made to future river management under the new plan may contribute to cumulative impacts; however, because plan development is in the preliminary stages the plan cannot be analyzed with regard to cumulative impacts.

**Bureau of Land Management Resource Management Plan.** The BLM is preparing a new resource management plan for public lands and resources located in Garfield, Piute, Sanpete, Sevier, and Wayne counties. The BLM also issues cattle grazing permits for BLM lands in these counties (NPS 2005a). Changes made to future resource management on BLM lands under the new plan may contribute to cumulative impacts; however, because plan development is in the preliminary stages, the plan cannot be analyzed with regard to cumulative impacts.

**Development in Surrounding Areas.** Areas nearby, but outside NRA boundaries (Ticaboo and Halls Crossing Airport) present opportunities for development and expansion of visitor services (secured storage, launching services, etc.).

## IMPAIRMENT ANALYSIS METHOD

NPS *Management Policies 2001* (NPS 2001a) require analysis of potential effects to determine whether or not actions would impair NRA resources or values.

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. The NRA's enabling legislation, as amended, further mandates resource protection. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, actions that would adversely affect NRA resources and values.

These laws give the National Park Service the management discretion to allow impacts to NRA resources and values when necessary and appropriate to fulfill the purposes of a park unit, so long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service this discretion, it is limited by the statutory requirement that the National Park Service must leave NRA resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

Impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of NRA resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any NRA resource or value may constitute an impairment. Impairment may result from NPS activities in managing the NRA, from visitor activities, or from activities undertaken by concessioners, contractors, and others operating in the NRA. Impairment of NRA resources can also occur from activities occurring outside recreation area boundaries. An impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect on a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the recreation area
- key to the natural or cultural integrity of the recreation area or to opportunities for enjoyment of the recreation area
- identified as a goal in the NRA's general management plan or other relevant NPS planning documents

A determination on impairment is included in the "Impact Analysis" section for all impact topics relating to recreation area natural and cultural resources.

## CRITERIA AND THRESHOLDS FOR IMPACT ANALYSIS

The following topics of this section provide a description of the related laws, regulations, and policies for each impact topic; the methodology and thresholds used in the impact analysis, and a description of the predicted impacts for each alternative.

## IMPACT TOPICS

### Land Use

#### Regulations and Policy

The enabling legislation for Glen Canyon NRA defines the purposes of the recreation area to include the following: ". . . to provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto . . . and to preserve, scenic, scientific, and historic features contributing to public enjoyment of the area (NPS 1979).

As part of the management planning for the recreation area that resulted in the 1979 GMP, planners defined land-use management zones within Glen Canyon NRA and specified management goals for each zone. Planning relative to activities and construction in these zones must consider the management goals for that zone.

### Methodology

The impact assessment for land use focused on effects the alternatives would have on the management zones described in the 1979 GMP, including the types of activities and construction allowed in each zone compared to the types of activities and construction proposed in each alternative. The analysis was conducted by examining the limits of each zone relative to the proposed construction, expansion, or relocation in each alternative. The following definitions were used to assess the intensity of impact:

| Impact Intensity | Land-Use Intensity Definition |
|---|---|
| Negligible | Land use in the form of construction of facilities and/or location or introduction of recreational opportunities in all cases conforms the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP. |
| Minor | Land use in the form of construction of facilities and/or location or introduction of recreational opportunities generally conforms with the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP. Nonconforming uses or activities can be easily mitigated to bring them into conformance. |
| Moderate | Land use in the form of construction of facilities and/or location or introduction of recreational opportunities generally conforms with the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP. Nonconforming uses or activities can be mitigated to bring them into conformance; however, such mitigation is difficult and expensive and may result in substantial changes to the proposal. |
| Major | Land use in the form of construction of facilities and/or location or introduction of recreational opportunities does not conform with the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP, and constitutes a conflicting use. Mitigation measures cannot be implemented to change the level of conformance. |

Short-term land-use impacts are those that last only during construction activities. Long-term land-use impacts would last longer than the construction period.

### Alternative A (No Action)

**Impact Analysis.** All existing land uses in the uplake developed areas conform to the land-use descriptions for the development zone in which the activity is located as discussed in the 1979 GMP. Because the existing uses conform to the land-use descriptions, and no changes would be made under the no-action alternative, there would be no impacts to land use under alternative A.

**Cumulative Impacts.** There would be no cumulative impacts as a result of the no-action alternative.

**Conclusion.** Because the existing uses conform to the land-use descriptions, and no changes would be made under the no-action alternative, there would be no impacts to land use under alternative A. Because the no-action alternative would not impact land use, there would be no cumulative impacts as a result of the no-action alternative.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, there would be no impact to land use from NPS maintenance facilities, airstrips, water-based stores, launch ramp support facilities, and the river runner takeout because there would be no changes in land use from the no-action alternative.

All existing land uses conform to the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP. All upgrades and expansions at Bullfrog and Halls Crossing proposed under alternative B would constitute a continuation or expansion of existing land uses in those locations and would, therefore, conform to the 1979 GMP.

Facility upgrades that would constitute new land uses at Hite under alternative B are the following:

- shower and laundry facilities
- land-based food service
- upgrades to SH 95 overlook
- development of the primitive campground

The 1979 GMP describes the proposed scope of development for the Hite developed zone as "Major visitor resort (marina, dry and wet boat storage, lodging, food service, campground, service station, store, RV park, employee housing)." The proposed developments at Hite are consistent with this land-use description.

Under alternative B, all proposed expansion and development would be consistent with the land-use descriptions in the 1979 GMP; therefore, there would be no impacts to land use.

**Cumulative Impacts.** There would be no cumulative impacts as a result of alternative B.

**Conclusion.** Under alternative B, all proposed expansion and development would be consistent with the land-use descriptions in the 1979 GMP; therefore, there would be no impacts to land use. There would be no cumulative impacts as a result of alternative B.

### Alternative C

**Impact Analysis.** All existing land uses conform to the land-use descriptions for the zone in which the activity is located as discussed in the 1979 GMP. All upgrades and expansion at Bullfrog and Halls Crossing proposed under alternative C would constitute a continuation or expansion of existing land uses in those locations, and would, therefore, conform to the 1979 GMP and result in no impact.

Proposed developments and expansion that have the potential to impact land use at Hite under alternative C would be the same as those under alternative B, except for the proposed addition of a land-based pumpout. Land-based pump-out service is consistent with the 1979 GMP land-use description for Hite.

Under alternative C, all proposed expansion and development would be consistent with the land-use descriptions in the 1979 GMP; therefore, there would be no impacts to land use.

**Cumulative Impacts.** There would be no cumulative impacts as a result of alternative C.

**Conclusion.** Under alternative C, all proposed expansion and development would be consistent with the land-use descriptions in the 1979 GMP; therefore, there would be no impacts to land use. There would be no cumulative impacts as a result of alternative C.

## Soils and Geology

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for soils and geology:

| Desired Conditions | Sources |
|---|---|
| Soil resources and processes function in as natural a condition as possible, except where special management considerations are allowable under policy. | NPS *Management Policies 2001* |
| Soils classified by the U.S. Department of Agriculture, Natural Resources Conservation Service, as prime or unique farmlands are retained. | Council on Environmental Quality (1980) memorandum on prime and unique farmlands |
| Natural geologic resources and processes function in as natural a condition as possible, except where special management considerations are allowable under policy. | NPS *Management Policies 2001* |
| Geologically hazardous areas would be avoided in the placement of new facilities. | NPS *Management Policies 2001* |

### Methodology

The impact assessment for soils and geology focused on effects the alternatives would have on geologic features and processes, including the formation and conservation of soil resources in the uplake area. Actions prescribed could affect soil resources through accelerated erosion, loss, or removal. The analysis was conducted by examining the types of soils and amount of area that would be disturbed or paved, and applying knowledge of expected effects under each alternative based on professional judgment. The following definitions were used to assess the intensity of impact:

| Impact Intensity | Soils and Geology Intensity Definition |
|---|---|
| Negligible | Impacts to soils or geologic features would not be measurable. Any effects on soil productivity or fertility would be slight, short term, and would occur in a relatively small area. |
| Minor | The effects on soils or geologic features would be detectable, but likely short term. Effects on soil productivity or fertility would be small, as would the area affected. If mitigation were needed to offset adverse effects, it would be relatively simple to implement and would likely be successful. |
| Moderate | The effects on soils or geologic features would be readily apparent, long term, and would slightly change the soil or geologic characteristics over a relatively large area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful. |
| Major | The effect on soils or geologic features would be readily apparent, long term, and would substantially change the soil or geologic characteristics over a large area in and out of the NRA. Mitigation measures to offset adverse effects would be needed, extensive, and their success could not be guaranteed. |

## Alternative A (No Action)

**Impact Analysis.** There would be no changes to existing operations or facilities under the no-action alternative. Geology would not be impacted because no rock excavation would occur. Soils would continue to be impacted by visitor and employee use of the uplake developed areas, largely as a result of off-road parking and visitors creating social trails. The impacts to soils would be long term, minor, and adverse.

**Cumulative Impacts.** Because the no-action alternative would not impact geology, there would be no cumulative impacts to geology from the no-action alternative. Most of the cumulative impact projects have the potential to impact soils including the road construction work associated with SH 24 and the Burr Trail / Notom Road, and the petroleum exploration well. Soils would be temporarily disturbed and permanently regraded by the construction activities resulting in short- and long-term, minor, adverse impacts to soils. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with the no-action alternative, would result in long-term, minor to moderate, adverse impacts to soils.

**Conclusion.** There would be no impacts to geology. The impacts to soils would be long term, minor, and adverse. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with the no-action alternative, would result in long-term, minor, adverse impacts to soils.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** At Hite, shallow soils would require blasting bedrock to bury the proposed underground water storage tank. This would result in localized, short- and long-term, minor, adverse impacts to geology. Soils would be reworked as part of the construction activities associated with alternative B. Up to an estimated 83.3 acres of new disturbance would occur as a result of planned construction activities (up to 38.8 acres at Bullfrog, up to 37.6 acres at Halls Crossing, and up to 7.5 acres at Hite; see table 2). Impacts to soils as a result of the increased disturbance and development of new facilities or relocation of existing facilities would be long term, minor, and adverse. Up to a total of 15.4 acres would be restored (up to 4.7 acres at Bullfrog and up to 10.7 acres at Halls Crossing). Long-term, negligible, beneficial impacts to soils would occur as a result of the restoration of these areas. Overall impacts to soils from alternative B would be long term, minor, and adverse.

**Cumulative Impacts.** Alternative B would result in localized, short- and long-term, minor, adverse impacts to geology. Most of the cumulative impact projects have the potential to impact geology and soils including the road construction work associated with SH 24 and the Burr Trail / Notom Road and the petroleum exploration well. Soils would be temporarily disturbed and permanently regraded and roadcuts may involve bedrock excavation resulting in short- and long-term, minor, adverse impacts to soils and geology. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative B, would result in long-term, minor, adverse impacts to soils and geology.

**Conclusion.** Alternative B would result in localized, short- and long-term, minor, adverse impacts to geology. Impacts to soils as a result of disturbance and development of new facilities or relocation of existing facilities would be long term, minor, and adverse. Long-term, negligible, beneficial impacts to soils would occur as a result of the restoration of areas. Overall impacts to soils from alternative B would be long term, minor, and adverse. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative B, would result in long-term, minor, adverse impacts to soils and geology.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** At Hite, shallow soils would require blasting bedrock to create space for the proposed underground water storage tank. This would result in localized, short- and long-term, minor, adverse impacts to geology. Soils would be reworked as part of the construction activities associated with alternative C. Up to an estimated 83.3 acres of new disturbance would occur as a result of planned construction activities (up to 38.8 acres at Bullfrog, up to 37 acres at Halls Crossing, and up to 7.5 acres at Hite). Impacts to soils as a result of the increased disturbance and development of new facilities or relocation of existing facilities would be long

term, minor, and adverse. Up to a total of 15.4 acres would be reclaimed (up to 4.7 acres at Bullfrog and up to 10.7 acres at Halls Crossing) and soils restored. Long-term, negligible, beneficial impacts to soils would occur as a result of the restoration of these areas. Overall impacts to soils from alternative C would be long term, minor, and adverse.

**Cumulative Impacts.** Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative C, would be long-term, minor, adverse impacts to soils and geology, the same as alternative B.

**Conclusion.** Alternative C would result in localized, short- and long-term, minor, adverse impacts to geology. Impacts to soils as a result of disturbance and development of new facilities or relocation of existing facilities would be long term, minor, and adverse. Long-term, negligible, beneficial impacts to soils would occur as a result of the restoration of these areas. Overall impacts to soils from alternative C would be long term, minor, and adverse. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative C, would result in long-term, minor, adverse impacts to soils and geology.

## Paleontology

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for paleontology:

| Desired Conditions | Sources |
|---|---|
| The National Park Service will study and manage paleontological resources in their paleontological context (that is, in terms of the geologic data associated with a particular fossil that provides information about the ancient environment). | NPS *Management Policies 2001* |
| Superintendents will establish programs to inventory paleontological resources and systematically monitor for newly exposed fossils, especially in areas of rapid erosion. Scientifically important resources will be protected by collection or by onsite protection and stabilization. | NPS *Management Policies 2001* |
| The National Park Service will take appropriate action to prevent damage to, and unauthorized collection of, fossils. | NPS *Management Policies 2001* |
| All NPS construction projects in areas with potential paleontological resources must be preceded by a preconstruction surface assessment prior to disturbance. For any occurrences noted, or when the site may yield paleontological resources, the site will be avoided, or the resources will, if necessary, be collected and properly cared for prior to initiation of construction activity. Areas with potential paleontological resources must also be monitored during construction. | NPS *Management Policies 2001* |

## Methodology

Information on paleontological resources was compiled from recreation area records, scientific publications, and consultation with recognized experts. The information gathered was compared with the locations of proposed developments and other actions. The impact analysis was based on the knowledge and best professional judgment of planners, biologists, paleontologists, data from recreation area records, and studies of similar actions and impacts when applicable. The planning team qualitatively evaluated the impact intensity and duration for paleontological resources based on human development and use and natural processes.

| Impact Intensity | Paleontology Intensity Definition |
|---|---|
| Negligible | There would be no measurable impact to or loss of fossils because (1) the activity would occur in a geologic layer not known to contain extensive fossils and the volume of bedrock disturbance would be negligible, or (2) the activity would occur in a fossil-rich geologic layer, but the volume of bedrock disturbed would be nearly indiscernible. Monitoring would not be likely to detect fossils and the loss of fossils and/or associated contextual information would be minimal. |
| Minor | A few fossils may be lost due to collecting or there would be a low probability of impact due to a ground-disturbing activity because (1) the activity would occur in a geologic layer not known to contain extensive fossils and the volume of bedrock disturbance would be negligible, or (2) the activity would occur in a fossil-rich geologic layer, but the volume of bedrock disturbed would be nearly indiscernible. Monitoring would be likely to detect fossils and the loss of fossils and/or associated contextual information would be minimal. |
| Moderate | A number of fossils may be lost due to collecting, or a moderate probability of impact due to a ground-disturbing activity because (1) the activity would occur in a geologic layer not known to contain extensive fossils and the volume of bedrock disturbance would be high, or (2) the activity would occur in a fossil-rich area and the volume of bedrock disturbance would be low. Most fossils uncovered would likely be found by monitoring, but some fossils and/or associated contextual information may be lost. |
| Major | Many fossils may be lost due to collecting or a high probability of impact due to a ground-disturbing activity because the activity would occur in a fossil-rich geologic layer and the volume of bedrock disturbance would be sizeable. Even with monitoring, many fossils and/or associated contextual information would likely be lost. |

Any impacts to paleontological resources would be considered long term.

## Alternative A (No Action)

**Impact Analysis.** There would be no changes to existing operations or facilities under the no-action alternative. Therefore, there would be no impacts to paleontology.

**Cumulative Impacts.** Because there would be no impacts under the no-action alternative, there would be no cumulative impacts in association with the no-action alternative.

**Conclusion.** There would be no impacts to paleontology under the no-action alternative. Because there would be no impacts under the no-action alternative, there would be no cumulative impacts in association with the no-action alternative.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** At Hite, shallow soils would require blasting bedrock to bury the proposed underground water storage tank. This would result in localized, long-term, negligible to minor, adverse impacts to paleontology, assuming the bedrock being excavated is rich in fossils.

**Cumulative Impacts.** Alternative B would result in localized, long-term, negligible to minor, adverse impacts to paleontology. Most of the cumulative impact projects have the potential to impact paleontology including road construction work associated with SH 24 and the Burr Trail / Notom Road and the petroleum exploration well. Roadcuts may involve bedrock excavation resulting in short- and long-term, negligible to minor, adverse impacts to paleontology. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative B, would result in long-term, negligible to minor, adverse impacts to paleontology.

**Conclusion.** Alternative B would result in localized, long-term, negligible to minor, adverse impacts to paleontology. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative B, would result in long-term, negligible to minor, adverse impacts to paleontology.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** At Hite, shallow soils would require blasting bedrock to bury the proposed underground water storage tank. This would result in localized, long-term, negligible to minor, adverse impacts to paleontology, assuming the bedrock being excavated contains fossils.

**Cumulative Impacts.** Alternative C would result in localized, long-term, negligible to minor, adverse impacts to paleontology. Overall cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative C, would result in long-term, negligible to minor, adverse impacts to paleontology.

**Conclusion.** Alternative C would result in localized, long-term, negligible to minor, adverse impacts to paleontology, assuming the bedrock being excavated contains fossils. Overall

cumulative impacts from past, present, and reasonably foreseeable future projects, in combination with alternative C, would result in long-term, negligible to minor, adverse impacts to paleontology.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Air Quality

### Laws, Regulations, and Policy

Air pollution sources within national parks must comply with all federal, state, and local regulations. The Clean Air Act established NAAQS to preserve and protect air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value (42 USC 7401 *et seq.*). The Clean Air Act provisions designate clean air classifications. Class I areas are afforded the greatest degree of air quality protection and include international parks, national wilderness areas, national memorial parks in excess of 5,000 acres, and national parks in excess of 6,000 acres that were in existence as of August 7, 1977, when the Clean Air Act was amended. Glen Canyon NRA is designated a class II air quality area, which allows moderate air quality deterioration under the Clean Air Act. However, the Glen Canyon NRA does not possess the authority to address issues of air quality improvements when air pollution originates outside its boundaries.

Section 4.7 of NPS *Management Policies 2001* directs park service units to perpetuate air quality that will preserve natural and cultural resources, sustain visitor enjoyment and human health, and preserve scenic landscapes. To accomplish these goals, park units are directed to comply with all federal, state, and local air quality regulations and permitting requirements. Additionally, NPS *Management Policies 2001* state that the National Park Service would assume an aggressive role in promoting and pursuing measures to protect air-quality-related values from adverse impacts of air pollution. Vegetation, visibility, water quality, wildlife, historic and prehistoric structures and objects, cultural landscapes, and most other elements of park unit environments are sensitive to air pollution and are referred to as "air-quality-related values." When existing or potential air pollution impacts on NRA resources are disputed, the National Park Service would err on the side of protecting air quality and related values for future generations.

The Organic Act and NPS *Management Policies 2001* apply equally to all NPS-managed areas, regardless of Clean Air Act designation. Therefore, the National Park Service will protect resources at both class I and class II designations. Furthermore, the NPS Organic Act and NPS *Management Policies 2001* provide additional protection from that afforded by the Clean Air Act alone because the National Park Service has documented that specific park unit air-

quality-related values can be adversely affected at levels below the NAAQS or by pollutants for which no NAAQS exist.

### Impact Indicators, Criteria, and Methodology

Analysis focused on impacts to air-quality-related values and human health (e.g., visibility, odor) from airborne pollutants related to construction activities implementing the proposed improvements. The following impact thresholds were established in order to clarify the relative changes in air quality under various management alternatives when compared to baseline conditions.

| Impact Intensity | Air Quality Intensity Definition |
|---|---|
| Negligible | There is no odor of exhaust and no visible emissions. Dust from construction activities can be controlled by mitigation. Construction of new facilities would not result in noticeable emissions or deteriorate air quality. Ambient air quality concentrations would not be anticipated to exceed the allowable Clean Air Act class II standards. |
| Minor | There is a slight odor of exhaust and emissions are visible during brief periods of time. Dust from dirt roads is visible during brief periods. Dust from construction activities is visible only during work hours and can be easily mitigated. Construction of new facilities would not result in noticeable emissions or deteriorate air quality. Ambient air quality concentrations would not be anticipated to exceed the allowable Clean Air Act class II standards. |
| Moderate | Gasoline fumes and exhaust are easily detectable in high-use areas. Emissions are visible during periods of high use. Dust from dirt roads or from construction activities is visible over a large area and for extended periods of time. Construction of new facilities could result in emissions, but would not deteriorate air quality. Mitigation is possible, but is only partially effective. Ambient air quality concentrations would not be anticipated to exceed the allowable Clean Air Act class II standards. |
| Major | Exhaust and gasoline fumes are easily detectable for extended periods of time over large areas. Dust from dirt roads and construction activities is visible for an extended amount of time and mitigation is unable to alleviate impacts. Construction of new facilities would result in emissions that could deteriorate air quality. Ambient air quality concentrations equal or occasionally exceed allowable Clean Air Act class II standards. |

Air quality impacts would be considered short term if impacts last during construction and is no longer than one year. They would be considered long term if impacts last beyond construction and are longer than one year.

### Alternative A (No Action)

**Impact Analysis.** Existing developments and activities at the uplake developed areas result in detectible fumes in developed areas. Vehicles driving on dirt roads at lower lake levels result in visible dust. Under alternative A (no-action alternative) there are existing long-term, minor, adverse impacts to air quality.

**Cumulative Impacts.** Road and highway improvements and the proposed petroleum exploration well would both involve increased emissions from equipment operation and

increased dust in the atmosphere. However, on a regional basis, adverse impacts to air quality would be short term and negligible. Overall cumulative impacts to air quality, including the impacts from alternative B, would be short term, negligible to minor, and adverse. These impacts, in conjunction with the impacts of alternative A (no-action alternative), would result in long-term, minor, adverse impacts to air quality.

**Conclusion.** Under alternative A (no-action alternative), there are existing short- and long-term, minor, adverse impacts to air quality. Cumulative impacts, in conjunction with the impacts of alternative A (no-action alternative), would result in long-term, minor, adverse impacts to air quality.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** In general, construction of expanded facilities proposed under alternative B would result in a short-term increase in dust emissions due to ground-clearing operations, construction vehicle movement, and demolition of existing structures. Dust generation would be mitigated through limiting the disturbed areas and use of water sprinkling for dust suppression. Air emissions could occur as a result of construction vehicle emissions or the use of construction materials such as asphalt. Ambient air quality concentrations would not be expected to exceed the allowable Clean Air Act class II standards. The short-term impacts as a result of construction activities would be minor and adverse. However, the use of supplemental power systems with solar or fuel-cell technology would result in decreases in air emissions. Long-term impacts would occur as a result of the changes proposed under alternative B. Employee and concessioner housing, visitor accommodations, and camping facilities would be expanded under alternative B, resulting in increased emissions as a result of vehicles accessing and using these expanded facilities and heating for the expanded units. The same increases would occur as a result of expansion of the Anasazi Restaurant. New parking areas and roads developed to access the lake at lower water levels would not be paved and dust emissions could occur from these areas under alternative B. Overall, long-term impacts to air quality would be minor to moderate and adverse.

**Cumulative Impacts.** Road and highway improvements and the proposed petroleum exploration well would both involve increased emissions from equipment operation and increased dust in the atmosphere. However, on a regional basis, the adverse impacts to air quality would be short term and negligible. Overall cumulative impacts to air quality, including the impacts from alternative B, would be short term, negligible to minor, and adverse. Because the other past, present, and reasonably foreseeable future projects have no long-term impacts, there would be no long-term cumulative impacts.

**Conclusion.** Impacts to air quality under alternative B would be short term, minor, and adverse, and long term, minor to moderate, and adverse. Overall cumulative impacts to air quality, including the impacts from alternative B, would be short term, negligible to minor, and adverse. Because the other past, present, and reasonably foreseeable future projects have no long-term impacts, there would be no long-term cumulative impacts.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** In general, impacts under alternative C would be the same as alternative B. The short-term impacts as a result of construction would be minor and adverse. However, the use of supplemental power systems with solar or fuel-cell technology would result in decreases in air emissions. Long-term air quality impacts would be negligible to minor and adverse.

**Cumulative Impacts.** Road and highway improvements and the proposed petroleum exploration well would both involve increased emissions from equipment operation and increased dust in the atmosphere. However, on a regional basis, the impacts to air quality would be short term, negligible, and adverse. Overall cumulative impacts to air quality, including impacts from alternative C, would be short term, negligible to minor, and adverse. Because other past, present, and reasonably foreseeable future projects have no long-term impacts, there would be no long-term cumulative impacts.

**Conclusion.** Impacts to air quality under alternative C would be short term, minor, and adverse, and long term, negligible to minor, and adverse. Overall cumulative impacts to air quality, including impacts from alternative C, would be short term, negligible to minor, and adverse. Because other past, present, and reasonably foreseeable future projects have no long-term impacts, there would be no long-term cumulative impacts.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Water Resources

### Regulation and Policy

NPS *Management Policies 2001* (sec. 4.6.3) states that the National Park Service will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations". The Clean Water Act, and supporting criteria and standards promulgated by the EPA, the Utah Department of Environmental Protection, and the Arizona Department of Environmental Quality are applicable at Glen Canyon NRA. These standards protect water quality, human health, health of the aquatic ecosystem, and recreational use.

The primary means of protecting water quality under the Clean Water Act is the establishment, implementation, and enforcement of water quality standards. Generally, the federal government has delegated the development of standards to individual states, subject to EPA approval. Water quality standards consist of three components: (1) the designated beneficial uses of a water body such as aquatic life, cold water fishery, or body contact recreation (i.e., swimming or wading); (2) the numeric or narrative criteria that define the limits of physical, chemical, and biological characteristics of water that are sufficient to protect the beneficial uses; and (3) an antidegradation provision to protect existing uses and quality of water.

Water quality criteria developed to protect specific uses are updated periodically by the EPA. New and revised criteria are published in the *Federal Register* and summarized periodically in *Quality Criteria for Water* (EPA 1986). *Quality Criteria for Water*, also known as "the Gold Book," recommends criteria for a state's water quality standards. The criteria are almost always adopted by states as a portion of their standards, and they represent the "minimum" level of protection afforded to water bodies of a state.

The State of Utah antidegradation policy establishes a plan to maintain and improve water quality, but also allows some reduction in water quality to support vital economic activities. Lake Powell is not afforded any special protection under this policy. Water quality standards are achieved by controlling pollutants allowed in point source discharges into receiving waters through section 402 of the Clean Water Act; state pollutant discharge elimination system permits; implementation of BMPs for nonpoint sources of pollution; and implementation of section 303d of the Clean Water Act, total maximum daily loads, on water bodies that have chronic and persistent violations of water quality standards. The objective of a total maximum daily load is to allocate allowable pollutant loads among different point and nonpoint sources of pollution.

Maximum contaminant levels for drinking water are developed under the Safe Drinking Water Act. The EPA periodically updates these national primary drinking water regulations; states have primary enforcement responsibility. New and revised standards are published in the *Federal Register*. These standards are applicable to finished drinking water that has undergone treatment processes.

Other considerations in assessing the magnitude of water quality impacts are the effects on those resources dependent on a certain quality or condition of water. Sensitive aquatic

organisms, submerged aquatic vegetation, riparian areas, and wetlands may all be affected by changes in water quality from direct and indirect sources.

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for water quality:

| Desired Conditions | Sources |
|---|---|
| Water quality will be perpetuated as integral components of national recreation area aquatic and terrestrial ecosystems. | Clean Water Act<br>Executive Order 11514<br>NPS *Management Policies 2001* |
| The quality of national recreation area surface water and groundwater resources will be determined. Whenever possible, the pollution of waters by human activities occurring within and outside of the national recreation area will be avoided. | Clean Water Act<br>Executive Order 12088<br>NPS *Management Policies 2001* |
| Drinking water supplies are protected from naturally occurring and human-made contaminants. | Safe Drinking Water Act, PL 93-523, modified by PL 99-339, and PL 104-182. |

## Methodology

The best available information was used to analyze impacts to water quality. Notably, water quality impacts are affected by dilution, and the volume of water in Lake Powell is approximately 27 million acre-feet at full pool. Impacts can be evaluated based on the potential for dilution lakewide and in coves where use is concentrated. Section 304(a)(1) of the Clean Water Act requires the EPA to develop and publish criteria for water quality that accurately reflects the latest scientific knowledge. Water quality criteria developed under section 304(a) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. If no criteria are listed for a pollutant, the EPA does not have any nationally recommended water quality criteria.

The following impact thresholds were established in order to differentiate the relative changes in water quality under various management alternatives when compared to baseline conditions:

| Impact Intensity | Water Quality Intensity Definition |
|---|---|
| Negligible | Chemical or physical changes to water quality would not be detectable, would be well below water quality standards or criteria. Both quality and flows would be within historical ambient and variability standards or desired water quality conditions. |
| Minor | Chemical or physical changes to water quality would be detectable, but water quality parameters would be well below water quality standards or criteria. Both quality and flows would be within the range of ambient standards, but measurable changes from historical norms would occur. State water quality antidegradation policy would not be violated. |

| Impact Intensity | Water Quality Intensity Definition |
|---|---|
| Moderate | Chemical or physical changes to water quality or flows would be readily apparent, but water quality parameters would be at or below all water quality standards for the designated use. Water quality or flows would be outside the range of ambient standards. Mitigation would probably be necessary to offset adverse effects and would likely be successful. State water quality antidegradation policy would not be violated. |
| Major | Chemical or physical changes to water quality or flows would be readily apparent, and some water quality parameters would periodically be exceeded. Flows would be outside the range of ambient conditions, and could include a complete loss of water in some areas or flooding in other areas. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured. State water quality antidegradation policy may be violated. |

Actions under the various alternatives were evaluated based on current conditions and proposed changes to the current conditions. Impacts were assessed based on professional judgment and past experience with similar projects.

Water resources / water quality impacts would be considered short term if impacts last during construction or initial operations only and for no longer than one year. Impacts to water quality are long term if the impacts last beyond construction or initial operations and duration is more than one year.

### Alternative A (No Action)

**Impact Analysis.** All land-based facilities and associated areas at Bullfrog, Halls Crossing, and Hite are managed to minimize stormwater impacts to the lake and to minimize impacts from leaking fuels, hydraulic fluids, and solvents. Management of human waste in the area is addressed through use of land-based comfort stations and vault toilets above the ordinary high water level, and portable micro-flush toilets and porta-potties below the ordinary high water level. There is also a requirement for appropriate disposal for all human waste while on the lake.

Watercraft use in the Bullfrog area would result in long-term minor increases in hydrocarbon emissions into Lake Powell. Implementation of the Lake Powell Clean Water Program is well established at Halls Crossing and Bullfrog and has resulted in long-term beneficial impacts to water quality from proper management of human waste. Water quality in Lake Powell meets all applicable standards.

Overall water quality in the developed areas is adequately controlled through the existing facilities and programs and meets safe drinking water standards. As a result, the no-action alternative would continue to result in long-term, negligible, adverse impacts to water quality.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future projects with the potential to impact water quality or water resources include the construction projects associated with road and highway improvements, the proposed petroleum exploration well, and potential development in areas surrounding Glen Canyon NRA. The construction projects anticipated in road and highway improvements could affect water quality through the release

of sediment into drainages. It is assumed that these projects would be carried out using BMPs for control of erosion and sediment transport, and that impacts to water quality would be negligible to minor and adverse. Use of the Colorado River through Canyonlands National Park and into the upper reaches of Lake Powell would be affected by the river management plan; however, because the plan is in the preliminary planning stages, impacts to water quality cannot be analyzed. Short-term construction-related impacts to water quality, along with long-term impacts as a result of development in areas surrounding Glen Canyon NRA, could result in adverse impacts to water quality; however, such impacts would be expected to be mitigated to some extent by BMPs and by the need to comply with federal, state, and local regulations governing protection of water quality. Impacts from development in the surrounding area would be expected to be short and long term, negligible, and adverse. Overall cumulative impacts, including the no-action alternative, would be short term, negligible to minor, and adverse, and long term, negligible, and adverse.

**Conclusion.** Overall water quality in the developed areas is adequately controlled through existing facilities and programs. The no-action alternative would continue to result in long-term, negligible, adverse impacts to water quality. Overall cumulative impacts, including the no-action alternative, would be short term, negligible to minor, and adverse, and long term, negligible, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Alternative B would result in temporary surface impacts in areas of construction at all three marinas.

Sediment accumulation would be expected to be negligible during construction. A stormwater general permit under the Utah Pollutant Discharge Elimination System would be required prior to initiation of construction. The permit would require development and implementation of a stormwater pollution prevention plan. The plan would outline specific BMPs that would be implemented to reduce any potential pollutants in stormwater runoff. The BMPs would include, but not be limited to, the minimization and isolation of disturbance areas, and placement of temporary erosion and sediment control measures (such as sand bags, silt fences, or equivalent control methods). The permit would be maintained until permanent erosion controls are in place. Existing disturbances totaling 4.7 acres at Bullfrog and 10.7 acres at Halls Crossing would be reclaimed to native vegetation. Erosion of soil into lake waters would be controlled through the implementation of BMPs and the construction of impermeable surfaces or vegetation restoration. Therefore, these impacts would be short term, negligible, and adverse.

Long-term, minor, adverse impacts to surface water quality would occur from continued recreational uses, including potential leaks and spills of boat fuels and continued use of watercraft. No violations of water quality standards would be expected.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future projects with the potential to impact water quality or water resources include construction projects associated with road and highway improvements, the proposed petroleum exploration well, and potential development in areas surrounding Glen Canyon NRA. The construction projects anticipated in the road and highway improvements could affect water quality through the release of sediment into drainages. It is assumed that these projects would be carried out using BMPs for the control of erosion and sediment transport and that impacts to water quality would be negligible to minor and adverse. Use of the Colorado River through Canyonlands and into the upper reaches of Lake Powell would be affected by the new river management plan; however, because the plan is in the preliminary planning stages, impacts to water quality cannot be analyzed. Short-term construction-related impacts to water quality, along with long-term impacts as a result of development in areas surrounding Glen Canyon NRA, could result in adverse impacts to water quality; however, such impacts would be mitigated to some extent by BMPs and compliance with federal, state, and local regulations governing protection of water quality. Impacts from development in the surrounding area would be expected to be short and long term, negligible, and adverse. Overall cumulative impacts, including those from alternative B, would be short term, negligible, and adverse, and long term, minor, and adverse.

**Conclusion.** Alternative B would result in short-term, negligible, adverse impacts on water quality from runoff during construction. Long-term, minor, adverse impacts on surface water quality would occur from continued recreational uses, including potential leaks and spills of boat fuels and continued use of watercraft. No violations of water quality standards would be expected. Overall cumulative impacts, including those of alternative B, would be short term, negligible, and adverse, and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** Alternative C would result in temporary surface impacts in areas of construction.

New disturbance would total 38.8 acres at Bullfrog, 37.6 acres at Halls Crossing, and 7.5 acres at Hite. Sediment accumulation would be expected to be negligible during construction. A stormwater general permit under the Utah Pollutant Discharge Elimination System would be required prior to initiation of construction. The permit would require development and implementation of a stormwater pollution prevention plan. The plan would outline specific BMPs that would be implemented to reduce potential pollutants in stormwater runoff. The

BMPs would include, but not be limited to, minimization and isolation of disturbance areas, and placement of temporary erosion and sediment-control measures (such as sand bags, silt fences, or equivalent control methods). The permit would be maintained until permanent erosion controls have been implemented. Existing disturbance totaling 4.7 acres at Bullfrog and 10.7 acres at Halls Crossing would be reclaimed to native vegetation. Erosion of soils into lake waters would be controlled through the implementation of BMPs and construction of impermeable surfaces or vegetation restoration. Therefore, these impacts would be short term, negligible, and adverse.

Long-term, minor, adverse impacts on surface water quality would occur from continued recreational uses, including potential leaks and spills of boat fuels and continued use of watercraft. No violations of water quality standards would be expected.

**Cumulative Impacts.** Overall cumulative impacts, including alternative C, would be short term, negligible, and adverse, and long term, minor, and adverse, the same as those for alternative B.

**Conclusion.** Alternative C would result in short-term, negligible, adverse impacts on water quality from runoff during construction. Long-term, minor, adverse impacts on surface water quality would occur from continued recreational uses, including potential leaks and spills of boat fuels and continued use of watercraft. No violations of water quality standards would be expected. Overall cumulative impacts, including alternative C, would be short term, negligible, and adverse, and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Waters of the United States, Including Wetlands

### Regulation and Policy

Current regulation, law, and policies require the following conditions be achieved with respect to waters of the United States, including wetlands:

| Desired Conditions | Sources |
|---|---|
| Section 404 of the Clean Water Act established the federal program that regulates activities in the nation's wetlands. Specifically, section 404 of the Clean Water Act established a program to regulate discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for the program is shared by the USACE and the EPA. | Clean Water Act, Section 404 |

| Desired Conditions | Sources |
|---|---|
| Each agency shall provide leadership and shall take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. | Executive Order 11990 (*Protection of Wetlands*) |
| The National Park Service adopts a goal of "no net loss of wetlands." In addition, the National Park Service will strive to achieve a longer-term goal of net gain of wetlands. NPS units will conduct parkwide wetlands inventories (or will obtain such inventories from appropriate sources such as the *National Wetlands Inventory*) to help assure proper planning with respect to management and protection of wetlands resources. For proposed new development or other new activities, plans, or programs that are either located in or otherwise have the potential for direct or indirect adverse impacts on wetlands, the National Park Service will employ a sequence of:<br>– avoiding adverse wetlands impacts to the extent practicable<br>– minimizing impacts that could not be avoided<br>– compensating for remaining unavoidable adverse wetlands impacts via restoration of degraded wetlands<br>Actions proposed by the National Park Service that have the potential for adverse impacts on wetlands will be addressed in an environmental assessment or an environmental impact statement. | NPS Procedural Manual 77-1: *Wetland Protection* |

## Methodology

The planning team based the impact analysis and the conclusions for possible impacts to waters of the United States and wetlands on the mapped navigable waters in the recreation area and on on-site inspections of known and potential jurisdictional wetlands within the recreation area. Conclusions and possible impacts were also based on review of existing literature and studies, information provided by experts in the National Park Service and other agencies, and Glen Canyon NRA staff insights and professional judgment.

The thresholds of change for the intensity of an impact are defined as follows:

| Impact Intensity | Waters of the United States and Wetlands Intensity Definition |
|---|---|
| Negligible | Impacts from activities covered under the USACE 404 permit for Lake Powell (waters of the United States) and/or wetlands functions and values that would be below or at the lower levels of detectable change. |
| Minor | The effects from impacts from activities covered under the USACE 404 permit for Lake Powell (water of the United States) and/or on wetlands that would be detectable and relatively small in terms of area and the nature of the change. The action would temporarily affect a limited area of Lake Powell (waters of the United States) and/or affect a limited number of individual plant or wildlife species within the wetlands. No mitigation would be needed. |

| Impact Intensity | Waters of the United States and Wetlands Intensity Definition |
|---|---|
| Moderate | The effects from activities covered under the USACE 404 permit for Lake Powell (waters of the United States) and/or on wetlands that would be readily apparent over a relatively small area, but the impact could be mitigated by a NEPA compliance review, correction measures, and possible changes to allowable activities under the 404 permit and/or restoration of previously degraded wetlands. The action would have a measurable effect on Lake Powell (waters of the United States) and/or on plant or wildlife species within the wetlands, but required water quality standards and limits set forth in the 404 permit and/or all wetland species would remain indefinitely viable. The impacts could be mitigated by modification of proposed facilities that affect Lake Powell (waters of the United States) and/or wetlands. |
| Major | The effects to Lake Powell (waters of the United States) an/or wetlands would be readily apparent over a relatively large area. The action would have measurable consequences for Lake Powell (waters of the United States) and/or the wetlands area that could not be mitigated. Water quality standards would be compromised and activities would be in violation of the 404 permit. Wetlands structures and/or function would be altered. The impact could not be mitigated by modification of proposed facilities. |

Impacts to Lake Powell (waters of the United States) would be considered short term per the permit limits, and allowable uses set forth in the current USACE 404 permit and any potential long-term impacts would require new NEPA compliance and consultation and changes to the permit. Wetlands impacts would be considered short term if the wetlands recover in less than three years and long term if the recovery takes longer than three years.

### Alternative A (No Action)

**Impact Analysis.** There would be no changes to existing conditions under the no-action alternative and, therefore, no impacts to Lake Powell (waters of the United States) and/or any wetlands.

**Cumulative Impacts.** Because there are no impacts to Lake Powell (waters of the United States) and/or any wetlands from the no-action alternative, there would be no cumulative impacts as a result of the no-action alternative.

**Conclusion.** There would be no changes to existing conditions under the no-action alternative and therefore no impacts to Lake Powell (waters of the United States) and/or any wetlands. Because there are no impacts to Lake Powell (waters of the United States) and/or any wetlands, there would be no cumulative impacts as a result of the no-action alternative. There would be no impairment to recreation area wetlands resources as a result of implementation of this alternative.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Proposed facilities fall within limits of the existing USACE 404 permit or require an update to change the maximum number of allowable floating facilities such as increased number of buoys, upgrades to fuel and courtesy docks, and pumpouts. The types of water-based activities or facilities do not change from alternative A. New construction or expansion of marina facilities is expected to have minor, short- and long-term impacts and will be managed through the 404 permit. Wetlands in the uplake areas at lower lake elevations have not been mapped. However, the new construction in the uplake developed areas is not expected to impact areas where wetlands could be present, except potentially for primitive camping located along the Colorado River during low water conditions at Hite, and the relocation of launch and ferry ramps and associated access and parking at all uplake developed areas during low water conditions. Facilities would be located to avoid wetlands to the extent possible. Should any wetlands be unavoidable during relocation of facilities at lower water levels, mitigation measures would be implemented. Impacts to wetlands under alternative B would be short and long term, negligible to minor, and adverse.

**Cumulative Impacts.** Other past, present, or reasonably foreseeable future projects with the potential to impact Lake Powell (waters of the United States) and/or any wetlands would include road improvements and the Canyonlands River Management Plan. Other road improvements and the Canyonlands River Management Plan would likely be designed to limit impacts to water quality and wetlands through mitigation measures that would include construction controls and operational measures to prevent pollution discharge into Lake Powell (waters of the United States) and/or the avoidance of wetlands. Impacts from other projects, in combination with those from alternative B, would be short and long term, negligible, and adverse.

**Conclusion.** Impacts to Lake Powell (waters of the United States) and/or any wetlands under alternative B would be expected to be short and long term, minor, and adverse. Impacts from other projects, in combination with alternative B, would be short and long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** Impacts to Lake Powell (waters of the United States) and/or any wetlands under alternative C would be short and long term, negligible to minor, and adverse, the same as those under alternative B.

**Cumulative Impacts.** Other past, present, or reasonably foreseeable future projects with the potential to impact Lake Powell (waters of the United States) and/or any wetlands would

include road improvements and the Canyonlands River Management Plan. Other road improvements and the Canyonlands River Management Plan would likely be designed to limit impacts to water quality and wetlands through mitigation measures that would include construction controls to prevent pollution and discharge into Lake Powell (waters of the United States) and/or the avoidance of wetlands. Impacts from other projects, in combination with those from alternative C, would be short and long term, negligible, and adverse.

**Conclusion.** Impacts to Lake Powell (waters of the United States) and/or any wetlands under alternative C would be expected to be short and long term, negligible to minor, and adverse. Impacts from other projects, in combination with alternative C, would be short and long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Floodplains

### Regulation and Policy

Current regulations, laws, and policies require the following conditions be achieved with respect to floodplains:

| Desired Conditions | Sources |
|---|---|
| Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains. | Executive Order 11988 (*Floodplain Management*) |
| Floodplain values will be preserved and potentially hazardous conditions associated with flooding will be minimized. | Procedural Manual 77-2, National Park Service, *Floodplain Management* |

### Methodology

The planning team based the impact analysis and the conclusions for possible impacts to floodplains on the on-site inspections of known and potential impacts to floodplains. Conclusions and possible impacts were also based on review of existing literature and studies, information provided by experts in the National Park Service and other agencies, and Glen Canyon NRA staff insights and professional judgment.

The thresholds of change for the intensity of an impact are defined as follows:

| Impact Intensity | Floodplains Intensity Definition |
|---|---|
| Negligible | There would be no change in the ability of a floodplain to convey floodwaters, or its values and functions. Projects would not contribute to flood flows. |
| Minor | Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local although the changes would be minimally measurable. Projects would not contribute to the flood. No mitigation would be needed for floodplain impacts. |
| Moderate | Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Projects could contribute to the flood. The impact could be mitigated by modification of proposed facilities in the floodplain. |
| Major | Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and widespread. Projects would contribute to the flood. The impact could not be mitigated by modification of proposed facilities. |

Floodplain impacts would be considered short term if they last only during the life of construction. Floodplain impacts would be considered long-term if floodplain impacts would be measurable during and after project construction.

### Alternative A (No Action)

**Impact Analysis.** Under the no-action alternative, there would be no impacts to floodplains because no new construction or expansion of existing operations would occur.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact floodplains include road improvements and the Canyonlands River Management Plan. Other road improvements and the Canyonlands River Management Plan would likely be designed to limit impacts to floodplains through mitigation measures that could include redesign to avoid floodplains or to minimize the changes to the floodplain as a result of construction activities. Impacts from other projects would be short and long term, negligible to minor, and adverse; however, since the no-action alternative would have no impact on floodplains there would be no cumulative impacts as a result of the no-action alternative.

**Conclusion.** Under the no-action alternative, there would be no impacts to floodplains as no new construction or expansion of existing operations would occur. Impacts from other projects would be short and long term, negligible to minor, and adverse; however, because the no-action alternative would have no impact on floodplains there would be no cumulative impacts as a result of the no-action alternative.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or

other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, the new construction in the uplake developed areas would not be expected to impact floodplains, except potentially for the primitive camping located along the Colorado River during low-water conditions at Hite and the relocation of the river runner takeout, launch and ferry ramps, and associated access and parking at all uplake developed areas during low water conditions. Permanent facilities would be located to avoid floodplains to the extent possible or, if not possible, impacts to floodplain functions and flood flow capacity would be minimized. As a result, impacts to floodplains under alternative B would be short and long term, negligible, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact floodplains include road improvements and the Canyonlands River Management Plan. Other road improvements and the Canyonlands River Management Plan would likely be designed to limit impacts to floodplains through mitigation measures that could include redesign to avoid floodplains or changes to minimize effects to floodplains. Impacts from other projects would be short and long term, negligible to minor, and adverse. Overall cumulative impacts, including those of alternative B, would be short and long term, negligible to minor, and adverse.

**Conclusion.** Impacts to floodplains under alternative B would be expected to be short and long term, negligible, and adverse. Overall cumulative impacts, including those of alternative B, would be short and long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** Impacts to floodplains under alternative C would be short and long term, negligible, and adverse, the same as alternative B.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact floodplains include road improvements and the Canyonlands River Management Plan. Other road improvements and the Canyonlands River Management Plan would likely be designed to limit impacts to floodplains through mitigation measures that could include redesign to avoid floodplains or changes to minimize the effects to floodplain. Impacts from other projects would be short and long term, negligible to minor, and adverse. Overall cumulative impacts, including alternative C, would be short and long term, negligible to minor, and adverse.

**Conclusion.** Impacts to floodplains under alternative C would be expected to be short and long term, negligible, and adverse. Overall cumulative impacts, including those of alternative C, would be short and long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Vegetation

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA:

| Desired Conditions | Sources |
|---|---|
| Populations of native plant species function in as natural a condition as possible, except where special management considerations are warranted. | NPS *Management Policies 2001* |
| Native species populations that have been severely reduced in or extirpated from Glen Canyon NRA are restored where feasible and sustainable. | NPS *Management Policies 2001* |
| Invasive species are reduced in numbers and area, or are eradicated from natural areas of Glen Canyon NRA. Such action is undertaken wherever such species threaten native vegetation or public health, or when control is prudent and feasible. | NPS *Management Policies 2001* |
| Federal and state-listed endangered or threatened species and their habitats are protected and sustained. | Endangered Species Act and equivalent state protective legislation<br>National Environmental Policy Act<br>NPS *Management Policies 2001* |

## Methodology

The following thresholds were used in interpreting the level of impact on vegetation in the uplake areas:

| Impact Intensity | Vegetation Intensity Definition |
|---|---|
| Negligible | Individual native plants occasionally may be affected, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur. |

| Impact Intensity | Vegetation Intensity Definition |
|---|---|
| Minor | Impacts on native plants are measurable or perceptible and localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover. |
| Moderate | Impacts on native plants would cause a change in the plant community (e.g., abundance, distribution, quantity, or quality); however, the impact would remain localized. |
| Major | Impacts on native plant communities would be substantial, highly noticeable, and long term, and include a sizable portion of the affected community type in and out of the NRA. Mitigation measures required to offset adverse effects would be extensive and their success would not be guaranteed. |

Duration of vegetation impacts is considered short term if the vegetation recovers in less than three years and long term if vegetation takes longer than three years to recover.

### Alternative A (No Action)

**Impact Analysis** Under the no-action alternative, there would be no changes to existing facilities at the uplake marinas and there would be no impacts to existing plant communities.

Within the developed areas, facilities and infrastructure would require future maintenance and possibly replacement with age. Maintenance would result in long-term, negligible, adverse, impacts to landscape vegetation and possibly to small remnant patches of semidesert grassland and shrubland.

The existing facilities would serve larger numbers of visitors as recreational use increases with time. As a result, plant communities adjacent to structures would receive increased social impacts, including trail development, soil compaction, increased erosion, trash accumulation, pet scat, and damage to existing plants. In areas supporting nonnative herbaceous and shrub flora, such as in the low water zone, the impact would be long term, negligible, and adverse. Localized areas of native plant communities that may include newly established riparian trees and shrubs, wetlands, and semidesert grasslands and shrublands would incur long-term, negligible to minor, adverse impacts.

The increased number of visitors may introduce nonnative species. Introduction of nonnative plant species would result in long-term, minor to moderate, adverse impacts to plant communities, potentially requiring localized control/eradication efforts.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future projects that could impact vegetation include improvements to Burr Trail within Capitol Reef National Park, improvements to SH 24, the proposed petroleum exploration well, and development in the surrounding area. The BLM Resource Management Plan would likely contain management information for vegetation; however, this plan is in the preliminary planning stages and impacts cannot be analyzed. Road improvements could result in realignment or road widening, disturbing vegetation along the new road corridor in both the short and long term. Some disturbance would be related to the construction; once construction is completed, the vegetation would be reestablished. Some vegetation in corridor realignment or widening areas

would be permanently removed. Development to provide additional visitor services in surrounding areas outside Glen Canyon NRA would result in long-term disturbance to vegetation. Cumulative impacts from other projects, in association with the no-action alternative, would be short and long term, minor to moderate, and adverse.

**Conclusion.** Overall impacts to vegetation of the uplake developed areas under the no-action alternative would be long term, minor to moderate, and adverse, resulting from facility and infrastructure maintenance, increased visitation, and introduction of nonnative plant species. Cumulative impacts from other projects, in association with the no-action alternative, would be short and long term, minor to moderate, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis** Under alternative B, there would be 83.9 acres of new disturbance on which development would completely remove and cover regionally common semidesert grassland and shrubland. There would also be disturbance to vegetation from primitive camping and campground improvements at Hite. The new construction and associated disturbance of vegetation would result in long-term, moderate, adverse impacts to vegetation in the uplake developed areas.

At Bullfrog 4.7 acres and 10.7 acres at Halls Crossing would be restored with plants native to the disturbed areas. Reclamation of these sites would result in a long-term, negligible, beneficial impact.

Within the developed areas, facilities and infrastructure would require maintenance and possibly replacement with age. Maintenance within the developed areas would result in long-term, negligible, adverse impacts to landscape vegetation and possibly to small remnant patches of regionally common semidesert grassland and shrubland.

New and existing facilities would accommodate larger numbers of visitors, as recreational use increases with time, and impacts would occur as described under alternative A (no-action alternative). The increased number of visitors may introduce nonnative plant species. Introduction of nonnative plant species would result in long-term, minor to moderate, adverse, impacts to plant communities, potentially requiring localized control/eradication efforts.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future projects that could result in impacts to vegetation include improvements to Burr Trail within Capitol Reef National Park, improvements to SH 24, the proposed petroleum exploration well, and development in the surrounding area. The BLM Resource Management Plan would likely

contain management information for vegetation; however, this plan is in its preliminary stages and impacts cannot be analyzed. The road improvements could result in realignment or road widening, disturbing vegetation along the new road corridor in both the short and long term. Some disturbance would be related to the construction; once construction is completed, the vegetation would become re-established. Some vegetation in corridor realignment or widening areas would be permanently removed. Development in surrounding areas outside Glen Canyon NRA to provide additional visitor services would result in long-term disturbance to vegetation. Cumulative impacts from other projects, in association with those of alternative B, would be short and long term, moderate, and adverse.

**Conclusion.** Overall impacts to vegetation of the uplake developed areas under alternative B would be long term, moderate, and adverse, resulting from facility and infrastructure construction, more intense development of primitive campsites, and long term, negligible, and beneficial due to restoration of previously disturbed plant communities. Cumulative impacts from other projects, in association with alternative B, would be short and long term, moderate, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis** Under alternative C, there would be 83.3 acres of new disturbance, on which developed areas could see complete removal and/or covering of regionally common semi-desert grassland and shrubland. The new construction and associated disturbance of vegetation would result in long-term, moderate, adverse impacts.

A total of 4.7 acres at Bullfrog and 10.7 acres at Halls Crossing would be restored with plants native to the disturbed areas. Reclamation of these sites would result in a long-term, negligible, beneficial impact.

Developed area facilities and infrastructure would require maintenance and possibly replacement with age, resulting in long-term, negligible, adverse impacts to landscape vegetation and possibly to small remnant patches of regionally common semidesert grassland and shrubland.

New and existing facilities would accommodate larger numbers of visitors as recreational use increases with time, and impacts would occur as described under alternative A (no-action alternative). The increased number of visitors may introduce nonnative plant species. Introduction of nonnative plant species would result in long-term, minor to moderate, adverse impacts to plant communities, potentially requiring localized control/eradication efforts.

**Cumulative Impacts.** Past, present, and reasonably foreseeable future projects that could result in impacts to vegetation include improvements to Burr Trail within Capitol Reef National Park, improvements to SH 24, the proposed petroleum exploration well, and development in the surrounding area. The BLM Resource Management Plan would likely contain management information for vegetation; however, this plan is in the preliminary planning stages and impacts cannot be analyzed. The road improvements could result in realignment or road widening disturbing vegetation along the new road corridor in both the short and long term. Some disturbance would be related to the construction; once construction is completed, vegetation would become reestablished. Vegetation in corridor realignment or widening areas would be permanently removed. Development in surrounding areas outside Glen Canyon NRA to provide additional visitor services would result in long-term disturbance to vegetation. Cumulative impacts from other projects, in association with alternative C, would be short and long term, moderate, and adverse.

**Conclusion.** Overall impacts to vegetation under alternative C would be long term, moderate, and adverse, resulting primarily from facility and infrastructure construction, more intense development of primitive campsites, and long term, negligible, and beneficial due to restoration of previously disturbed plant communities. Cumulative impacts from other projects, in association with alternative C, would be short and long term, moderate, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Wildlife

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for wildlife:

| Desired Conditions | Sources |
|---|---|
| Populations of native animal species function in as natural a condition as possible, except where special management considerations are warranted. | NPS *Management Policies 2001* |
| Native species populations that have been severely reduced in or extirpated from Glen Canyon NRA are restored where feasible and sustainable. | NPS *Management Policies 2001* |
| Invasive species are reduced in numbers and area, or are eliminated from the natural areas of Glen Canyon NRA. Such action is undertaken wherever such species threaten the native wildlife or public health, or when control is prudent and feasible. | NPS *Management Policies 2001* |

| Desired Conditions | Sources |
|---|---|
| Federal and state-listed threatened or endangered species and their habitats are protected and sustained. Endangered Species Act and equivalent state protective legislation. | National Environmental Policy Act<br>NPS *Management Policies 2001* |

## Methodology

Information was gathered from literature and from recreation area, state, and federal wildlife specialists to determine whether any of the alternatives could potentially disrupt the natural behavior of wildlife species in Bullfrog, Halls Crossing, or Hite. The following criteria were used in interpreting the level of impact on wildlife:

| Impact Intensity | Wildlife Intensity Definition |
|---|---|
| Negligible | Wildlife and habitats would not be affected or the effects would be at or below the level of detection 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, although the effects would be small and of little consequence to the overall 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, with consequences on the overall population. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful. |
| Major | Effects on wildlife and habitats would be obvious 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. |

The duration of wildlife impacts is considered short term if the recovery is less than one year and long term if the recovery is longer than one year.

## Alternative A (No Action)

**Impact Analysis.** Under the no-action alternative, existing impacts to wildlife would continue to occur as a result of the high level of human activity in the developed areas and the associated noise. Wildlife habitat would be impacted by trampling of native plant species, by social trailing, or parking in undesignated areas. Wildlife would continue to either become accustomed to human activity or relocate outside of the developed areas. Existing impacts to wildlife in the developed areas would continue and would be long term, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact wildlife include the road and highway improvement projects, the proposed petroleum exploration well, and potential development in surrounding areas. Wildlife would be temporarily displaced during the construction projects and there could be limited potential for some wildlife to be injured or killed by construction equipment. The highway-related

construction projects would not result in increased human activity after construction is completed; impacts would be short term, minor, and adverse. The petroleum exploration well and the potential for development in surrounding areas would result in long-term, minor, adverse impacts to wildlife. Overall cumulative impacts, including the no-action alternative, would be long term, minor, and adverse.

**Conclusion.** Existing impacts to wildlife in the developed areas are long term, minor, and adverse. Overall cumulative impacts, including the no-action alternative, would be long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Wildlife species are currently being impacted as a result of human activity and disturbance in the uplake developed areas. As discussed under alternative A (no-action alternative), these impacts currently are long term, minor, and adverse. Under alternative B, facilities would be constructed, expanded, and relocated resulting in increased noise and human activity during construction. During construction, larger wildlife would likely avoid the construction zones. Some small animals such as rodents may be killed or forced to relocate to areas outside the construction zones. Population size and structure for the affected species would not be permanently impacted. In the long term, completion of construction and vegetation restoration would allow some return of wildlife species; however, overall habitat would be reduced due to expansion of facilities. Impacts to wildlife species and habitat would be short and long term, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact wildlife include the road and highway improvement projects, the proposed petroleum exploration well, and potential development in surrounding areas. Wildlife would be temporarily displaced during the construction projects and there could be limited potential for some wildlife to be injured or killed by construction equipment. The highway-related construction projects would not result in increased human activity after construction is completed. Impacts would be short term, minor, and adverse. The petroleum exploration well and the potential for development in surrounding areas would result in long-term, minor, adverse impacts to wildlife. Overall cumulative impacts, including alternative B, would be short and long term, minor, and adverse.

**Conclusion.** Impacts to wildlife species and habitat under alternative B would be short and long term, minor, and adverse.

**Impairment.** 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 established legislation

or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** Impacts under alternative C would be the same as alternative B. Impacts to wildlife species and habitat would be short and long term, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact wildlife include the road and highway improvement projects, the proposed petroleum exploration well, and potential development in surrounding areas. Wildlife would be temporarily displaced during the construction projects and there could be limited potential for some wildlife to be injured or killed by construction equipment. The highway-related construction projects would not result in increased human activity after construction is completed; impacts would be short term, minor, and adverse. The petroleum exploration well and the potential for development in surrounding areas would result in long-term, minor, adverse impacts to wildlife. Overall cumulative impacts, including alternative C, would be short and long term, minor, and adverse.

**Conclusion.** Impacts to wildlife species and habitat under alternative C would be short and long term, minor, and adverse. Overall cumulative impacts, including impacts of alternative C, would be short and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Threatened and Endangered Species and Species of Concern/ Designated Critical Habitat

### Regulation and Policy

| Desired Conditions | Sources |
|---|---|
| Federally listed and state-listed threatened and endangered species and their habitats would be sustained. | Endangered Species Act<br>NPS *Management Policies 2001*<br>Executive Order 13112 (*Invasive Species*) |
| Native species populations that have been severely reduced or extirpated from the recreation area would be restored where feasible and sustainable. | Endangered Species Act<br>NPS *Management Policies 2001*<br>Executive Order 13112 (*Invasive Species*) |

| Desired Conditions | Sources |
|---|---|
| The management of populations of nonnative plant and animal species, up to and including eradication, would be undertaken wherever such species threaten recreation area resources or public health and when control is prudent and feasible. | Endangered Species Act<br>NPS *Management Policies 2001*<br>Executive Order 13112 (*Invasive Species*) |

The thresholds of change for the intensity of an impact are defined as follows:

| Impact Intensity | Threatened and Endangered Species and Species of Concern/ Critical Habitat Intensity Definition |
|---|---|
| Negligible | The action could result in a change to a population or individuals of a species or designated critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence and would be well within natural variability. This impact intensity equates to a USFWS "no effect" or "may affect, not likely to adversely affect" determination. |
| Minor | The action could result in a change to a population or individuals of a species or designated critical habitat. The change would be measurable, but small and localized and of little consequence. Mitigation measures, if needed to offset the adverse effects, would be simple and successful. This impact intensity equates to a USFWS "may affect, not likely to adversely affect" determination. |
| Moderate | Impacts on federally listed threatened and endangered species, as well as federal and state species of special concern and their habitats, or the natural processes sustaining them would be detectable and occur over a large area. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful. This impact intensity equates to a USFWS "may affect, likely to adversely affect" determination. |
| Major | The action would result in a noticeable effect to viability of a population or individuals of a species or resource or designated critical habitat. Impacts on a special-status species, critical habitat, or the natural processes sustaining them would be detectable, both in and out of the recreation area. Loss of habitat might affect the viability of at least some special-status species. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed. This impact intensity equates to a USFWS "may affect, likely to jeopardize the continued existence of a species or adversely modify critical habitat for a species" determination. |

Special-status species impacts for wildlife are considered short term if the species recovers in less than one year and long term if it takes longer than one year for the species to recover. Special-status species impacts for vegetation are considered short term if the vegetative species recovers in less than three years and long term if the vegetative species takes longer than three years.

### Alternative A (No Action)

**Impact Analysis.** Existing impacts to threatened or endangered species, designated critical habitat, and State of Utah species of concern related to noise and human activity would continue. Species sensitive to noise and human activity would continue to avoid the developed areas. Additional construction is not proposed under the no-action alternative so additional loss of habitat would not occur. Relocation of the river runner takeout from the Hite launch

ramp to a temporary location along the Colorado River would continue to impact threatened and endangered fish species through activity in areas likely to be critical habitat for both adult and young fish. Impacts from the no-action alternative would be long term, localized, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact threatened and endangered species or critical habitat include the road and highway improvements, the proposed petroleum exploration well, the Canyonlands River Management Plan, the BLM Resource Management Plan, and development in surrounding areas. Both the Canyonlands River Management Plan and the BLM Resource Management Plan are in the early stages of development and cannot be fully analyzed for cumulative effects; however, it should be recognized that these projects would likely have impacts, both beneficial and adverse, on threatened or endangered species. The road and highway improvements, the petroleum exploration well, and development in surrounding areas would result in short-term impacts from construction activities associated with these projects. Some of the road improvements might require drainage crossing that could include small areas of riparian habitat. The work involving road improvement at drainage crossings could result in additional sediment loads to the lake; however, such sediment loading would be controlled through appropriate mitigation measures during construction activity. As such, it is not believed that the cumulative projects would have an impact on threatened or endangered fish species. Bald eagles are likely to avoid disturbed areas. The presence of heavy equipment, additional noise related to construction equipment, and disturbance of previously undisturbed areas would result in short-term, negligible, adverse impacts to threatened and endangered species and critical habitat.

Over the long term, construction activities would cease; however, road and highway improvements could result in increased traffic and human activity. The exploration well would result in increased human activity and equipment noise. Continued development in surrounding areas would result in permanent disturbance of new areas as well as increased noise and human activity. The long-term impacts would be negligible and adverse.

Overall cumulative impacts, including the impacts of alternative A (no-action alternative), would be long term, negligible to minor, and adverse.

**Conclusion.** Impacts from the no-action alternative would be long term, localized, minor, and adverse. Overall cumulative impacts, including the no-action alternative, would be long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, the project work would increase the accommodation of visitors in the uplake developed areas, likely resulting in a general increase in human activity and noise. Construction activities would result in short-term, minor, adverse impacts to threatened and endangered species, designated critical habitat, and State of Utah species of concern because of the use of heavy equipment, noise, and the potential for increased sediment loads to reach lake waters. However, much of the proposed construction in the developed areas would occur in areas already heavily disturbed and where human activity is already concentrated. There would be long-term, minor, adverse impacts to threatened and endangered species, designated critical habitat, and State of Utah species of concern. The activities proposed under alternative B that would potentially occur outside the current developed area or would occur in areas most likely to impact threatened or endangered species, designated critical habitat, and State of Utah species of concern would include the development of shoreline camping along the Colorado River at Hite during low water levels and the relocation of launch and ferry ramps at Bullfrog and Halls Crossing, as needed, when water levels drop. These activities would occur in areas not previously disturbed and the primitive shoreline camping at Hite is likely to occur in a riparian area that is suitable habitat for southwestern willow flycatcher. Mitigation for potential minor impacts to southwestern willow flycatcher would include timing the construction work outside of breeding season. Camping would also be restricted in the low water shoreline camping area at Hite during breeding season. Also under alternative B, 4.7 acres at Bullfrog and 10.7 acres at Halls Crossing would be restored to semidesert grassland and shrubland providing habitat for some listed species and a negligible to minor beneficial impact that would offset some adverse impacts resulting from proposed development. Overall, the impacts to threatened and endangered species, species of concern, or their critical habitat would be short and long term, minor, and adverse.

The Utah State listed species of special concern considered in this DCP/EA include the burrowing owl, common chuckwalla, glossy snake, fringed myotis, Townsend's big-eared bat, and the big free-tailed bat. Burrowing owls are known to nest adjacent to the airstrip that serves Bullfrog. The airstrip is not included within the analysis area for this DCP, so this species is not likely to be adversely affected by alternative B. The three bat species inhabit caves, mines, and buildings. Alternative B would result in upgrading and relocation of some buildings in the developed areas that could currently contain bats. To mitigate for any impacts to bat species, all buildings that would be impacted would be surveyed for bats prior to initiating demolition/construction and any bats found would be relocated.

The common chuckwalla are predominantly found near cliffs, boulders, or rocky slopes where they use rocks as basking sites and rock crevices for shelter. Habitat of this type may be disturbed with this alternative. Impacts to this species from alternative B would be short and long term, minor, and adverse. Similarly, the glossy snake may occupy barren desert open ground in sand or rocky areas, some of which may potentially be disturbed by alternative B. Impacts to this species from alternative B would be short and long term, minor, and adverse. Mitigation for these two reptiles would consist of surveys for species' presence prior to disturbance and potentially collection and movement of individuals to prevent direct impacts.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact threatened and endangered species or critical habitat include the road and highway improvements, the proposed petroleum exploration well, the Canyonlands River Management Plan, the BLM Resource Management Plan, and development in surrounding areas. Both the Canyonlands River Management Plan and the BLM Resource Management Plan are in the early stages of development and cannot be fully analyzed for cumulative effects; however, it should be recognized that these projects would likely have impacts, both beneficial and adverse, on threatened or endangered species. The road and highway improvements, the petroleum exploration well, work under the 404 permit, and development in surrounding areas would result in short-term impacts as a result of construction activities associated with these projects. Some of the road improvements might require drainage crossing that could include small areas of riparian habitat. The work at road improvement drainage crossings could result in additional sediment loads to the lake; however, such sediment loading would be controlled through appropriate mitigation measures during construction activity. As such, it is not believed that the cumulative projects would have an impact on threatened or endangered fish species. Bald eagles are likely to avoid disturbed areas. The presence of heavy equipment, additional noise related to construction equipment, and disturbance of previously undisturbed areas would result in short-term, negligible, adverse impacts to threatened or endangered species and species of concern.

Over the long term, construction activities would cease; however, the road and highway improvements could result in increased traffic and human activity. The exploration well would result in increased human activity and equipment noise. Continued development in surrounding areas would result in permanent disturbance of new areas as well as increased noise and human activity. The long-term impacts would be negligible and adverse.

Overall cumulative impacts, including alternative B, would be short and long term, minor, and adverse.

**Conclusion.** The determination of effect for alternative B on both the southwestern willow flycatcher (listed endangered) and the bald eagle (listed threatened) is "may affect, not likely to adversely affect." This equates to minor adverse impacts. Alternative B will have "no effect" on the following listed species: bonytail, California condor, Colorado pikeminnow, humpback chub, Jones cycladenia, Mexican spotted owl, razorback sucker, or the yellow-billed cuckoo. This equates to negligible impacts.

Overall cumulative impacts, including impacts of alternative B, would be short and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Alternative C

**Impact Analysis.** The impacts under alternative C would be the same as those under alternative B.

The impacts of alternative C on threatened and endangered species and their designated critical habitat, would be short and long term, minor, and adverse. The impacts of alternative C on Utah species of special concern would be short and long term, minor, and adverse. Overall impacts would be short and long term, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact threatened and endangered species or critical habitat include the road and highway improvements, the proposed petroleum exploration well, the Canyonlands River Management Plan, the BLM Resource Management Plan, and development in surrounding areas. Both the Canyonlands River Management Plan and the BLM Resource Management Plan are in the early stages of development and cannot be fully analyzed for cumulative effects; however, it should be recognized that these projects would likely have impacts, both beneficial and adverse, on threatened or endangered species. The road and highway improvements, the petroleum exploration well, and development in surrounding areas would result in short-term impacts as a result of construction activities associated with these projects. Some of the road improvements might require drainage crossing that could include small areas of riparian habitat. The work at road improvement drainage crossings could result in additional sediment loads to the lake; however, such sediment loading would be controlled through appropriate mitigation measures during construction activity. As such, it is not believed that the cumulative projects would have an impact on threatened or endangered fish species. Bald eagles are likely to avoid disturbed areas. The presence of heavy equipment, additional noise related to construction equipment, and disturbance of previously undisturbed areas would result in short-term, negligible, adverse impacts to threatened or endangered species or critical habitat.

Over the long term, construction activities would cease; however, road and highway improvements could result in increased traffic and human activity. The exploration well would result in increased human activity and equipment noise. Continued development in surrounding areas would result in permanent disturbance of new areas as well as increased noise and human activity. The long-term impacts would be negligible and adverse.

Overall cumulative impacts, including impacts of alternative C, would be short and long term, minor, and adverse.

**Conclusion.** The determination of effect for alternative C on both the southwestern willow flycatcher (listed endangered) and the bald eagle (listed threatened) is “may affect, not likely to adversely affect.” This equates to minor adverse impacts. Alternative C will have “no effect” on the following listed species: bonytail, California condor, Colorado pikeminnow, humpback chub, Jones cycladenia, Mexican spotted owl, razorback sucker, or the yellow-billed cuckoo. This equates to negligible impacts. Overall cumulative impacts, including the no-action alternative, would be short and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Visual Resources

### Regulation and Policy

| Desired Conditions | Sources |
|---|---|
| Protect the landscape character and quality according to the guidelines of the existing visual management class III designation. | Glen Canyon NRA *General Management Plan*, 1979 |

### Methodology

It is within the context of the existing visual management class III designation that the following definitions apply. For further explanation, see the discussion of visual contrast and the accompanying matrix indicating compatibility with the various visual management designations.

| Impact Intensity | Visual Resources Intensity Definition |
|---|---|
| Negligible | Changes to visual quality, while visible, are not at a level that would be readily evident to the casual viewer. |
| Minor | Changes to visual quality would be readily evident to the casual viewer and perceived as adverse. |
| Moderate | Changes to visual quality would be highly negative and compete for dominance with the natural features present. |
| Major | Changes to visual quality would be seen as dominating adverse elements in the landscape. |

### Alternative A (No Action)

**Impact Analysis.** Under alternative A, all existing facilities would remain in their current location and would only receive routine maintenance and minor repairs. The boat maintenance and repair facility at Bullfrog is located in the Village Center, and at Halls Crossing at the secured storage area, northeast of the launch ramp. Both of these facilities detract visually from the surroundings because they are located in visitor use areas. At Bullfrog and Halls Crossing, employee trailer housing units in their existing location adversely impact

the visual resources of the area because of the dated appearance of trailer units, and because at Bullfrog, the housing is located in proximity to the visitor use areas. Taken together, the existing adverse impact to visual resources is long term and minor.

**Cumulative Impacts.** Construction activities associated with road and highway improvements would result in short-term, minor, adverse impacts to visual resources from construction activity, equipment, and dust plumes that would detract from the quality of the visual resources of the area during the period of construction. Over the long term, these construction projects would not change the overall visual landscape and therefore would not result in long-term visual impacts. The no-action alternative would result in long-term, minor, adverse impacts to visual resources. As a result of the no-action alternative, cumulative impacts to visual resources would be short and long term, minor, and adverse.

**Conclusion.** Existing impacts to visual resources from facilities that visually detract from busy visitor use areas are long term, minor, and adverse. Cumulative impacts to visual resources would be short and long term, minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, facilities and associated infrastructure would be upgraded, expanded, and improved at the uplake developed areas. Numerous uplake facilities would be expanded and upgraded, potentially resulting in long-term adverse impacts to visual resources.

These additions would be somewhat evident to a visitor, but consistent with the developed setting at the uplake developed areas. In general, consistent use of low-profile structures and architectural themes and colors designed to blend with the surrounding landscape and existing facilities would reduce any potential long-term adverse impacts of expanded development to a negligible level. Proposed stacked storage units in the secured storage areas and houseboat storage and repair facilities would be tall and would have a visual presence. However, these facilities would be located out of the primary viewshed, and would be designed to blend into the landscape using natural colors. Expansion of the secured storage areas in both locations would be visually screened as well, further mitigating any adverse impacts to visual resources. Actual construction would tend to be more disruptive of visual resources than the final product. For all proposed improvements, actual construction work would have short-term, negligible to minor, adverse impacts on visual resources as equipment and activity would be either visible from main visitor access points or actually located within visitor use areas.

Beneficial impacts to visual resources could be realized through the relocation of facilities and services proposed under alternative B. Relocation of concessioner housing to the NPS

residential area and elimination of concessioner employee trailer housing units would beneficially impact visual resources by permitting the existing location to be reclaimed and by consolidation of like uses in one location. Relocation of the concessioner boat maintenance and repair and property maintenance facilities at Bullfrog would move this operation area away from the Village Center and would include visual screening of the facility from the rest of the developed area. Relocation of concessioner boat maintenance and repair and property maintenance facilities to the old airstrip at Halls Crossing would make the facility less visible from all points in the Halls Crossing area.

Short-term, negligible to minor, adverse impacts on visual resources would result from construction activities. Overall long-term impacts under this alternative would be minor and beneficial due to the positive effects of relocating certain facilities outside visitor viewscapes and reclaiming previously developed areas.

**Cumulative Impacts.** Activities associated with road and highway improvements would result in short-term, minor, adverse impacts to visual resources from construction activity, equipment, and dust plumes that would detract from the quality of the visual resources of the area during the period of construction. Over the long term, these construction projects would not change the overall visual landscape and therefore would not result in long-term visual impacts. The cumulative projects, in combination with alternative B, would result in short-term, minor, adverse impacts to visual resources and long-term, minor, beneficial impacts.

**Conclusion.** Short-term, negligible to minor, adverse impacts on visual resources would result from construction activities. Overall long-term impacts under this alternative would be minor and beneficial due to the positive effects of relocating certain facilities outside visitor viewscapes and reclaiming previously developed areas. The cumulative projects, in combination with impacts of alternative B, would result in short-term, minor, adverse impacts to visual resources, and long-term, minor, beneficial impacts.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative C

**Impact Analysis.** Most impacts to visual resources resulting from construction and operation of alternative C would be the same as those described for alternative B. Consolidation of the Halls Crossing RV park and campground sites at the campground location would allow the existing RV park to be reclaimed. In addition, the NPS maintenance facility would be relocated behind the family rental units (a less visible location) and screened, and a land-based visitor / ranger contact station and combined emergency facilities building would be added, consolidating like uses. By further consolidating like uses in one location and reclaiming a currently developed area, the long-term impacts to visual resources would be minor and beneficial.

Short-term, negligible to minor, adverse impacts on visual resources would result from construction activities.

**Cumulative Impacts.** Activities associated with road and highway improvements would result in short-term, minor, adverse impacts to visual resources from construction activity, equipment, and dust plumes that would detract from the quality of the visual resources of the area during the period of construction. Over the long term, these construction projects would not change the overall visual landscape and therefore would not result in long-term visual impacts. The cumulative projects, in combination with impacts of alternative C, would result in short-term, minor, adverse impacts to visual resources and long-term, minor, beneficial impacts.

**Conclusion.** Short-term, negligible to minor, adverse impacts on visual resources would result from construction activities. Overall long-term impacts under this alternative would be minor and beneficial due to the positive effects of relocating certain facilities outside visitor view-scapes and reclaiming previously developed areas. The cumulative projects, in combination with impacts of alternative C, would result in short-term, minor, adverse impacts to visual resources, and long-term, minor, beneficial impacts.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

## Soundscapes

### Regulations, and Policy

| Desired Conditions | Sources |
|---|---|
| The agency is required to preserve, to the greatest extent possible, the natural soundscapes of recreation areas. Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. The superintendent is to identify what levels of human-caused sound can be accepted within the management purposes of the NRA. | NPS *Management Policies 2001* |
| Director's Order – 47 defines appropriate and inappropriate sound. The overall goal of NPS units is the protection, maintenance, or restoration of the natural soundscape resource. However, it does state that some sound-producing activities, including recreational activities, may be appropriate if they are included in the recreation area's purpose as defined by its enabling legislation. | Directors Order – 47: *Soundscape Preservation and Noise Management* |

| Desired Conditions | Sources |
|---|---|
| The enabling legislation for Glen Canyon NRA states that the purpose of the recreation area is "to provide for public outdoor recreation use and enjoyment… and to preserve scenic, scientific, and historic features contributing to public enjoyment of the area." | 86 Statute 1311 *(Glen Canyon NRA establishing legislation)* |
| Operating a vessel in or upon inland waters so as to exceed a sound level of 82 decibels measured at a distance of 82 feet (25 meters) from the vessel is prohibited. These standards are difficult to enforce, as they require estimation of distances in addition to monitoring sound. | Laws for noise abatement of motorized vessels are regulated by the National Park Service within Glen Canyon NRA and other units of the national park system (36 CFR Part 3.7) |

## Methodology

Impact intensity thresholds for soundscapes are as follows:

| Impact Intensity | Soundscapes Intensity Definition |
|---|---|
| Negligible | In the recreation and resource utilization (RRU) zone and development zone (designated in the Glen Canyon NRA GMP), sound levels rarely exceed levels specified in 36 CFR 3.7. Within the RRU and development zones, low level human-caused sound would occur 50% or less of the time during daylight hours. Human-caused sound is rare between the hours of 10:00 p.m. and 6:00 a.m. |
| Minor | In the RRU and development zones, sound levels occasionally exceed levels specified in 36 CFR 3.7. During the busiest days, the RRU and development zones may experience human-caused sound at moderate levels for a substantial portion of each hour during daylight hours. Human-caused sound is infrequently noticeable between the hours of 10:00 p.m. and 6:00 a.m. |
| Moderate | In the RRU and development zones, human-caused sound is present in a majority of the area during most of the daylight hours. When present, sound levels can be high compared to 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 and development zones may experience human-caused sound at moderate to high levels compared to the natural soundscape for a majority of daylight hours. Human-caused sound is occasionally noticeable between the hours of 10:00 p.m. and 6:00 a.m. |
| Major | In the RRU and development zones, human-caused sound is present in most of the areas during most of the daylight hours. When present, sound levels can be high compared to 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 and development zones may experience human-caused sound at moderate-to-high levels compared to the natural soundscape for most of each hour during daylight hours. Human-caused sound is often noticeable between the hours of 10:00 p.m. and 6:00 a.m. |

Construction-related impacts to soundscapes would be considered short term, while human-caused noise as a result of recreational activities would be considered long term.

### Alternative A (No Action)

**Impact Analysis.** Current human-generated sounds in the uplake developed areas include automobile traffic, watercraft, visitors, and campers. Under the no-action alternative, the routine sounds typically associated with the uplake developed areas would not change. In addition, there would be no substantial construction activities. Public perception of noise on the lake does not indicate existing problems. Nearly 50% of respondents to the 2005 visitor survey indicated that the level of noise on the lake was no problem. Impacts would vary seasonally and would be long term, localized, and adverse, and range from negligible to minor depending on the season of activity.

**Cumulative Impacts.** Road and highway improvements would increase the transportation and operation of equipment and construction activity in the area, which would impact the soundscape. Such increases would only be during the period of construction and would be short term, localized, minor to moderate, and adverse. There would be no overall cumulative impacts as a result of construction activities under alternative A (no-action alternative) as there would be no substantial construction under alternative A (no-action alternative).

**Conclusion.** Impacts would vary seasonally and would be long term, localized, and adverse, and range from negligible to minor depending on the season of activity. There would be no overall cumulative impacts as a result of construction activities under alternative A as there would be no substantial construction under alternative A (no-action alternative).

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, impacts to soundscapes from NPS maintenance facilities, airstrips, water-based stores, launch ramp support facilities, and the river runner takeout would be the same as alternative A because there would be no changes from the no-action alternative.

Numerous facilities and associated infrastructure would be upgraded, expanded, and improved at the uplake developed areas under alternative B. Construction-generated sound would include construction equipment, vehicles, and building activities. At Hite, short-term, moderate, adverse impacts to soundscapes would result from blasting needed to bury the new 100,000-gallon underground potable water storage tank. Actual construction associated with the proposed development and expansion would result in localized short-term, moderate, adverse impacts to soundscapes through the increased activity and equipment operation during the construction period.

To reduce potential impacts on soundscapes, all construction vehicles and equipment would be equipped with properly operating and maintained mufflers. In addition, noise-generating construction activities would be limited to daylight hours to minimize the potential impacts on overnight visitors of the uplake marina areas. Implementation of these measures would reduce potential construction impacts from moderate to minor in many cases.

Expansion of and additional construction of buildings would add some low-level noise to the sound environment over the long term from their operating systems; however, that noise would only be expected to produce a negligible adverse impact to the natural soundscape.

Expansion of visitor accommodations in the form of campsites, family rental units, and lodge space has the potential to increase impacts to the natural soundscape as a result of increased visitation at the developed areas. Visitor noise would vary seasonally and would only be expected to result in minor increases over the existing noise levels during the busy summer months.

Increased boat motor noise resulting from increased boater activity on Lake Powell, and increased generator use in campgrounds resulting from campground expansion would increase the level and frequency of human-caused noise over current levels during daylight hours. Human-caused noise between the hours of 10:00 p.m. and 6:00 a.m. could potentially increase in conjunction with increased nighttime launches; however, nighttime generator use would be restricted in the campground. These effects would result in long-term, minor to moderate, adverse impacts on natural soundscapes.

The short-term impacts to soundscapes from construction activities as a result of implementation of alternative B would be negligible to moderate and adverse. The long-term impacts to soundscapes as a result of human-caused sound from the implementation of alternative B would vary seasonally and be negligible to moderate and adverse.

**Cumulative Impacts.** Road and highway improvements would increase the transportation and operation of equipment and construction activity in the area, which would impact the soundscape. Such increases would only occur during the period of construction and would be short term, minor to moderate, and adverse. The overall cumulative impacts, including impacts of alternative B, would vary seasonally and with construction activities and would be short term, minor to moderate, and adverse.

**Conclusion.** The short-term impacts to soundscapes from construction activities as a result of implementation of alternative B would be negligible to moderate and adverse. The long-term impacts to soundscapes as a result of human-caused sound from the implementation of alternative B would vary seasonally and be negligible to moderate and adverse. The overall cumulative impacts, including impacts of alternative B, would vary seasonally and with construction activities and would be short term, minor to moderate, and adverse.

### Alternative C

**Impact Analysis.** Impacts on natural soundscapes resulting from alternative C would be similar to those described for alternative B. Wet moorage at the marina facilities would be extended further than in alternative B; however, because only an estimated 20% of boats moored on the lake operate at any one time, this increased number of wet moorage would only negligibly increase boat motor noise. Development of launch ramps at Bullfrog to a maximum width of 150 feet and development of a ramp to a maximum width of 110 feet at Halls Crossing would increase the capacity to launch at lower lake levels, which would result in faster launching times (less waiting to launch) at current visitation levels and an increase in the

number of boats on the lake only with increased visitation. Therefore, impacts to natural soundscapes would be the same as alternative B. The short-term impacts to soundscapes from construction activities as a result of implementation of alternative C would be negligible to moderate and adverse. The long-term impacts to soundscapes as a result of human-caused sound from the implementation of alternative C would vary seasonally and be negligible to moderate and adverse.

**Cumulative Impacts.** Road and highway improvements would increase transportation and operation of equipment and construction activity in the area, which would impact soundscapes. Such increases would only occur during the period of construction and would be short term, minor to moderate, and adverse. The overall cumulative impacts, including alternative C, would vary seasonally and with construction activities and would be short term, minor to moderate, and adverse.

**Conclusion.** The short-term impacts to soundscapes from construction activities as a result of implementation of alternative C would be negligible to moderate and adverse. The long-term impacts to soundscapes as a result of human-caused sound from the implementation of alternative C would vary seasonally and be negligible to moderate and adverse. The overall cumulative impacts, including impacts of alternative C, would vary seasonally and with construction activities and would be short term, minor to moderate, and adverse.

## Archeological Resources

### Regulation and Policy

Current laws and policy direct NPS management strategies related to archeological resources. Pertinent legislation and associated responsibilities include the following.

| Desired Conditions | Sources |
|---|---|
| The National Park Service has a responsibility to preserve, unimpaired, the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. | The NPS Organic Act |
| The protection of prehistoric, historic, and scientific features is required on federal lands, with penalties for unauthorized destruction or appropriation of antiquities. | The Antiquities Act of 1906 |
| Section 106 of the act requires that federal agencies with direct or indirect jurisdiction over undertakings take into account the effects such undertakings may have upon properties listed on, or eligible for listing on, the NRHP. Section 110 requires that programs be established to identify, evaluate, and nominate properties to the NRHP. | The National Historic Preservation Act of 1966 |
| The federal government has a responsibility to American Indians to protect and preserve access to sites, use and possession of scared objects, and the freedom to worship through ceremonial and traditional rites on federal land. | American Indian Religious Freedom Act |

| Desired Conditions | Sources |
|---|---|
| The federal government has a responsibility to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands. The act requires federal permits for excavations, the development of plans for archeological survey on public land, and systems for reporting violations; provides for confidentiality of site locations, preservation and custody of excavated materials, records, and data; and encourages cooperation with other parties in the protection of archeological resources. | Archeological Resources Protection Act |
| The federal government has the responsibility to accommodate access to, and ceremonial use of, Indian scared sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites on public land. | Executive Order 13007 *(Sacred Indian Sites)* |
| It is the policy of the National Park Service to protect cultural resources and carefully consider the effects that NPS actions may have on them. Specific guidance for the management of NPS cultural resources is provided in Director's Order – 28: *Cultural Resource Management* and the accompanying *Cultural Resources Management Guideline.* | NPS *Management Policies 2001* |
| The act addresses the rights of lineal descendants of American Indian tribes and Native Hawaiian organizations to certain American Indian human remains, funerary objects, sacred objects, and objects of cultural patrimony with which they are affiliated. NAGPRA legislation protects American Indian graves on federal and tribal lands, recognizes tribal authority over treatment of unmarked graves and prohibits the commercial selling of deceased American Indians. It also requires an inventory and repatriation of human remains held by the federal government and institutions that receive federal funding. NAGPRA further requires these same institutions to return inappropriately acquired sacred objects and other important communally owned property to American Indians | *Native American Graves Protection and Repatriation Act* |

## Methodology

Certain important research questions about human history can only be answered by the actual physical material of archeological resources. Archeological resources have the potential to answer, in whole or in part, such research questions. A cultural site(s) can be eligible to be listed on the NRHP if the site(s) has yielded, or may be likely to yield, information important in prehistory or history. A cultural site(s) can be nominated to the NRHP in one of three historic contexts or levels of significance: local, state, or national (see *National Register Bulletin 15*, *How to Apply the National Register Criteria for Evaluation*) (NPS 2002c).

In accordance with the Advisory Council on Historic Preservation regulations implementing National Historic Preservation Act, section 106, impacts to cultural resources were identified and evaluated by

- determining each area of potential effect
- identifying cultural resources present in the area of potential effect that are either listed or eligible to be listed on the NRHP
- applying the criteria of effect to cultural resources listed or eligible to be listed on the NRHP
- considering ways to avoid, minimize, or mitigate adverse effects

Under Advisory Council regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected cultural resources. An *adverse effect* occurs when an action (or undertaking) may alter, directly or indirectly, any of the characteristics of a cultural site that qualify the site for inclusion in the NRHP in a manner that would diminish the integrity of the site's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. A determination of *no adverse effect* indicates that while there is an effect, it does not diminish in any way the characteristics of the resource that qualify it for inclusion in the NRHP. Council on Environmental Quality regulations and NPS *Conservation Planning, Environmental impact Analysis and Decision-making* (Director's Order – 12) also call for a discussion of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (for example, from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by section 106 is similarly reduced. Archeological resources are nonrenewable resources and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under section 106 may be mitigated, the effect remains adverse.

A section 106 summary is included in the impact analysis sections. The section 106 summary is an assessment of the effect of the undertaking (implementation of the alternative) on NRHP-eligible or -listed cultural resources only, and is based on the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

Potential impacts to cultural resources are described in terms of type (beneficial or adverse), context (site-specific, local, or even regional), duration (short term or long term) and intensity (negligible, minor, moderate, or major), which is consistent with the regulations of the Council on Environmental Quality, which implement NEPA (42 USC 4321 *et seq.)*. These impact analyses are also intended to comply with sections 106 and 110 of the National Historic Preservation Act.

For purposes of analyzing impacts to archeological resources, thresholds of change for the intensity of an impact are based on the potential of the site(s) to yield information important in prehistory or history, as well as the probable historic context of the affected site(s):

| Impact Intensity | | Archeological Resources Intensity Definition |
|---|---|---|
| Negligible | | The impact is at the lowest level of detection or barely measurable, with no perceptible consequences, either adverse or beneficial, to the archeological resources. For purposes of section 106, the determination of effect would be *no adverse effect*. |
| Minor | Adverse Impact | The impact would affect archeological site(s) with the potential to yield information important in prehistory or history. For purposes of section 106, the determination of effect would be *adverse effect*. |
| | Beneficial Impact | A site would be preserved in its natural state. For purposes of section 106, the determination of effect would be *no adverse effect*. |
| Moderate | Adverse Impact | The impact would affect an archeological site with the potential to yield information important in prehistory or history. For purposes of section 106, the determination of effect would be *adverse effect*. |
| | Beneficial Impact | The site would be stabilized. For purposes of section 106, the determination of effect would be *no adverse effect*. |
| Major | Adverse Impact | The impact would affect an archeological site with the potential to yield important information about human history or prehistory. For purposes of section 106, the determination of effect would be *adverse effect*. |
| | Beneficial Impact | Active intervention would be taken to preserve the site. For purposes of section 106, the determination of effect would be *no adverse effect*. |

Adverse impacts on virtually all archeological features would be long-term effects because archeological resources are nonrenewable.

### Alternative A (No Action)

**Impact Analysis.** Current effects to archeological would continue under the no-action alternative. Visitor use in areas of cultural sensitivity results in inadvertent trampling of sites and moving of resources. Glen Canyon NRA contains a wealth of cultural sites and although much of the developed areas have been disturbed, there are areas where cultural resources could occur below the surface. Site-specific impacts from visitor activities are long term and adverse and range from negligible to minor.

Glen Canyon NRA operations affect cultural sites in various ways. Maintenance operations for roadways, development of overflow parking, and relocating or extending waterlines or sewerlines can all cause impacts to cultural resources. Adverse impacts from maintenance operations are long term, localized, negligible to minor, and adverse.

**Cumulative Impacts.** Other projects with the potential to impact archeological resources include construction projects associated with road and highway improvements, development of the petroleum exploration well, and potential development in surrounding areas. Any work on federal lands or with federal assistance would include a cultural resource survey and associated mitigation, if necessary, to ensure that cultural resources are protected and adverse impacts to cultural resources are negligible. Work on private lands (as long as there is no federal funding or permitting involved) would not undergo a survey or mitigation and could impact cultural resources. However, because most of the cumulative projects are on public lands, the impacts to cultural resources would be long term, negligible, and adverse. The

overall cumulative impacts, including the impacts of alternative A (no-action alternative), would be long term, negligible to minor, and adverse.

**Conclusion.** Localized impacts to archeological resource from visitor use and recreation area operations would be long term adverse and range from negligible to minor. The overall cumulative impacts, including the impacts from alternative A (no-action alternative), would be long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Existing impacts to archeological resources as discussed under the no-action alternative would remain. Potential additional impacts would be associated with ground-disturbing activities. Up to 83.9 acres may be disturbed under this alternative. However, the area has been surveyed for archeological resources and site density is low. NRHP-eligible sites would be avoided to the greatest extent possible. It is not expected that any known sites would be affected. If disturbance of an eligible site is unavoidable, NRA staff would mitigate adverse effects through documentation and other means deemed appropriate in consultation with the SHPO.

If it is determined that ground disturbance would occur in a previously unsurveyed area, an archeological clearance survey would be completed and development plans would be modified to avoid or minimize impacts to archeological resources. Therefore, impacts from alternative B would be long term, localized, negligible to minor, and adverse, depending on the activity and site.

**Cumulative Impacts.** Other projects with the potential to impact archeological resources include construction projects associated with road and highway improvements, development of the petroleum exploration well, and potential development in surrounding areas. Any work on federal lands or with federal assistance would include a cultural resource survey and associated mitigation, if necessary, to ensure that cultural resources are protected and adverse impacts to cultural resources are negligible. Work on private lands (as long as there is no federal funding or permitting involved) would not undergo a survey or mitigation and could impact cultural resources. However, because most of the cumulative projects are on public lands, the impacts to cultural resources would be long term, negligible, and adverse. The overall cumulative impacts, including impacts of alternative B, would be long term, negligible to minor, and adverse.

**Conclusion.** Archeological resource impacts under alternative B would be long term, negligible to minor, and adverse. The overall cumulative impacts, including alternative B, would be long term, negligible to minor and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

**Section 106 Summary.** Under 36 CFR 800, *Protection of Historic and Cultural Properties*, an adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association.

After applying Advisory Council on Historic Preservation criteria of adverse effect (36 CFR 800.5), the National Park Service determined that the activities proposed in alternative B would have *no adverse effect* to cultural resources.

### Alternative C

**Impact Analysis.** Up to 83.3 acres may be disturbed under this alternative. Impacts to archeological resources as discussed under alternative B would remain the same under alternative C. Impacts from alternative C would be long term, localized, negligible to minor and adverse, depending on the activity and site.

**Cumulative Impacts.** Other projects with the potential to impact archeological resources include construction projects associated with road and highway improvements, development of the petroleum exploration well, and potential development in surrounding areas. Any work on federal lands or with federal assistance would include a cultural resource survey and associated mitigation, if necessary, to ensure that cultural resources are protected and adverse impacts to cultural resources are negligible. Work on private lands (as long as there is no federal funding or permitting involved) would not undergo a survey or mitigation and could impact cultural resources. However, because most of the cumulative projects are on public lands, impacts to cultural resources would be long term, negligible, and adverse. The overall cumulative impacts, including impacts of alternative C, would be long term, negligible to minor, and adverse.

**Conclusion.** Archeological resource impacts under alternative C would be long term, adverse, and range from negligible to minor. The overall cumulative impacts, including impacts of alternative C, would be long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

**Section 106 Summary.** Under 36 CFR 800, *Protection of Historic and Cultural Properties*, an adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association.

After applying Advisory Council on Historic Preservation criteria of adverse effect (36 CFR 800.5), the National Park Service determined that the activities proposed in the alternative B would have *no adverse effect* to cultural resources.

## Ethnographic Resources

### Regulation and Policy

Ethnographic resources relate to cultural content and context of cultural resources. They involve the identity and heritage of contemporary peoples or groups. As defined by the National Park Service, an ethnographic resource is a site, structure, object, landscape, or natural resource feature that has been assigned a traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. Some specific places of traditional cultural use may be eligible for inclusion in the NRHP if they meet national register criteria for traditional cultural properties.

The same regulations and policy as described above for cultural resources would also apply to ethnographic resources.

### Methodology

Impact intensity thresholds for ethnographic resources are as follows:

| Impact Intensity | | Ethnographic Resources Intensity Definition |
|---|---|---|
| Negligible | | Impact is barely perceptible and would alter neither resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of beliefs and practices. There would be no change to a group's body of beliefs and practices. For purposes of section 106, the determination of effect on ethnographic resources would be *no adverse effect.* |
| Minor | Adverse Impact | Impact is slight but noticeable. It does not appreciably alter resource conditions, such as traditional access or site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices. For purposes of section 106, the determination of effect on ethnographic resources would be *no adverse effect*. |
| | Beneficial Impact | Impact allows traditional access and/or accommodates a group's traditional practices or beliefs. For purposes of section 106, the determination of effect on ethnographic resources would be *no adverse effe*ct. |
| Moderate | Adverse Impact | Impact is apparent and alters resource conditions. Interference occurs with traditional access, site preservation, or the relationship between the resource and the affiliated group's beliefs and practices, even though the group's beliefs and practices would survive. For purposes of section 106, the determination of effect on ethnographic resources would be *adverse effe*ct. |

| Impact Intensity | | Ethnographic Resources Intensity Definition |
|---|---|---|
| | Beneficial Impact | A group's beliefs and practices and/or traditional access are facilitated. For purposes of section 106, the determination of effect on ethnographic resources would be *no adverse effect*. |
| Major | Adverse Impact | Impact alters resource conditions. Traditional access, site preservation, or the relationship between the resource and the affiliated group's body of beliefs and practices are blocked or greatly affected, to the extent that the survival of a group's beliefs and/or practices would be jeopardized. For purposes of section 106, the determination of effect on ethnographic resources would be *adverse effect*. |
| | Beneficial Impact | A group's beliefs or practices are encouraged and/or accommodated. For purposes of section 106, the determination of effect on ethnographic resources would be *no adverse effect.* |

Impacts on ethnographic resources would be long term because ethnographic resources are nonrenewable.

### Alternative A (No Action)

**Impact Analysis.** Current effects to ethnographic resources would continue under the no-action alternative. Visitor use in areas of ethnographic resources results in inadvertent trampling of sites and moving of resources. Glen Canyon NRA contains a number of ethnographic resources and although much of the developed areas have been disturbed, there are areas where ethnographic resources could continue to be present. Impacts from visitor activities are site-specific, long term, negligible to minor, and adverse.

Impacts from recreation area operations, such as minor trail realignments and the installation of vault toilets, constitute a localized, long-term, minor, adverse impact to ethnographic resources.

**Cumulative Impacts.** Other projects with the potential to impact ethnographic resources include construction projects associated with road and highway improvements, development of the petroleum exploration well, and potential development in surrounding areas. Any work on federal lands or with federal assistance would include an evaluation of impacts to ethnographic resources and associated mitigation, if necessary, and would ensure that adverse impacts to ethnographic resources are negligible. Work on private lands would not undergo an evaluation or mitigation and could impact ethnographic resources. However, because most of the cumulative projects are on public lands, impacts to ethnographic resources would be long term, negligible, and adverse. The overall cumulative impacts, including those of the no-action alternative, would be long term, negligible to minor, and adverse.

**Conclusion.** Ethnographic resource impacts related to visitor use would be long term, negligible to minor, and adverse in the developed areas. Impacts from recreation area operations would have long-term, minor, adverse impacts. Cumulative impacts to ethnographic resources would be long term, negligible to minor, and adverse, depending on the scope, type, and location of the activity.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

### Alternative B (Preferred Alternative)

**Impact Analysis.** In general, impacts to ethnographic resources would be the same as under the no-action alternative. Visitor use in areas of ethnographic resources results in trampling of sites and moving of resources. Glen Canyon NRA contains a number of ethnographic resources and although much of the developed areas have been disturbed, there are areas where ethnographic resources could to be present. Site-specific impacts from visitor activities are long term, negligible to minor, and adverse. Impacts from recreation area operations, such as minor trail realignments and the installation of vault toilets, constitute a long-term, minor, localized, adverse impact to ethnographic resources.

Because the entire Halls Crossing area is considered a traditional cultural property, any activities in this area would have the potential to adversely affect ethnographic resources. The Halls Crossing area is already highly developed and any specific future development would be planned in consultation with the SHPO and any interested stakeholding tribes. Therefore any major adverse impacts would be mitigated. With mitigation, impacts under alternative B would be resource-specific, long term, negligible to minor, and adverse.

**Cumulative Impacts.** The overall cumulative impacts, including impacts of alternative B, would be the same as for alternative A (no-action alternative): long term, negligible to minor, and adverse.

**Conclusion.** With mitigation, adverse impacts under alternative B would be resource-specific long term and negligible to minor. The overall cumulative impacts, including impacts of alternative B, would be long term, negligible to minor, and adverse.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

**Section 106 Summary.** Under 36 CFR 800, *Protection of Historic and Cultural Properties*, an adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association.

After applying Advisory Council on Historic Preservation criteria of adverse effect (36 CFR 800.5), the National Park Service determined that the activities proposed in the alternative B would have *no adverse effect* to ethnographic resources.

### Alternative C

**Impact Analysis.** Under alternative C, impacts to cultural resources would be the same as those associated with alternatives A (no-action alternative) and B.

With mitigation, impacts under alternative C would be resource-specific long term and negligible to minor.

**Cumulative Impacts.** The overall cumulative impacts, including impacts of alternative C, would be the same as for alternatives A (no-action alternative) and B: long term, negligible to minor, and adverse.

**Conclusion.** With mitigation, impacts to ethnographic resources under alternative C would be resource-specific and long term and would range from negligible to minor. The overall cumulative impacts, including alternative C, would be long term, negligible to minor, and adverse to ethnographic resources.

**Impairment.** 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 established legislation or proclamation of Glen Canyon NRA; (2) key to the natural or cultural integrity of the recreation area; or (3) identified as a goal in the recreation area's general management plan or other relevant NPS planning documents, there would be no impairment of recreation area resources or values.

**Section 106 Summary.** Under 36 CFR 800, *Protection of Historic and Cultural Properties*, an adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP, e.g., diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association.

After applying Advisory Council on Historic Preservation criteria of adverse effect (36 CFR 800.5), the National Park Service determined that the activities proposed in the alternative B would have *no adverse effect* to ethnographic resources.

## Visitor Use and Experience

### Regulation and Policy

It is the management policy of the National Park Service to provide for enjoyment of recreation area resources and values by the people of the United States as part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate high-quality opportunities for visitors to enjoy Glen Canyon NRA, consistent with

current policies and laws. The following conditions may be achieved in Glen Canyon NRA for visitor use and experience:

| Desired Conditions | Sources |
|---|---|
| Visitors have opportunities to enjoy the recreation area in ways that leave resources unimpaired for future generations. | NPS Organic Act.<br>NPS *Management Policies 2001* |
| Visitors understand and appreciate Glen Canyon NRA values and resources and have the information necessary to adapt to the area's environment. | NPS *Management Policies 2001* |
| Recreational uses are promoted and regulated. Basic visitor needs are met in keeping with the national recreation area purposes. | NPS Organic Act<br>Title 36 CFR<br>NPS *Management Policies 2001* |
| To the extent feasible, facilities, programs and services in the national recreation area are accessible to and usable by all people, including those with disabilities. | Americans with Disabilities Act<br>Architectural Barriers Act<br>Rehabilitation Act<br>NPS *Management Policies 2001* |
| Visitors who use federal facilities and services for outdoor recreation may pay a greater share of the cost of providing those opportunities than the population as a whole. | NPS *Management Policies 2001*<br>Recreational Fee Demonstration Program (U.S. Department of the Interior et al. 1998) |
| Glen Canyon NRA has identified implementation commitments for visitor carrying capacities for all areas of the unit. | 1978 National Parks and Recreation Act (PL 95-625)<br>NPS *Management Policies 2001* |

## Methodology

Impact thresholds are listed as follows:

| Impact Intensity | Intensity Definition |
|---|---|
| Negligible | The visitor would not be affected or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative. |
| Minor | Changes in visitor use and/or experience would be detectable, although the changes would be slight. Some of the visitors would be aware of the effects associated with the alternative, but the effects would be slight and not noticeable by most visitors. |
| Moderate | Changes in visitor use and/or experience would be readily apparent to most of the visitors. Visitors would be aware of the effects associated with the alternative and might express an opinion about the changes. |
| Major | Changes in visitor use and/or experience would be readily apparent to all of visitors, severely adverse or exceptionally beneficial. Visitors would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes. |

Impacts to visitor use and experience are considered short term if the effects last only as long as the construction period. Impacts are considered long term if the effects last longer than the construction period.

### Alternative A (No Action)

**Impact Analysis.** Over time, the aging and dated appearance of the visitor accommodations, specifically the family rental trailer units at Bullfrog and Halls Crossing, would begin to affect visitor use and experience. These units are older units showing signs of age at this point in time and potential maintenance and quality-of-life issues would continue to increase as the units grow older. The aging family rental units would no longer be a desirable place to stay and visitors would be left with no other choice for accommodations at Halls Crossing and Hite. The impacts to visitor use and experience from these aging accommodations would be long term, negligible to minor, and adverse.

The no-action alternative does not contemplate any increases in facilities as a result of an increase in the number of visitors and associated demand for visitor services at the uplake developed areas. Although visitation has remained relatively constant or shown a slight decrease during the recent years of the drought, for the 20 years prior to that time visitation steadily increased. Visitation would be expected to show slight increases as the water level returns to nearer full pool. With no changes to visitor services or facilities under the no-action alternative, there would be long-term, minor, adverse impacts to visitor use and experience.

Existing capacity of the uplake launch ramps and marina facilities exceeds the carrying capacity at:

- Halls Crossing, at lake elevations of 3,550, 3,600, and 3,700 feet
- Bullfrog and Halls Crossing combined, at lake elevation 3,700 feet

At a lake elevation of 3,700 feet, the capacity of the launch ramps and marina facilities at Halls Crossing currently exceeds carrying capacity by approximately 85 launches per day. Combined, the Bullfrog and Halls Crossing facilities exceed carrying capacity by approximately 60 launches per day. While existing use of the launch ramps is not known, it is generally believed to be below full capacity. Therefore, actual use may be equal to carrying capacity or exceed carrying capacity by less than 60 to 80 launches per day.

The primary limiting factor at all lake elevations in all zones is recreational quality. At some lake elevations in certain zones physical capacity is the limiting factor, but those instances are clear exceptions.

Because a large majority of respondents to the 2005 Visitor Survey indicated that litter on the shoreline and finding a beach campsite is a moderate or serious problem, future use near or above carrying capacity without additional mitigation could result in continuation of existing long-term moderate adverse impacts on visitors using the shoreline.

Overall, impacts to visitor use and experience from the no-action alternative would be long term, minor to moderate, and adverse and would be a result of the lack of increases in visitor services as visitor numbers increase, the aging of visitor accommodations, limited availability of shoreline campsites, and shoreline litter.

**Cumulative Impacts.** Road and highway improvements would have a short-term adverse impact on visitor use and experience on visitors traveling the roads to reach the uplake district developed areas due to traffic delays, and long-term beneficial impacts by improving the routes visitors travel. Development in surrounding areas would have a beneficial impact on visitor use and experience by providing visitor services, in addition to the limited services available within the recreation area. Cumulative impacts, including the impacts of alternative A (no-action alternative), would be short term, negligible to minor, and adverse and long term, negligible, and beneficial as a result of some of the planned improvements.

**Conclusion.** Overall impacts to visitor use and experience from the no-action alternative would be long term, minor to moderate, and adverse. Cumulative impacts, including the no-action alternative would be overall short term, negligible to minor, and adverse and long term, negligible and beneficial.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, numerous facilities and associated infrastructure would be upgraded, expanded, and improved at the uplake developed areas resulting in various impacts to visitor use and experience. Facility upgrades and expansions would improve the overall visitor use and experience by providing additional and improved opportunities for visitors to use facilities at the uplake areas and by allowing more visitors to make use of specific facilities.

Some facilities would be more heavily used by visitors than other facilities. For example, visitors would be more likely to make use of upgraded and expanded stores and food service, whereas fewer visitors would make use of day-use facilities because most visitors are overnight visitors who would have similar amenities to the day-use areas either on the water or in their designated campground or overnight accommodation. Water-based improvements would be more heavily used by visitors in a boat or other watercraft. However, the range of expanded and improved services is designed to accommodate both water-based and land-based visitors. At Hite, expanded visitor services, including shower and laundry facilities, an expanded store, and food service, would be directed toward not only visitors with boats, but also river runners and backcountry visitors.

Some facilities at the uplake areas would also be relocated to improve traffic circulation and the viewscape for visitors and provide for a sharing of amenities and activities. The relocation of the Bullfrog RV park away from the seasonal housing units and the relocation of the concessioner housing units away from the family rental units would provide a separation of employees and visitors and improve the viewscape from each of the visitor facilities. The relocation of the shower and laundry facilities at Bullfrog would provide a more centrally located facility for visitors who want to use the shower and laundry facilities and a more convenient location for visitors who use the campground. Access to these facilities would be easier with less traffic congestion and more available parking. The laundry location would be less convenient than the existing location for those visitors using the family rental units. Relocation of the concessioner maintenance facilities from the Village Center at Bullfrog would improve traffic circulation and provide for a better separation of visitors and employees. Visitors would be less likely to experience conflicts or delays as a result of

deliveries or moving of equipment. The relocation would open up space at the Village Center to add visitor services in that location and would improve the aesthetics of the Village Center. Relocation of the concessioner maintenance and repair facility and the secured storage at Halls Crossing would improve traffic circulation and move these facilities from the main access to the marina facilities. Again visitors would be less likely to experience conflicts with deliveries and the overall viewscape for visitors would be improved.

New facilities proposed under alternative B, such as designated low-water shoreline camping at Hite, and new land-based food service at all developed areas would provide new opportunities to visitors and improve the visitor experience. Increases to buoy and secured storage facilities would offer on-site services to visitors who are currently on waiting lists. Expansion and/or addition of retail facilities and food service would offer greater variety and expand the services that are available to visitors, enhancing visitor use and experience.

Respondents to the 2005 visitor survey clearly indicated support for increasing facilities and services on the shoreline and improving public access to the lake. Respondents generally supported expansion of marina facilities, although not as strongly as the support indicated for increased facilities and services on the shoreline. Overall, increased development of facilities both on and off the water would be well-received and would result in long-term, minor to moderate, beneficial impacts.

In the short term, there would be inconveniences that would occur as a result of construction activities and traffic associated with each expansion, relocation, or new construction activity. The impacts from construction activities would be negligible to minor and adverse depending on the facility location and the methods used for construction. Construction-related impacts would cease upon completion of the construction activity.

The potential exists that increases in camp sites, lodge rooms, and family rental units could increase the number of boats using the launch ramp. While the exact volume of existing launches is not known, it is believed that the maximum capacity of the launch ramp is not fully utilized. The capacity of the launch facilities to launch boats would be expected to accommodate additional boats resulting from expanded accommodations and facilities. Visitor experience could be adversely impacted by increased congestion and delays in launching/retrieving should boaters not take advantage of less busy times at the launch facilities. Mitigation in the form of increased use of management strategies to provide information on the status of congestion at the ramp, availability of 24-hour launching, and encouraging launching during off-peak hours would reduce long-term adverse impacts to a negligible level.

With the addition of 55 buoy field moorings and development of the rental boat fleet to 580 boats, the combined capacity to launch boats at the Bullfrog and Halls Crossing Marinas would exceed carrying capacity at lake elevation 3,700 by 157 launches per day.

Recreational quality was evaluated as a limiting factor in the supplemental calculations to the 1987 CCS and found it to be a primary limiting factor for all zones at differing lake elevations. However, the 2005 Visitor Survey respondents indicated overwhelmingly that recreational quality (seeing, hearing, and/or recreating in close proximity to others) is not an issue for them. While increased numbers of boats and visitors may impact visitor experience, that impact is

mitigated by the fact that survey respondents indicated a high level of acceptance for changes in experience in order to continue to have unrestricted access to Lake Powell. Therefore, no adverse impacts to visitor use and experience would be expected as a result of increased facilities and accommodations and full use of existing launch capability that could facilitate increased visitation, use, and numbers of boats on Lake Powell.

Physical capacity (number of shoreline campsites) is identified in the supplemental calculations to the CCS as the limiting factor in zone 7 at lake elevations 3,700 and 3,600; and in zone 10 at lake elevation 3,550. The CCS assumed 100 feet of shoreline with a slope of 25% or less would be required for each shoreline campsite. Should the launch ramps be used at their full capacity and marina facilities be expanded as proposed under alternative B, the number of boaters seeking shoreline campsites in some zones could exceed the availability of sites in some zones. This could force boaters who want to shoreline camp to camp closer than 100 feet away from the adjacent campsites. Because visitor survey respondents indicated that recreational quality is not an issue for them, closer proximity camping would only result in long-term, negligible to minor, adverse impacts on visitor use and experience.

Closer proximity shoreline camping (campers electing to camp closer than 100 feet apart) could result in increased shoreline impacts, such as increased incidence of trash and fire rings. Because shoreline litter is perceived as a moderate to serious problem, increased impacts resulting from closer proximity shoreline camping could further contribute to adverse impacts to visitor use and experience. As a mitigation measure the recreation area would expand the existing Trash Tracker program as well as ongoing visitor education efforts that provide trash bags to encourage "pack it in / pack it out."

Boaters who cannot find shoreline campsites in their preferred location/zone may redistribute to other zones in order to shoreline boat camp. Because Visitor Survey respondents indicated that finding shoreline campsites is a moderate to serious problem, choosing to relocate to another zone in order to find shoreline camp sites may adversely impact boaters experience in the long term because they are unable to shoreline camp in their preferred location. Mitigation in the form of increased use of management tools to provide information that would direct boaters seeking shoreline campsites to less-used areas would reduce adverse impacts.

Supplementing power systems with solar and / or fuel-cell technology as appropriate would have a long-term minor beneficial impact on visitor use and experience, as the National Park Service is considered a leader in sustainable practices. The use of solar and / or fuel-cell technology at the recreation area would be actively promoted by Glen Canyon NRA.

Short- and long-term adverse impacts to visitor use and experience from construction and increased use of Lake Powell affecting shoreline camping and litter would be negligible to minor.

Mitigation measures implemented in the 1990s to address human waste impacts on water quality at Lake Powell were highly successful, so much so that water quality is no longer a limiting factor in calculating carrying capacity. It is expected that implementation of mitigation measures to address issues with shoreline camping and litter would be equally successful. However, should proactive visitor contacts redirecting visitors to less-used shoreline campsite and less-busy launch times prove inadequate mitigation of potential adverse impacts to visitor

use and experience, the recreation area could implement permit systems to more effectively manage launching, shoreline campsite occupancy, and length-of-stay in heavily impacted zones.

In summary, most visitors would make use of one or more of the improvements or expansions and would be positively impacted by the relocations. Because many visitors to Glen Canyon NRA are repeat visitors, they would generally be aware of changes and react in a favorable manner. With mitigation, adverse impacts associated with increased use would only slightly offset beneficial impacts. The overall impacts to visitor use and experience as a result of alternative B would be short term, minor and adverse and long term, minor, and beneficial.

**Cumulative Impacts.** Road and highway improvements would have a short-term adverse impact on visitor use and experience on visitors traveling the roads to reach the uplake areas due to traffic delays, and long-term beneficial impacts by improving the routes visitors travel. Development in surrounding areas would have a beneficial impact on visitor use and experience by providing visitor services, in addition to the limited services available within the recreation area. Cumulative impacts, including impacts of alternative B, would be short term, minor, and adverse and long term, minor to moderate, and beneficial.

**Conclusion.** Short-term impacts to visitor use and experience as a result of activities associated with expansion, relocation or construction of facilities at the uplake areas would be minor and adverse. Long-term impacts to visitor use and experience would be minor and beneficial. Cumulative impacts, including impacts of alternative B would be short term, minor, and adverse and long term, minor to moderate, and beneficial.

### Alternative C

**Impact Analysis.** Alternative C would implement many of the same changes as alternative B though there are differences as follows:

- The Halls Crossing RV park would be consolidated with the campground in the existing campground location and shower and laundry facilities would be constructed in the campground rather than at the Village Center, and an amphitheater would be added.
- A land-based ranger station and emergency facilities building would be constructed at either the Village Center or campground at Halls Crossing.
- The NPS maintenance facilities at Bullfrog would be relocated to east of the family rental units.
- A hardened surface would be applied to new parking areas or roads rather than allowing them to remain as dirt or gravel.
- Wet moorage at the marina facilities would be extended to a greater number than in alternative B.
- Launch ramps would be constructed to access low water levels at a width of 150 feet.
- A land-based boat pump-out facility would be constructed at Hite.

Additional relocation of facilities and consolidation of like uses under alternative C would further enhance visitor use and experience by improving traffic flow patterns and reducing the number of visitors experiencing fewer conflicts with deliveries while improving the viewscape.

Supplementing power systems with solar and / or fuel-cell technology as appropriate would have a long-term minor beneficial impact on visitor use and experience, as the National Park Service is considered a leader in sustainable practices. The use of solar and / or fuel-cell technology at the recreation area would be actively promoted by Glen Canyon NRA.

Over half of respondents to the 2005 visitor survey indicated that the amount of time spent waiting in line to launch a boat was a moderate or serious problem. The experience of numerous visitors would be improved through the increased width and length of launch ramps, allowing for speedier launches and providing visitor access to the recreational resource at lower lake levels and through expanded wet moorage.

Adverse impacts from increased visitation to launching, shoreline camping, and litter control would be much the same as those described under alternative B. Under alternative C, water-based facilities would be increased by 56 wet slips; the equivalent of 11 additional launches per day. The combined capacity to launch boats at the Bullfrog and Halls Crossing Marinas would exceed carrying capacity at lake elevation 3,700 by 168 launches per day under alternative C. This increase would not change the impacts as described under alternative B. Short- and long-term adverse impacts to visitor use and experience from construction and increased use of Lake Powell affecting shoreline camping and litter would be negligible to minor.

Impacts from short-term inconveniences associated with construction would be the same as alternative B and would be short term, minor, and adverse. The long-term impacts from alternative C would be minor to moderate and beneficial.

**Cumulative Impacts.** Road and highway improvements would have a short-term adverse impact on visitor use and experience on visitors traveling the roads to reach the uplake district developed areas due to traffic delays, and long-term beneficial impacts by improving the routes visitors travel. Development in surrounding areas would have a beneficial impact on visitor use and experience by providing visitor services, in addition to the limited services available within the recreation area. Cumulative impacts, including impacts of alternative C would be short term, minor, and adverse and long term, minor to moderate, and beneficial.

**Conclusion.** Short-term impacts to visitor use and experience as a result of activities associated with expansion, relocation, or construction of facilities at the uplake areas would be minor and adverse. Long-term impacts to visitor use and experience would be minor to moderate and beneficial. Cumulative impacts, including impacts of alternative C, would be short term, minor, and adverse; and long term, minor to moderate, and beneficial.

## Socioeconomic Environment

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for socioeconomics:

| Desired Conditions | Sources |
|---|---|
| Public participation in planning and decision-making ensures that the National Park Service fully understands and considers the public's interests in Glen Canyon NRA, which is part of their national heritage, cultural traditions and community surroundings. The service actively seeks out and consults with existing and potential visitors, neighbors, people with traditional cultural ties to national recreation area lands, scientists and scholars, concessioner, cooperating associations, gateway communities, other partners and government agencies. | NPS *Management Policies 2001* |
| The service works cooperatively with others to improve the condition of Glen Canyon NRA to enhance public service; and to integrate the national recreation area into sustainable ecological, cultural and socioeconomic systems. | NPS *Management Policies 2001* |
| In the spirit of partnership, the service seeks opportunities for cooperative management agreements with state or local agencies that will allow for more effective and efficient management of Glen Canyon NRA. | NPS *Management Policies 2001*<br>National Parks Omnibus Management Act of 1998, Section 802 |
| Possible conflicts between alternatives and land-use plans, policies or controls for the area concerned (including those of local and state governments and Indian tribes) and the extent to which the national recreation area will reconcile the conflict are identified in environmental documents. | National Environmental Policy Act |

### Methodology

In evaluating the impacts on socioeconomic resources, commercial operations within Glen Canyon NRA, in adjacent communities and in the region were considered. Impacts on socioeconomic resources for each alternative are included in the consequences section.

| Impact Intensity | Socioeconomic Intensity Definition |
|---|---|
| Negligible | No effects would occur or the effects on socioeconomic conditions would be below or at the level of detection. The effect would be slight and no long-term effects on socioeconomic conditions would occur. |
| Minor | The effects to socioeconomic conditions would be detectable. Any adverse or beneficial effects would be small. If mitigation were needed to offset potential adverse effects, it would be simple and successful. |

| Impact Intensity | Socioeconomic Intensity Definition |
|---|---|
| Moderate | The effects on socioeconomic conditions would be readily apparent and likely long term. Any adverse or beneficial 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, long term and would cause substantial adverse or beneficial changes to socioeconomic conditions in the region. If mitigation measures were required to offset potential adverse effects, they would be expensive and their success could not be guaranteed. |

Socioeconomic effects would be short term if the effects last one year or less and long term if effects last longer than one year.

### Alternative A (No Action)

**Impact Analysis.** Alternative A would allow current uses to continue. As noted under "Visitor Use and Experience," the no-action alternative does not contemplate an increase in facilities to accommodate growth in visitor use at NRA uplake areas.

Visitation did not increase during the recent six years of drought, but visitation did grow steadily for 20 years prior to that time. Visitation would be expected to increase again as the water level returns to nearer full pool.

However, assuming no change to services or facilities under alternative A, there would potentially be long-term minor adverse socioeconomic impacts to visitor use from two sources: (1) the quality of the overnight visitor experience at Halls Crossing and Hite would potentially decline from the aging of visitor accommodations and other facilities, and (2) future drought conditions would potentially impact visitor use if changes to launch and water-based facilities are not made to accommodate low water levels. Either or both of these impacts would potentially shift the future growth trend of visitor use at the NRA to lower than the trend that could be projected from the past under normal water levels.

Impacts to visitor use would spill over to commercial operations within the NRA and in gateway communities. Commercial operations would experience the impact under alternative A as less-than-expected business growth in the long term. Impacts to business receipts and employment and to personal income would be long term, minor, and adverse.

Impacts to business activity and personal income under alternative A would lead to proportionate impacts to local government revenues that are derived from sales taxes and from property (or "privilege") taxes. Revenue losses would adversely impact the fiscal condition of local government, schools, and other taxing jurisdictions. Though service providers may see lower variable costs as well as lower revenues, overhanging fixed costs would potentially create long-term minor adverse impacts. Fiscal impacts would affect the local government's ability to maintain tax-supported service capacity and quality in the long term.

Under alternative A, impacts to the economy and local government fiscal conditions in towns near the uplake developed areas and associated counties would be negligible to minor, long

term, and adverse. With no additional investment in facilities under alternative A, more impact to visitor use is likely to occur over time as family rental units age and show maintenance and livability issues. Where effects to visitor use are greatest, impacts to the economy and to local government fiscal conditions would be long term, minor, and adverse.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact socioeconomics include the road and highway improvement projects, the proposed petroleum exploration well, and the potential for additional development in surrounding areas. The road improvement projects would result in short-term beneficial negligible impacts as a result of the potential jobs and spending during the road construction. In the long term, road improvements would provide negligible beneficial impacts in improving access to the uplake developed areas and surrounding communities. The proposed petroleum exploration well would provide negligible socioeconomic benefits as a result of the drilling activities. Potential development in surrounding areas would provide minor socioeconomic benefits. The overall cumulative socioeconomic impacts would be short term, negligible, beneficial and long term, negligible to minor, and beneficial. In combination with alternative A, the cumulative impacts would be long term, minor, and adverse as a result of the lack of future investment in recreation area facilities and long term, negligible to minor, and beneficial as a result of the potential for development in the surrounding areas.

**Conclusion.** Under alternative A, impacts to the economy and local government fiscal conditions in towns near the uplake developed areas and associated counties would be negligible to minor, long term and adverse. Where effects to visitor use are greatest, impacts to the economy and to local government fiscal conditions would be long term, minor, and adverse. In combination with alternative A, the cumulative impacts would be long term, minor, and adverse as a result of the lack of future investment in recreation area facilities and long term, negligible to minor, and beneficial as a result of the potential for development in the surrounding areas.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Alternative B would allow facility upgrades, expansion, and improvements up to and including those included in the existing DCPs for the uplake areas. Projects that could be undertaken under alternative B would potentially employ local construction labor and lead to local purchases of materials and services during the short-term construction period.

In general, alternative B would improve the overall visitor experience at the uplake areas and allow more visitors to make use of specific uplake facilities. Projects under alternative B are intended to accommodate anticipated growth in visitor use that is consistent with the growth trends of the past, given normal water levels. In addition, changes to launch ramps and water-based facilities would facilitate access to the water even when a drought occurs like that of recent years.

It is assumed that construction under alternative B would occur as budgets allow, that the individual projects would be relatively small, and that employment and spending would likely be split between local and nonlocal sources. The economic impact of construction under

alternative B would be generally beneficial. However, economic impacts would be cyclical as projects begin and end and would be minor and short term for each project because of their scope and economic leakage.

Alternative B would likely prevent deterioration of the visitor experience and loss of visitor use over time and facilitate normal visitation in the future even at low water levels like those from 1999 to 2004. Under alternative B, commercial operations in the NRA and communities nearby would gradually return to expected levels of business activity as suggested by the trend in visitor growth in the past at normal water levels. Expansions to concession facilities would be made as they are determined to be economically feasible. Occupancy information for various commercial services provided by the concessioner indicates that most services were 90 percent or more occupied during the peak visitor season even during years of drought and decreased visitation. This would seem to indicate that expansion of service levels would be warranted and economically viable with increased visitation.

Increasing the size of facilities and variety of services offered by concession operations in the recreation area would improve the profitability of concession contracts and perhaps increase the competitiveness for the contracts in the future. Increased competition for concession contracts could in turn result in increased franchise fees paid to the recreation area, which would increase future investment in infrastructure.

Alternative B would benefit businesses and the local economy by avoiding lost jobs, earnings, and public revenues, and by gradually restoring normal levels of activity and expectations for growth. The benefits of this part of alternative B to concessioners and to visitor-related business and public revenue would be beneficial, minor to moderate, and long term.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact socioeconomics include the road and highway improvement projects, the proposed petroleum exploration well, and the potential for additional development in surrounding areas. The road improvement projects would result in short-term beneficial negligible impacts as a result of the potential jobs and spending during the road construction. In the long term, road improvements would provide negligible beneficial impacts in improving access to the uplake developed areas and surrounding communities. The proposed petroleum exploration well would provide negligible socioeconomic benefits as a result of the drilling activities. Potential development in surrounding areas would provide minor socioeconomic benefits. The overall cumulative socioeconomic impacts would be short term, negligible, and beneficial and long term, negligible to minor, and beneficial. In combination with alternative B, the cumulative impacts would be short term, negligible to minor and beneficial and long term, minor to moderate, and beneficial as a result of the potential for development in the surrounding areas.

**Conclusion.** Impacts to socioeconomics from the construction projects planned as part of alternative B would be short term, minor and beneficial. The benefits of alternative B to concessioners and to visitor-related business and public revenue would be beneficial, minor to moderate, and long term. In combination with alternative B, the cumulative impacts would be short term negligible to minor and beneficial and long term minor to moderate and beneficial as a result of the potential for development in the surrounding areas.

### Alternative C

**Impact Analysis.** Alternative C is similar to alternative B but would include some additional construction spending for other changes, improvements, and upgrades to uplake facilities.

In general, additional construction projects under alternative C would occur occasionally as budgets allow. Individual projects would be relatively small, and the employment and spending associated with them would only be partly local. Thus, like alternative B, alternative C would result in short-term, minor, beneficial impacts as a result of construction projects.

Under alternative C commercial operations in the NRA and in communities nearby would be the same as under alternative B. The benefits of this part of alternative C to concessioners and to visitor-related business and public revenue would be long term, minor to moderate, and beneficial.

**Cumulative Impacts.** Other past, present, and reasonably foreseeable future projects with the potential to impact socioeconomics include the road and highway improvement projects, the proposed petroleum exploration well, and the potential for additional development in surrounding areas. The road improvement projects would result in short-term beneficial negligible impacts as a result of the potential jobs and spending during the road construction. In the long term, road improvements would provide negligible beneficial impacts in improving access to the uplake developed areas and surrounding communities. The proposed petroleum exploration well would provide negligible socioeconomic benefits as a result of the drilling activities. Potential development in surrounding areas would provide minor socioeconomic benefits. The overall cumulative socioeconomic impacts would be short term, negligible, and beneficial, and long term, negligible to minor, and beneficial. In combination with alternative C, the cumulative impacts would be short term, negligible to minor, and beneficial and long term, minor to moderate, and beneficial as a result of the potential for development in the surrounding areas.

**Conclusion.** Alternative C would result in short-term minor beneficial impacts as a result of construction projects. The benefits of alternative C to concessioners and to visitor-related business and public revenue would be long term minor to moderate, and beneficial. In combination with alternative C, the cumulative impacts would be short term, negligible to minor, and beneficial and long term, minor to moderate, and beneficial as a result of the potential for development in the surrounding areas.

## Park Operations

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for recreation area operations:

| Desired Conditions | Sources |
|---|---|
| Utilities within the national recreation area will be as unobtrusive as possible and will have the least possible resource impact. | NPS *Management Policies 2001* |
| The National Park Service will use municipal or other utility systems outside of the national recreation area whenever economically and environmentally practicable. | NPS *Management Policies 2001* |
| The National Park Service will use the least polluting power supply options, either through onsite generation or through power purchases, where appropriate, available and cost effective; or where such purchases help meet federal or state emissions goals or alternative energy goals. | NPS *Management Policies 2001* |

## Methodology

Impact thresholds are as follows:

| Impact Intensity | Recreation Area Operations Intensity Definition |
|---|---|
| Negligible | NRA 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 recreation area operations. |
| Minor | The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on recreation area operations. If mitigation were needed to offset adverse effects, it would be relatively simple and likely successful. |
| Moderate | The effects would be readily apparent and would result in a substantial change in recreation area operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and likely would be successful. |
| Major | The effects would be readily apparent and would result in a substantial change in recreation area operations in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, would be extensive, and their success could not be guaranteed. |

Impacts to recreation area operations would be short term if the effects last only for the duration of the construction activities, and long term if the effects last longer than the duration of the construction activities.

This park operations section analyzes impacts to the existing infrastructure and associated management requirements against the totality of park operations, both NPS and concessioner. What entity actually manages this infrastructure in the future is a function of available funding.

### Alternative A (No Action)

**Impact Analysis.** Under the no-action alternative, the current Bullfrog, Halls Crossing, and Hite facilities are adequately served by the water supply and sewage treatment facilities.

Over time, aging employee housing and visitor accommodations would affect recreation area operations as these units become increasingly difficult to maintain and require a greater investment of resources, which reduces resources available for other priorities. In addition, the quality, type, and quantity of housing available may impact the recreation area and concessioner's ability to recruit and retain high-quality employees. Maintaining current levels of housing and visitor accommodations would have a long-term minor adverse impact on recreation area operations.

Although recreation area operations are expected to remain constant, an increase in recreation area visitation is expected when water levels return to near full pool. Additional demands would occur on recreation area and concessioner staff to handle the increased visitation.

Overall impacts to recreation area operations from alternative A would be long term, minor, and adverse from meeting the ongoing maintenance needs of aging facilities and the increased demands as a result of increased visitation.

**Cumulative Impacts.** The proposed oil exploration well would result in a short- and long-term adverse impact to operations as the drilling operation would require ongoing monitoring by NRA staff to ensure the exploration is not damaging recreation area resources and is in compliance with operating permits. Development in surrounding areas could increase the number of incidental business permits for businesses based outside the recreation area and operating inside the recreation area, resulting in long-term increased management and oversight requirements as well as potentially negatively impacting concessioner operations. All of these past, present, and reasonably foreseeable future projects would result in short-term, negligible to minor, adverse impacts and long-term minor adverse impacts to recreation area operations. Cumulative impacts, including impacts of alternative A (no-action alternative), would result in long-term minor adverse impacts to recreation area operations.

**Conclusion.** Overall impacts to recreation area operations from alternative A (no-action alternative) would be long term, minor, and adverse from meeting the ongoing maintenance needs of aging facilities and the increased demands as a result of increased visitation. Cumulative impacts would result in long-term minor adverse impacts to recreation area operations.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Construction of additional facilities under alternative B would have a long-term minor adverse impact on recreation area operations because they are additions to the existing inventory of facilities that would accordingly increase operational requirements as well as future maintenance and repairs. Actual construction work for each of these projects would have short-term, minor to moderate, adverse impacts on recreation area operations through increased levels of activity and equipment in the vicinity of other recreation area

operations as well as the need for NRA staff for oversight. Beneficial impacts to recreation area operations from facility expansion not specifically discussed would be negligible or would have no impact.

Upgrading existing facilities such as employee housing and visitor accommodations would directly and indirectly impact NRA operations by replacing aged units with new units that require less maintenance and repair work. Construction of additional housing would provide housing that is essential for employees working in the remote uplake locations. Updated housing units could contribute to the NPS' and concessioners' ability to attract and retain quality employees, which would result in more efficient and cost-effective operations. This would result in long-term minor beneficial impacts to NRA operations.

Expansion of facilities may result in utility systems being inadequate to supply the development. Water and wastewater systems may require expansion as well, which would add to the operations and maintenance demands.

Under alternative B, power systems may be supplemented with solar and / or fuel-cell technology as appropriate. This potential use of "green" technology could result in negligible increases in maintenance and repair requirements of the system by using somewhat unproven technology, and ultimately would increase the complexity of the system. Some negligible cost benefits would be realized through use of these technologies. The beneficial and adverse impacts of the technology would offset each other.

In summary, short-term, negligible to minor, adverse impacts would occur to recreation area operations from construction activities; long-term minor adverse impacts would result from increased operational demands from facility expansion; and long-term minor beneficial impacts to recreation area operations would result from reduced maintenance and repair requirements for upgraded facilities and perhaps retention of quality staff.

**Cumulative Impacts.** The proposed oil exploration well would result in a short- and long-term adverse impact to NRA operations as the drilling operation would require ongoing monitoring by NRA staff to ensure the exploration is not damaging NRA resources and is incompliance with operating permits. Development in surrounding areas could increase the number of incidental business permits for businesses based outside the NRA and operating inside the NRA, resulting in long-term increased management and oversight requirements as well as potentially negatively impacting concessioner operations. All of these past, present, and reasonably foreseeable future projects would result in short-term, negligible to minor, adverse impacts and long-term minor adverse impacts to recreation area operations. Cumulative impacts, including alternative B, would result in short- and long-term, minor, and adverse impacts to recreation area operations.

**Conclusion.** Overall, short-term, negligible to minor, adverse impacts would occur to recreation area operations from construction activities; long-term, minor and adverse impacts would result from increased operational demands from facility expansion; and long-term minor beneficial impacts to recreation area operations would result from reduced maintenance and repair requirements for upgraded facilities. Cumulative impacts, including impacts of alternative A (no-action alternative), would result in short- and long-term, minor, adverse impacts to NRA operations.

## Alternative C

**Impact Analysis.** Many impacts to recreation area operations resulting from construction and operation of alternative C would be the same as those described for alternative B. Addition of a land-based visitor/ranger contact station in a combined emergency facility in association with the Village Center or campground at Halls Crossing under alternative C would consolidate all of these related activities and their related operational support (such as storage) into one location, which would improve operational efficiency. These improvements would result in long-term negligible beneficial impacts to recreation area operations.

Expansion of facilities may result in utility systems being inadequate to supply the development. Water and wastewater systems may require expansion as well, which would add to the operations and maintenance demands.

Under alternative C, power systems may be supplemented with solar and/or fuel-cell technology as appropriate. This potential use of "green" technology could result in negligible increases in maintenance and repair requirements of the system by using somewhat unproven technology, and ultimately would increase the complexity of the system. Some negligible cost benefits would be realized through use of these technologies. The beneficial and adverse impacts of the technology would offset each other.

Overall, under alternative C, short-term, negligible to minor, adverse impacts would occur to recreation area operations from construction activities; long-term minor adverse impacts would result from increased operational demands from facility expansion; and long-term minor beneficial impacts to recreation area operations would result from reduced maintenance and repair requirements for upgraded facilities.

**Cumulative Impacts.** The proposed oil exploration well would result in a short- and long-term adverse impact to NRA operations as the drilling operation would require ongoing monitoring by NRA staff to ensure the exploration operations are not damaging recreation area resources and are incompliance with operating permits. Development in surrounding areas could increase the number of incidental business permits for businesses based outside the recreation area and operating inside the recreation area, resulting in long-term increased management and oversight requirements as well as potentially negative impacts on concessioner operations. All of these past, present, and reasonably foreseeable future projects would result in short-term, negligible to minor, adverse impacts and long-term minor adverse impacts to recreation area operations. Cumulative impacts, including impacts of alternative C would result in short- and long-term minor and adverse impacts to recreation area operations.

**Conclusion.** Overall, under alternative C, short-term, negligible to minor, adverse impacts would occur to recreation area operations from construction activities; long-term minor adverse impacts would result from increased operational demands from facility expansion; and long-term minor beneficial impacts to recreation area operations would result from reduced maintenance and repair requirements for upgraded facilities. Cumulative impacts, including impacts of alternative C, would result in short- and long-term, minor, adverse impacts to recreation area operations.

## Public Health and Safety

### Regulation and Policy

| Desired Conditions | Sources |
|---|---|
| A safe and healthful environment is provided for visitors and employees. | NPS *Management Policies 2001* |
| Toxic and flammable chemicals are stored, used and disposed of properly so that accidental releases are prevented and the severity of releases that do occur is minimized. The national recreation area will have an oil and chemical spill response management plan. | Resource Conservation and Recovery Act<br>NPS *Management Policies 2001* |

Impacts on public health and safety were assessed by gathering information on public use at Bullfrog, Halls Crossing, and Hite from NPS staff and by using professional judgment, and were based on experience with similar projects. The following definitions were used in the assessment of impacts on public safety at Bullfrog, Halls Crossing, and Hite:

| Impact Intensity | Public Health and Safety Intensity Definition |
|---|---|
| Negligible | Health and safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on visitor or employee health and safety. |
| Minor | The effect would be detectable, but would not have an appreciable effect on health and safety. If mitigation were needed, it would be relatively simple and would likely be successful. |
| Moderate | The effects would be readily apparent and would result in substantial, noticeable effects to health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful. |
| Major | The effects would be readily apparent and would result in substantial, noticeable effects to health and safety on a regional scale. Extensive mitigation measures would be needed, and their success would not be guaranteed. |

The effects to safety are considered short term if the effects last for the period of construction and long term if the effects last beyond the period of construction.

### Alternative A (No Action)

**Impact Analysis.** Because no changes would occur to existing facilities at the uplake developed areas under the no-action alternative, there would be no impacts to health and safety.

**Cumulative Impacts.** Because there would be no impacts to health and safety under the no-action alternative, there would be no contribution to cumulative impacts.

**Conclusion.** Because no changes would occur to existing facilities at the uplake developed areas under the no-action alternative, there would be no impacts to health and safety. Because there would be no new impacts to health and safety under the no-action alternative, there would be no contribution to cumulative impacts.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B, some facilities would be expanded, receive upgrades, or be relocated which could adversely affect worker health and safety in the short term during construction. However, proper use of personal protective equipment and use of BMPs would reduce these adverse impacts to a negligible level. Expansion and/or upgrading of facilities and amenities would generally have no impact on public health and safety, with a few minor exceptions.

- Upgrades to utility systems, which include water and sewer systems, would ensure that facility expansion would not over-tax the water and sewer systems and risk exposing the public to raw sewage or compromise the potable water supply, resulting in long-term, negligible to minor, beneficial impacts.

- Improvements to roads and parking areas to accommodate added or relocated facilities would insure safe access for visitors in vehicles as well as pedestrians, resulting in long-term, negligible to minor, beneficial impacts.

In addition, the relocation of concessioner maintenance facilities away from the Village Center at Bullfrog would minimize the potential for health and safety issues as a result of visitors wandering into maintenance work areas or being exposed to chemicals resulting in long-term, negligible to minor, beneficial impacts.

The supplemental calculations to the CCS did not indicate that safety is a limiting factor in any zones at any lake elevations. Should monitoring of Lake Powell indicate that safety is becoming problematic, the entirety of a zone could be designated as wakeless (meaning that boats would be required to operate at low speeds so as not to create a wake). Boats moving at slower speeds require much less time and space to avoid collision, therefore a wakeless requirement would allow a greater number of boats to operate safely in the zone.

**Cumulative Impacts.** Road and highway improvements would have a short-term adverse impact on health and safety for visitors traveling the roads to reach the uplake district developed areas due to hazards associated with road work, and long-term beneficial impacts by maintaining or improving the safety of routes visitors travel. Overall cumulative impacts, including those of alternative B, would be short term, negligible to minor, and adverse and long term, minor, and beneficial.

**Conclusion.** Impacts to health and safety under alternative B would be short term, negligible and adverse, and long term negligible to minor, and beneficial. Overall cumulative impacts, including impacts of alternative B, would result in short-term, negligible to minor, adverse, and long-term minor beneficial impacts to health and safety.

### Alternative C

**Impact Analysis.** Under alternative C, in addition to the impacts described under alternative B, the existing ranger / visitor contact station and emergency facilities at Halls Crossing would be upgraded, and hardened surfaces would be added for new parking areas and roads accessing marina facilities. Overall impacts to health and safety would be the same as alternative B, and would be short term, negligible, and adverse and long term, minor, and beneficial.

**Cumulative Impacts.** Road and highway improvements would have a short-term adverse impact on health and safety for visitors traveling the roads to reach the uplake district developed areas due to hazards associated with road work, and long-term beneficial impacts by maintaining or improving the safety of routes visitors travel. Overall cumulative impacts to health and safety, including impacts of alternative C, would be short term, negligible to minor, and adverse, and long term, minor, and beneficial.

**Conclusion.** Overall impacts to health and safety from alternative C would be short term, negligible, and adverse, and long term, minor, and beneficial. Overall cumulative impacts to health and safety, including impacts of alternative C, would be short term, negligible to minor, and adverse, and long term, minor, and beneficial.

## Transportation

### Regulation and Policy

Current laws and policies require that the following conditions be achieved in Glen Canyon NRA for public health and safety, including transportation:

| Desired conditions | Sources |
|---|---|
| A safe and healthful environment is provided for visitors and employees. | NPS *Management Policies 2001* |
| Toxic and flammable chemicals are stored, used and disposed of properly so that accidental releases are prevented and the severity of releases that do occur is minimized. The national recreation area will have an oil and chemical spill response management plan. | Resource Conservation and Recovery Act<br>NPS *Management Policies 2001* |

### Methodology

The following definitions of intensity were used for the analysis of impacts on transportation and traffic:

| Impact Intensity | Transportation Intensity Definition |
|---|---|
| Negligible | Impacts would not include measurable or perceptible changes in transportation routes or traffic volumes. |
| Minor | Changes to traffic volumes would be anticipated to be less than 25%, with only slight changes to transportation routes (e.g., paving or realignment). New or improved roads and traffic devices consistent with expected traffic would be implemented to mitigate traffic volume increases in excess of 25%. |
| Moderate | Changes to traffic volumes would be anticipated to be between 26% and 75%, and changes to transportation routes would include new roads and traffic devices to partially mitigate for additional traffic. |
| Major | Changes to traffic volumes would be anticipated to be greater than 75%, and changes to transportation routes would include substantial new roads (greater than 50% increase to total road length over current conditions); new roads and traffic devices would not adequately mitigate for increased traffic volumes. |

### Alternative A (No Action)

**Impact Analysis.** Because no changes would be made under the no-action alternative there would be no impacts to transportation under the no-action alternative.

**Cumulative Impacts.** Because the no-action alternative would not impact transportation, there would be no cumulative impacts as a result of the no-action alternative.

**Conclusion.** Because no changes would be made under the no-action alternative, there would be no impacts to transportation under alternative A. Because the no-action alternative would not impact transportation, there would be no cumulative impacts as a result of the no-action alternative.

### Alternative B (Preferred Alternative)

**Impact Analysis.** Under alternative B no changes would be made to NPS maintenance facilities, airstrips, water-based stores, launch ramp support facilities, and the river runner takeout.

Expansion of some facilities in the recreation area would increase accommodation and amenities for existing visitors and add additional facilities for increased visitor numbers. Actual construction work for expansion of the expanded facilities would have a short-term, minor to moderate, adverse impact on transportation as equipment and activity would, in some cases, be located in the visitor use and recreation area operational areas that already experience heavy traffic and can be congested. In the long-term, impacts from increased visitors as a result of increased facilities would result in negligible adverse impacts to transportation.

Facility relocation proposed under alternative B would have beneficial impacts on transportation through improved traffic circulation and separation of maintenance facilities from high visitor use areas. These improvements would result in a long-term minor beneficial impact to transportation as traffic flow through the developed areas and access would be

improved, and conflicts with deliveries and other operational vehicles, and congestion would be reduced. Actual construction of relocated facilities and a road to the relocated secured storage / property maintenance area at Halls Crossing would have short-term minor adverse impacts to transportation.

Construction of an unimproved road to primitive shoreline camping at Hite would result in short-term minor adverse impacts due to the actual construction activity. Long-term minor beneficial impacts would result from a direct access route for visitors accessing the primitive shoreline camping area, preventing travel overland to reach shoreline camping.

The overall impacts to transportation from alternative B would be short term, minor, and adverse resulting from increased traffic and congestion during construction periods, and long term, minor, and beneficial resulting from consolidation of like activities, centrally locating facilities to reduce traffic, and improved circulation patterns.

**Cumulative Impacts.** Road and highway improvements and the proposed petroleum exploration well would result in minor adverse impacts from short-term increases in truck and heavy equipment operation and traffic within and/or in the vicinity of the uplake developed areas. Road and highway improvements would have long-term negligible beneficial impacts by improving the travel routes. The overall cumulative projects, including alternative B, would result in short-term minor adverse impacts and long-term minor beneficial impacts to transportation.

**Conclusion.** The overall impacts to transportation from alternative B would be short term minor and adverse resulting from increased traffic and congestion during construction periods; and long term, minor, and beneficial resulting from consolidation of like activities, centrally locating facilities to reduce traffic, and improved circulation patterns. The overall cumulative impact from projects, including impacts of alternative B, would result in short-term minor adverse impacts and long-term minor beneficial impacts to transportation.

### Alternative C

**Impact Analysis.** Most impacts under alternative C would be the same as those under alternative B. In addition to the improvements in alternative B, the Halls Crossing RV park would be consolidated with the campground at the existing campground location. This relocation further consolidates like uses and would negligibly reduce traffic and congestion. Impacts to transportation under alternative C would be the same as alternative B: short term, minor, and adverse, and long term, minor, and beneficial.

The overall impact to transportation from alternative C would be short term, minor, and adverse during the construction period and long term, minor, and beneficial from the consolidation of like activities and improvement of roads at low lake levels.

**Cumulative Impacts.** Road and highway improvements, the proposed petroleum exploration well would result in minor adverse impacts from short-term increases in truck and heavy equipment operation and traffic within and/or in the vicinity of the uplake developed areas. Road and highway improvements would have long-term negligible beneficial impacts by

improving the travel routes. The overall cumulative impact from projects, including alternative C, would result in short-term minor adverse impacts and long-term minor beneficial impacts to transportation.

**Conclusion.** The overall impacts to transportation from alternative C would be short term minor, and adverse during the construction period and long term, minor, and beneficial from the consolidation of like activities. The overall cumulative impact from projects, including impacts of alternative C, would result in short-term minor adverse impacts and long-term minor beneficial impacts to transportation.

# Consultation and Coordination

## CONSULTATION AND COORDINATION

During the planning process for the Uplake DCP/EA, formal and informal efforts were made by the National Park Service to involve the public, and federal, state, and local agencies in the planning process. The project was launched by requesting comments, through the scoping process, to determine the range of issues that affect the study areas and the issues the public has interest in through the planning process.

FIGURE 36. OPEN HOUSE MEETING

The NRA American Indian liaison conducted consultation with affiliated and interested tribes throughout the project. A summary of meeting minutes and trip reports are in appendix D.

As part of data gathering, various agencies were contacted for information during the planning process to supplement data obtained through recreation area studies, inventories, and NPS staff experts. This chapter describes those efforts in detail and is concluded with a list of individuals involved with the preparation and review of this document.

## AGENCY CONSULTATION

### Endangered and Special-Status Species

The Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*), requires that all federal agencies to consult with the USFWS to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitat. The National Park Service obtained a list of federally endangered, threatened, proposed, and candidate species that may occur in the Bullfrog, Halls Crossing, and Hite developed areas from the USFWS (see appendix D).

The USFWS is engaged in informal consultation with the National Park Service as part of the endangered and special-status species analysis in this DCP/EA. All consultation requirements must be completed as defined by section 7 of the Endangered Species Act before the DCP/EA can be finalized and a finding of no significant impact can be determined by the National Park Service.

## Cultural Resources

The NPS cultural resource management program operates in accordance with section 106 of the National Historic Preservation Act and 36 CFR Part 800, and other laws, regulations, and policies. In accordance with the National Historic Preservation Act, efforts were made to identify and consider traditional cultural places. Traditional cultural places are ethnographic resources that are eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that are (1) rooted in that community's history, and (2) important in maintaining the continuing cultural identity of the community. Construction activities would avoid impacting known cultural resources in compliance with section 106 of the National Historic Preservation Act and NPS policy. Cultural resource surveys would also occur for any areas not previously covered prior to any construction activities contemplated by this Uplake DCP. A copy of this DCP/EA would be sent to the Utah SHPO for concurrence on the proposed project activities and historic resource protection. Should unknown archeological resources be uncovered during construction, work would be halted in the discovery area, the site secured, and Glen Canyon NRA would consult according to 36 CFR 800.13 and, as appropriate, provisions of NAGPRA.

A scoping letter was sent to the Utah State Historic Society on March 24, 2004 (see appendix D). Newsletter updates have been sent to this office as part of ongoing agency coordination and public involvement during the project. No comments have been received to date. To continue coordination, the draft DCP/EA will be submitted to the Utah Sate Historic Society for comment during the public comment period.

Tribal consultation has been conducted using scoping brochures and presentations, and through participation and sharing of project updates at regular tribal meetings by the NRA American Indian liaison. Because the DCP/EA is a nonNAGPRA-related issue, ongoing consultation is with the 12 tribes that have traditionally expressed interest in activities at Glen Canyon NRA that are nonNAGPRA-related (see appendix D). The 12 tribes/nations include:

- Hopi Tribal Council, Arizona
- Havasupai Tribal Council, Arizona
- Hualapai Indian Tribal Council, Arizona
- Navajo Nation, Arizona, New Mexico & Utah
- Pueblo of Acoma, New Mexico
- Pueblo of Nambe, New Mexico
- Pueblo of San Juan, New Mexico
- Pueblo of Zuni, New Mexico
- Kaibab Paiute Tribal Council (this Tribal Band is included/Paiute Indian Tribe of Utah)
- Paiute Indian Tribe of Utah Council (Kanosh, Koosharem, Shivwits Bands)
- San Juan Southern Paiute Council, Arizona
- Ute Mountain Ute Tribal Council (White Mesa Ute Band) Colorado & Utah

## PUBLIC INVOLVEMENT

The purpose of the scoping process is to identify issues and concerns related to the project and to identify the range of issues to be addressed in the environmental assessment. In preparation for scoping, a mailing list of approximately 350 individuals was established. A scoping notice was prepared in February 2004, and mailed to those on the list. The scoping notice included a brief description of the issues and opportunities for public participation (i.e., the upcoming public scoping workshops). The notice referenced the Web site where readers could obtain more information and send comments. A press release was issued by the National Park Service, Glen Canyon NRA, in January announcing the initiation of the scoping meetings.

Two public scoping meetings were held in late February 2004 in Grand Junction, Colorado, and in Bullfrog, Utah. The public was notified of the meeting through press releases and a newsletter. The purpose of the meeting was to describe the project and existing conditions, and gather information. The attendees at the public meeting were asked to visit map stations where they could learn more information about key subjects, and provide to NPS representatives and the consulting team. Exhibits and topics presented at the meeting stations included:

- meeting sign-in / mailing list sign-up
- recreation area and project orientation
- existing site conditions
- the planning process
- future goals and comment station

Attendees provided their input through comment cards, on-site flipcharts, or to NPS representatives and consultants. Other comments were received from mail-in comment cards or by e-mail through the recreation area planning Web site.

A series on informal open house gatherings were conducted in Bullfrog and Halls Crossing in July 2004 to keep the visiting public informed about the project and to increase the mailing list. An additional newsletter was sent in August 2004 to a revised mailing list of approximately 2,400 individuals, agencies, and organizations.

NPS staff presented updates at quarterly meetings of the San Juan, Garfield, and Kane county commissioners throughout the project.

## INDIVIDUALS INVOLVED IN PREPARATION AND REVIEW OF THE DOCUMENT

### List of Preparers

This DCP/EA was prepared by engineering-environmental Management, Inc. ($e^2M$), under the direction of the National Park Service. Glen Canyon NRA park staff provided critical and valuable assistance in the development and technical review of this document.

### National Park Service

Kitty Roberts – Superintendent
Nancie Ames – Deputy Superintendent
Mark Anderson - Chief, Aquatic Resource Management
Dan Bishop – Chief, Facilities and Maintenance
Mary Lou Douglas – Concessions Management Specialist
Jacki Blais - Concessions Management Specialist
Liza Ermeling – Project Manager / Landscape Architect
Max King – Branch Chief, Interpretation
Chris Kincaid – Archeologist
Steve Luckesen – Uplake District Ranger
Mike Mayer – Chief Ranger
Lex Newcomb – GIS Specialist
Pat Quinn – Chief, Business Management
Hank Snyder – Chief of Resource Management and Interpretation
Chris Thompson – Uplake Maintenance Foreman
Stan White - Uplake Maintenance Supervisor
Barbara Wilson – Environmental Specialist/ Planner
Pauline Wilson - American Indian Liaison

### engineering-environmental Management, Inc. ($e^2M$)

Steve Yarbrough – Project Manager
Anne Baldrige – Environmental Conservation / Planning
Chris Baker – Cultural Resources Specialist
Sarah Boyes – GIS Specialist
Dale Lindeman - GIS Specialist
Schelle Frye – NEPA Planning Specialist
Wanda Gray Lafferty – Technical Publications Specialist
Keith Pohs – Technical Writer
Cheryl Schmidt, Ph.D. – Biologist
Jim von Loh – Biologist

### Applied Hydrology, Inc.

Cathy Begej – Hydrologist

### Lloyd Levy Consulting

Lloyd Levy – Socioeconomics

### List of Agencies and Organizations

Organizations and agencies contacted for information, or that assisted in identifying important issues, developing alternatives, or analyzing impacts; or that will be invited to review and comment on the DCP/EA are listed below.

#### Federal Agencies

Canyonlands National Park
Capitol Reef National Park
U.S. Army Corps of Engineers
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

#### State Agencies

Utah Department of Environmental Quality
Utah Department of Natural Resources
Utah Division of Wildlife Resources
Utah State Historic Society

#### Local Governments / Organizations

ARAMARK Sports and Entertainment Services, Inc.
City of Blanding
City of Hanksville
Garfield County
Kane County
San Juan County

#### Native American Tribes and Chapters

In 1995, Glen Canyon NRA and Rainbow Bridge National Monument contacted 36 American Indian tribes potentially affiliated with Glen Canyon NRA and/or Rainbow Bridge National Monument. These contacts were made to determine those tribes who wished to consult with Glen Canyon NRA and Rainbow Bridge National Monument on matters relating to the implementation of NAGPRA of 1990. At that time, 12 tribes responded that their communities were closely affiliated with Glen Canyon NRA and/or Rainbow Bridge National Monument and that they would like to be consulted. Since the original list of 36 tribes was constructed to reflect all American Indian tribes having the potential of historic and cultural affiliation, the resulting shorter list has since been routinely used to consult on a wider range of issues.

The preparation of the DCP/EA is considered one of the nonNAGPRA-related projects. Since Glen Canyon NRA has routinely used the list of 12 tribes to consult on other nonNAGPRA-related work such as planning, management, and visitor education activities, it would be consistent to use this shorter list for consultation on the DCP/EA including:

Hopi Tribal Council, Arizona
Havasupai Tribal Council, Arizona
Hualapai Indian Tribal Council, Arizona
Kaibab Paiute Tribal Council (This Tribal Band is included/Paiute Indian Tribe of Utah)
Navajo Nation, Arizona, New Mexico & Utah
Pueblo of Acoma, New Mexico
Pueblo of Nambe, New Mexico
Pueblo of San Juan, New Mexico
Pueblo of Zuni, New Mexico
Paiute Indian Tribe of Utah Council (Kanosh, Koosharem, Shivwits Bands)
San Juan Southern Paiute Council, Arizona
Ute Mountain Ute Tribal Council (White Mesa Ute Band), Colorado & Utah

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# Appendix A – Public Involvement

# Glen Canyon
## National Recreation Area

National Park Service
U.S. Department of the Interior

**Project Scoping** **February 2004**

### Glen Canyon National Recreation Area Uplake Development Concept Plan / Environmental Assessment

In December 2003, the National Park Service initiated work on a Development Concept Plan (DCP) and Environmental Assessment (EA) for Bullfrog, Halls Crossing, and Hite marina areas. The DCPs for these areas were approved almost 20 years ago and an update is needed due the changing lake conditions and the age of various lake facilities. This DCP will address lake access issues during fluctuating lake levels and evaluate visitor services, infrastructure, and facility needs. The new DCP is intended to guide future development for the next 15+ years. The EA will evaluate potential impacts to the environment from the DCP alternatives in accordance with the National Environmental Policy Act and the National Historic Preservation Act.

### Background

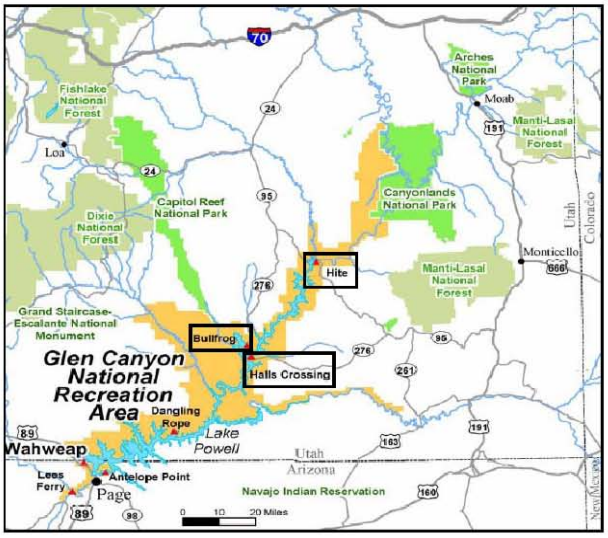
Bullfrog, Halls Crossing, and Hite developed areas lie on the northern end of Lake Powell in Glen Canyon National Recreation Area (NRA). Bullfrog lies in Kane and Garfield Counties, Utah, while Halls Crossing and Hite lie in San Juan County, Utah. Bullfrog is the largest marina on the northern portion of Lake Powell and Hite is the northernmost marina on the lake. The Hite marina is unique in that it services both lake and river boaters. For purposes of the DCP/EA, the Hite developed area consists of Hite, Farley Canyon, White Canyon, and Blue Notch Canyon.

Facilities and services found at all three areas at traditional lake levels include ranger stations, wet and dry boat storage, employee housing, boat and car fuel stations, post offices, boat repair facilities, visitor centers, boat rentals, launch ramps, campgrounds, public rental units (housekeeping units), sanitary waste pump-out and disposal stations, and emergency medical response.

Additional facilities at Bullfrog include a hotel, food service, a snack bar facility, grocery store, firehouse, and ferry service to Halls Crossing. Primitive, developed, and shoreline camping are available at Bullfrog.

Additional facilities available at Halls Crossing include a floating store, snack bar, and ferry service to Bullfrog. Only developed camping is available at Halls Crossing.

Primitive and shoreline camping are available at Hite.




### Public Meetings

You are invited to attend one of the public meetings to be held on the Glen Canyon NRA Uplake DCP/EA.

The meetings will begin with a short presentation that will be repeated each hour, if appropriate. The public is then invited to view display stations highlighting various aspects of the project and study area. There will be a time of informal interaction with exhibits and opportunities to make written and verbal comments.

**February 27, 2004** **6:00 - 8:00 PM (local time)**

Grand Junction City Hall
250 North 5th Street
Grand Junction, Colorado

**February 28, 2004** **12:00 - 2:00 PM (local time)**

Lake Powell School
Glen Canyon National Recreation Area
Bullfrog, Utah

**Overview of Process / Schedule**

The overall planning process is anticipated to extend over a period of approximately 12 months. Project milestones include:

| | |
|---|---|
| Project Initiation | December 2003 |
| Data Collection and Studies | January - June 2004 |
| Public Scoping Meetings | February 27 and 28, 2004 |
| Scoping Period | February 1 through March 31, 2004 |
| Public Review of Draft DCP/EA | Fall 2004 |
| Completion of DCP/EA | Late Fall/Early Winter 2004 |

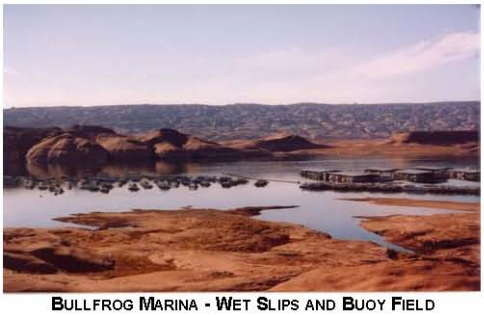
**What does the scoping period mean?** Scoping is done in the initial phase of a project to seek input from a variety of sources. The input is used to identify issues, areas requiring additional study, and topics that will be analyzed in the DCP/EA process. The scoping period is an opportunity for you to provide us with your suggestions, comments, and concerns regarding the Glen Canyon NRA uplake developed areas. Your comments will help to identify services, facilities, and infrastructure that will be evaluated in the DCP and potential environmental impacts associated with development.

**Is scoping my only opportunity to comment on the DCP/EA?** Once the draft DCP is developed, an EA is prepared and both documents will be made available for public review. Public comments will be collected for approximately 30 days.

**Overall Objectives**

The purpose of this DCP is to implement the objectives of the Glen Canyon NRA General Management Plan. Some of the broad objectives of the General Management Plan include:

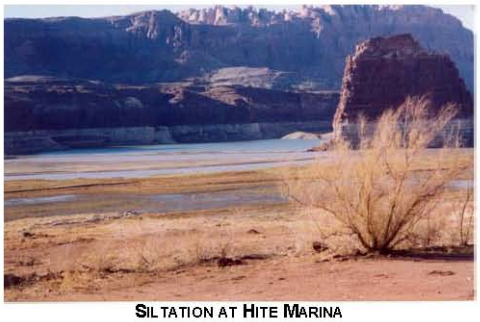
- Manage the recreation area so that it provides maximal recreational enjoyment to the American public and their guests.
- Maximize the recreational experience and the number of opportunities for enjoying the recreation area.
- Provide the richest possible interpretive experience to visitors to the recreation area.
- Manage the recreation area within its legislatively imposed constraints.



BULLFROG MARINA - WET SLIPS AND BUOY FIELD

In addition to the broad planning objectives for the area, other project objectives include:

- Preserve the quality of natural resources and recreational opportunities.
- Do not exceed land development allowances and established lake carrying capacities.
- Identify range of commercial, operational, and maintenance facilities appropriate to provide visitor opportunities and services at varying lake levels and access to shorelines.



SILTATION AT HITE MARINA

***We Want Your Comments!***

Anyone interested in this planning effort is encouraged to visit the Glen Canyon NRA Web site at **http://www.nps.gov/glca/plan.htm**, which contains information on current project activities and links to project comment forms. Your comments can be e-mailed to:

**glca_uplake_dcpea@nps.gov**

Or you may send your written comments to:

**National Park Service**
**Glen Canyon National Recreation Area**
**ATTN: GLCA Uplake DCP/EA**
**PO Box 1507**
**Page, AZ 86040**

**Please provide your comments to us no later than March 31, 2004**

**Glen Canyon**
**National Recreation Area**

National Park Service
U.S. Department of the Interior

# Scoping Comment Form

Glen Canyon National Recreation Area
Uplake Development Concept Plan / Environmental Assessment

Use this form to share your thoughts with us. Feel free to attach additional sheets if necessary. Fold the form in thirds so that the National Park Service return address is visible, tape closed, add a first-class stamp, and mail. Please send us your comments by **March 31, 2004**, or respond by e-mail at: **glca_uplake_dcpea@nps.gov**

Please be aware that names and addresses of respondents may be released under the Freedom of Information Act. Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the record, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold from the record a responder's identity, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your written comments. We will make all submissions from organizations or businesses and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

**Hite (including Hite, Farley Canyon, White Canyon, and Blue Notch Canyon)**
What are the issues and concerns you see with development at Hite? What facilities would you like to see added or enhanced? What facilities would you like to see eliminated?

What environmental issues are of concern at Hite?

**Bullfrog**
What are the issues and concerns with development at Bullfrog? What facilities would you like to see added or enhanced? What facilities would you like to see eliminated?

What environmental issues are of concern at Bullfrog?

**Halls Crossing**
What are the issues and concerns you see with development at Halls Crossing? What facilities would you like to see added or enhanced? What facilities would you like to see eliminated?

What environmental issues are of concern at Halls Crossing?

**National Park Service**
**c/o e²M**
**1510 West Canal Court, Suite 2000**
**Littleton, CO 80120**

---

**Please *print* your name and address below, then check any boxes that may apply.**

Name: _____

Address: _____

_____

City, State, Zip Code: _____

- ☐ Please add my name to the mailing list.
- ☐ Please keep my name on the mailing list.
- ☐ Please remove my name from the mailing list.
- ☐ Please note corrections to my name or address.

---

Place Stamp Here

National Park Service
Glen Canyon National Recreation Area
ATTN: GLCA Uplake DCP / EA
PO Box 1507
Page, AZ 86040

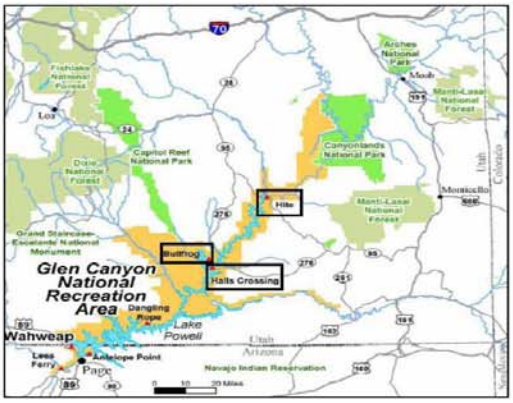
# Planning Project Opportunity

## Drop by this weekend to learn about the Uplake Development Concept Plan and Environmental Assessment process & progress this weekend!

### Background

In December 2003, the National Park Service initiated work on a Development Concept Plan (DCP) and Environmental Assessment (EA) for Bullfrog, Halls Crossing, and Hite marina areas. The DCPs for these areas were approved almost 20 years ago and an update is needed due to changing lake conditions and the age of various facilities. This DCP will address lake access issues during fluctuating lake levels and evaluate visitor services, infrastructure, and facility needs. The new DCP is intended to guide future development for the next 15+ years. The EA will evaluate potential impacts to the environment from the DCP alternatives in accordance with the National Environmental Policy Act and the National Historic Preservation Act.

### Project Study Areas




### Where we are in the planning process

| Completed | Item Description | Target Date |
|---|---|---|
| ☑ | Project Initiation | December 2003 |
| ☑ | Data Collection and Studies | January - July 2004 |
| ☑ | Public Scoping Meetings | February 27 and 28, 2004 |
| ☑ | Public Comment - Scoping Period | February 1 through March 31, 2004 |
| ☐ | **Develop range of DCP Alternatives** | **March – August 2004** |
| ☐ | Evaluation of alternatives (Development of EA document) | June – September 2004 |
| ☐ | Public Review of Draft DCP/EA | Fall 2004 |
| ☐ | Completion of DCP/EA | Late Fall/Early Winter 2005 |

### Where you can find us this weekend!

**Friday July 23rd**

| | |
|---|---|
| 10:30 am - 12:30 pm | Bullfrog Conoco Fuel Station |
| 1:30 pm - 3:30 pm | Boat-n-Go store Bullfrog Marina |
| 4:30 pm - 6:30 pm | Bullfrog Lodge |

**Saturday July 24th**

| | |
|---|---|
| 10:00 am - 1:00 pm | Halls Crossing Marina Store |
| 4:30 pm - 6:30 pm | Bullfrog Lodge |

**Sunday July 25th**

| | |
|---|---|
| 9:00 am - 11:30 am | Bullfrog Boat-Ready/Picnic Area |

### Other sources for Information

Anyone interested in this planning effort is encouraged to visit the Glen Canyon NRA website at http://www.nps.gov/glca/plan.htm, and look for Uplake Development Concept Plan (DCP) and Environmental Assessment (EA).

A draft DCP/EA document will be available for public review and comment this fall and will provide you another opportunity for input!

**Want to be on our mailing list for project information? Send your mailing info to:**
Glen Canyon National Recreation Area • ATTN: GLCA Uplake DCP/EA • PO Box 1507 • Page, AZ 86040
or email to: glca_uplake_dcpea@nps.gov

# Glen Canyon National Recreation Area

Newsletter 2

**Project Update** **August 2004**

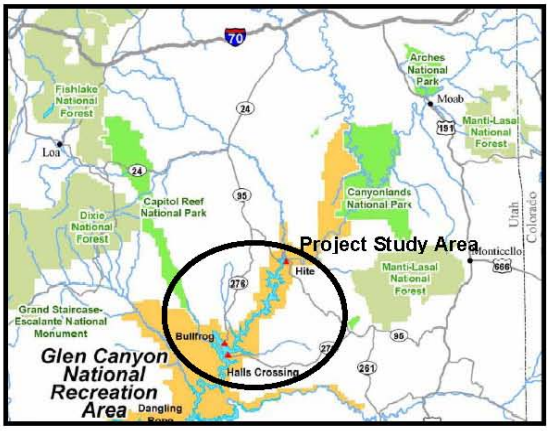
## Glen Canyon National Recreation Area Uplake Development Concept Plan / Environmental Assessment

In December 2003, the National Park Service initiated work on a Development Concept Plan (DCP) and Environmental Assessment (EA) for Bullfrog, Halls Crossing, and Hite Marina areas. The DCPs for these areas were approved almost 20 years ago and an update is needed due to the changing lake conditions and the age of various lake facilities. This DCP will address lake access issues during fluctuating lake levels and will evaluate visitor services, infrastructure, and facility needs. The new DCP is intended to guide future development for the next 15-plus years. The EA will evaluate potential impacts to the environment from the DCP alternatives, in accordance with the National Environmental Policy Act and the National Historic Preservation Act.

### Public Involvement

Public involvement is an integral part of the planning process. A number of public outreach activities have occurred since initiation of the work on the DCP/ EA. Public scoping meetings were held in Grand Junction, Colorado, and Bullfrog, Utah, in late February 2004. The project had an initial mailing list of 1,600 individuals, organizations, and agencies and has been expanded to include over 2,300 names. Meetings have been initiated with tribal representatives and will continue to be held throughout the planning process. A project information page has been established and is linked to the park Web site. This page provides ongoing information regarding the uplake DCP and EA. Information and draft alternatives were posted at the Bullfrog and Halls Crossing Marina areas in late July for visitor viewing.


PUBLIC SCOPING MEETING IN GRAND JUNCTION, COLORADO




### Project Issues

As a result of scoping meetings with the public, other agencies and organizations, and initial feedback from tribal consultation, the following issues were identified:

- access limitations to water-based facilities at varied lake levels
- long-range impacts of siltation
- the extent and scale of facilities available at specific marina areas
- traffic congestion and parking limitations at all marinas
- maintenance and extension of launch ramps
- protection of water quality
- availability of water-based restroom / pump-out facilities
- separation of houseboat rentals from other boat storage

### Project Schedule

| Item Description | Target Date | Completed |
|---|---|---|
| Project Initiation | 12/03 | ☑ |
| Data Collection and Studies | 12/03 – 7/04 | ☑ |
| Public Scoping Meetings | 2/04 | ☑ |
| Public Comment Scoping | 2/04 – 3/04 | ☑ |
| **Tribal Consultations** | **ongoing** | ☐ |
| **Development of Alternatives** | **3/04 – 9/04** | ☐ |
| **Evaluation of Alternatives (EA)** | **6/04 – 9/04** | ☐ |
| Public Review & Comment Draft DCP & EA | Fall 2004 | ☐ |
| Completion of DCP/EA | Early 2005 | ☐ |

**(bold items underway)**

**DCP Draft Alternatives Under Consideration**

Four alternatives for each uplake marina location have been developed based on feedback obtained during scoping. These alternatives address identified issues and represent a range of alternatives for consideration from no new development to major new development.

- **Alternative A (the no-action alternative)** represents no change from the current size, location, or scope of facilities and management practices, except for development currently funded and already under construction.
- **Alternative B (minor development)** represents minor changes to the current facilities at the uplake marinas, primarily in the form of facility upgrades and limited expansion or improvements.
- **Alternative C (moderate development)** includes some major improvements and expansions along with upgrades to some facilities.
- **Alternative D (major development)** represents the most significant opportunities for major changes to the facilities at the uplake marinas and includes major expansion projects as well as upgrades, relocation of existing facilities, and construction of new projects.


HALLS CROSSING AT LOW WATER IN EARLY 2004

**What do the alternatives under consideration mean?**

Input from the public, other agencies, and organizations is used to develop ideas on how the uplake marinas are to be managed in the future. These ideas are combined into various alternatives for management. The alternatives represent different approaches to management of the uplake marinas. After careful consideration, some alternatives may be eliminated for various reasons such as disturbance to a sensitive resource or cost. Alternatives not eliminated are carried forward for a full discussion in the draft DCP as alternatives under consideration. The draft DCP will also address any alternatives that have been eliminated, stating the reason for elimination.

**What are my opportunities to comment on the DCP/EA?**

Once the draft DCP is developed, an EA is prepared and both documents will be made available for public review. Public comments will be collected for approximately 30 days. Public review of the DCP is expected to occur in the fall of 2004.

HITE SILTATION DELTA – NOVEMBER 2003

**Low Water Consideration**

The alternatives considered for each marina area address a range of facilities appropriate for different levels of development and different water elevations. Within each alternative, changes in water level could further impact the experience on the lake including:

- location of marina facilities due to shoreline changes and proximity of marina to land-based support facilities and services
- visitor experience due to reduced side channel availability for isolated camping and recreation
- safety considerations due to reduced lake surface effects on the concentration and distribution of boaters
- launch ramp access due to changes in shoreline slope as water levels recede
- water quality impacts due to concentration of use at reduced shoreline

Management strategies will be developed and included in the draft DCP/EA with each alternative to address these concerns.


BULLFROG FERRY RAMP AT LOW WATER

A brief summary of alternatives for each marina are contained in the following tables. Full descriptions of each alternative will be included in the draft DCP and EA document during the public review period this fall.

## Draft Range of Alternatives - HITE & VICINITY

| Alternative A (No-Action Alternative) | Alternative B (Minor Development) | Alternative C (Moderate Development) | Alternative D (Major Development) |
|---|---|---|---|
| • Maintain employee housing | • Upgrade employee housing, maintain quantities | • Upgrade employee housing, add up to 5 employee RV sites | • Upgrade employee housing, add up to 5 employee RV sites |
| • Maintain family rental units | • Family rental units upgraded, expanded from 5 to up to 10 units | • Family rental units upgraded, expanded from 5 to up to 20 units | • Family rental units upgraded, expanded from 5 to up to 20 units |
| • Maintain primitive campground | • Upgrade campground amenities / utilities | • Upgrade campground amenities / utilities | • Upgrade campground amenities / utilities at Hite; add primitive camping at Blue Notch Canyon |
| • Shoreline camping | • Define shoreline campsites, add portable toilets at low water | • Define shoreline campsites / add portable toilets at low water | • Define shoreline campsites; add portable toilets at low water |
| • Maintain grocery store / fuel pumps / post office / RV dump station | • Upgrade store / RV dump station | • Upgrade store / RV dump station; add food service, shower, and laundry | • Upgrade store / RV dump station; add food service, shower, and laundry |
| • Maintain day-use area at Highway 95 overlook | • Improve day-use area at Highway 95 overlook | • Improve day-use area at Highway 95 overlook | • Improve day-use area at Highway 95 overlook; add day use area at Hite launch ramp |
| • Maintain visitor contact / EMS facilities | • Maintain visitor contact / EMS facilities | • Maintain visitor contact / EMS facilities | • Maintain visitor contact / EMS facilities |
| • Maintain dry boat storage | • Maintain dry boat storage | • Improve screening for dry boat storage | • Improve screening; expand dry boat storage from 107 to up to 160 boats |
| • Maintain launch ramp support facilities | • Maintain launch ramp support facilities | • Maintain launch ramp support facilities | • Maintain launch ramp support facilities at Hite; develop primitive launch ramp support facilities at Blue Notch Canyon |
| • Maintain utility systems | • Upgrade utility systems as needed | • Upgrade utility systems as needed | • Upgrade utility systems as needed at Hite; add primitive utility systems at Blue Notch Canyon |
| • Maintain automated fee collection | • Maintain automated fee collection | • Maintain automated fee collection | • Maintain automated fee collection at Hite; add fee collection at Blue Notch Canyon |
| • Maintain access (roadways and airstrip) and parking | • Maintain access (roadways and airstrip), expand parking | • Maintain access (roadways and airstrip), expand parking | • Maintain roadways and airstrip access; expand parking at Hite; improve Blue Notch Canyon and Red Canyon access / parking |
| • Maintain marina facilities, (rentals, buoys, and services) above lake elevation 3,610 ft. —below 3,610 ft. no marina facilities | • Maintain marina facilities; relocate rental operations / boat repair to Bullfrog above lake elevation 3,610 ft. (as long as silt levels allow) | • Limited marina facilities above lake elevation 3,610 ft. (as long as silt levels allow); relocate rental operations / boat repair to Bullfrog / Halls Crossing, reduce other services | • No marina facilities at Hite, fuel / pump-out at Blue Notch Canyon |
| • Maintain existing launching capabilities above lake elevation 3,610 ft. —below 3,610 ft. no launching | • Above lake elevation 3,610 ft., implement boat size launch restrictions as necessary due to siltation—below 3,610 ft. no launching | • Above lake elevation 3,610 ft., implement boat size launch restrictions, as siltation necessitates establish hoisting operation to maintain access, below 3,610 ft. lake elevation no launching | • No launching at Hite, launch ramp constructed at Blue Notch |
| • Maintain river takeout access | • Maintain river takeout access as siltation allows, evaluate alternate takeout locations | • Maintain river takeout access as siltation allows, evaluate alternate takeout locations | • Maintain river takeout access as siltation allows, evaluate alternate takeout locations |

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## Draft Range of Alternatives - HALLS CROSSING

| Alternative A (No-Action Alternative) | Alternative B (Minor Development) | Alternative C (Moderate Development) | Alternative D (Major Development) |
|---|---|---|---|
| • Maintain employee housing | • Upgrade employee housing, expand employee RV park from 3 sites to up to 12 sites | • Upgrade employee housing, expand employee housing units from 48 to up to 54 units, expand employee RV park from 3 sites to up to 12 sites | • Upgrade employee housing, expand employee housing units from 48 to up to 61 units, expand employee RV sites from 3 to up to 12 sites |
| • Maintain family rental units | • Upgrade family rental units, maintain quantity | • Upgrade family rental units, expand from 20 to up to 40 units | • Upgrade family rental units, expand from 20 to up to 60 units |
| • Maintain developed campground and RV park | • Campground and RV park upgraded, RV waste disposal upgraded, and amphitheater added | • Campground upgraded, RV park relocated to campground, RV waste disposal upgraded, amphitheater added | • Campground upgraded, RV park relocated to campground, campground expanded from 96 sites to up to 135 sites, RV waste disposal upgraded; amphitheater added |
| • Maintain shower / laundry facilities at campground and adjacent rental housekeeping units | • Shower / laundry facilities upgraded in existing locations | • Shower and laundry facilities upgraded, relocated to campground | • Shower and laundry facilities upgraded, relocated to campground |
| • Maintain store / fuel station / post office | • Post office / fuel station upgraded; store replaced | • Post office / fuel station upgraded, store replaced, snack bar added | • Post office / fuel station upgraded; store replaced; snack bar added |
| • Maintain San Juan County K-6 school | • Upgrade San Juan County school building | • Upgrade San Juan County school building | • Upgrade San Juan County school building |
| • No day-use facilities | • Day-use area constructed adjacent lower parking lot | • Day-use area constructed adjacent lower parking lot | • Day-use area constructed adjacent lower parking lot |
| • Maintain emergency services | • Upgrade helipad; relocate emergency services building | • Upgrade helipad, relocate emergency services building | • Upgrade helipad, relocate emergency services building |
| • Maintain NPS maintenance area | • Maintain NPS maintenance building, install visual screening | • Maintain NPS maintenance building, install visual screening | • Maintain NPS maintenance building, install visual screening; construct visitor contact station |
| • Maintain dry boat storage location / size | • Dry boat storage relocated, no change in size | • Dry boat storage relocated, no change in size | • Dry boat storage relocated, increased from 230 to up to 500 boats |
| • Maintain utility systems | • Maintain utility systems | • Maintain utility systems | • Upgrade utility systems as needed |
| • Maintain fee collection | • Maintain fee collection | • Maintain fee collection | • Maintain fee collection |
| • Maintain access and parking | • Maintain access, upgrade parking as needed | • Maintain access (roads and airstrip), upgrade parking as needed | • Maintain access (roads and airstrip); upgrade parking as needed |
| • Maintain marina facilities (buoy field, wet slips, rental boats, rental PWCs, services) | • Maintain marina services, add fishing dock, buoy field / wet slips to be consolidated with Bullfrog (split as appropriate between the two marinas with no change in quantity of buoys—with 54 added from Hite below lake elevation 3,600 ft.), total wet slips increased from 471 to up to 524, rental boats / rental boat maintenance relocated to Bullfrog | • Maintain marina services, add fishing dock, buoy field / wet slips to be consolidated with Bullfrog, split as appropriate between the two marinas with total buoys increased from 400 to up to 430 (with 54 added from Hite below lake elevation 3,600 ft.), total wet slips increased from 471 to up to 524, rental boats / rental boat maintenance relocated to Bullfrog | • Maintain marina services; add fishing dock, upgrade fuel docks, buoy field / wet slips to be consolidated with Bullfrog (split as appropriate between the two marinas with total buoys increased from 400 to up to 455, with 54 added from Hite below lake elevation 3,600 ft.), total wet slips increased from 471 to up to 524; rental boats / rental boat maintenance relocated to Bullfrog |
| • Maintain main launch ramp to water elevation 3,560 ft., below 3,560 ft.—no launching | • Maintain main launch ramp to water elevation 3,560 ft., below 3,560 ft. new launch ramp to be constructed | • Maintain main launch ramp to water elevation 3,560 ft., below 3,560 ft. new launch ramp to be constructed | • Maintain main launch ramp to water elevation 3,560 ft., below 3,560 ft. new launch ramp to be constructed |
| • Maintain ranger station / visitor contact | • Maintain ranger station / visitor contact | • Maintain ranger station / visitor contact | • Maintain ranger station / visitor contact |
| • Maintain ferry services at main ferry ramp to 3,618 ft., at main launch ramp to 3,550 ft., below 3,550 ft.—no ferry service | • Maintain ferry services at main ferry ramp to 3,618 ft., at main launch ramp to 3,550 ft., below 3,550 ft.—no ferry service | • Maintain ferry services at main ferry ramp to 3,618 ft., at main launch ramp to 3,550 ft., below 3,550 ft.—no ferry service | • Maintain ferry services at main ferry ramp to 3,618 ft., at main launch ramp to 3,550 ft., below 3,550 ft.—no ferry service |

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## Draft Range of Alternatives – BULLFROG

| Alternative A (No-Action Alternative) | Alternative B (Minor Development) | Alternative C (Moderate Development) | Alternative D (Major Development) |
|---|---|---|---|
| • Maintain employee / partner housing | • Upgrade employee / partner housing, relocate all employee housing to current NPS employee housing area, increase employee / partner housing from 206 units to up to 224 units, convert public RV park to up to 24-site employee RV park, construct employee shower / laundry facility | • Upgrade employee / partner housing, relocate all employee housing to current NPS employee housing area, increase employee / partner housing from 206 units to up to 246 units, convert public RV park to up to 24-site employee RV park, construct employee shower / laundry facility | • Upgrade employee / partner housing, relocate all employee housing to current NPS employee housing area, increase employee / partner housing from 206 units to up to 246 units, convert public RV park to up to 24-site employee RV park, construct employee shower / laundry facility |
| • Maintain lodge and family rental units | • Upgrade lodge and family rental units, no change in total units | • Upgrade lodge and family rental units, increase total number from 56 to up to 100 units | • Upgrade lodge and family rental units, increase total number from 56 to up to 150 units; add resort amenities |
| • Maintain developed campground and RV park | • Consolidate campground and RV park in campground location, expand from 102 sites to up to 180 total sites; add small store; add amphitheater | • Consolidate campground and RV park in campground location, expand from 102 sites to up to 180 total sites; add small store; add amphitheater | • Consolidate campground and RV park in campground location, expand from 102 sites to up to 180 total sites; add small store; add amphitheater |
| • Maintain shower / laundry facilities | • Relocate shower / laundry facilities to campground | • Relocate shower / laundry facilities to campground | • Relocate shower and laundry facilities to campground |
| • Maintain stores (village center store with fuel station, auto repair, gift shop, admin. offices and land-based marina store) | • Maintain stores (village center store with fuel station, auto repair, gift shop, administrative offices, land-based marina store) | • Expand village center stores / parking, upgrade administrative offices | • Expand village center stores / parking; add snack bar; upgrade administrative offices |
| • Maintain restaurant and snack bar | • Expand restaurant from 180 seats to up to 250 seats | • Expand restaurant from 180 seats to up to 250 seats; add second restaurant | • Expand restaurant from 180 to up to 250 seats, add second restaurant, expand snack bar |
| • Maintain ranger station / visitor contact station / emergency facilities | • Maintain ranger station / visitor contact station / emergency facilities | • Maintain ranger station / visitor contact station / emergency facilities | • Maintain ranger station / visitor contact station / emergency facilities |
| • Maintain boat maintenance / repair / property maintenance facility | • Improve screening of boat / property maintenance area | • Relocate boat maintenance / repair facility to dry boat storage | • Relocate boat maintenance / repair facility to dry-boat storage |
| • Maintain NPS maintenance area | • Improve screening at NPS maintenance area, expand water quality laboratory | • Improve screening at NPS maintenance area; expand water quality laboratory | • Relocate NPS maintenance area, expand water quality laboratory |
| • Maintain dry boat storage location and size | • Dry boat storage expanded from 750 boats to up to 1,000 boats, screening improved, space utilization evaluated | • Dry-boat storage expanded from 750 to up to 1,000 boats; screening improved, space utilization / covered storage evaluated | • Dry-boat storage expanded from 750 boats to up to 1,000 boats, screening improved, space utilization / covered storage evaluated |
| • Maintain utility systems, continue upgrades to sewage system | • Maintain water supply, expand power supply, continue upgrades to sewer system | • Maintain water supply, expand power supply, evaluate alternate power sources, continue upgrades to sewer system | • Maintain water supply with additional water storage, expand power supply, evaluate alternate power, continue upgrades to sewer system |
| • Maintain fee collection | • Maintain fee collection | • Upgrade fee collection | • Upgrade fee collection |
| • Maintain Lake Powell school | • Maintain Lake Powell school | • Maintain Lake Powell school; add library building | • Maintain Lake Powell school, add library building |
| • Maintain marina facilities (buoy field, wet slips, rental boats, rental PWCs, services) | • Maintain marina services, buoy field / wet slips consolidated with Halls Crossing (split as appropriate between the two marinas with no change in quantity of buoys—with 54 added from Hite below lake elevation 3,600 ft.), wet slips increased from 471 to up to 524, rental boats / rental boat maint. relocated to Bullfrog | • Maintain marina services, buoy field / wet slips consolidated with Halls Crossing (split as appropriate between the two marinas with buoys increased from 400 to up to 430—with 54 added from Hite below lake elevation 3,600), wet slips increased from 471 to up to 524, all rental boats / rental boat maint. relocated to Bullfrog | • Maintain marina services, add floating restaurant, buoy field / wet slips consolidated with Bullfrog (split as appropriate between marinas with buoys increased from 400 to up to 455—with 54 added from Hite below lake elevation 3,600 ft.), wet slips increased from 471 to up to 524, all rental boats / rental boats maint. relocated to Bullfrog |
| • Maintain 150-foot-wide main launch ramp to water elevation 3,605 ft., 75-foot-wide to 3,580 ft, north launch ramp paved to 3,583 ft., continue extending or relocating launch ramps as necessary to provide water access | • Widen main launch ramp to 150 feet to water elevation 3,580 ft. or lower, continue extending or relocating launch ramps as necessary to provide water access | • Widen main launch ramp to 150 feet to water elevation 3,580 ft. or lower, continue extending or relocating launch ramps as necessary to provide water access, evaluate methods to control launching | • Widen main launch ramp to 150 feet to water elevation 3,580 ft. or lower; continue extending or relocating launch ramps as necessary to provide water access, evaluate methods to control launching, add concessioner-only launch ramp |
| • Maintain ferry services at main ferry ramp to 3,600 ft., ferry launch ramp location moves as water levels drop—no ferry service below 3,550 ft. | • Maintain ferry services at main ferry ramp to 3,600 ft., ferry launch ramp location moves as water levels drop—no ferry service below 3,550 ft. | • Maintain ferry services at main ferry ramp to 3,600 ft., ferry launch ramp location moves as water levels drop—no ferry service below 3,550 ft. | • Maintain ferry services at main ferry ramp to 3,600 ft., ferry launch ramp location moves as water levels drop—no ferry service below 3,550 ft. |

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## Glen Canyon National Recreation Area

Newsletter 2

**Project Update**

**Anyone interested in this planning effort is encouraged to visit the Glen Canyon NRA Web site at http://www.nps.gov/glca/plan.htm, which contains information on current project activities.**

**If you want to be added to or removed from the mailing list or have changes to your current contact information for the mailing list, please send us an e-mail at glca_uplake_dcpea@nps.gov or write to us at Glen Canyon National Recreation Area ▪ ATTN: GLCA Uplake DCP/EA ▪ PO Box 1507 ▪ Page, AZ 86040**

BULLFROG LAUNCH RAMP JULY 2004

BULLFROG LAUNCH RAMP 1967

**National Park Service**
**Glen Canyon National Recreation Area**
**691 Scenic Drive / P.O. Box 1507**
**Page, AZ 86040**

*OMB # 1024-0224 (NPS # 05-018 )*
*Expires: 03/31/2006*

**Survey #_____**

# Glen Canyon National Recreation Area
# 2005 Visitor Survey

**Your feedback is important. The survey results will assist us in managing visitor services, improving facilities, and protecting our resources. Please note, when questions refer to Glen Canyon National Recreational Area / Lake Powell, it is in reference to the overall park. When questions refer to "the lake," it is specific to Lake Powell.**

**About Your Previous Visits to the Glen Canyon National Recreation Area / Lake Powell**

**1. Approximately how many times *(ever)* have you visited Glen Canyon National Recreation Area / Lake Powell?**

____ Never (SKIP TO QUESTION 22)

____ ONE time

____ 2 - 5 times

____ 6 - 10 times

____ more than 10 times

**2. In what month and year did you LAST visit Glen Canyon National Recreation Area/Lake Powell?**
Month: _____ Year: _____

**3. In what month and year did you FIRST visit Glen Canyon National Recreation Area/Lake Powell?**
Month: _____ Year: _____

**About Your Most Recent Visit to the Glen Canyon National Recreation Area/Lake Powell**

**Think about the YOUR MOST RECENT VISIT to Glen Canyon National Recreation Area/ Lake Powell. Share your opinions about that visit when you answer the following questions.**

**4. During your MOST RECENT visit to the Glen Canyon National Recreation Area/Lake Powell, who was with you?** *Please check all that apply.*

____No one. I traveled alone
____Family and/or friends
____Business
____Tour
____Other (please specify):

**5a. During your MOST RECENT visit to Glen Canyon National Recreation Area/Lake Powell, how many people were in your personal group? _____**

**5b. Was your personal group part of a tour group? ____ Yes ____No**

**6. Where did you access the lake the last time you visited?** ***Please check all that apply.***

____ Wahweap /Stateline ____ Bullfrog ____ Halls Crossing ____ Hite ___ Antelope Point

____ Other (please specify, e.g., Lone Rock, Farley Canyon):_____

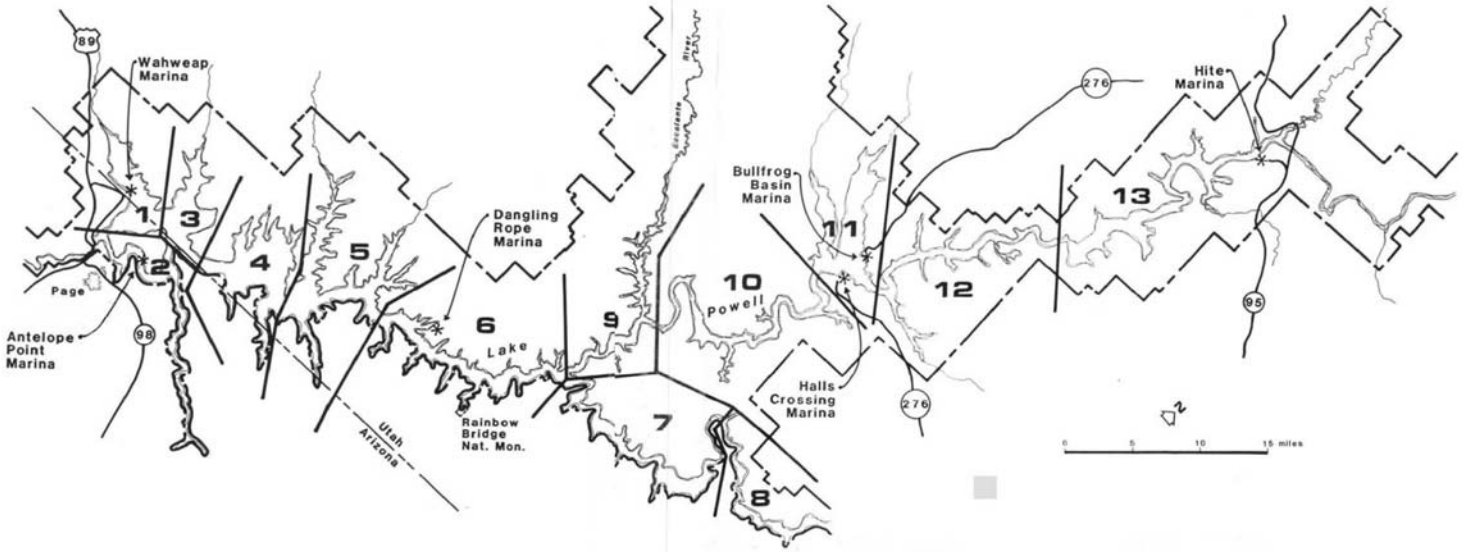
**7a. Please refer to the map of Glen Canyon/ Lake Powell on the following page. Please circle the ZONE or ZONES below indicating where you spent most of your time on the lake during your most recent visit:**

**1 2 3 4 5 6 7 8 9 10 11 12 13**

**7b. If you shoreline camped during your most recent visit, put an "X" on the map to show your approximate camp location(s).**

***<u>If you did not shoreline camp</u>*, please check here: ____**

2




**Zone 1:** Wahweap Bay, Wahweap Marina, Lone Rock
**Zone 2:** Glen Canyon Dam, Carl Hayden Visitor Center, Antelope Point Marina
**Zone 3:** Crosby Canyon, Warm Creek Bay, Castle Rock
**Zone 4:** Padre Bay, Gunsight Butte, Crossing of the Fathers
**Zone 5:** Last Chance Bay, Rock Creek Bay, Gregory Butte
**Zone 6:** Dangling Rope Marina, Rainbow Bridge, Cathedral Canyon
**Zone 7:** San Juan Arm, Bald Rock Canyon, Piute Canyon
**Zone 8:** Nokai Canyon, Copper Canyon
**Zone 9:** Cottonwood Canyon, Hole-in-the-Rock, Escalante River
**Zone 10:** The Rincon, Iceberg Canyon, Slick Rock Canyon
**Zone 11:** Bullfrog Marina, Halls Crossing Marina, Stanton Creek
**Zone 12:** Defiance House Ruin, Forgotten Canyon, Knowles Canyon
**Zone 13:** Hite Marina, Farley Canyon, Dirty Devil River, Colorado River

**8. Please look at the list of activities below. Please check *all* the activities you spent time participating in during your most recent visit to Glen Canyon National Recreation Area / Lake Powell.**

___ Hiking
___ Fishing
___ Hunting
___ Rock Climbing
___ Tour boat ride
___ Camping
___ Motor boating
___ Paddling (canoe or kayak)
___ Using a personal watercraft (PWC)
___ Participating in water sports
___ Mountain biking
___ Wildlife watching
___ Driving (Burr Trail, Hole in the Rock Road, etc.)
___ Visiting archaeological sites
___ Bird watching
___ Other (please list):_____

**9. During your most recent visit to the lake, how many nights did you spend at each location listed below? *Please write the number of nights spent at each location.***

____ I did not spend any nights at Lake Powell
____ # nights anchored on the lake
____ # nights shoreline vehicle camping
____ # nights shoreline boat camping
____ # nights backcountry camping using the lake to access
____ # nights in a developed campground at Lake Powell
____ # nights in a lodge or housekeeping unit at Lake Powell
____ # nights overnight in marina facilities (covered slips, etc.)
____ # nights camping in other locations (please specify):

## About your Watercraft Use on the Lake

**10. How many of each type of watercraft did you use on the lake during your most recent visit? Please indicate whether you owned or rented it.**

***If you did not use any watercraft,* please check here: ____.**

| Total number of watercraft | Type of watercraft | Number owned or co-owned | Number rented from onsite concessioner | Number rented from somewhere else |
|---|---|---|---|---|
| ____ | Houseboat | ____ | ____ | ____ |
| ____ | Runabout / Powerboat | ____ | ____ | ____ |
| ____ | Cabin cruiser | ____ | ____ | ____ |
| ____ | Personal watercraft (PWC) | ____ | ____ | ____ |
| ____ | Non-motorized watercraft (kayak, canoe, etc) | ____ | ____ | ____ |
| ____ | Water toys (skis, wakeboards, tubes, etc) | ____ | ____ | ____ |
| ____ | Other (please specify): | ____ | ____ | ____ |

## Your Preferences Regarding the Level of Human Activity at Glen Canyon / Lake Powell

**11. During your MOST RECENT visit to Lake Powell, how did you feel about the number of people and watercraft you saw on the lake?** *Please check one statement in each column.*

| People | Watercraft |
|---|---|
| ____ Fewer than expected | ____ Fewer than expected |
| ____ About what I expected | ____ About what I expected |
| ____ More than expected | ____ More than expected |
| ____ Don't know | ____ Don't know |

*****If you have only visited Glen Canyon/ Lake Powell one time, please skip to question 14.*****

4

**12. During your MOST RECENT visit to the Glen Canyon National Recreation Area/Lake Powell, how did you feel about the level of crowding on the lake?** *Please check one statement that best explains how you felt.*

____Less crowded than in the past
____About the same level of crowding as in the past } *Skip to Q-14*
____More crowded than in the past → *Continue to Q-13*
____Don't know

**13. If you felt the lake was more crowded than in the past, what was the reason?** ***Please check all that apply.***

____ More people and/or boats on the lake near me on the water than in the past
____ Lower water levels in the lake than in the past
____ More recreational activities occurring in an area
____ Camping closer together on the shoreline
____ Other reason (please specify):_____

**14a. Excluding marinas, fueling docks, and no wake zones, which *one* statement below best describes your preference for seeing and hearing other visitors during the majority of your visit to the lake?**

___ I prefer seeing or hearing a lot of other visitors and enjoy social interaction with individuals not in my group

___ I prefer seeing or hearing a moderate number of others, but not right next to my campsite or lake space

___ I prefer seeing or hearing some others, but not total isolation

___ I prefer seeing or hearing as few others as possible, total isolation

**14b. Lower lake levels result in less lake surface area and potentially require management strategies that limit lake access to maintain similar levels of crowding on the lake. These management strategies could limit your ability to access the lake.**

**If lake access was limited because of low water levels, which *one* statement below best describes the maximum human activity level you would be willing to accept to ensure you continue to have lake access**

___ My preference would remain unchanged

___ I would accept seeing or hearing any number of visitors to continue to have lake access

___ I would accept seeing or hearing a moderate number of others

___ I would accept seeing or hearing some others; I would not require total isolation

___ I would only accept seeing or hearing as few others as possible, total isolation

**15. We would like to know how you felt about seeing different levels of human activity at various locations during your most recent visit to the lake. Complete columns A, B and C for each location on the lake. If you did not visit the location, circle "no" in column A, and go to the next location. If you don't recall how you felt, circle "9" in column B.**

| | COLUMN A | COLUMN B | | | | | | | | COLUMN C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | In general, how acceptable was the level of human activity you saw? | | | | | | | | |
| **LOCATION** | **Did you visit the location?** ***(circle one)*** | Very Acceptable | | | | | | Very Unacceptable | Don't Recall | **If you circled 5, 6, or 7 in Column B, what made you feel this way?** ***(Please check all that apply)*** |
| 15a: At marina, fueling docks and no wake zones | yes<br>no *(go to 15b)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |
| 15b: On the lake surface, excluding no wake zone | yes<br>no *(go to 15c)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |
| 15c: On the lake shore | yes<br>no *(go to 15d)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |
| 15d: While camping at shoreline | yes<br>no *(go to 15e)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |
| 15e: At the launch ramp | yes<br>no *(go to 15f)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |
| 15f: Other (specify): | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | DR | _____too few watercraft<br>_____too many watercraft<br>_____too few people<br>_____too many people<br>_____something else (specify): |

**16. Which of the following unsafe boating practices did you observe on your most recent visit to the lake?** ***Please check all that apply.***

____ I did not observe any unsafe boating practices during my most recent visit to the lake.
____ proximity of boats
____ unsafe speeds
____ nonadherence to wakeless zones
____ other (please describe the unsafe activity and where it occurred):

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**Reasons for Your Visit to Glen Canyon National Recreation Area**

**17. Below is a list of possible experiences visitors may have while visiting Glen Canyon / Lake Powell. Please indicate how important each experience was to you *on your most recent visit*. Then, for each experience for which you circled either a *1 or 2*, please indicate how much you were able to attain each of those experiences.**

| Experience: | Very Important | Important | Neither Important nor Unimportant | Unimportant | Very unimportant | Totally Attained | Moderately Attained | Somewhat Attained | Did Not Attain |
|---|---|---|---|---|---|---|---|---|---|
| To be on my own | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To use my equipment | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To experience an undeveloped lake | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To experience nature | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To experience natural quiet | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To do something with my family | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To be with members of my group | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To be with people who enjoy the same things I do | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To meet new people | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To participate in recreational activities | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To learn about the cultural history of the area | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To learn about the natural history of the area | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To participate in interpretive and educational activities | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To experience new and different things | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To test my skills and abilities | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To stargaze | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To enjoy the scenery of Lake Powell | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To think about my personal values | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To be close to nature | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To challenge myself | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To sketch, paint or take photographs | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To get exercise | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To be away from other people | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To relax physically | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To experience solitude | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To get away from the usual demands of life | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To have thrills and excitement | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To share my skill and knowledge with others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |
| To feel healthier | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 |

Other (Please specify): _____

**Situations Experienced While Visiting Glen Canyon/Lake Powell**

**18a. This question concerns possible situations you may have experienced while visiting the Glen Canyon National Recreation Area/Lake Powell. Please indicate the problem level for each situation below.** *Circle one number that best describes how much of a problem, if any, you found each to be.*

| Situation: | No Problem | Slight Problem | Moderate Problem | Serious Problem | Very Serious Problem | Don't Know |
|---|---|---|---|---|---|---|
| Finding an unoccupied campsite | 1 | 2 | 3 | 4 | 5 | DK |
| Finding a beach campsite | 1 | 2 | 3 | 4 | 5 | DK |
| Litter on beaches and shoreline | 1 | 2 | 3 | 4 | 5 | DK |
| Poor water quality | 1 | 2 | 3 | 4 | 5 | DK |
| Sufficient navigational aids on Lake Powell | 1 | 2 | 3 | 4 | 5 | DK |
| People being inconsiderate | 1 | 2 | 3 | 4 | 5 | DK |
| Too many motorized watercraft on the lake | 1 | 2 | 3 | 4 | 5 | DK |
| The number of commercial tour boats | 1 | 2 | 3 | 4 | 5 | DK |
| Unsafe operation of motorized watercraft | 1 | 2 | 3 | 4 | 5 | DK |
| Boats closer to my boat than I like | 1 | 2 | 3 | 4 | 5 | DK |
| The level of noise on the lake | 1 | 2 | 3 | 4 | 5 | DK |
| Conflicts with others for beach space | 1 | 2 | 3 | 4 | 5 | DK |
| Conflicts with watercraft operators on lake | 1 | 2 | 3 | 4 | 5 | DK |
| Evidence of pets and their droppings | 1 | 2 | 3 | 4 | 5 | DK |
| Adequate toilet facilities at landings | 1 | 2 | 3 | 4 | 5 | DK |
| Adequate floating toilet facilities on lake | 1 | 2 | 3 | 4 | 5 | DK |
| Human waste on lake shore or in water | 1 | 2 | 3 | 4 | 5 | DK |
| Confusion about rules and regulations | 1 | 2 | 3 | 4 | 5 | DK |
| Amount of light on the lake at night | 1 | 2 | 3 | 4 | 5 | DK |
| Amount of light at the marinas at night | 1 | 2 | 3 | 4 | 5 | DK |
| Evidence of livestock | 1 | 2 | 3 | 4 | 5 | DK |
| Evidence of mining operations | 1 | 2 | 3 | 4 | 5 | DK |
| Availability of National Park Service presence on the lake | 1 | 2 | 3 | 4 | 5 | DK |
| Availability of interpretive and educational opportunities | 1 | 2 | 3 | 4 | 5 | DK |
| Noise from airplanes | 1 | 2 | 3 | 4 | 5 | DK |
| Amount of time spent waiting in line to launch boat | 1 | 2 | 3 | 4 | 5 | DK |
| Travel farther on the lake to find solitude | 1 | 2 | 3 | 4 | 5 | DK |
| Travel farther on the lake to find fuel | 1 | 2 | 3 | 4 | 5 | DK |
| Travel farther on the lake to find shoreline campsite | 1 | 2 | 3 | 4 | 5 | DK |
| Amount of time spent to park trailer & tow vehicle | 1 | 2 | 3 | 4 | 5 | DK |
| Amount of time spent to shuttle back to marina | 1 | 2 | 3 | 4 | 5 | DK |
| Management of visitor activity on the lake | 1 | 2 | 3 | 4 | 5 | DK |
| Other things (please specify)_____ | | | | | | |

**18b. If you circled 4 or 5 for any of the situations, please describe the problems you encountered:**

_____

_____

_____

_____

_____

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**Management Actions at the Glen Canyon National Recreation Area/Lake Powell**

**19. Given the conditions in the Glen Canyon National Recreation Area, to what extent do you 'support' or 'oppose' each of the following possible management actions?** *Circle one number for each action.*

After you have looked over the list, please rank the TOP FIVE management actions that you feel the most strongly about. *(Rank the actions that you believe are the most important for the National Park Service to consider, with a "1" being the most important, by putting a 1, 2, 3, 4, or 5 in front of the management actions.)*

| Rank | Management Action: | Strongly Support | Support | Neither Support nor Oppose | Oppose | Strongly Oppose |
|---|---|---|---|---|---|---|
| _____ | Establish specific use zones | 1 | 2 | 3 | 4 | 5 |
| _____ | Establish zones to protect sensitive resources | 1 | 2 | 3 | 4 | 5 |
| _____ | Limit number of boats allowed on lake | 1 | 2 | 3 | 4 | 5 |
| _____ | Limit number of motorized watercraft allowed on lake at any one time | 1 | 2 | 3 | 4 | 5 |
| _____ | Limit number of non-motorized watercraft allowed on lake at any one time | 1 | 2 | 3 | 4 | 5 |
| _____ | Regulate the number of people using lake at any one time | 1 | 2 | 3 | 4 | 5 |
| _____ | Regulate the number of people *per group* allowed on lake | 1 | 2 | 3 | 4 | 5 |
| _____ | Improve public access to the lake | 1 | 2 | 3 | 4 | 5 |
| _____ | Expand the number of marina slips | 1 | 2 | 3 | 4 | 5 |
| _____ | Expand existing facility development | 1 | 2 | 3 | 4 | 5 |
| _____ | Provide more information to visitors about appropriate behavior | 1 | 2 | 3 | 4 | 5 |
| _____ | Provide more park rangers on the lake to educate visitors about appropriate behavior | 1 | 2 | 3 | 4 | 5 |
| _____ | Require visitors to learn about appropriate behavior on the lake | 1 | 2 | 3 | 4 | 5 |
| _____ | More aggressively enforce safety rules and regulations on lake | 1 | 2 | 3 | 4 | 5 |
| _____ | Provide visitors with more educational information about the area | 1 | 2 | 3 | 4 | 5 |
| _____ | Designate some areas for specific types of watercraft use | 1 | 2 | 3 | 4 | 5 |
| _____ | Use management controls to prevent conflicts between lake users | 1 | 2 | 3 | 4 | 5 |
| _____ | Use management controls to prevent damage to the environment by visitors | 1 | 2 | 3 | 4 | 5 |
| _____ | Provide more toilet facilities on the water | 1 | 2 | 3 | 4 | 5 |
| _____ | Close area to pets | 1 | 2 | 3 | 4 | 5 |
| _____ | More rules governing the types of recreation that can take place at various locations | 1 | 2 | 3 | 4 | 5 |
| _____ | Improve boater education and orientation | 1 | 2 | 3 | 4 | 5 |
| _____ | Increase facilities on the shoreline (launch ramps, parking, etc) | 1 | 2 | 3 | 4 | 5 |
| _____ | Increase services on the shoreline (fueling stations, slips, buoys, etc) | 1 | 2 | 3 | 4 | 5 |
| _____ | Other things (please specify): | 1 | 2 | 3 | 4 | 5 |

**Service Quality and Visitor Satisfaction While Visiting Glen Canyon/Lake Powell**

**20. How satisfied were you with the quality of the services provided for you at Glen Canyon National Recreation Area/ Lake Powell?** *Circle one number for each item.*

| Service | Very Satisfied | Somewhat Satisfied | Neither Satisfied nor Dissatisfied | Somewhat Dissatisfied | Very Dissatisfied | Did not Use/Don't know |
|---|---|---|---|---|---|---|
| Visitor information | 1 | 2 | 3 | 4 | 5 | DK |
| Exhibits and other educational materials | 1 | 2 | 3 | 4 | 5 | DK |
| Concessioner food service | 1 | 2 | 3 | 4 | 5 | DK |
| Concessioner lodging | 1 | 2 | 3 | 4 | 5 | DK |
| Concessioner retail stores | 1 | 2 | 3 | 4 | 5 | DK |
| Concessioner boat rentals | 1 | 2 | 3 | 4 | 5 | DK |
| Land based visitor facilities (e.g., lodge, visitor center, etc.) | 1 | 2 | 3 | 4 | 5 | DK |
| Water based visitor facilities (e.g., marina, pump outs, etc.) | 1 | 2 | 3 | 4 | 5 | DK |
| Interpretive and educational activities | 1 | 2 | 3 | 4 | 5 | DK |
| National Park Service employee assistance | 1 | 2 | 3 | 4 | 5 | DK |
| Concessioner employee assistance | 1 | 2 | 3 | 4 | 5 | DK |
| Overall quality of services | 1 | 2 | 3 | 4 | 5 | DK |

**21. Please describe any activities or services you think should be offered at Lake Powell that currently are not offered?**

_____

_____

_____

_____

_____

_____

**About You**

**22. What is your gender?** ____Female ____Male

**23. What is your age?** ____years

**24. What is the highest level of education you have completed?** (*Check one*)

____Some high school
____High school graduate or GED
____Some college, business or trade school
____College graduate
____Post Graduate

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**25. What was your total household income (before taxes) in 2004?** ***(check one):***

____ Less than $25,000
____ $25,000 to $49,999
____ $50,000 to $74,999
____ $75,000 to $99,999
____ $100,000 or more

**26. In what ethnicity and race would you place yourself?**

**Ethnicity**
____ Hispanic or Latino
____ Not Hispanic or Latino

**Race.** ***Please check all that apply.***
____ American Indian or Alaska Native
____ Asian
____ Black or African American
____ Native Hawaiian or other Pacific Islander
____ White

**27. Please share any additional comments about your visit to the Glen Canyon National Recreation Area or any suggestions you may have about managing the area.**

## *Thank you for your help!*

***Please return this questionnaire using the prepaid, self-addressed envelope provided.***

If you want more information about this study, contact the University of Minnesota Cooperative Park Studies Program, 115 Green Hall, 1530 Cleveland Avenue North, St. Paul, MN 55108-1027, 612-624-2721.

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by the National Park Service to improve resource management and planning and better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. The information you provide will be anonymous. Please do not put your name or that of any member of your group on the questionnaire. Public reporting burden for this form is estimated to average 20 minutes per respondent. Direct comments regarding the burden estimate or any other aspect of this form to the Attention Desk Officer for the Interior Department, Paperwork Reduction Project 1024-0224 (NPS99-024), and to the Information Collection Clearance Officer, WASO APC, Accountability and Audits Team, National Park Service, 1849 C Street, N.W., Washington, D.C. 20240. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

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# Appendix B – Class C Costs

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| Number | Item | Unit | Unit Cost | Quantity | Extended cost | Notes and/or assumptions |
|---|---|---|---|---|---|---|
| **Employee, Concessioner, and Partner Housing** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$2,654,586.00** | |
| | Site Development - Demolition | LS | **$311,220.00** | 1 | **$311,220.00** | Includes clearing and grubbing 27.3 acres of land. |
| | Site Development - New Housing | LS | **$1,871,000.00** | 1 | **$1,871,000.00** | Housing includes: 1) 4 NPS 3-bedroom houses that are 1,300 square feet. 2) One concessioner dormitory that is 3,000 square feet. 3) 6 partner 3-bedroom houses that are 1,300 square feet. |
| | Site Development - Upgrade RV Park | LS | **$272,400.00** | 1 | **$272,400.00** | Cost of upgrade is 50% the cost of a new RV site. |
| | Site Rehabilitation - Landscaping | LS | **$187,100.00** | 1 | **$187,100.00** | Landscaping is 10% the cost of each housing unit. Includes earthwork, seeding, and planting shrubs and small trees. |
| | Site Rehabilitation - Reclaim concessioner RV park | LS | **$12,866.00** | 1 | **$12,866.00** | Reclaim the land using native plants. |
| | **Alternative C** | | **Total** | | **$2,654,586.00** | |
| | Same as Alternative B | | | | | |
| **Visitor Overnight Accommodations** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$5,229,256.00** | |
| | Site Development - Demolition | LS | **$79,800.00** | 1 | **$79,800.00** | Assume that medium grubbing is required for site preparation. 6.6 acres is for family rental units and 0.4 acres is for the lodge. |
| | Site Removal - Removal of existing family rental units | LS | **$40,000.00** | 1 | **$40,000.00** | Assume that is costs $5,000 to remove each of the 8 modular homes. |
| | Site Development - Expand Lodge | LS | **$1,920,000.00** | 1 | **$1,920,000.00** | Expansion includes 60 rooms. Assume that each room is 400 square feet and construction costs are $80.00 per square foot. |
| | Site Development - Add Family Rental Units | LS | **$2,724,960.00** | 1 | **$2,724,960.00** | Each modular house is 800 square feet. Includes the replacement of the existing 8 family rental units and 34 additional family rental units. |
| | Site Rehabilitation - Landscaping | LS | **$464,496.00** | 1 | **$464,496.00** | Landscaping is 10% the cost of each housing unit. Includes earthwork, seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$5,229,256.00** | |
| | Same as Alternative B | | | | | |
| **Visitor Camping** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$2,513,631.00** | |
| | Site Development - Demolition | LS | **$4,560.00** | 1 | **$4,560.00** | Assume that medium grubbing is required for site preparation. 0.4 acres will need to be prepared for the RV park. |
| | Site Development - Camp sites | LS | **$260,110.00** | 1 | **$260,110.00** | The plan calls for 128 additional sites for the campground. Assume that 85 will be with hookups and 37 will not include RV hookups. 6 sites will be a pod of group campsites, each site accommodating 15 people. Price includes additional restroom facilities, roads, and other improvements. |
| | Site Development - RV sites | LS | **$1,929,500.00** | 1 | **$1,929,500.00** | The plan calls for 128 additional sites for the campground. Assume that 85 will be with hookups and 37 will not include RV hookups. 6 sites will be a pod of group campsites, each site accommodating 15 people. Price includes additional restroom facilities, roads, and other improvements. |
| | Site Development - Group Campsites | LS | **$41,100.00** | 1 | **$41,100.00** | Class C estimating guide provides a cost per group site accommodating 25 people. Estimate cost for 6 sites accommodating 15 at 4 sites accommodating 25. |
| | Site Development - Amphitheater | LS | **$54,000.00** | 1 | **$54,000.00** | Amphitheater holds 50 visitors and costs $1080 per seat. |
| | Site Rehabilitation - Landscaping | LS | **$224,361.00** | 1 | **$224,361.00** | Landscaping costs are 10% of the building costs for all structures and camp sites. Includes earthwork, seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$2,513,631.00** | |
| | Same as Alternative B | | | | | |
| **Shower and Laundry Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | **Alternative B** | | **Total** | | **$249,150.00** | |
| | Site Development - Shower and laundry facility | LS | **$226,500.00** | 1 | **$226,500.00** | Assume the building is 1500 square feet and the cost is $151 per square foot. |
| | Site Rehabilitation - Landscaping | LS | **$22,650.00** | 1 | **$22,650.00** | Landscaping costs are 10% of the building costs for all structures and camp sites. Includes earthwork, seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$249,150.00** | |
| | Same as Alternative B | | | | | |
| **Land based stores** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$328,000.00** | |
| | Site Preparation | LS | **$21,600.00** | 1 | **$21,600.00** | Village Store will expand onto land where maintenance buildings have been moved. Site will require minor grading. |
| | Site Development - Expand Village Center store | LS | **$150,000.00** | 1 | **$150,000.00** | Expansion will include food service and other family entertainment. Price is based upon an expansion of 1000 square feet with a price of $150.00 per square foot. |
| | Site Development - Construct general store at the campground | LS | **$119,000.00** | 1 | **$119,000.00** | Assume general store is 1000 square feet and the cost is similar to the building of a ranger station ($119.00 per square foot). |
| | Site Rehabilitation | LS | **$37,400.00** | 1 | **$37,400.00** | Landscaping is 10% the cost of each housing unit. Includes earthwork, seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$328,000.00** | |
| | Same as Alternative B | | | | | |
| **Land-Based Food Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$105,000.00** | |
| | Site Development - Expand Anasazi Restauraunt | LS | **$105,000.00** | 1 | **$105,000.00** | Assume expansion will cost $1500 per seat for 70 additional seats. |
| | **Alternative C** | | **Total** | | **$105,000.00** | |
| | Same as Alternative B | | | | | |
| **Day use Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Ranger Station/Visitor Contact Station and Emergenc Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Concessioner Boat Maintenance and Repair, and Propert Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | **Alternative B** | | **Total** | | **$106,433.00** | |
| | Site Demolition - Relocation of concessioner facilities | LS | **$100,000.00** | 1 | **$100,000.00** | Assume the cost is $100,000 to move the all structures and clean up the site. |
| | Site reclamation - Reclamation of land where concessioner maintenanc facilities were located. | LS | **$6,433.00** | 1 | **$6,433.00** | Reclaim the land using native plants. |
| | **Alternative C** | | **Total** | | **$106,433.00** | |
| | Same as Alternative B | | | | | |
| **National Park Service Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$153,534.00** | |
| | Site Demolition - Relocation of NPS facilities | LS | **$100,000.00** | 1 | **$100,000.00** | Assume the cost is $100,000 to move the all structures and clean up the site. |
| | Site Demolition - Clearing and grubbing | LS | **$29,640.00** | 1 | **$29,640.00** | Assume that medium grubbing is required for site preparation. Assume that one acre needs to be reclaimed. |
| | Site reclamation - Reclamation of land where NPS maintenance facilitie were located. | LS | **$23,894.00** | 1 | **$23,894.00** | Reclaim the land using native plants. Assume one acre needs to be reclaimed. |
| **Secured Storage** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$1,705,900.00** | |
| | Site Demolition - Clearing and grubbing | LS | **$68,400.00** | 1 | **$68,400.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Secured spaces | LS | **$200,000.00** | 1 | **$200,000.00** | Assume it costs $1000 per space and that the expansion includes 200 additional spaces. This includes paving, lighting, and other utilities that are required. |
| | Site Development - Enclosed storage | LS | **$1,237,500.00** | 1 | **$1,237,500.00** | Assume 750 square feet per space for 35 space. Used vehicle storage building rate from estimating guide at $33 per square foot. |
| | Site Development - Perimeter screening | LS | **$200,000.00** | 1 | **$200,000.00** | Includes costs for 8ft high screen wall around secured storage and concessioner maintenance facilities at $100 per linear foot. |
| | **Alternative C** | | **Total** | | **$1,705,900.00** | |
| | Same as Alternative B | | | | | |
| **Utility Systems** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$500,000.00** | |
| | Site Development - Expand energy system | LS | **$500,000.00** | 1 | **$500,000.00** | Assume it will cost $500,000 to expand utility needs to the additional structures. |
| | **Alternative C** | | **Total** | | **$1,000,000.00** | |
| | Site Development - Expand energy system | LS | **$500,000.00** | 1 | **$500,000.00** | Assume it will cost $500,000 to expand utility needs to the additional structures. |
| | Site Development - Utilize solar and fuel cell technology. | LS | **$500,000.00** | 1 | **$500,000.00** | Assume it will cost $500,000 to include solar and fuel cell technology |
| **Roads and Parking** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Fee Collection** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |

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|---|---|---|---|---|---|---|
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$130,900.00** | |
| | Site Development - Upgrade Fee collection booth. | LS | **$119,000.00** | 1 | **$119,000.00** | Assume fee collection booth expansion is 1000 square feet and the cost is similar t the building of a ranger station ($119.00 per square foot). |
| | Site Rehabilitation - Landscaping | LS | **$11,900.00** | 1 | **$11,900.00** | Landscaping costs are 10% of the building costs for all structures. |
| | **Alternative C** | | **Total** | | **$130,900.00** | |
| | Same as Alternative B | | | | | |
| **School** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$500,000.00** | |
| | Site Development - Install library in existing school | LS | **$500,000.00** | 1 | **$500,000.00** | Assume that the library expansion will be 2000 square feet and cost $250 per squa foot including the price of books. |
| | **Alternative C** | | **Total** | | **$500,000.00** | |
| | Same as Alternative B | | | | | |
| **Airstrip** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Boat Wash-Down Area** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$60,000.00** | |
| | Site Development - Expansion of boat wash-down facility | LS | **$60,000.00** | 1 | **$60,000.00** | Assume that it will cost $60,000 to expand the facilities including additional water sources, structures, and other costs. |
| | **Alternative C** | | **Total** | | **$60,000.00** | |
| | Same as Alternative B | | | | | |
| **Marina facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$55,000.00** | |
| | Site Development - Installation of buoy-field moorings | LS | **$55,000.00** | 1 | **$55,000.00** | Assume that it will cost $1,000 per additional space for 55 extra spaces. These spaces are split with Hall's Crossing Marina but will be included here for cost purposes. |
| | **Alternative C** | | **Total** | | **$223,000.00** | |
| | Site Development - Installation of buoy-field moorings | LS | **$55,000.00** | 1 | **$55,000.00** | Assume that it will cost $1,000 per additional space for 55 extra spaces. These spaces are split with Hall's Crossing Marina but will be included here for cost purposes. |
| | Site Development - Installation of wet slips | LS | **$168,000.00** | 1 | **$168,000.00** | Assume that it will cost $3,000 per additional slip for 56 additional spaces. These spaces are split with Hall's Crossing Marina but will be included here for cost purposes. |
| **Water-Based Store** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |

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|---|---|---|---|---|---|---|
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Water-Based Food Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$240,000.00** | |
| | Site Development - Installation of 80-seat restaurant | LS | **$240,000.00** | 1 | **$240,000.00** | Assume that the restaurant expansion will cost $3,000 per seat. |
| | **Alternative C** | | **Total** | | **$240,000.00** | |
| | Same as Alternative B | | | | | |
| **Launch Ramps** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$86,136.00** | |
| | Site Development - Extension of boat launch to water level | LS | **$86,136.00** | 1 | **$86,136.00** | Assume that the ramp will need to be extended 100 feet over the next ten years at a minimum width of 80 feet. |
| | **Alternative C** | | **Total** | | **$161,505.00** | |
| | Site Development - Extension of boat launch ramp to the water level at maximum width of 150 ft. | LS | **$161,505.00** | 1 | **$161,505.00** | Assume that the ramp will need to be extended 100 feet over the next ten years at the maximum width of 150 feet. |
| **Launch Ramp Support** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Ferry Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **River Runner Takeout** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Grand Total** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | **Alternative B** | | **Total** | | **$14,463,992.00** | |
| | Concept Plan Contingency | | **25%** | | **$3,615,998.00** | |

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|---|---|---|---|---|
| Contractors, General Conditions, Profit, Bonds, and Overhead | | 12% | $1,735,679.04 | |
| **Subtotal** | | | **$19,815,669.04** | **Allowance for Planning and Design Fees** |
| Architecture and Engineering Fees Allowance | | 20% | $3,963,133.81 | |
| Owners Construction Contingency | | 5% | $990,783.45 | |
| **Total** | | | **$24,769,586.30** | |
| **Alternative C** | **Total** | | **$15,360,895.00** | |
| Concept Plan Contingency | | 25% | $3,840,223.75 | |
| Contractors, General Conditions, Profit, Bonds, and Overhead | | 12% | $1,843,307.40 | |
| **Subtotal** | | | **$21,044,426.15** | **Allowance for Planning and Design Fees** |
| Architecture and Engineering Fees Allowance | | 20% | $4,208,885.23 | |
| Owners Construction Contingency | | 5% | $1,052,221.31 | |
| **Total** | | | **$26,305,532.69** | |

Hall Crossing Cost estimates

| Number | Item | Unit | Unit Cost | Quantity | Extended cost | Notes and/or assumptions |
|---|---|---|---|---|---|---|
| **Employee, Concessioner, and Partner Housing** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$4,037,072.00** | |
| | Site Demolition - Clearing and grubbing | LS | $39,900.00 | 1 | **$39,900.00** | Assume that medium grubbing is required for site preparation. |
| | Site Removal - Removal of existing NPS and concessioner housing units | LS | $250,000.00 | 1 | **$250,000.00** | Assume that is costs $5,000 to remove one modular home. |
| | Site Development - Housing | LS | $3,134,120.00 | 1 | **$3,134,120.00** | Housing includes: 1) 2 NPS 3-bedroom houses that are 1,300 square feet. 3) 4 partner 3-bedroom houses that are 1,300 square feet. 3) 50 800 square-foot modular homes to replace those that were removed. |
| | Site Development - RV sites | LS | $272,400.00 | 1 | **$272,400.00** | Includes the installation of 12 RV sites at $22,700 per site. |
| | Site Rehabilitation - Landscaping | LS | $340,652.00 | 1 | **$340,652.00** | Landscaping is 10% the cost of each housing unit. Includes earthwork, seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$4,037,072.00** | Same as Alternative B |
| | Same as Alternative B | | | | | |
| **Overnight Visitor Accomodations** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$4,448,200.00** | |
| | Site Demolition - Clearing and grubbing | LS | $66,120.00 | 1 | **$66,120.00** | Assume that medium grubbing is required for site preparation. |
| | Site Removal - Removal of existing family rental units | LS | $100,000.00 | 1 | **$100,000.00** | Assume that is costs $5,000 to remove one modular home. |
| | Site Development - Add family rental units | LS | $3,892,800.00 | 1 | **$3,892,800.00** | Each modular house is 800 square feet. Includes the replacement of the existing 20 family rental units and 40 new family rental units. |
| | Site Rehabilitation - Landscaping | LS | $389,280.00 | 1 | **$389,280.00** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$4,448,200.00** | |
| | Same as Alternative B | | | | | |
| **Visitor Camping** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$887,241.00** | |
| | Site Demolition - Clearing and grubbing | LS | $9,120.00 | 1 | **$9,120.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - RV sites | LS | $181,600.00 | 1 | **$181,600.00** | Price is for an additional 8 RV sites at $22,700 per site. |
| | Site Development - Upgrade campsites | LS | $224,960.00 | 1 | **$224,960.00** | Assume that the upgrade costs 50% the cost of a new campsite for 64 sites. |
| | Site Development - Upgrade RV sites | LS | $363,200.00 | 1 | **$363,200.00** | Assume that the upgrade costs 50% the cost of a RV site for 32 sites. |
| | Site Development - Upgrade restrooms | LS | $30,200.00 | 1 | **$30,200.00** | Assume that the campground has four standard vault toilets and that the upgrade will cost 50% of the cost of a new toilet. |
| | Site Development - Upgrade RV waste disposal station | LS | $31,350.00 | 1 | **$31,350.00** | Assume that an upgrade costs 50% of the cost of a new waste station |
| | Site Development - Landscaping | LS | $46,811.00 | 1 | **$46,811.00** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$946,130.00** | |
| | Site Demolition - Clearing and grubbing | LS | $66,120.00 | 1 | **$66,120.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Upgrade campsites | LS | $224,960.00 | 1 | **$224,960.00** | Assume that the upgrade costs 50% the cost of a new campsite for 64 sites. |
| | Site Development - Upgrade RV sites | LS | $363,200.00 | 1 | **$363,200.00** | Assume that the upgrade costs 50% the cost of a RV site for 32 sites. |
| | Site Development - Camp sites | LS | $70,300.00 | 1 | **$70,300.00** | The plan calls for 16 additional sites for the campground. Assume that 10 will be without hookups and 6 will include RV hookups. Price includes additional restroom facilities, roads, and other improvements. |
| | Site Development - RV sites | LS | $136,200.00 | 1 | **$136,200.00** | The plan calls for 16 additional sites for the campground. Assume that 10 will be without hookups and 6 will include RV hookups. Price includes additional restroom facilities, roads, and other improvements. |
| | Site Development - Upgrade RV waste disposal station | LS | $31,350.00 | 1 | **$31,350.00** | Assume that an upgrade costs 50% of the cost of a new waste station. |

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Hall Crossing Cost estimates

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|---|---|---|---|---|---|---|
| | Site Development - Amphitheater | LS | $54,000.00 | 1 | **$54,000.00** | Amphitheater holds 50 visitors and costs $1080 per seat. |
| | Site Development - Landscaping | LS | $22,650.00 | 1 | **$22,650.00** | Landscaping costs are 10% of the building cost. |
| **Shower and Laundry Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$50,000.00** | |
| | Laundry and shower facilities found in the expanded Village Center general store. | | | | | |
| | Site Demolition - Removal of shower/laundry facilities | LS | $50,000.00 | 1 | **$50,000.00** | Assume that it will cost $50,000 to remove the shower/laundry building and prepare the ground for reclamation. |
| | **Alternative C** | | **Total** | | **$299,150.00** | |
| | Site Demolition - Removal of shower/laundry facilities | LS | $50,000.00 | 1 | **$50,000.00** | Assume that it will cost $50,000 to remove the shower/laundry building and prepare the ground for reclamation. |
| | Site Development - Shower and laundry facility | LS | $226,500.00 | 1 | **$226,500.00** | Assume the building is 1500 square feet and the cost is $150 per square foot. |
| | Site Rehabilitation - Landscaping | LS | $22,650.00 | 1 | **$22,650.00** | Landscaping costs are 10% of the building cost. |
| **Land-based Stores** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$478,478.00** | |
| | Site Demolition - Clearing and grubbing | LS | $4,560.00 | 1 | **$4,560.00** | Assume that medium grubbing is required for site preparation. |
| | Site Demolition - Removal of existing Village Center store | LS | $50,000.00 | 1 | **$50,000.00** | Assume that it will cost $50,000 to remove the general store and prepare the ground for construction of the new store. |
| | Site Demolition - Minor regrading of the fuel station area | LS | $13,068.00 | 1 | **$13,068.00** | Assume that 0.5 acres will need minor regrading (top 2-3 inches). |
| | Site Development - Construction of new general store | LS | $302,000.00 | 1 | **$302,000.00** | Assume that the price will be equal to the price for the building of a new shower/laundry facility ($151.00 per square foot) and the size will be 2000 square feet. |
| | Site Development - Repave the fuel station area | LS | $78,650.00 | 1 | **$78,650.00** | Assume the size to be repaved is 0.5 acres |
| | Site Rehabilitation - Landscaping | LS | $30,200.00 | 1 | **$30,200.00** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$644,578.00** | |
| | Site Demolition - Clearing and grubbing | LS | $4,560.00 | 1 | **$4,560.00** | Assume that medium grubbing is required for site preparation. |
| | Site Demolition - Removal of existing Village Center store | LS | $50,000.00 | 1 | **$50,000.00** | Assume that it will cost $50,000 to remove the general store and prepare the ground for construction of the new store. |
| | Site Demolition - Minor regrading of the fuel station area | LS | $13,068.00 | 1 | **$13,068.00** | Assume that 0.5 acres will need minor regrading (top 2-3 inches). |
| | Site Development - Construction of new general store | LS | $453,000.00 | 1 | **$453,000.00** | Assume that the price will be equal to the price for the building of a new shower/laundry facility ($151.00 per square foot) and the size will be 3000 square feet. The building will be larger than the one in Alternative B and includes room for a small snack bar. |
| | Site Development - Repave the fuel station area | LS | $78,650.00 | 1 | **$78,650.00** | Assume the size to be repaved is 0.5 acres |
| | Site Rehabilitation - Landscaping | LS | $45,300.00 | 1 | **$45,300.00** | Landscaping costs are 10% of the building cost. |
| **Land-Based Food Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Food service facilities are included in the Village Center Store. | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative B | | | | | |
| **Day-Use Facilites** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$118,573.00** | |
| | Site Demolition - Clearing and grubbing | LS | $4,560.00 | 1 | **$4,560.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Shade shelters | LS | $36,760.00 | 1 | **$36,760.00** | Build four shade shelters at 100 square feet for each one. |

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Hall Crossing Cost estimates

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|---|---|---|---|---|---|---|
| | Site Development - Picnic tables | LS | $6,488.00 | 1 | **$6,488.00** | Install 8 picnic tables. |
| | Site Development - Restroom facilities | LS | $60,400.00 | 1 | **$60,400.00** | Install 4 regular vault toilets. |
| | Site Rehabilitation - Landscaping | LS | $10,364.80 | 1 | **$10,364.80** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$118,573.00** | |
| | Same as Alternative B | | | | | |
| **Ranger Station/Visitor Contact Station and Emergency Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$431,133** | Same as Alternative A |
| | Site Development - Establishment of a permanent helipad | | $431,133 | 1 | **$431,133** | Assume the helipad is 200 feet by 200 feet. |
| | **Alternative C** | | **Total** | | **$669,133** | |
| | Site Development - Establishment of a permanent helipad | | $431,133 | 1 | **$431,133** | Assume the helipad is 200 feet by 200 feet. |
| | Site Development - Construction of a visitor services/ranger station building | LS | $238,000.00 | 1 | **$238,000.00** | The building will serve as a visitor center, fire station, provide storage for emergency services and search and rescue equipment, and several ranger offices. Price is the same as a ranger station at $119 per square foot and the building is 2000 square feet. |
| **Concessioner Boat Maintenance and Repair, and Property Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$100,000.00** | |
| | Site Demolition - Relocation of maintenance facilities and secured storage | LS | $100,000.00 | 1 | **$100,000.00** | Assume the cost is $100,000 to move the all structures and clean up the site. |
| | **Alternative C** | | **Total** | | **$100,000.00** | |
| | Same as Alternative B | | | | | |
| **National Park Service Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Secured Storage** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$1,584,583.00** | |
| | Site Demolition - Clearing and grubbing | LS | $285,000.00 | 1 | **$285,000.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Installation of additional secured storage sites | LS | $135,000.00 | 1 | **$135,000.00** | Assume it costs $1000 per space for 135 additional spaces. This includes paving, lighting, and other utilities that are required. |
| | Site Development - Installation of enclosed storage | LS | $866,250.00 | 1 | **$866,250.00** | Assume 750 square feet per space for 35 spaces. Used vehicle storage building rate from estimating guide at $33 per square foot. |
| | Site Development - Screen facilities from the public | LS | $200,000.00 | 1 | **$200,000.00** | Includes costs for 8ft high screen wall around secured storage and concessioner maintenance facilities at $100 per linear foot. |
| | Site reclamation - Reclaim land with native plants | LS | $98,333.00 | 1 | **$98,333.00** | Reclaim the land using native plants. |
| | **Alternative C** | | **Total** | | **$1,584,583.00** | |
| | Same as Alternative B | | | | | |

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Hall Crossing Cost estimates

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|---|---|---|---|---|---|---|
| **Utility Systems** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$750,000.00** | |
| | Site Development - Expand energy system | LS | $750,000.00 | 1 | **$750,000.00** | Assume it will cost $750,000 to expand utility needs to the additional structures. |
| | **Alternative C** | | **Total** | | **$1,250,000.00** | |
| | Site Development - Expand energy system | LS | $750,000.00 | 1 | **$750,000.00** | Assume it will cost $750,000 to expand utility needs to the additional structures. |
| | Site Development - Utilize solar and fuel cell technology. | LS | $500,000.00 | 1 | **$500,000.00** | Assume it will cost $500,000 to include solar and fuel cell technology |
| **Roads and Parking** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$243,500.00** | |
| | Site Development - Gravel access road | LS | $243,500.00 | 1 | **$243,500.00** | Assume that the road is 0.5 miles long and will be gravel. |
| | **Alternative C** | | **Total** | | **$243,500.00** | |
| | Same as Alternative B | | | | | |
| **Fee Collection** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **School** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Airstrip** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Boat Wash-Down Area** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$90,000.00** | |
| | Site Development - Construct a boat wash-down facility | LS | $90,000.00 | 1 | **$90,000.00** | Assume it costs $90,000 to build a boat wash-down area with water hook-ups and other necessary utilities. |
| | **Alternative C** | | **Total** | | **$90,000.00** | |
| | Same as Alternative B | | | | | |
| **Marina Facilities** | | | | | | |

4

Hall Crossing Cost estimates

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | The cost for the new marina buoy field spaces is included in the estimate for Bullfrog Marina | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | The cost of the new marina buoy field spaces and wet slips is included in the estimate for Bullfrog Marina | | | | | |
| | Site Development - Chip-sealed roads down to the marina facilities | LS | $0.00 | 1 | **$0.00** | Assume that 0.5 miles will be chip sealed |
| **Water-Based Store** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Water-Based Food Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$300,000.00** | |
| | Site Development - Construct a water-based food service facility | LS | $300,000.00 | 1 | **$300,000.00** | Assume the building is 2000 square feet and costs $150 per square foot to build. |
| | **Alternative C** | | **Total** | | **$300,000.00** | |
| | Same as Alternative B | | | | | |
| **Launch Ramps** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$86,136.00** | |
| | Site Development - Extend the boat launch ramp to the water level | LS | $86,136.00 | 1 | **$86,136.00** | Assume that the ramp will need to be extended 100 feet over the next ten years at a minimum width of 80 feet. |
| | **Alternative C** | | **Total** | | **$118,437.00** | |
| | Site Development - Extension of boat launch ramp to the water level at maximum width of 110 ft. | LS | $118,437.00 | 1 | **$118,437.00** | Assume that the ramp will need to be extended 100 feet over the next ten years at the maximum width of 110 feet. |
| **Launch Ramp Support** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Ferry Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$50,000.00** | |
| | Site Development - Locate new fery launch locations | LS | $50,000.00 | 1 | **$50,000.00** | Assume it will cost $50,000 to locate and establish new ferry launch locations as the lake levels drop. |
| | **Alternative C** | | **Total** | | **$50,000.00** | |
| | Same as Alternative B | | | | | |

5

Hall Crossing Cost estimates

| | | | | |
|---|---|---|---|---|
| **River Runner Takeout** | | | | |
| | **Alternative A** | **Total** | **$0.00** | |
| | No cost associated with Alternative A | | | |
| | **Alternative B** | **Total** | **$0.00** | |
| | Same as Alternative A | | | |
| | **Alternative C** | **Total** | **$0.00** | |
| | Same as Alternative A | | | |
| **Grand Total** | | | | |
| | **Alternative A** | **Total** | **$0.00** | |
| | **Alternative B** | **Total** | **$13,654,915.99** | |
| | Concept Plan Contingency | **25%** | **$3,413,729.00** | |
| | Contractors, General Conditions, Profit, Bonds, and Overhead | **12%** | **$1,638,589.92** | **Allowance for Planning and Design Fees** |
| | **Subtotal** | | **$18,707,234.91** | |
| | Architecture and Engineering Fees Allowance | **20%** | **$3,741,446.98** | |
| | Owners Construction Contingency | **5%** | **$935,361.75** | |
| | **Total** | | **$23,384,043.63** | |
| | **Alternative C** | **Total** | **$14,899,355.99** | |
| | Concept Plan Contingency | **25%** | **$3,724,839.00** | |
| | Contractors, General Conditions, Profit, Bonds, and Overhead | **12%** | **$1,787,922.72** | **Allowance for Planning and Design Fees** |
| | **Subtotal** | | **$20,412,117.71** | |
| | Architecture and Engineering Fees Allowance | **20%** | **$4,082,423.54** | |
| | Owners Construction Contingency | **5%** | **$1,020,605.89** | |
| | **Total** | | **$25,515,147.13** | |

6

Hite cost estimates

| Number | Item | Unit | Unit Cost | Quantity | Extended cost | Notes and/or assumptions |
|---|---|---|---|---|---|---|
| **Employee Housing** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$1,244,688.00** | |
| | Site Demolition - Clearing and grubbing | LS | $22,800.00 | 1 | **$22,800.00** | Assume that medium grubbing is required for site preparation. |
| | Site Removal - Removal of existing NPS and concessioner housing units | LS | $80,000.00 | 1 | **$80,000.00** | Assume that is costs $5,000 to remove each of the 16 modular homes. |
| | Site Development - Housing | LS | $1,038,080.00 | 1 | **$1,038,080.00** | Housing includes the replacement of 6 NPS modular NPS homes and 10 modular concessioner homes. Each modular house is 800 square feet at a price of $81.10 per square foot. |
| | Site Rehabilitation - Landscaping | LS | $103,808.00 | 1 | **$103,808.00** | Landscaping is 10% the cost of each housing unit. Includes earthwork seeding, and planting shrubs and small trees. |
| | **Alternative C** | | **Total** | | **$1,244,688.00** | |
| | Same as Alternative B | | | | | |
| **Visitor Overnight Accomodations** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$1,472,880.00** | |
| | Site Demolition - Clearing and grubbing | LS | $20,520.00 | 1 | **$20,520.00** | Assume that medium grubbing is required for site preparation. |
| | Site Removal - Removal of existing family rental units | LS | $25,000.00 | 1 | **$25,000.00** | Assume that is costs $5,000 to remove each of the 5 modular homes. |
| | Site Development - Add family rental units | LS | $1,297,600.00 | 1 | **$1,297,600.00** | Each modular house is 800 square feet at a price of $81.10 per square foot. Includes the replacement of the existing 5 family rental units and 15 additional family rental units. |
| | Site Rehabilitation - Landscaping | LS | $129,760.00 | 1 | **$129,760.00** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$1,472,880.00** | |
| | Same as Alternative B | | | | | |
| **Visitor Camping** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$74,750.00** | |
| | Site Development - Develop 25 Sites | LS | $39,250.00 | 1 | **$39,250.00** | |
| | Site Development - Install restrooms | LS | $30,200.00 | 1 | **$30,200.00** | Assume that four standard vault toilets would be installed. |
| | Site Development - Landscaping | LS | $5,300.00 | 1 | **$5,300.00** | Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | | **$74,750.00** | |
| | Same as Alternative B | | | | | |
| **Shower and Laundry Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |

1

Hite cost estimates

| | | | | | |
|---|---|---|---|---|---|
| | General store will include laundry and shower facilities. | | | | |
| | **Alternative C** | | **Total** | **$0.00** | |
| | Same as Alternative B | | | | |
| **Land-based Stores** | | | | | |
| | **Alternative A** | | **Total** | **$0.00** | |
| | No cost associated with Alternative A | | | | |
| | **Alternative B** | | **Total** | **$435,654.00** | |
| | Site Development - Expand Village Center store | LS | $150,000.00 | 1 | **$150,000.00** Expansion will include a seasonal snack bar, laundry/shower facilities, and other family entertainment. Price is based upon an expansion of 1000 square feet with a price of $150.00 per square foot. |
| | Site Development - Install shade shelter | LS | $55,140.00 | 1 | **$55,140.00** Assume the shade shelter is 600 square feet and costs $91.90 per square foot. |
| | Site Development - Repave the fuel station area | LS | $78,650.00 | 1 | **$78,650.00** Assume the area to be repaved is 0.5 acres. |
| | Site Development - Screen general store from fuel station | LS | $100,000.00 | 1 | **$100,000.00** Includes a 8ft high screen wall screening the general store from the fuel area that costs $100.00 per linear foot. |
| | Site Development - Upgrade RV waste disposal station | LS | $31,350.00 | 1 | **$31,350.00** Assume that an upgrade costs 50% of the cost of a new waste station. |
| | Site Rehabilitation - Landscaping | LS | $20,514.00 | 1 | **$20,514.00** Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | **$435,654.00** | |
| | Same as Alternative B | | | | |
| **Land-Based Food Service** | | | | | |
| | **Alternative A** | | **Total** | **$0.00** | |
| | No cost associated with Alternative A | | | | |
| | **Alternative B** | | **Total** | **$0.00** | |
| | General store will include a seasonal snack bar | | | | |
| | **Alternative C** | | **Total** | **$0.00** | |
| | Same as Alternative B | | | | |
| **Day-Use Facilities** | | | | | |
| | **Alternative A** | | **Total** | **$0.00** | |
| | No cost associated with Alternative A | | | | |
| | **Alternative B** | | **Total** | **$118,573.00** | |
| | Site Demolition - Clearing and grubbing | LS | $4,560.00 | 1 | **$4,560.00** Assume that medium grubbing is required for site preparation. |
| | Site Development - Shade shelters | LS | $36,760.00 | 1 | **$36,760.00** Build four shade shelters at 100 square feet for each one. |
| | Site Development - Picnic tables | LS | $6,488.00 | 1 | **$6,488.00** Install 8 picnic tables |
| | Site Development - Restroom facilities | LS | $60,400.00 | 1 | **$60,400.00** Install 4 regular vault toilets |
| | Site Rehabilitation - Landscaping | LS | $10,365.00 | 1 | **$10,365.00** Landscaping costs are 10% of the building cost. |
| | **Alternative C** | | **Total** | **$118,573.00** | |
| | Same as Alternative B | | | | |
| **Ranger Station/Visitor Contact Station and Emergency Facilities** | | | | | |
| | **Alternative A** | | **Total** | **$0.00** | |

2

Hite cost estimates

| | | | | | | |
|---|---|---|---|---|---|---|
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Concessioner Boat Maintenance and Repair, and Property Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **National Park Service Maintenance Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Secured Storage** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$72,380.00** | |
| | Site Demolition - Clearing and grubbing | LS | $19,380.00 | 1 | **$19,380.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Add secured storage sites | LS | $53,000.00 | 1 | **$53,000.00** | Assume it costs $1000 per space for 53 additional spaces. This includes paving, lighting, and other utilities that are required. |
| | **Alternative C** | | **Total** | | **$72,380.00** | |
| | Same as Alternative B | | | | | |
| **Utility Systems** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$1,108,188.00** | |
| | Site Development - Expand energy system | LS | $250,000.00 | 1 | **$250,000.00** | Assume it will cost $250,000 to expand utility needs to the additional structures. |
| | Site Development - Drill and Blast | LS | $134,568.00 | 1 | **$134,568.00** | Assume an area 2,242 square feet by 15 feet deep required for 100,000-gallon underground potable water storage tank. |
| | Site Development - Rubble Removal | LS | $17,568.60 | 1 | **$17,568.60** | Assume 1 CY per ton |
| | Site Development - Expand water storage capacity | LS | $205,500.00 | 1 | **$205,500.00** | Assume a 100,000-gallon underground tank will be installed. |

3

Hite cost estimates

| | | | | | | |
|---|---|---|---|---|---|---|
| | Site Development - Utilize solar and fuel cell technology. | LS | $500,000.00 | 1 | **$500,000.00** | Assume it will cost $500,000 to include solar and fuel cell technology |
| | **Alternative C** | | **Total** | | **$1,108,188.00** | |
| | Site Development - Expand energy system | LS | $250,000.00 | 1 | **$250,000.00** | Assume it will cost $250,000 to expand utility needs to the additional structures. |
| | Site Development - Drill and Blast | LS | $134,568.00 | 1 | **$134,568.00** | Assume an area 2,242 square feet by 15 feet deep required for 100,000-gallon underground potable water storage tank. |
| | Site Development - Rubble Removal | LS | $17,568.60 | 1 | **$17,568.60** | Assume 1 CY per ton |
| | Site Development - Expand water storage capacity | LS | $205,500.00 | 1 | **$205,500.00** | Assume a 100,000-gallon underground tank will be installed. |
| | Site Development - Utilize solar and fuel cell technology. | LS | $500,000.00 | 1 | **$500,000.00** | Assume it will cost $500,000 to include solar and fuel cell technology |
| **Roads and Parking** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$266,300.00** | |
| | Site Demolition - Clearing and grubbing | LS | $22,800.00 | 1 | **$22,800.00** | Assume that medium grubbing is required for site preparation. |
| | Site Development - Gravel road to primitive campsites. | LS | $243,500.00 | 1 | **$243,500.00** | Assume that it will require 0.5 miles of new road to access the primitive campsites along the shoreline. |
| | **Alternative C** | | **Total** | | **$266,300.00** | |
| | Same as Alternative B | | | | | |
| **Fee Collection** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **School** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Airstrip** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |

4

Hite cost estimates

| | | | | | | |
|---|---|---|---|---|---|---|
| | Same as Alternative A | | | | | |
| **Boat Wash-Down Area** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$90,000.00** | |
| | Site Development - Construction of a boat wash-down area | LS | $90,000.00 | 1 | **$90,000.00** | Assume it costs $90,000 to build a boat wash-down area with water hook-ups and other necessary utilities. |
| | **Alternative C** | | **Total** | | **$90,000.00** | |
| | Same as Alternative B | | | | | |
| **Marina Facilities** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Water-Based Store** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Water-Based Food Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Launch Ramps** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |

5

Hite cost estimates

| | | | | | | |
|---|---|---|---|---|---|---|
| **Launch Ramp Support** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$62,700.00** | |
| | Site Development - Land-based boat pump-out facility | LS | $62,700.00 | 1 | **$62,700.00** | Assume cost of land-based boat pump-out similar to a sanitary dump station. |
| **Ferry Service** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **River Runner Takeout** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | No cost associated with Alternative A | | | | | |
| | **Alternative B** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| | **Alternative C** | | **Total** | | **$0.00** | |
| | Same as Alternative A | | | | | |
| **Grand Total** | | | | | | |
| | **Alternative A** | | **Total** | | **$0.00** | |
| | **Alternative B** | | **Total** | | **$4,883,413.00** | |
| | Concept Plan Contingency | | **25%** | | **$1,220,853.25** | |
| | Contractors, General Conditions, Profit, Bonds, and Overhead | | **12%** | | **$586,009.56** | **Allowance for Planning and Design Fees** |
| | **Subtotal** | | | | **$6,690,275.81** | |
| | Architecture and Engineering Fees Allowance | | **20%** | | **$1,338,055.16** | |
| | Owners Construction Contingency | | **5%** | | **$334,513.79** | |
| | **Total** | | | | **$8,362,844.76** | |
| | **Alternative C** | | **Total** | | **$4,946,113.00** | |
| | Concept Plan Contingency | | **25%** | | **$1,236,528.25** | |
| | Contractors, General Conditions, Profit, Bonds, and Overhead | | **12%** | | **$593,533.56** | **Allowance for Planning and Design Fees** |
| | **Subtotal** | | | | **$6,776,174.81** | |
| | Architecture and Engineering Fees Allowance | | **20%** | | **$1,355,234.96** | |
| | Owners Construction Contingency | | **5%** | | **$338,808.74** | |
| | **Total** | | | | **$8,470,218.51** | |

6

# Appendix C – Bald Eagle Sightings

# Appendix C

## Summary of Bald Eagle Winter Observations at Lake Powell for Indicated Time Spans of Recent Years (1991–2002)

| Location of Bald Eagle Sightings – (Area No.) | 11–91 03–92 | 12–92 02–93 | 11–93 03–94 | 11–94 02–95 | 11–95 02–96 | 01–97 02–97 | 12–97 02–98 | 12–98 02–99 | 12–99 01–00 | 12–01 02–02 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alcove Canyon – 5 | 1 | 1 | — | — | — | — | — | — | — | — |
| Annies Canyon – 4 | — | — | — | — | — | 1 | — | — | — | — |
| Antelope – 2 | — | — | — | — | — | — | 2 | 4 | 1 | 1 |
| Antelope Island – 2 | — | — | 1 | 1 | — | 2 | 6 | 2 | 4 | 3 |
| Antelope Point – 2 | — | — | — | — | 2 | — | — | — | — | — |
| Blue Notch – 9 | — | — | — | — | — | — | — | — | — | 1 |
| Bullfrog – 8 | 1 | — | 2 | 1 | — | 1 | — | — | — | — |
| Bullfrog Airport – 8 | — | — | 1 | — | — | — | — | — | — | — |
| Bullfrog Bay – 8 | 5 | 3 | — | 10 | 1 | 2 | 2 | 5 | 3 | 4 |
| Bullfrog Creek – 8 | — | — | — | — | — | — | — | — | — | 2 |
| Bullfrog (East) – 8 | 1 | — | — | — | — | — | — | — | — | — |
| Bullfrog (South) – 8 | — | — | — | — | — | — | 4 | — | — | — |
| Castle Butte – 9 | — | — | — | — | 1 | — | — | — | — | — |
| Castle Rock – 2 | — | — | 2 | — | 1 | 1 | 1 | 1 | — | 1 |
| Castle Rock (West of) – 2 | — | — | — | — | 1 | — | — | — | — | — |
| Cataract Canyon – 10 | 1 | 1 | 1 | 4 | 1 | 1 | — | 4 | 1 | 4 |
| Cataract Canyon (Below) – 10 | — | — | — | — | — | — | — | 1 | — | — |
| Cedar Canyon – 9 | 1 | — | — | — | — | — | — | — | — | — |
| CHA Canyon – 5 | — | 1 | 1 | — | — | — | — | — | — | — |
| Clay Hills – 6 | 1 | 2 | — | — | 1 | — | 2 | — | — | 1 |
| Clearwater Canyon – 10 | 1 | — | — | — | — | — | — | — | — | — |
| Colorado River – 1 | — | — | — | — | — | 1 | — | — | — | — |
| Cookie Jar – 3 | — | 1 | — | 1 | — | — | 2 | — | — | — |
| Copper Canyon – 5 | — | — | — | 2 | 1 | — | — | — | 1 | 1 |
| Cottonwood Bay – 4 | — | 1 | — | — | — | — | — | — | — | — |
| Cow Canyon – 7 | — | — | — | — | — | 1 | — | — | — | — |
| Crosby Canyon – 2 | — | — | — | — | — | — | — | 2 | — | — |
| Dangling Rope – 3 | 1 | — | — | — | — | — | 1 | — | — | 1 |
| Dirty Devil – 9 | — | — | — | — | — | — | — | 1 | 2 | — |
| Dirty Devil (Mouth) – 9 | — | — | — | — | — | — | — | — | 1 | — |
| Dominiques Butte – 3 | 4 | — | — | — | — | — | — | — | — | — |
| Face Canyon – 3 | — | — | — | — | — | – – | 2 | 4 | 2 | — |
| Farley Canyon – 9 | — | — | — | — | — | — | — | — | — | 1 |
| Finger Rock Canyon – 3 | — | — | — | — | — | — | — | 1 | — | — |
| Forgotten Canyon – 9 | — | — | — | — | — | — | — | — | 1 | — |
| Fourmile Canyon – 9 | — | — | 1 | — | — | — | — | — | — | — |
| Good Hope Bay – 9 | 6 | — | 2 | 2 | — | — | 1 | 1 | — | 1 |

| Location of Bald Eagle Sightings – (Area No.) | 11–91 03–92 | 12–92 02–93 | 11–93 03–94 | 11–94 02–95 | 11–95 02–96 | 01–97 02–97 | 12–97 02–98 | 12–98 02–99 | 12–99 01–00 | 12–01 02–02 |
|---|---|---|---|---|---|---|---|---|---|---|
| Good Hope Bay (South) – 9 | 1 | 1 | — | — | 1 | 3 | — | — | — | — |
| Great Bend – 6 | — | — | — | — | — | — | 1 | — | — | — |
| Gregory Butte – 3 | 1 | — | — | — | — | — | — | — | — | 3 |
| Gregory Point – 3 | — | — | 1 | — | — | — | — | — | — | — |
| Gunsight – 3 | — | 1 | — | — | — | 1 | 1 | 3 | 1 | 2 |
| Gunsight Butte – 3 | — | 3 | — | 1 | — | — | — | — | — | — |
| Gypsum Canyon – 10 | 2 | — | — | — | — | — | — | — | — | — |
| Halls Bay – 8 | — | — | 1 | — | — | — | — | — | — | — |
| Halls Creek – 8 | — | 7 | 2 | 3 | 2 | — | 3 | — | 2 | 4 |
| Halls Creek Bay – 8 | — | — | 1 | — | — | 1 | 2 | 5 | 3 | 9 |
| Halls Crossing – 8 | 2 | — | — | 2 | 3 | 2 | 3 | 2 | — | 4 |
| Halls Crossing Bay – 8 | — | — | — | — | — | — | — | 1 | — | — |
| Halls Crossing (West Side) – 8 | — | — | — | — | — | 1 | — | — | — | — |
| Hite – 9 | 2 | — | — | — | — | 2 | 5 | 1 | 1 | 2 |
| Hite Bay – 9 | 1 | — | 1 | 3 | 1 | — | — | — | — | — |
| Iceberg Canyon – 4 | — | 1 | — | — | — | — | — | — | — | — |
| Jakes Arch – 7 | — | — | — | — | 1 | — | — | — | — | — |
| Kane Point – 8 | — | — | — | — | — | — | — | — | — | — |
| Lone Rock – 2 | — | — | 1 | — | 1 | 1 | 1 | — | — | — |
| Long Canyon (Entrance) – 4 | — | 1 | — | — | — | — | — | — | — | — |
| Marina (South of) – 9 | — | — | — | — | — | 1 | — | — | — | — |
| Mikes Canyon – 5 | — | — | — | — | — | — | — | 1 | — | — |
| Mile 7 Below Dam – 1 | — | — | 1 | — | — | — | — | — | — | — |
| Mille Grag Bend – 10 | 1 | — | — | — | — | — | — | — | — | — |
| Monitor Butte – 6 | 2 | — | 1 | — | — | — | — | — | — | — |
| Narrows Canyon – 10 | — | — | — | — | 2 | 1 | — | 2 | 3 | — |
| Navajo Canyon – 2 | — | — | — | — | 1 | — | — | 1 | — | 2 |
| Neskahi Wash – 5 | — | — | 1 | — | — | — | — | — | — | — |
| Nokai Canyon – 5 | 1 | — | — | — | — | — | — | — | — | — |
| Nokai Canyon (Across from) – 5 | — | — | 1 | — | — | — | — | — | — | — |
| No Man's Mesa – 5 | — | 1 | — | — | — | — | — | — | — | — |
| North Warm Creek – 2 | — | — | — | — | 1 | — | — | — | — | — |
| Oak Canyon – 3 | — | — | — | — | — | — | — | 1 | — | — |
| Padre Bay – 3 | — | 1 | 3 | 4 | 1 | — | — | — | — | 2 |
| Page Airport – 2 | — | — | — | — | — | — | — | — | 1 | — |
| Piute Farms – 5 | 1 | 1 | 2 | — | — | 1 | — | — | — | — |
| Piute Wash – 5 | — | — | — | — | — | — | — | 1 | — | — |
| Red Canyon – 9 | — | — | — | — | — | — | 1 | 3 | 1 | — |
| Rincon – 4 | 1 | — | — | — | — | — | — | — | — | — |
| Rock Creek – 3 | — | 3 | — | 1 | — | — | — | — | — | — |
| Romana Mesa – 3 | — | — | — | 2 | — | — | — | — | — | 1 |
| San Juan – 5 | — | — | 1 | — | — | 1 | 5 | 3 | 2 | 3 |
| San Juan Arm – 5 | — | — | — | 1 | — | — | — | — | — | — |

| Location of Bald Eagle Sightings – (Area No.) | 11–91 03–92 | 12–92 02–93 | 11–93 03–94 | 11–94 02–95 | 11–95 02–96 | 01–97 02–97 | 12–97 02–98 | 12–98 02–99 | 12–99 01–00 | 12–01 02–02 |
|---|---|---|---|---|---|---|---|---|---|---|
| San Juan Canyon – 5 | — | 1 | — | — | — | — | — | — | — | — |
| San Juan (Great Bend) – 5 | — | — | — | — | — | — | — | — | — | 1 |
| San Juan (Mouth) – 5 | — | 1 | 1 | — | — | — | — | — | — | — |
| San Juan River – 6 | — | — | 1 | — | — | — | 1 | — | 2 | — |
| Seven Mile Creek – 9 | — | — | — | — | — | — | 1 | — | — | — |
| Sheep Canyon – 10 | — | — | 1 | — | — | — | — | — | — | — |
| Slick Rock (Slickrock) Canyon – 4 | — | — | 1 | 1 | — | — | — | — | — | — |
| Stanton Creek – 8 | — | 1 | — | 5 | — | — | 1 | — | — | — |
| Stevens Arch – 7 | — | — | 1 | — | — | — | — | — | — | — |
| Tapestry (South) – 9 | 1 | — | — | — | — | — | — | — | — | — |
| Tapestry Wall – 9 | — | 1 | 1 | — | — | — | — | 1 | — | — |
| Tapestry (West) – 9 | — | 1 | — | — | — | — | — | — | — | — |
| The Chains – 2 | — | — | — | — | 1 | — | — | — | — | — |
| The Horn – 9 | 1 | — | — | — | — | 1 | — | — | 2 | 2 |
| The Narrows – 10 | 1 | — | — | — | — | — | — | — | — | — |
| Ticaboo Canyon – 9 | — | — | — | — | — | — | — | 1 | — | — |
| Ticaboo (South of) – 8 | — | — | — | 1 | — | — | — | — | — | — |
| Trachyte Creek – 9 | — | — | — | — | — | — | 1 | — | — | — |
| Two Mile Canyon – 9 | — | 2 | — | — | — | — | — | — | — | — |
| Wahweap Bay – 2 | — | 1 | 1 | — | — | 1 | 1 | 5 | 2 | 6 |
| Wahweap Creek – 2 | — | — | — | — | — | — | — | — | — | 2 |
| Warm Creek – 2 | 1 | — | 4 | 4 | — | 3 | — | 1 | 3 | 5 |
| Warm Creek Bay – 2 | — | — | — | — | — | 1 | — | — | — | — |
| Waterhole Canyon – 1 | — | — | — | — | — | 1 | — | — | — | — |
| Waterhole Flats – 10 | 1 | — | 1 | — | — | — | — | — | — | — |
| West Canyon – 3 | — | — | — | — | — | 1 | — | 1 | — | 1 |
| West Canyon (East) – 3 | — | — | 1 | — | — | — | — | — | — | — |
| West Canyon (Mouth) – 3 | — | — | — | — | 1 | — | — | — | — | — |
| White Canyon – 9 | — | — | — | — | — | — | — | 2 | — | — |
| Zahn Bay – 5 | — | — | 1 | 4 | — | — | 1 | — | — | — |
| **Total Observations** | **43** | **39** | **42** | **53** | **25** | **33** | **51** | **61** | **39** | **70** |

Note: Only 1 month of data (23 bald eagle observations) were recorded during December 2000 (Spence 2002), so that winter season was not included in the table.

Source: Spence 2002

# Appendix D – Consultation

Glen Canyon National Recreation Area
Project Scoping meetings with affiliated Tribes

Uplake Development Concept Plan/Environmental Assessment

The **White Mesa Ute Band** the Ute Mountain Ute Tribe had their meeting in Blanding, Utah on February 10, 2004. Approximately 10 tribal members attended the meeting, which included 5 board members.

**Comments and Questions:**

- The White Mesa Ute Band Board will disperse this information to their people and if they have any major concerns, the Board Chairperson Mary Jane Yazzie will contact our office.
- Inquires were made as to the Antelope Point Marina's low water affects.

**Hopi Tribe**: The Hopi Tribal Cultural Preservation meeting was on February 18, 2004 in Kykotsmovi, Arizona. The Cultural Preservation staff has requested that an on site visit to Farley, White, and Blue Notch Canyons to see if there are any archeological sites or rock arts.

They asked to be kept informed of the planning document through its completion.

The **Kaibab Paiute Tribe:** The tribal council had their meeting on February 19, 2004 and approximately 20 people were in attendance including the council members.

**Comments:**

- We really appreciate your efforts in communicating with our tribe.
- We still have not received word from the Bureau of Reclamations on what is being planned as far as the pipeline (water from Lake Powell) is concerned.
- Antelope Point – Is the development still in process or have they stopped the development due to low water?
- What is the current lake elevation?
- Unfortunately, some of our staff is not present that would have some input your planning document, but we will past this information on to them. They will contact you if they have any major concerns.

**Koosharem Band of the Paiute Indian Tribe of Utah:** The tribal meeting consisted of five council members and approximately 15 people in attendance on February 22, 2004.

**Comments:**

- The council members inquired about the locations of Farley, White and Blue Notch Canyons on the Glen Canyon NRA map.
- They wanted know if access roads are already in place.
- The tribe would like to be kept up to date on the low water affects and any new developments such as the relocation of Hite Marina if that should happen.

crossing. We do not believe that's right. If they do than include Antelope Point Marina.

- We wonder if the Park would allow us to go back to farming in the side canyons if the water keeps getting low.
- The Hite Marina facilities should not be moved to other areas, if water is low, than visitors should be decreasing too.
- It is good to get an update of the marina operations throughout the lake and to get an understanding of how low water effects these operations.
- We appreciate the Park Service coming to tell us about the low water effects and seeing these pictures on how it really is out there. Sometimes when people tell about areas, you really don't understand it until you see. Thank you.

**San Juan Southern Paiute:** Contact with this tribe has been difficult. Telephone calls have been made numerous times and responses have been very limited by receiving tentative meeting dates with no real commitments.

**Shivwits Band of Southern Paiute:** The tribe has one meeting a month and schedule has been a conflict with other meetings. Finally, we have an opening to attend the June 3, 2004 tribal meeting. Their input and comments will be updated after their meeting.

Pauline Wilson

# Kaibab Band of Paiute Indians

August 31, 2004

Pauline Wilson
American Indian Liaison
Glen Canyon National Recreation Area
PO Box 1507
Page, AZ 86040-1507

Dear Ms. Wilson;

Thank you for your request for tribal involvement in the Glen Canyon National Recreation Area Uplake Development Concept Plan/ Environmental Assessment. We appreciate your recognition of our tribe's sovereign status.

As you probably know, the Kaibab Paiutes consider issues relating to Glen and Grand canyons to have special significance. The existing extensive development associated primarily with the NRA does not lend itself to resource protection; this is troubling to the tribe. Actions that seek to increase development or visitation are counter to our view of the desired treatment for this area.

Based on the draft range of alternatives for all of the sites, the Kaibab Band of Paiute Indians supports Alternative A (the No Action Alternative) in all cases. We hope that you respect our wishes.

Please be advised that parties wishing to appear before the Kaibab Paiute Tribal Council (held every third Thursday in a given month) need to submit their request to appear on the agenda by the second Wednesday.

Once more, thank you for requesting our involvement in this matter.

Regards,

LeAnn Skrzynski
Environmental Program Director

Tribal Affairs
HC 65 Box 2
Pipe Spring, Arizona 86022
Phone (928) 643-7245
Fax (928) 643-7260

**Trip Report**
**April 11, 2006**
**Pauline Wilson, American Indian Liaison**

**AREA VISITED:**

The Paiute Indian Tribes of Utah, Kanosh Paiute Band on the Kanosh Paiute Indian Reservation. of Kanosh, Utah near Cedar City..

**PURPOSE:**

Provide updated information to the Kanosh Paiute Tribe of Glen Canyon National Recreation Area (NRA) planning projects.

**PRINCIPAL PARTICIPANTS:**

The Kanosh Paiute Band Council of Kanosh, Utah; community members approximately 20 people and me.

**ISSUES DISCUSSED:**

I presented to the Kanosh Paiute Band Council:

- Uplake Development Concept Plan (DCP)
- Hazard Tree Removal in developed areas of the park
- Lees Ferry Improvement.
- Colorado River Restoration Project.
- Viking Oil Project that will be forthcoming in the future.

**RECOMMENDATIONS/DECISIONS:**

Questions that were posed were:

1. The lake elevation is at what level? Answer: About 3580.
2. How is Hite Marina, is it still operating as a marina? Answer: No, the Hite bay now only has a river.
3. A couple of our Paiute members had traveled to Bullfrog Marina in Utah to give input on Burr Trail. We always want to be kept informed of the areas around Halls Crossing and we want thank you for not forgetting us out here, we know it is a long ways out there.

**OBSERVATIONS:**

The council members gave appreciation for my being at their meeting, considering the long drive to their reservation. They would like to continue to be informed all new developments in the Uplake Marinas. Thus far they have a lot of respect for the National Park Service for making the effort to involve the Kanosh Paiute Band.

April 24, 2006
Submitted by Pauline Wilson, American Indian Liaison, Glen Canyon NRA

Statement regarding American Indian Tribes/Nations
with various associations or affiliation to the park

In 1995, Glen Canyon National Recreation Area (NRA) and Rainbow Bridge National Monument (NM) contacted 36 American Indian tribes potentially affiliated with Glen Canyon NRA and/or Rainbow Bridge NM. These contacts were made to determine those tribes who wished to consult with Glen Canyon NRA and Rainbow Bridge NM on matters relating to the implementation of the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990. At that time, 12 tribes responded that their communities were closely affiliated with Glen Canyon NRA and/or Rainbow Bridge NM and that they would like to be consulted. Since the original list of 36 tribes was constructed to reflect all American Indian tribes having the potential of historic and cultural affiliation, the resulting shorter list has since been routinely used to consult on a wider range of issues.

The present effort to prepare a draft environmental assessment for the Uplake Development Concept Plan (DCP) is one of these non-NAGPRA related issues. Since Glen Canyon NRA has routinely used the list of 12 tribes to consult on other non-NAGPRA related work such as planning, management, and visitor education activities, it would be consistent to use this shorter list for consultation on the Uplake DCP.

12 Tribes/Nations:

Hopi Tribal Council, Arizona
Havasupai Tribal Council, Arizona
Hualapai Indian Tribal Council, Arizona
Navajo Nation, Arizona, New Mexico & Utah
Pueblo of Acoma
Pueblo of Nambe
Pueblo of San Juan
Pueblo of Zuni
Kaibab Paiute Tribal Council (This Tribal Band is included/Paiute Indian Tribe of Utah)
Paiute Indian Tribe of Utah Council (Kanosh, Koosharem, Shivwits Bands)
San Juan Southern Paiute Council, Arizona
Ute Mountain Ute Tribal Council (White Mesa Ute Band), Colorado & Utah

**Trip Report**
**May 17, 2006**
**Pauline Wilson, American Indian Liaison**

**AREA VISITED:**

Pueblo of San Juan in San Juan, New Mexico

**PURPOSE:**

Provide updated information to the Pueblo of San Juan about the Glen Canyon National Recreation Area (NRA) planning projects.

**PRINCIPAL PARTICIPANTS:**

**ISSUES DISCUSSED:**

I presented to the Pueblo of San Juan the following documents/projects.

- Uplake Development Concept Plan (DCP)
- Hazard Tree Removal in developed areas of the park.
- Lees Ferry Improvement.
- Colorado River Restoration Project.
- Viking Oil Project that will be forthcoming in the future.

**RECOMMENDATIKONS/DECISIONS:**

Comments:

It was stated

**OBSERVATIONS:**

United States Department of the Interior

FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

GLEN CANYON NATIONAL RECREATION AREA
RECEIVED: JUN 22 2004

| RTG | OFFICE | INT/DATE |
|---|---|---|
| 1 | SUPERINTENDENT | 6/22 |
| | ASST SUPERINTENDENT | |
| | MANAGEMENT ASST | |
| | SAFETY OFFICER | |
| | CH FACILITIES MGMT | |
| | CH ADMINISTRATIVE SVC | |
| | BUDGET | |
| | PERSONNEL | |
| | CH RANGER | |
| | FEE MANAGER | |
| | CH INTERPRETATION | |
| | CH CONCESSIONS MGMT | |
| CR | CH RESOURCE MANAGEMENT | |
| | LIBRARY | |
| 2 | LIZA Ermeling | |

In Reply Refer To
FWS/R6
ES/UT
04-0813

June 14, 2004

Kitty L. Roberts
National Park Service
Glen Canyon National Recreation Area
P.O. Box 1507
Page, Arizona 86040

RE: Request for Threatened and Endangered Species list for Bullfrog, Halls Crossing, and Hite Marina Areas Within Glen Canyon NRA

Dear Ms. Roberts:

Thank you for informing us that the information we provided in response to your April 12, 2004 request for a species list, was for an inaccurate location. Included is a species list for Garfield, Kane and San Juan Counties. We apologise for the inconvenience.

Based on information provided in your letter of April 12, below is a list of endangered (E), threatened (T), and candidate (C) species that may occur in the area of influence of your proposed action.

| Common Name | Scientific Name | Status |
|---|---|---|
| GARFIELD | | |
| Aquarius Paintbrush | *Castilleja aquariensis* | C |
| Autumn Buttercup | *Ranunculus aestivalis* | E |
| Jones Cycladenia | *Cycladenia humilis* var. *jonesii* | T |
| Maguire Daisy | *Erigeron maguirei* | T |
| Ute Ladies'-tresses | *Spiranthes diluvialis* | T |
| Bonytail[4,10] | *Gila elegans* | E |
| Colorado Pikeminnow[4,10] | *Ptychocheilus lucius* | E |
| Humpback Chub[4,10] | *Gila cypha* | E |
| Razorback Sucker[4,10] | *Xyrauchen texanus* | E |
| Bald Eagle[3] | *Haliaeetus leucocephalus* | T |
| California Condor[7] | *Gymnogyps californianus* | E |
| Mexican Spotted Owl[1,4] | *Strix occidentalis lucida* | T |
| Southwestern Willow Flycatcher | *Empidonax traillii extimus* | E |

| | | |
|---|---|---|
| Western Yellow-billed Cuckoo | *Coccyzus americanus occidentalis* | C |
| Utah Prairie Dog | *Cynomys parvidens* | T |
| KANE | | |
| Jones Cycladenia | *Cycladenia humilis* var. *jonesii* | T |
| Kodachrome Bladderpod | *Lesquerella tumulosa* | E |
| Navajo Sedge | *Carex specuicola* | T |
| Siler Pincushion Cactus | *Pediocactus sileri* | T |
| Welsh's Milkweed[4] | *Asclepias welshii* | T |
| Kanab Ambersnail[5] | *Oxyloma haydeni kanabensis* | E |
| Coral Pink Sand Dunes Tiger Beetle | *Cincindela limbata albissima* | C |
| Colorado Pikeminnow[4,10] | *Ptychocheilus lucius* | E |
| Razorback Sucker[4,10] | *Xyrauchen texanus* | E |
| Bald Eagle[3] | *Haliaeetus leucocephalus* | T |
| California Condor[7] | *Gymnogyps californianus* | E |
| Mexican Spotted Owl[1,4] | *Strix occidentalis lucida* | T |
| Southwestern Willow Flycatcher | *Empidonax traillii extimus* | E |
| Western Yellow-billed Cuckoo | *Coccyzus americanus occidentalis* | C |
| Utah Prairie Dog | *Cynomys parvidens* | T |
| SAN JUAN | | |
| Navajo Sedge | *Carex specuicola* | T |
| Bonytail[4,10] | *Gila elegans* | E |
| Colorado Pikeminnow[4,10] | *Ptychocheilus lucius* | E |
| Humpback Chub[4,10] | *Gila cypha* | E |
| Razorback Sucker[4,10] | *Xyrauchen texanus* | E |
| Bald Eagle[3] | *Haliaeetus leucocephalus* | T |
| California Condor[7] | *Gymnogyps californianus* | E |
| Gunnison Sage Grouse | *Centrocercus minimus* | C |
| Mexican Spotted Owl[1,4] | *Strix occidentalis lucida* | T |
| Southwestern Willow Flycatcher | *Empidonax traillii extimus* | E |
| Western Yellow-billed Cuckoo | *Coccyzus americanus occidentalis* | C |
| Black-footed Ferret[6] | *Mustela nigripes* | E |

Nests in this county of Utah.
[2] Migrates through Utah, no resident populations.
[3] Wintering populations (only five known nesting pairs in Utah).
[4] Critical habitat designated in this county.
[5] Critical habitat proposed in this county.
[6] Historical range.
[7] Experimental nonessential population.
[8] Introduced, refugia population.
[9] Candidate species have no legal protection under the Endangered Species Act. However, these species are under active consideration by the Service for addition to the Federal List of Endangered and Threatened Species and may be proposed or listed during the development of the proposed project.
[10] Water depletions from *any* portion of the occupied drainage basin are considered to adversely affect or adversely modify the critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.

# United States Department of the Interior

NATIONAL PARK SERVICE
Glen Canyon National Recreation Area
P.O. Box 1507
Page, Arizona 86040

MAR 24 2004

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
H4217 GLCA-1445-C

Wilson Martin, Director
Utah State Historical Society
300 Rio Grande
Salt Lake City, Utah 84101-1182

Reference: Glen Canyon National Recreation Area (NRA), Environmental Assessment (EA) to Evaluate Potential Impacts of Uplake Development Concept Plan (DCP)

Subject: Section 106 Compliance

Dear Mr. Martin:

Glen Canyon NRA has initiated planning on the draft Uplake DCP to study the facilities and visitor services provided at Hite, Bullfrog, and Halls Crossing marina areas. Draft alternatives for future development will be identified and an EA will be prepared to evaluate potential impacts to the natural and human environment. Existing DCPs for these areas were approved almost 20 years ago and an update is needed to address changing lake levels and the age of various lake facilities. When completed, the final DCP will guide development in the uplake areas for the next 10+ years.

This letter is to inform your office that we will be developing a combined environmental impact document that addresses both compliance with Section 106 of the National Historic Preservation Act, as amended, and the National Environmental Policy (as described in 36 CFR 800.8[a-c]). Upon its completion, the draft EA will be distributed to your office for review, comment, and concurrence with the National Park Service's determination of effects on cultural resources. Additional supporting information resulting from the analysis process will be included with the draft EA as appropriate.

We look forward to receiving your input on the planning process. We believe that it will ensure that cultural resources are adequately considered while meeting our planning objectives. As required by 36 CFR 800, the Advisory Council on Historic Preservation has also been notified as to our intent to include Section 106 compliance within the environmental assessment document.

If you have any questions or need additional information, please contact Archeologist Chris Kincaid of my staff at 928-608-6277.

Sincerely,

KITTY L. ROBERTS

Kitty L. Roberts
Superintendent

bcc:
Chief, Resource Mgmt, GLCA
Archeologist, GLCA
Project Mgr, GLCA

C.Kincaid:jmh:3/22/04:p:Kincaid/Uplake DCP UT SHPO EA 106 Notification ltr.doc

United States Department of the Interior

NATIONAL PARK SERVICE
Glen Canyon National Recreation Area
P.O. Box 1507
Page, Arizona 86040

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

D18 GLCA-1448
UL DCP

JUN 23 2006

RECEIVED JUN 2006

Mr. Henry Maddox, Field Supervisor
US Fish and Wildlife Service
Utah Field Office
2369 West Orton Circle, Suite 50
West Valley City, Utah 84119

Dear Mr. Maddox:

The National Park Service, Glen Canyon National Recreation Area (NRA) is in the process of completing an Environmental Assessment for the future development of the existing developed marina areas located in Garfield, Kane, and San Juan Counties in Southern Utah. This document is titled "Draft Uplake Development Concept Plan (DCP)/Environmental Assessment (EA)." The marina areas included in this DCP, highlighted on a location map (enclosure 1), include Hite, Bullfrog, and Halls Crossing. An initial scoping letter and request for a species list for this project was sent to your office on April 24, 2004.

This letter is being forwarded to you in order to fulfill our obligation as required by Section 7 of the Endangered Species Act.

The Environmental Assessment for the DCP includes Alternative A (No Action Alternative), Alternative B – Moderate Build out (preferred Alternative) and Alternative C – Extreme Build out. A list of proposed projects for each location is included as enclosure 2. A map showing the No Action Alternative for each development area is included as enclosures 3, 4, and 5. A map showing Alternative B for each developed area is included as enclosures 6, 7, and 8. A map showing Alternative C for each developed area is included on enclosures 9 and 10. The majority of the proposed project for Alternatives B and C will expand existing facilities within the disturbed footprint of each developed area. Projects that will disturb new areas include the placement of new visitor use boat ramps and State of Utah Ferry ramps at Bullfrog and Halls Crossing (see enclosure 11 ) should the water level of Lake Powell recede below 3550 feet in elevation. Additionally, a new shoreline camping area is proposed for the Hite developed area.

As shown in the enclosed species status table (enclosure 12), NPS biologists have determined that the range of proposed projects will have no affect on the following listed species: Bonytail, California Condor, Colorado Pikeminnow, Humpback Chub, Jones Cycladenia, Mexican Spotted Owl, Razorback Sucker, and Yellow-billed Cuckoo. The species status table also provides

explanation of why the majority of species listed in Garfield, Kane, and San Juan Counties including those that occur or have habitat within the boundary of Glen Canyon NRA will not be affected.

We have also determined that our proposed range of projects could create a "may affect, not likely to adversely affect" situation for the Southwestern Willow Flycatcher and the Bald Eagle.

In the paragraphs below we provide information used as the basis for determining the DCP related impacts to the Southwestern Willow Flycatcher and Bald Eagle.

**Southwestern Willow Flycatcher (Empidonax traillii extimus)**
Potentially suitable habitat for the Southwestern Willow Flycatcher occurs along the eastern side of the boat ramp at the Hite Marina Area as seen in the enclosed photo log (enclosure 13). This area may be described as a large, gently sloping plane that extends approximately 2000 feet to the waters edge. A large area of tamarisk/willow habitat is growing on this plane, with the largest trees being found along the upland transition zone. This habitat proceeds unbroken from 3670 feet in elevation to the shoreline of the Colorado River at 3550 feet in elevation. The habitat can be characterized as dense with a small number of fragmented openings. These openings generally contain a thick cover of herbaceous vegetation. While composition information has not been collected for the project area, anecdotally, the site appears to be predominately tamarisk/willow, with the numbers of tamarisk far exceeding the number of willows.

This area has been proposed as the site of low water shoreline camping. The proposed project would include installation of a graded, gravel surfaced road and portable restrooms. Camping sites would be by individual visitor choice and the camping area would be closed during the breeding season of the Southwestern Willow Flycatcher.

Both the habitat area and the camping area are subject to periodic inundation as the level of Lake Powell rises. Much of this shoreline growth is the result of drought conditions during the last 5-8 years, which has resulted in an accumulation of sediment and downstream movement of the boundary between the lake and river. The accumulation of sediment has caused the main channel to move against the western bank, leaving large areas of backwater and sediment islands along the eastern bank. This has provided the ideal substructure for the development of dense stands of tamarisk/willow habitat. As the water rises and falls, dependent on water releases from Glen Canyon Dam, the river edge area is periodically inundated, generally during the summer months when the migratory bird would be nesting and raising young. Much of this habitat area was underwater as late as 2000 and would again be underwater if the drought ended and the necessary amount of run-off entered the lake.

Presence and Absence surveys have not been conducted for this species in this area. Determination of affect was based on the habitat description for the Southwestern Willow Flycatcher as found in its recovery plan. Our observations reveal clear evidence of dense riparian thickets of large patch size that are near quiet, slow-moving backwater that is subject to periodic inundation, scouring floods and sediment deposition.

Yearly surveys were conducted from 1992 to 2000 for the Southwestern Willow Flycatcher below Glen Canyon Dam in Glen Canyon NRA. In May 1993 and 1994, several individuals were detected but did not remain at the locations they were observed and were probably migrants. Additionally, these sightings were in early to late May and identification was not positive and therefore, could have possibly been Northern Willow Flycatchers, which migrate through the area in late spring, before the Southwestern Willow Flycatchers arrive. The nearest known breeding site is on the Colorado River about 50 miles below Glen Canyon Dam and over 100 miles southwest of the Hite developed area. Surveys have not been conducted at Hite.

There is no suitable habitat at or adjacent to the Bullfrog and Halls Crossing Developed areas (see enclosure 14 and 15).

**Determination - May Affect, Not Likely To Adversely Affect.**

Mitigation Measures:

In order to lessen the possible minor affects to Southwestern Willow Flycatcher habitat and any individual birds that may be using this area for roosting, foraging or nesting, the following mitigation measures have been incorporated into the EA: construction of the access road, restrooms and any other incidental actions needed to develop this camping area will take place outside the Southwestern Willow Flycatcher breeding season. Additionally, use of the camping area will be restricted to the non-breeding season. These restrictions will be lifted should the water level increase and drown the habitat area. As the water rises and falls, the shoreline camping area will be adjusted accordingly.

**Bald Eagle (Haliaeetus leucocephalus)**

**Bald eagle** (*Haliaeetus leucocephalus*) can be found in Glen Canyon NRA around the Lake Powell shoreline during the wintertime. During this time, they have generally been found roosting on sandstone outcrops and cottonwood snags. Bald eagles have not been found elsewhere in the park. Aerial surveys for this species are completed during the annual Audubon Christmas Bird Count and in the last 4 years, 95 percent have been sighted on cliffs and rounded sandstone hilltops. These birds do not breed in Glen Canyon NRA and our bird specialist, Dr. John Spence believes that these birds are from nearby Arizona and Colorado breeding populations. The earliest seasonal record of a bald eagle in Glen Canyon NRA is September 7$^{th}$ and the latest record is March 19$^{th}$. Between 1990 and 2002, 699 bald eagles were recorded during 60 aerial surveys with high year-to-year variability. Glen Canyon NRA staff continues to monitor bald eagles annually

Both adult and immature bald eagles have been seen foraging in Bullfrog Bay and have also been seen roosting on sandstone hilltops north and south of the Bullfrog developed area and north and south of the Hite developed area. The area south of the Bullfrog developed area and north and south of the Halls Crossing developed area have been proposed as expansion areas for visitor use boat ramps and the State of Utah Ferry ramp, should the level of Lake Powell drop below 3550 feet in elevation. At this elevation, the current ramps will become unusable; and due to topography, extension of these ramps will not be possible and new ramps will have to be built.

**Determination: May affect, not likely to adversely affect.**

Mitigation Measures: None

While bald eagles are seen in the park during winter months, adverse impacts under either of the alternatives would be negligible for this species. Most roost sites found during yearly surveys were located well outside the developed areas along remote sections of the shoreline. Additionally, the bald eagles in the NRA are able to move freely from one roost site to another and always vacate an area being occupied (even temporarily) by humans.

These recommendations will be included in the Draft Uplake DCP/EA to be released for public review in mid-July. The NPS requests your concurrence with our determination.

Please contact Ms. Barbara Wilson, Environmental Compliance Specialist, at 928-608-6333 or by email at Barbara_Wilson@nps.gov.

Sincerely,

Kitty L. Roberts
Superintendent

Enclosures - 16

☐ Concur No Effect

☒ Concur Not Likely to Adversely Affect

☐ No Comment

for U.S.F.W.S. – Utah Field Supervisor

Date_____

# Appendix E – 2005 Visitor Survey Excerpt

# Glen Canyon National Recreation Area: 2005 Visitor Study

**Technical Report**

Prepared for

**Glen Canyon National Recreation Area**
**National Park Service**

by

Dorothy H. Anderson, Ph.D.
Jerrilyn L. Thompson
Katherine M. Flitsch
Jacob S. Donnay

**October 2005**

# Glen Canyon National Recreation Area
# 2005 Visitor Study

## Technical Report

Prepared for

Glen Canyon National Recreation Area
National Park Service

by

Dorothy H. Anderson, Ph.D.
Department of Forest Resources
University of Minnesota
115 Green Hall
1530 N. Cleveland Ave
St. Paul, MN 55108
dha@umn.edu

Jerrilyn L. Thompson
National Park Service
Great Lakes Northern Forest CESU
115 Green Hall
1530 N. Cleveland Ave
St. Paul, MN 55108
Jerrilyn_Thompson@nps.gov

Katherine M. Flitsch
Department of Forest Resources
University of Minnesota
115 Green Hall
1530 N. Cleveland Ave
St. Paul, MN 55108
flit0003@umn.edu

Jacob S. Donnay
Department of Forest Resources
University of Minnesota
115 Green Hall
1530 N. Cleveland Ave
St. Paul, MN 55108
donn0061@umn.edu

October, 2005

## INTRODUCTION

Glen Canyon National Recreation Area (Glen Canyon NRA) is located in northern Arizona and southern Utah along the Colorado River. The centerpiece of Glen Canyon NRA is Lake Powell, a 186-mile long reservoir created when the Colorado River was dammed near Page, Arizona. The Glen Canyon Dam creates hydroelectric power and stores water as part of the Colorado River Compact, an agreement on the division of the water in the Colorado River among the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The dam itself is a major attraction of Glen Canyon NRA. Lake Powell has more than 1,800 miles of shoreline because of the many side canyons off the main canyon. A variety of recreational opportunities exist on and around the Lake. For example, kayaking, riding a tour boat, power boating, sailing, using personal watercraft, water skiing, and fishing are among the many water sports visitors enjoy. Opportunities also exist for hiking in the surrounding canyon areas. Visitors can enjoy a range of camping opportunities from remote and undeveloped campsites to fully developed campgrounds. Finally, visitors to the area can see archeologically and culturally significant sites such as Rainbow Bridge, a site of spiritual importance for American Indians, and the tallest natural bridge in the United States.

Between 1999 and 2004 water levels at Glen Canyon NRA dropped 100 vertical feet. The drop was caused primarily by the occurrence of drought in the desert southwest. This drop in water level changes the surface area of Lake Powell. One consequence of this change is that the physical carrying capacity of Lake Powell for recreational boating decreases. Moreover, the social carrying capacity and quality of the visitor experience may also change as a result of the drop in water level.

The National Park Service is the managing authority for Glen Canyon NRA and is charged with providing high quality recreation experience opportunities for Glen Canyon NRA visitors. The current recreation management plan for recreational boating was written and implemented before the drought occurred. The physical and social carrying capacities outlined in the current management plan are based on conditions that existed prior to the drought. Glen Canyon NRA staff asked NPS staff and University of Minnesota researchers associated with the Cooperative Park Studies Program (CPSP) and the Great Lakes Northern Forest Cooperative Ecosystem Studies Unit (GLNF CESU) to conduct a study of visitor use at Glen Canyon NRA. The CPSP was asked to conduct the study because it had conducted the visitor study that was used to establish social carrying capacity for Lake Powell prior to the drought. The research team at the University of Minnesota collaborated with $e^2M$, a consulting firm in Denver, Colorado with a long history of developing physical carrying capacity models for the NPS, and with Glen Canyon NRA park staff to develop and administer the visitor survey instrument. Glen Canyon NRA staff will use the study results to determine physical and social carrying capacities for recreational use, especially boating use, at Glen Canyon NRA.

## PURPOSE OF THE STUDY

Lower water levels change the surface area of Lake Powell with subsequent changes in amount of shoreline, number of access points to enter and exit Lake Powell, number of quality shoreline camping opportunities, and number of overnight anchoring sites for recreational boaters. However, visitor demand for access and quality boating and camping experiences may not change as a result of lower water levels. Changes in facilities and condition of facilities impacts visitor expectations and experiences. Specifically, the net effect of lower water levels may be an increase in visitor competition for recreational space and resources resulting in increased visitor crowding and conflicts.

Specific topics addressed in this survey included:

- Characteristics of respondents' visits (e.g., activities engaged in and type of boat used at Glen Canyon NRA),
- Respondents' socioeconomic background (e.g., age, gender, education, income, ethnicity and race, residence, past experience at Glen Canyon NRA),
- Respondents' desired experiences and benefits they attain as a result of visiting Glen Canyon NRA,
- Respondents' preferences for seeing and hearing other visitors at Glen Canyon NRA,
- Respondents' perceptions of problems such as crowding and use conflicts at specific locations on Lake Powell,
- Respondents' preferences for management actions to solve visitor problems resulting from lower water levels, and
- Respondents' satisfaction with the quality of service at Glen Canyon NRA.

These data will allow Glen Canyon NRA planners and managers to determine if changes in physical and social carrying capacities are needed, where changes might be appropriate, and how the recreating public will respond to changes made as a result of lower water levels.

## STUDY METHODS

A mailback survey was used to gather study data. Glen Canyon NRA staff and e²M consultants worked with GLNF CESU researchers to develop the survey instrument. Once the survey instrument was designed and approved by all parties, University of Minnesota researchers prepared and submitted the survey and survey documentation to the Office of Management and Budget (OMB) for their approval. NPS staff at Glen Canyon NRA gathered names and mailing addresses of past visitors to Glen Canyon NRA. The names and addresses came from various mailing lists maintained by the park. Specifically, the mailing lists represented the following groups: a) boaters who rent slips, dry boat storage space or buoys at Glen Canyon NRA, b) individuals on NPS and concessioner marina mailing lists, c) independent business partners with the park, and d) public information lists used for mailing information notices on past park planning efforts. These lists represented a total of 2,922 names and addresses. The names and addresses were sent to e²M where their consultants checked the lists for duplicate names and incomplete addresses. Once duplicates or incomplete addresses were removed, e²M drew a random sample of 500 names for the study. Dillman's Tailored Design Method (2000) was followed so that each person in the sample received a prenotice postcard, mailed questionnaire with cover letter explaining the purpose of the study, and follow-up reminder postcards and re-mailings of questionnaires as needed. The survey is included in Appendix B and copies of each piece of survey correspondence is included in Appendix C of this report. The survey packet included a self-addressed, stamped envelope for respondents to mail their completed questionnaire back to University of Minnesota researchers who were responsible for raw data retrieval, data entry, data analysis, and report writing. The survey mailings took place during May and June 2005. Four questionnaires were undeliverable resulting in a total sample size of 496. A total of 332 usable questionnaires were returned resulting in a response rate of 66 percent [(332)/(500-4)].

### Study Limitations

A purpose of this study is to look at how visitor characteristics, use patterns, expectations, and perceptions have changed since the 1999-2000 visitor use studies were conducted. This study is being conducted because of the significant change in water levels at Lake Powell since 2000. The study population for the 2005 study represents a convenience sample from which names were randomly selected. It does not represent a random selection of visitors using Lake Powell during any particular season. It also is not representative of visitor use by access point. Caution should be exercised when comparing this study's results to results of the 1999-2000 visitor use studies. Those studies represented a random sample of visitors by access point to Lake Powell and the degree of confidence in generalizing the study sample responses to the entire Lake Powell recreational visitor population is high compared to the ability to generalize this study's findings to the larger population.

Compared to the 1999-2000 study respondents, the 2005 study respondents are:

- More likely to be male (83 percent in 2005 vs. 60 percent in 1999-2000),
- More likely older (average age of 54 vs. 42),
- More likely to have a college education (55 percents vs. 49 percent),
- More likely to have a significantly higher income (75 percent > $75,000 vs. 75 percent > $40,000),
- More likely to have visited the area more times (96 percent > 10 visits vs. 58 percent > 5 visits),
- More likely to spend fewer nights in the area (5 nights vs. 5.7 nights), and
- More likely to use a houseboat on the lake (58 percent vs. 20 percent).

## DISCUSSION

This study was conducted because water levels in Lake Powell have dropped dramatically due to drought conditions. The change in water level creates changes in lake characteristics such as amount of surface area available for recreational use, the location of shoreline camping options and the number of shoreline campsites available, travel distances by water to specific points on Lake Powell, and the number of usable access points to the lake. When lake characteristics change, recreational behaviors, experiences and on-site benefits related to experiences and perceptions of resource conditions may also change. In particular, crowding and conflicts among recreational user groups may increase causing lower levels of visitor attainment of on-site beneficial experiences. Visitor impacts to the resource area especially beaches and shoreline camping areas may increase. Visitor perceptions of the kinds and seriousness of problems present in the resource area may become greater. Finally, visitor preferences for management actions to resolve problems may change.

The type of changes noted above relate to the physical carrying capacity and social carrying capacity of Lake Powell. The physical carrying capacity is the ability of the resource to accommodate a specified number of watercraft on the lake surface without causing unacceptable resource impact to water quality and lake shoreline. The social carrying capacity is the ability of the resource to sustain a given level of use over a specified time period without causing unacceptable damage to the resource area and the quality of the visitor experience. The most recent visitor use studies conducted at Glen Canyon NRA occurred in 1999 and 2000 (James, et al, 2001a, 2001b, and 2001c). Data from these studies was used in setting physical and social carrying capacities for Lake Powell. With the dramatic drop in water levels at Glen Canyon NRA over the past few years, appropriate levels of use based on capacity figures for non-drought conditions may need to be adjusted.

When looking at study results relevant to carrying capacity, the data suggest that respondents are aware that lake levels have dropped and may have adjusted their expectations about crowding or the acceptability of the number of watercraft and people they see on Lake Powell. In the 1999-2000 study the overall mean scores for the number of watercraft and people on the lake surface, on the lake shore, at shoreline campsites, at fueling docks and at landings were all rated as slightly unacceptable. In the 2005 study the overall mean scores for these same locations were rated in the acceptable range.

Data displaying respondent ratings of potential problems and the seriousness of them, though, shows an increase in mean scores over the 1999-2000 data. In the earlier studies, the only potential problem to be rated as slightly serious was finding a beach campsite. The 2005 data show 11 potential problems were given scores that show them to be slight to moderate problems. The kinds of problems rated in this way are associated with problems that are likely to be related to low water levels, which suggests that even though respondents may have adjusted their expectations about crowding, crowding is playing a role in their ability to get away from other boats on the lake surface and to find beach and shoreline campsites. The decrease in the surface area of the lake may also be responsible for the higher ratings they gave to problems such as the amount of litter they see on beaches and the shoreline, the number of inconsiderate people they encounter, and the number of people they see operating their boats unsafely.

Potential problems may also be related to the lake area shrinking and the impact that has on respondents' ability to travel to other parts of Lake Powell. If demand for recreational use on Lake Powell has not changed from 1999-2000, then less surface area means people and their watercraft will be in closer proximity to one another. In the 1999-2000 studies the heaviest used zones were Zones 1, 6, 9, 11, and 12. Zones 1, 11, and 12 continue to experience high use but Zones 1 and 11 are the major access points for Lake Powell so their continued high number of users is to be expected. Zones 6 and 9, though, experienced significantly less use in 2005 than in the earlier studies. Low water levels are probably the cause of fewer respondents traveling to these zones. As a result, the distribution of use and travel patterns on Lake Powell has changed and might be impacting visitors' experiences and perceptions of problems. Both Zones 6 and 9 are considered uplake zones. Uplake respondents rated problems such as the amount of time waiting to launch a boat, seeing evidence of pets and

their droppings, having to travel farther to find fuel, and having adequate toilet facilities on the lake and at landings as more serious problems than downlake respondents. They may have perceived some of these problems as more serious because of the constraints low water levels place on their ability to move around the lake.

Respondent preferences for ways to address problems do not vary significantly from the earlier studies to the 2005 study. In both studies, respondents prefer indirect management tactics such as visitor education and information as a way to persuade visitors to change their behavior or use of the area. Persuasive tactics, though, can be problematic in that managers can develop the materials but it is the visitor choice whether to take advantage of and use the education and/or information materials (McCool and Braithwaite, 1992; Cole et al, 1997a). Time may also be a factor in persuading people to behave differently. It is also common for visitors to prefer more facilities and services to address perceived problems. If wait times are longer than visitors like at launch points or if toilet facilities are inadequate on the lake and at other points along the lake shore, the assumption is that more of these things will solve the problem. But research in a variety of disciplines has shown that this approach is not always successful. Increasing launch areas may increase traffic to the lake creating greater congestion and crowding at access points, on the water, and at shoreline camping spots.

Limits and regulations are generally more effective at setting physical and social carrying capacities. They are viewed as fair from a distributive justice point of view because they apply equally to everyone (Frost and McCool 1988). However, recent research suggests that from a visitor's point of view fairness is more related to how the limit or regulation was developed and less to whom it might apply (Davenport, and Anderson, 2005). If visitors view the process of establishing limits or regulations as fair they are far more likely to agree with them. If park staff believes that new physical and social carrying capacities are necessary at this time and that they must use limits or new regulations to maintain quality resource conditions and visitor experiences during low water conditions, they should seek to make sure the process they use to set limits or regulations is transparent to the public and if possible has public involvement as a part of the process. Public involvement in the process leading up to implementing of use limits can be a positive factor in whether use limits become an accepted part of the management plan for a given area. In general, acceptance of use limits increases when stakeholders and the public understand that maintaining acceptable biophysical or social conditions depends upon implementing use limits (McCool and Christensen 1993; Cole et al. 1997b). Moreover, most visitors support use limits to reduce crowding and protect resources (Anderson and Manfredo 1986; Shelby et al. 1992). It might also be possible for park staff to set a time limit on how long the limits or regulations are in effect. In other words, establish limits or regulations that only apply to low water levels and when water levels come back to some acceptable level either remove the limits or regulations or review whether their continued use is necessary.

Finally, park staff should carefully look at the respondent management preferences for solving potential problems related to recreational use. For many of the problems there are a variety of solutions proposed. But not all of the solutions are supported by respondents. Some solutions are opposed by all respondents and some are only opposed by respondents who do not see a particular problem. Other solutions to address a particular problem are supported by all respondents regardless of whether they think a particular problem exists or not. Also, since many of the solutions can be used to address more than one problem, park staff should look at the most efficient suite of actions to address any of the problems listed. A useful source to help park staff decide which actions to pursue can be found at: http://www.cnr.umn.edu/CPSP/publications/revtactics_handbook.pdf (Anderson et al. 1998). This handbook was developed with National Park Service managers and outlines a strategy and process for selecting management actions that are most likely to be successful in resolving visitor caused problems to the resource and / or visitor experiences (Wang et al. 2000).

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. Administration.

NPS July 2006 / Printed on recycled paper

**National Park Service**
**U.S. Department of the Interior**

Glen Canyon National Recreation Area
Utah and Arizona

EXPERIENCE YOUR AMERICA