National Park Service
U.S. Department of the Interior

Grand Canyon National Park

Special Flight Rules Area in the Vicinity of Grand Canyon National Park

Actions to Substantially Restore Natural Quiet

Draft Environmental Impact Statement
DES 10-60

Volume One

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February 2011

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UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DES 10-60)
SPECIAL FLIGHT RULES AREA IN THE VICINITY OF GRAND CANYON NATIONAL PARK
GRAND CANYON NATIONAL PARK
COCONINO COUNTY, ARIZONA

Abstract This Draft Environmental Impact Statement (EIS) for the Special Flight Rules Area (SFRA) in the Vicinity of Grand Canyon National Park (GCNP) identifies and assesses a No Action Alternative and three Action Alternatives for management of overflight activity in Grand Canyon National Park to substantially restore natural quiet. Action Alternatives differ in combination and implementation of strategies used to accomplish goals and objectives identified in Chapter 1. Key features of the four Alternatives being considered include

Alternative A No Action/Current Condition

- continue current management and current helicopter and fixed-wing air-tour routes
- long and short-loop air-tours operate in Zuni Point and Dragon Corridors year-round
- annual allocation of 93,971 air-tour flights
- no quiet-technology incentives or conversion requirement
- four existing General Aviation corridors
- Flight-free Zone ceilings at 14,499 feet, except Sanup at 7,999 feet

Alternative E Alternating Seasonal Use

- short-loop air-tours alternate use of Zuni Point and Dragon Corridors seasonally
- no long-loop tours over North Rim; no routes over Marble Canyon; dogleg in Dragon Corridor
- annual allocation of 93,971 air-tour and air-tour related flights
- daily cap of 364 air-tour and air-tour-related flights
- full conversion to quiet-technology aircraft by date to be determined
- only quiet-technology aircraft allowed on East End routes early and late hours of flight day
- three modified general-aviation corridors
- all Flight-free Zone ceilings raised to 17,999 feet, and three zone boundaries enlarged

Alternative F Modified Current Condition

- similar to current routes and altitudes, except seasonal shift in Dragon Corridor, and changes in West End routes
- annual allocation of 93,971 air-tour flights
- incentives for quiet-technology aircraft; conversion to quiet-technology aircraft in 10 to 12 years
- One general-aviation corridor eliminated; three general-aviation corridors as in Alternative A
- Flight-free Zone ceilings same as current; Flight-free Zone boundaries changed to accommodate seasonal shift in Dragon Corridor

NPS Preferred Alternative

- short-loop air-tours alternate between Zuni Point and Dragon Corridors on a seasonal basis
- long-loop air-tour routes over North Rim open year-round, phased-in for quiet-technology only
- dogleg in Dragon Corridor; increased altitudes for some air-tour route segments
- annual allocation of 65,000 air-tour and air-tour-related flights
- daily cap of 364 air-tour flights
- air-tour route changes to better protect Nankoweap area, Little Colorado River confluence, Marble Canyon
- incentives for quiet-technology aircraft; conversion to quiet-technology aircraft required within ten years
- four general-aviation corridors with modifications in two
- Flight-free Zone ceilings raised to 17,999 feet with exceptions for aircraft in transit on Victor airways or under positive control of an air-traffic control center or tower

Potential environmental consequences of each Alternative are evaluated for a range of impact topics including: Soundscape, Wilderness Character, Ethnographic Resources, Visitor Use and Experience, Wildlife, Special Status Species, and Socioeconomic Environment.

Public Review and Comment

Public comment will be accepted for 120 days after distribution of this Draft EIS. If you wish to comment on the Draft EIS, we encourage you to submit your comments on the NPS Planning, Environment, and Public Comment database (PEPC) at http://www.parkplanning.nps.gov/grca. Select the link Special Flight Rules Area in the Vicinity of Grand Canyon National Park to submit comments and download a copy of the Draft EIS. It is preferred that comments be submitted on the above website, but comments may also be mailed to: Superintendent, Attn: Office of Planning and Compliance, P.O. Box 129, Grand Canyon, Arizona 86023.

Before including your address, phone number, email address, or other personal identifying information in your comment, be aware your entire comment—including personal identifying information—may be made publicly available at any time. While you can ask in your comment to withhold personal identifying information from public review, we cannot guarantee we will be able to do so.

EXECUTIVE SUMMARY

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DES 10-60)
SPECIAL FLIGHT RULES AREA IN THE VICINITY OF GRAND CANYON NATIONAL PARK

Background

The **1987 National Parks Overflights Act** (Public Law 100-91), referred to hereafter as the 1987 Overflights Act, requires restoration of natural quiet and visitor experience in Grand Canyon National Park (GCNP). Section 3(b) mandates the Secretary of the Interior to submit to the FAA Administrator recommendations "regarding actions necessary for the protection of resources in the Grand Canyon from adverse impacts associated with aircraft overflights. The recommendations shall provide for substantial restoration of the natural quiet and experience of the park and protection of public health and safety from adverse effects associated with aircraft overflight." (For a chronology of significant aircraft overflights events and laws concerning Grand Canyon National Park, see Appendix A). In March 1987, the FAA established a Special Flight Rules Area (SFRA) and other flight restrictions in the vicinity of GCNP to "reduce the impact of aircraft noise on the park" (1987, Federal Register volume 52, number 58, page 9,768).

Since 1987 Overflights Act passage, steps have been taken to restore natural quiet in GCNP. In compliance with the 1987 Overflights Act and in 1995 Report to Congress, "substantial restoration of natural quiet" in Grand Canyon National Park was defined as "50% or more of the park achieving natural quiet (i.e., no aircraft audible) for 75% to 100% of the day." In an April 9, 2008 Federal Register notice (73 Federal Register 55130), the NPS clarified that Substantial Restoration of Natural Quiet in GCNP will be achieved when reduction of noise from aircraft operations below 18,000 feet mean sea level (MSL) results in 50% or more of GCNP achieving restoration of the natural quiet (i.e., no aircraft audible) for 75% to 100% of the day, each and every day. The NPS also clarified that 50% of GCNP is a *minimum* in the restoration goal.

In April 2000, Congress passed the National Parks Air Tour Management Act (Public Law 106-181). The Act affirmed the requirement to achieve Substantial Restoration of Natural Quiet in GCNP, and required the FAA to designate reasonably achievable requirements for fixed-wing aircraft and helicopters to employ quiet-aircraft technology. The Act also called for the FAA, in consultation with the NPS and the Grand Canyon Working Group[1], to create incentive routes for commercial air-tour quiet-technology aircraft[2] operating in GCNP, as long as the routes do not negatively impact substantial restoration of natural quiet, tribal lands, or safety.

PURPOSE AND NEED

Purpose

The purpose of action is to complete and implement a recommendation through this EIS to substantially restore natural quiet and experience at Grand Canyon National Park. This action is compliant with the 1987 Overflights Act statutory mandate to substantially restore natural quiet and experience of the park and protect public health from adverse effects associated with aircraft overflights. The proposed action will also meet other applicable provisions of the 1987 Overflights Act and the National Parks Air Tour Management Act (Public Law 106-181), as well as other

[1] The **Grand Canyon Working Group** was established under authority of the National Parks Overflights Advisory Group, and consisted of representatives from NPS, FAA, air-tour operators, environmental groups, tribes, commercial and general aviation, recreational interests, and other Federal agencies. The Working Group developed recommendations for proposed actions to meet the statutory mandate contained in the 1987 Overflights Act. Specifically, the purpose was to: review data and analysis, identify and review issues related to overflight noise, consider a variety of Alternatives to address issues, and make recommendations for a Grand Canyon Overflight Plan. Information on the Grand Canyon Working Group is available at http://www.faa.gov/about/office_org/headquarters_offices/arc/programs/grand_canyon_overflights/documents/documents_list.cfm

[2] Procedures for determining the Grand Canyon National Park quiet-aircraft technology designation status for different aircraft are defined in Part 93 of chapter I of Title 14, Code of Federal Regulations. Designation of Grand Canyon National Park quiet-aircraft technology is generally based on measured flyover sound levels of an aircraft and seating configuration. Table 3.15 shows types of aircraft designated Grand Canyon National Park quiet-technology aircraft

laws, regulations, policies and objectives of the NPS. In addition, it is intended to be compliant with FAA laws, regulations and policies regarding aviation safety and airspace management.

Need

The proposed action (the NPS Preferred Alternative) is needed in response to a series of National Environmental Policy Act (NEPA) documents and FAA rulemakings that have occurred since 1987. These actions reduced adverse effects of aircraft overflights and increased the amount of GCNP achieving substantial restoration of natural quiet, with the current condition[3] Peak Day[4] achieving 55% restoration according to noise modeling results. However, the NPS is concerned sensitive natural and cultural resources and ground-based visitors in some park areas continue to be adversely affected by aircraft overflights. The NPS determined additional action is needed to achieve Substantial Restoration of Natural Quiet at more than minimum levels (50%), to improve visitor experience, and ensure restoration of natural quiet is maintained over time.

SIGNIFICANCE OF GRAND CANYON NATIONAL PARK

Grand Canyon National Park, established in 1919, encompasses approximately 1,216,000 acres of public land on the Colorado Plateau's southern end, and is a globally significant natural resource containing scenic vistas known throughout the world. In recognition of its significant values, GCNP was designated as a World Heritage Site on October 26, 1979.

A 277-mile stretch of the Colorado River runs through GCNP, and thousands of miles of tributary side canyons are included in park boundaries. Exposed geologic strata rise more than a mile above the river, representing one of the most complete geological records seen anywhere in the world. GCNP contains several major ecosystems, from the lower canyon's Sonoran Desert to North Rim's coniferous forest. Many plant and animal species make up these diverse ecosystems, including migratory and threatened and endangered species.

Eleven American Indian tribes attach traditional cultural significance to Grand Canyon, the Colorado River, and various sites and resources within the landscape of Grand Canyon. Many park sites and resources are considered sacred by tribal communities, and are integral to maintaining beliefs, ancestral ties, and cultural identities of these communities. Among Grand Canyon's culturally affiliated tribes, lands of the Havasupai Tribe, Hualapai Tribe, and Navajo Nation adjoin the park boundary.

More than four million recreational park visits occur yearly, primarily on South Rim. Recreational pursuits include sightseeing, hiking, photography, nature study, and river running.

ISSUES TO BE ADDRESSED

Major issues raised during scoping

- Air-tour noise
- Natural resource impacts
- Wilderness impacts
- Economic impacts related to air tours
- Appropriate management and regulation
- Various management strategies
- Planning process concerns
- Ground-based visitor experience
- Air-tour visitor experience
- Cultural resource impacts
- Tribal concerns
- Air-tour safety

[3] Current Condition is the situation described in Alternative A, No Action/Current Condition

[4] Peak Day Noise analysis for this EIS is based on a 12-hour time period of 7 a.m. to 7 p.m. on the Peak Day; the day with the highest total number of air-tour and air-tour-related operations. Based on a review of the best available data at the time EIS noise modeling analysis began in 2005, Peak Day occurred August 8, 2005, with a total 635 operations. This day forms the basis for Base Year analyses for the Alternatives. Data for subsequent years was checked to ensure use of 2005 Peak Day as the basis for Base Year analysis was still reasonable

This EIS considers issues identified during scoping by developing Alternatives to address these concerns. The EIS analyzes the following impact topics

- Soundscape
- Wilderness Character
- Ethnographic Resources
- Visitor Use and Experience (ground-based and air-tour visitors)
- Wildlife and Special Status Species
- Socioeconomic Environment

SUMMARY OF ALTERNATIVES

Four Alternatives were evaluated: Alternative A, No Action/Current Condition, and three Action Alternatives. Alternative A is required by the National Environmental Policy Act as the baseline against which to compare Action Alternatives. Evaluation covers a Base Year[5] and Ten-Year Forecast[6] during which air-tour aircraft use was projected based route configurations and operations of each Alternative.

ALTERNATIVE A, NO ACTION/ CURRENT CONDITION continues all aspects of current management for general aviation and air-tour operations in the Special Flight Rules Area. Although some air-tour operators use quiet-technology aircraft, there are currently no requirements or incentives to do so. Under Alternative A, operations will continue in the Special Flight Rules Area's

- East End[7]: 8 a.m. to 6 p.m. May through September
  9 a.m. to 5 p.m. October through April
- West End: No limits on daily or seasonal allowable operation times.
- No maximum daily cap; air-tour annual allocation of 93,971 flights

Under Alternative A, a range of air-tour aircraft noise would be present in the Special Flight Rules Area. Sounds would be concentrated beneath air-tour routes such as Zuni Point and Dragon Corridors in the East End, beneath Blue Direct routes that bisect the Special Flight Rules Area in a generally east-to-west direction, and, in the northwest corner of the West End, where concentrated short-loop tours occur.

- Alternative A would achieve Substantial Restoration of Natural Quiet in 55% of GCNP Base Year, and in 53% of GCNP Ten-Year Forecast
- In Marble Canyon, air-tour sounds would be of relatively low intensity and occurrence. Few adverse effects on resources and values would be expected in this area
- East End, beneath Zuni Point and Dragon Corridors, air-tour noise would be present from over half- to virtually 100% of the day. This would have adverse effects on natural Soundscape, Wilderness Character, Ethnographic Resources, Visitor Use and Experience, Wildlife, and Special Status Species. Beneath Bright Angel Flight-free Zone, air-tour sounds would diminish away from the corridors, based on GCNP's complex terrain. Near the river, natural ambient sounds would reduce effects of air-tour noise
- Central area, air-tour noise would be quite low, with limited impacts on resources and visitors. Key impacts would include adverse effects on Wilderness Character and Visitor Use and Experience
- West End, sound from air-tour aircraft using the Blue Direct routes to and from Las Vegas would affect rim and canyon locations above natural sound levels but would be below ambient sound levels near the river. Beneath West End's Blue and Green air-tour routes, high levels of nearly continuous noise would occur in some

[5] The best available data as of the end of 2005 is used as the Base Year for noise modeling. Since 2005, the 2005 database has been checked against data from subsequent years, and although there are some differences, given all factors contributing to those differences, the 2005 database continues as a reasonable base for evaluating impacts of Alternatives in this EIS

[6] Ten-Year Forecast is the best estimate of what will occur ten years after implementing each Alternative, starting from the Base Year scenario. For the Ten-Year Forecast, growth in aircraft operations was assumed as explained in Appendix D. Also, full implementation of each Alternative's action elements is assumed to be achieved in the Ten-Year Forecast (for example, full conversion to quiet-technology aircraft if that is an Alternative element)

[7] As shown in Map 3.2, for the purpose of this Environmental Impact Statement, Grand Canyon National Park is divided to four geographical sections, 1) Marble Canyon, 2) East End, 3) Central, and 4) West End

locations, resulting in adverse impacts on natural Soundscapes, Wilderness Character, Ethnographic Resources, Visitor Use and Experience, Wildlife, and Special-Status Species

- For air-tour visitors and operators, Alternative A would provide a variety of options for tours. Iconic landforms and resources would continue to be viewed. Air-tour industry growth would increase air tours over Grand Canyon between Base Year and Ten-Year Forecast conditions

ALTERNATIVE E, ALTERNATING SEASONAL USE would implement seasonal air-tour route use and maximize GCNP area in Flight-free Zones. This Alternative includes reduction in hours and area available for air-tour overflights to increase ground-based opportunities for natural quiet. A mix of curfews and conversion to best available quiet-technology aircraft would be implemented to achieve project objectives. Alternative E would allow a daily maximum 364 total operations by air-tour and air-tour-related flights in the SFRA, and an annual maximum 93,971 flights.

Under Alternative E, a range of air-tour aircraft noise would continue in the SFRA. As described for Alternative A, air-tour sounds would remain concentrated in the East and West Ends and beneath Blue Direct North.

- Alternative E would produce the greatest area of Substantial Restoration of Natural Quiet of proposed Alternatives. In the Base Year, Alternative E would achieve Substantial Restoration of Natural Quiet in 75% of GCNP during Alternative E's Peak Season[8] (July 1 through September 15), and in 78% of GCNP during Alternative E's Off-Peak Season (September 16 through June 30). For the Ten-Year Forecast, Substantial Restoration of Natural Quiet would be achieved in 84% of GCNP during Alternative E's Peak Season, and 86% of GCNP during Alternative E's Off-Peak Season
- Extension of Bright Angel Flight-free Zone northward would virtually eliminate air-tour noise at Marble Canyon
- Alternating seasonal use of Zuni Point and Dragon Corridors, and elimination of a long-loop tour between corridors over North Rim would reduce overall East End air-tour aircraft sounds, resulting in notable seasonal improvements for resource conditions and visitors at a variety of locations in this area
- Blue Direct South would be eliminated, and Blue Direct North would be reconfigured with a shortened segment passing over the SFRA. These changes would result in reduced Central area and West End impacts from air tours
- Conditions at the far West End would remain largely unchanged from current conditions
- Alternative E would provide fewer options for air-tour visitors and operators than Alternatives analyzed. Views of iconic landforms would be reduced and long-loop tours eliminated. Effects of these changes could be decreased flight operations and passenger volume compared to Alternative A

ALTERNATIVE F, MODIFIED CURRENT CONDITION minimizes changes from current practices. East End seasonal route changes would move Dragon Corridor air-tour routes west December 1 through January 31. Blue Direct routes would be reconfigured and would include additional time over the canyon to enhance tour aspects. Allowable hours of operation would be the same as Alternative A. This Alternative supports a broad array of changes including Dragon Corridor seasonal shifts, one general-aviation corridor closure, and quiet-technology incentives. Alternative F would have the same annual allocation provision (93,971 commercial air-tour operations) as Alternative A. There would be no daily cap under this Alternative.

- Base Year, Alternative F would achieve Substantial Restoration of Natural Quiet in 51% of GCNP during Alternative F's Peak Season (February 1 through November 30), and in 59% of GCNP during Alternative F's Off-Peak Season (December 1 through January 31). Ten-Year Forecast, Substantial Restoration of Natural Quiet would be achieved in 66% of GCNP during Alternative F's Peak Season, and 75% of GCNP during Alternative F's Off-Peak Season
- In Marble Canyon, air-tour sounds would be of relatively low intensity and occurrence. Few adverse effects on resources and values would be expected

[8] Because Action Alternatives (E, F, and the NPS Preferred) propose seasonal route shifts, Alternatives are evaluated for different Peak and Off-Peak Seasons. Each season can encompass periods of both high and low visitation. Peak and Off-Peak Seasons refer more to the analysis than visitation levels. Dates may correspond to avian nesting, non-motorized vs. motorized river use, and spring/fall high-demand Wilderness backpacking use to provide opportunity to experience these under quieter conditions

- Dragon Corridor seasonal use would relocate air-tour sounds west from the current Dragon Corridor, reducing overall East End air-tour noise to a limited degree Ten-Year Forecast
- In the Central area, air-tour noise would be quite low, with limited impacts on resources and visitors. Key impacts would include adverse effects on Wilderness Character and Visitor Use and Experience
- West End, high air-tour-sound levels would persist but would decrease over the Ten-Year Forecast with quiet-technology conversion, providing benefits to resources and visitors in this area
- Under Alternative F, opportunities for air-tour visitors and operators would be similar to Alternative A for East and West End visitors. Blue Direct routes would provide air-tour visitors with more time over the canyon than any other proposed Alternative. A range of tours would be available year-round, and iconic views would be available for aerial viewing from a variety of routes

THE NPS PREFERRED ALTERNATIVE include alternating use of Zuni Point and Dragon Corridors for short-loop tours, raising Flight-free Zone upper boundaries, quiet-technology incentives, modified tour routes to avoid sensitive resources, modified curfews, full conversion to quiet-technology aircraft, and moving most non-tour flights outside the SFRA. Air-tours and air-tour-related operations would have an annual allocation limit of 65,000 flights, with a daily cap of 364 air-tours.

- Base Year, the NPS Preferred Alternative would achieve Substantial Restoration of Natural Quiet in 53% of GCNP during the NPS Preferred Alternative's Peak Season (May 1through October 31), and in 63% of GCNP during the NPS Preferred Alternative's Off-Peak Season (November 1 through April 30). Ten-Year Forecast, Substantial Restoration of Natural Quiet would be achieved in 67% of GCNP during the NPS Preferred Alternative's Peak Season, and 77% of GCNP during the NPS Preferred Alternative's Off-Peak Season
- In Marble Canyon, there would be fewer routes with all flights using quiet-technology aircraft. Therefore, air-tour aircraft sounds would be low and barely audible
- East End, as with the other Alternatives, air-tour aircraft sounds would continue to be concentrated beneath air-tour routes in Zuni Point and Dragon Corridors. However, an overall noise reduction would occur with seasonal use of short-loop tour routes and curfews, and conversion to all quiet-technology aircraft (Ten-Year Forecast). This portion of the SFRA would see a variety of benefits to resources and visitors, depending on proximity to air-tour routes
- Central area, conditions would be as described for Alternative A, with generally negligible air-tour noise impacts
- West End air-tour routes would be similar to current conditions, and effects on resources and visitors would be similar to those described for Alternative A
- The NPS Preferred Alternative would provide a range of tours year-round, and iconic views would be available for aerial viewing from a variety of routes
- The NPS Preferred Alternative represents the Environmentally Preferred Alternative because it provides the best balance between resource protection and a wide range of beneficial uses of the environment without degradation, risk to health and safety, or other undesirable or unintended consequences

ELEMENTS COMMON TO ALL ALTERNATIVES

Several elements to manage aircraft over the park and within the Special Flight Rules Area would be common to all Alternatives, including Alternative A, as described below.

As clarified in the Federal Register April 9 and September 24, 2008,

- Substantial Restoration of Natural Quiet at Grand Canyon National Park will be achieved when reduction of noise from aircraft operations at or below 17,999 feet MSL within the Special Flight Rules Area results in 50% or more of the park achieving restoration of natural quiet (i.e., no aircraft audible) for 75% to 100% of the day, each and every day. 50% of the park is the *minimum* restoration goal
- Substantial Restoration of Natural Quiet from all aircraft above 17,999 feet MSL means there will be overall reduction in aviation noise generated above 17,999 feet MSL above the park over time through implementation of measures in accordance with FAA commitments

Although this EIS does not propose Alternatives to manage aircraft operating at or above 18,000 feet MSL, noise impacts generated by these aircraft are considered in the Cumulative Effects analysis.

Unless otherwise noted in the Alternatives, existing SFRA regulations, 14 Code of Federal Regulations (CFR) Part 93 Subpart U, Noise Limitations for Aircraft Operations Special Flight Rules in the Vicinity of Grand Canyon National Park, Arizona, would continue to apply and be enforced.

Under all Alternatives, operations in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Weather and safety route segments may be created or modified by the FAA as needed to address prospective safety concerns of regular SFRA routes. As currently required, Deviation Reports will be filed with the FAA Las Vegas Flight Standards District Office any time deviations from an existing SFRA route occur.

IMPLEMENTATION, MONITORING, AND ADAPTIVE MANAGEMENT

Monitoring and noise modeling will be conducted as part of an adaptive management approach to ensure noise provisions of sections 804 of Public Law 106-181 would be met.

After a Record of Decision (ROD) has been signed, the NPS will provide a recommendation to the FAA for implementation through rulemaking. Additionally, in coordination with stakeholders, the NPS will develop a detailed plan for monitoring and adaptive management to ensure park goals and objectives are met, including substantial restoration of natural quiet.

ENVIRONMENTAL CONSEQUENCES

An impact analysis for each impact topic was completed for each Alternative in the EIS. Beneficial and adverse environmental consequences ranging in intensity from negligible to major occur in all four Alternatives. Tables 2.7 to 2.15 provide a matrix of impacts by Alternative and impact topic, and Chapter 4 describes the impacts in detail. Chapter 4's impact analysis identifies intensity, context, duration, timing, and cumulative effects for each topic by each Alternative. The NPS Preferred Alternative meets all goals and objectives, as well as provides a balance of management opportunities to provide both excellent air-tour and ground-based visitor experiences while protecting natural and cultural resources.

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CHAPTER 1 INTRODUCTION

HISTORY LEADING UP TO THIS ENVIRONMENTAL IMPACT STATEMENT

The **1987 National Parks Overflights Act** (Public Law 100-91) (hereafter referred to as the 1987 Overflights Act) requires restoration of natural quiet in Grand Canyon National Park (GCNP). Section 3(b) mandates the Secretary of the Interior submit to the Federal Aviation Administration (FAA) Administrator recommendations "regarding actions necessary for the protection of resources in the Grand Canyon from adverse impacts associated with aircraft overflights. The recommendations shall provide for substantial restoration of the natural quiet and experience of the park and protection of public health and safety from adverse effects associated with aircraft overflight." (Appendix A is a chronology of significant aircraft overflights events and laws concerning Grand Canyon National Park).

The 1987 Overflights Act required the Secretary of the Interior's recommendations contain provisions prohibiting the flight of aircraft below the canyon rim, and designate Flight-free Zones excepting flights for administration and emergency operations, and flights required for transporting persons and supplies to and from Supai Village and lands of the Havasupai Tribe. In addition, the Act provided an exemption for helicopters that fly a direct route between a point on north rim outside the park and locations on the Hualapai Reservation solely for transporting people and guides to or from boat trips on the Colorado River.

Since 1987 Overflights Act passage, steps have been taken to restore natural quiet in GCNP. In March 1987, the Federal Aviation Administration established **a Special Flight Rules Area** (SFRA) (see Map 1.1) and other flight restrictions in the park vicinity to reduce aircraft accident risk and to "reduce the impact of aircraft noise on the park." (March 26, 1987, Federal Register notice establishing Special Federal Aviation Regulation, SFAR 50, summary, vol. 52, no. 58, p. 9768.)

On May 27, 1988, the FAA issued Special Federal Aviation Regulation **50-2**, revising procedures for aircraft operation in the airspace above the park. Among its provisions, SFAR 50-2

- extended the Special Flight Rules Area from the surface up to and including 14,499 feet mean sea level (MSL) and extended the boundary to include the northeast extension of Marble Canyon;
- prohibited flights below a certain altitude with certain exceptions;
- established three Flight-free Zones from the surface to 14,499 feet MSL, and one up to 7,999 feet MSL above large areas of GCNP; and
- provided special corridors to help general-aviation aircraft navigate the Special Flight Rules Area while avoiding Flight-free Zones, commercial air-tour operators, and transient operators through the canyon area

A major provision of the 1987 Overflights Act required the Department of the Interior submit a **Report to Congress** on whether SFAR 50-2 had successfully restored natural quiet in the park. In 1994, a Report was submitted to Congress on Effects of Aircraft Overflights on the National Park System (published in July 1995 but commonly referred to as the 1995 Report to Congress); part of this report specifically focused on Grand Canyon National Park. The report defined "substantial restoration of natural quiet" as "50% or more of the park achieving natural quiet (i.e., no aircraft audible) for 75% to 100% of the day." The report also recommended numerous revisions to SFAR 50-2 to substantially restore natural quiet in GCNP.

In April 1996, a **Presidential Memorandum** directed the Secretary of Transportation, in consultation with the Secretary of the Interior and National Park Service (NPS) Director, to take further action to restore natural quiet in the park (see Need for Action). The Presidential Memorandum also required development of a plan to complete restoration and maintenance of natural quiet in GCNP should Final Rulemaking determine such a plan necessary.

In December 1996, FAA issued a **Final Environmental Assessment and Finding of No Significant Impact (FONSI), and a Final Rule** (61 Federal Register 69302) implementing some of the recommendations included in the 1995 Report to Congress, including, 1) Flight-free Zones and corridors; 2) minimum flight altitudes; 3) general operating procedures; 4) curfews in the eastern part of the park (Zuni Point and Dragon Corridors); 5) reporting requirements; and 6) a limit on number of commercial sightseeing aircraft that could operate in the SFRA. The 1996 Final Rule modified SFRA dimensions, increasing vertical airspace limits from 14,499 feet MSL up to but not including 18,000 feet MSL. The rule also modified existing and established new, Flight-free Zones (Bright Angel,

Desert View, Toroweap /Shinumo, and Sanup Flight-free Zones) and flight corridors (Zuni Point, Dragon and Tuckup Corridors). However, implementation of portions of the 1996 Rule (Flight-free Zones, flight corridors, airspace structure) encountered a series of delays, modifications, reissuance, and litigation.

In February 2000, FAA issued the **Final Supplemental Environmental Assessment Special Flight Rules in the Vicinity of the Grand Canyon National Park and Finding of No Significant Impact.** This 2000 Environmental Assessment (EA) supplemented the December 1996 Final Environmental Assessment. The 2000 EA completed by the FAA, as lead agency, in cooperation with the NPS and Hualapai Tribe, attempted to resolve the issue of restoring natural quiet to GCNP. The 2000 Final Supplemental Environmental Assessment evaluated proposed rules to modify SFAR 50-2, including changes to the SFRA and Flight-free Zones, changes in commercial air-tour routes, and changes in limits on number of commercial air-tour operations authorized to operate in the SFRA.

In April 2000, the FAA published a **Final Rule** (Air Tour Limitation Rule, 65 Federal Register 17708) to replace the limit on number of commercial aircraft as contained in the 1996 Final Rule. The 2000 provision limited number of commercial air-tour operations in the SFRA to 93,971. This is the total number of flights reported by air-tour operators May 1, 1997 to April 30, 1998. In addition, the Rule revised reporting requirements for SFRA commercial air tours. FAA also published another Final Rule at the same time (65 Federal Register 17736) that modified SFRA dimensions and Flight-free Zones. These Rules were part of an overall strategy to control aircraft noise in GCNP and achieve the 1987 Overflights Act's statutory mandate. However, implementation of airspace and route changes encountered a series of delays, reissuance of modifications, and litigation. A modified route structure (new routes on the SFRA's West End, and continuation of previous East End routes) was implemented in April 2001.

Also in April 2000, Congress passed the **National Parks Air Tour Management Act** (Public Law 106-181). This Act affirmed the requirement to achieve Substantial Restoration of Natural Quiet in GCNP. It required FAA designate reasonably achievable requirements for fixed-wing aircraft and helicopters to employ quiet-aircraft technology[9]. The Act also called for FAA, in consultation with NPS and Grand Canyon Working Group[10] to create incentive routes for commercial air-tour quiet-technology aircraft operating in GCNP, as long as the routes do not negatively impact substantial restoration of natural quiet, tribal lands, or safety. Commercial air-tour operations by fixed-wing or helicopter aircraft that employ quiet-aircraft technology and replace existing aircraft, or were in an operator's fleet on the date of enactment of this Act, or were subsequently modified to meet quiet-technology requirements, are not subject to use of an annual allocation as applies to other commercial air-tour operations flying over the park—provided the cumulative impact of such operations does not increase noise in the park. This Act also required any methodology adopted by a Federal agency to assess air-tour noise in any unit of the national park system, including Grand Canyon National Park, be based on reasonable scientific methods.

In May 2000, FAA implemented the **Final Rule** limiting commercial air-tour operations and expanding the SFRA East End boundary. However, FAA determined Final Rule implementation for air-tour route changes for GCNP's East End, and expansion of the Desert View Flight-free Zone as outlined in the Final 2000 Supplemental EA, should be delayed to address safety concerns raised after the Final Rule (65 Federal Register 69846, 69848). Between May 2000 and January 2006, FAA issued several Final Rules extending the delay for implementation of East End changes.

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[9] Procedures for determining the Grand Canyon National Park quiet-aircraft technology designation status for different aircraft are defined in Part 93 of chapter I of Title 14, Code of Federal Regulations. Designation of Grand Canyon National Park quiet-aircraft technology is generally based on measured flyover sound level of an aircraft and seating configuration. Table 3.15 shows types of aircraft designated Grand Canyon National Park quiet-technology aircraft

[10] The Grand Canyon Working Group was established under authority of the National Parks Overflights Advisory Group, and consisted of representatives from NPS, FAA, air-tour operators, environmental groups, tribes, commercial and general aviation, recreational interests, and other Federal agencies. The Working Group developed recommendations for proposed actions to meet the statutory mandate contained in the 1987 Overflights Act. Specifically, the purpose of the group was to: review data and analysis, identify and review issues related to overflight noise, and consider a variety of Alternatives to address issues. Information on the Grand Canyon Working Group is available at http://www.faa.gov/about/office_org/headquarters_offices/arc/programs/grand_canyon_overflights/documentation/Grand%20Canyon%20Working%20Group%20Final%20Report%2017%20July%202009.pdf

On January 25, 2006, the NPS and FAA published in a **Notice of Intent** (NOI) to prepare this EIS (71 Federal Register 4192).

On February 24, 2006, FAA issued another **Final Rule** (71 Federal Register 09439) that further delayed implementation of airspace and commercial air-tour route changes for GCNP's East End. This further delay was to allow the NPS and FAA, in consultation with the U.S. Institute for Environmental Conflict Resolution and involved park stakeholders, to consider additional measures to be incorporated into the EIS to address quiet-aircraft technology provisions.

In an April 9, 2008, **Federal Register** notice (73 Federal Register 55130), the NPS clarified that Substantial Restoration of Natural Quiet at GCNP will be achieved when reduction of noise from aircraft operations below 18,000 feet MSL results in 50% or more of the park achieving restoration of the natural quiet (i.e., no aircraft audible) 75% to 100% of the day, each and every day. Further, NPS defined Substantial Restoration of Natural Quiet from all aircraft above 17,999 feet MSL to mean there will be an overall reduction in aviation noise generated above 17,999 feet MSL over the park over time through implementation of measures in accordance with commitments made by FAA. NPS also clarified that 50% of the park is a *minimum* in the restoration goal.

PURPOSE OF AND NEED FOR ACTION

Purpose of Action

The purpose of action is to complete and implement a recommendation through this EIS to substantially restore natural quiet[11] and experience at Grand Canyon National Park. This action is compliant with the 1987 Overflights Act statutory mandate to substantially restore natural quiet and experience of the park and protect public health from adverse effects associated with aircraft overflights. The proposed action will also meet other applicable provisions of the 1987 Overflights Act and the National Parks Air Tour Management Act (Public Law 106-181), as well as other laws, regulations, policies and objectives of the NPS. In addition, it is intended to be compliant with FAA laws, regulations and policies regarding aviation safety and airspace management.

Objectives

The NPS has the following objectives for the proposed action

1. Improve and maintain Substantial Restoration of Natural Quiet and enhance GCNP visitor experience
2. Provide a reasonable opportunity for visitors to safely experience Grand Canyon by air tour, without adversely affecting the national airspace system
3. Protect public health from adverse effects associated with aircraft overflights
4. Protect wilderness character in Wilderness in the Special Flight Rules Area
5. Provide primitive recreation opportunities without aircraft intrusions in most backcountry areas, most Colorado River locations, and destination points accessed by both backcountry and river visitors
6. Provide recreational opportunities with limited aircraft intrusions for visitors at developed areas along the rim and major front-county destination points accessible by road
7. Protect sensitive wildlife habitat and cultural resources
8. Provide a quality aerial viewing experience while protecting park resources and minimizing conflicts with other park visitors
9. Maintain an economically viable and safe air-tour industry

These objectives are based on several sources including the 1987 Overflights Act, the 1995 NPS Report to Congress, the 1996 Presidential Memorandum Earth Day Initiative, Parks for Tomorrow, and mission statements of agencies participating in the Grand Canyon Working Group.

[11] Natural quiet refers to natural ambient sound conditions found in parks (natural soundscape), meaning all natural sounds that exist in parks in absence of human-caused noise

Need for Action

The proposed recommendation through this EIS to substantially restore natural quiet for Grand Canyon National Park is needed following a series of FAA rulemaking actions and National Environmental Policy Act (NEPA) documents issued since 1987 (see Chapter 1, History Leading Up to This Environmental Impact Statement). Actions since 1987 have reduced adverse effects of aircraft overflights and increased the amount of GCNP achieving substantial restoration of natural quiet, with the current condition[12] Peak Day[13] achieving 55% restoration. However, NPS is concerned that sensitive natural and cultural resources and ground-based visitors in some park areas continue to be adversely affected by aircraft overflights. NPS has determined additional action is needed to achieve Substantial Restoration of Natural Quiet at more than minimum levels (50%), improve visitor experience, and ensure restoration of natural quiet is maintained over time.

On April 22, 1996, President Clinton issued a Presidential Memorandum titled the Earth Day Initiative, Parks for Tomorrow. Among other things, the Memorandum directed the Secretary of Transportation, in consultation with the Secretary of the Interior and the NPS Director, to issue proposed regulations to appropriately limit sightseeing aircraft over GCNP to reduce aircraft noise immediately, and make further substantial progress to restore natural quiet while maintaining aviation safety in accordance with the 1987 Overflights Act.

In April and May 2000, the FAA adopted Final Rules modifying Special Federal Aviation Regulation 50-2 (SFAR 50-2). The Final Rules modified commercial air-tour routes and limited commercial air-tour operations within the SFRA. However, safety concerns were raised concerning portions of the Final Rules, and FAA subsequently determined implementation of proposed commercial air-tour route changes for GCNP's East End should be delayed to address the safety concerns.

The proposed action also addresses 2002 decision of the Washington, D.C. Circuit Court of Appeals in the case of United States Air Tour Association v. FAA, 298F.3d997 regarding the definition of Substantial Restoration of Natural Quiet and noise methodology in the FAA 2000 Final Supplemental Environmental Assessment Special Flight Rules in the Vicinity of the Grand Canyon National Park and Finding of No Significant Impact (FONSI). *Substantial Restoration of Natural Quiet* was defined in the NPS 1995 Report to Congress (NPS 1994), and subsequently clarified in 2002 and 2008 (see Chapter 1, History Leading Up to This Environmental Impact Statement).

Finally, the proposed action supports compliance with relevant quiet-technology provisions of section 804 of the National Parks Air Tour Management Act of 2000 (Public Law 106-181).

To address all of the above needs, on January 25, 2006, the NPS and FAA jointly published a Notice of Intent to Prepare an EIS for Actions to Substantially Restore Natural Quiet to the Grand Canyon National Park in 71 Federal Register 4192.

In addition to NEPA compliance, changes proposed to SFAR 50-2, as contained in Title 14 of the Code of Federal Regulations (CFR), Part 93, Subpart U, require an FAA rulemaking action. This EIS satisfies NEPA requirements for NPS, and once a Record of Decision (ROD) is reached will lead to an FAA rulemaking.

This Special Flight Rules in the Vicinity of the Grand Canyon National Park Environmental Impact Statement is written in accordance with the Council on Environmental Quality's (CEQ) implementing regulations for the National Environmental Policy Act; and NPS Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision Making.

[12] Current Condition is the situation described in Alternative A, No Action/Current Condition

[13] Peak Day Day of the highest amount of air-tour aircraft activity. Modeling aircraft noise based on the Peak Day of activity should assure substantial restoration of natural quiet is achieved on any given day

IMPAIRMENT

NPS Management Policies 2006 requires analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill park purposes, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS management discretion to allow certain impacts in parks, discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. Prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm integrity of park resources and values, including opportunities that otherwise would be present for the enjoyment of these resources or values. An impact to any park resource or value may, but does not necessarily, constitute impairment, but an impact would be more likely to constitute impairment when there is a major or severe adverse effect on a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the area's establishing legislation or proclamation or,
- key to the area's natural or cultural integrity or opportunities for enjoyment of the area, or
- identified as a goal in the area's General Management Plan or other relevant NPS planning documents

An impact would be less likely to constitute impairment if it is an unavoidable result of an action necessary to pursue or restore integrity of park resources or values and cannot be further mitigated. An impairment determination was made for the Preferred Alternative and can be found in Appendix B.

APPROPRIATE USE

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

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

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

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

Section 8.2 of NPS Management Policies 2006 states, "To provide for enjoyment of the parks, the National Park Service will encourage visitor use activities that

- are appropriate to the purpose for which the park was established; and
- are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
- can be sustained without causing unacceptable impacts to park resources and values"

Under appropriate circumstances, air tours serve the public interest, providing opportunities for visitors to understand and appreciate the park, and are inspirational and educational for many visitors. Commercial air tours are

an established use at GCNP and generally consistent with the park's General Management Plan (GMP) and related park plans. With this in mind, NPS finds commercial air tours managed under conditions as prescribed in this EIS an appropriate use at Grand Canyon National Park.

NATURE OF THE FEDERAL ACTION

Decision to be Made

The decision to be made is how best to meet the purpose, objectives, and need for action. The selected Alternative will ultimately include any measures necessary to mitigate or prevent significant adverse impacts, unacceptable impacts, and impairment of park resources due to aircraft flying below 18,000 feet MSL within the Special Flight Rules Area over Grand Canyon National Park. The resulting Federal action will be the decision by the NPS, on behalf of the Secretary of the Interior, to submit specific recommendations to the FAA for implementation. Under 1987 Overflights Act provisions, the FAA Administrator is required to implement, by appropriate regulation, Secretary of the Interior recommendations without change, unless the Administrator determines implementation would adversely affect aviation safety. FAA rulemaking would follow receipt of the NPS recommendation. A summary of the process is provided in Figures 4.2 to 4.5.

NPS Mission

The 1916 NPS Organic Act directs the Department of the Interior and National Park Service to manage national park system units "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 United States Code 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978, which states the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically directed by Congress" (16 United States Code 1a-1). If a conflict between visitor use and resource protection should occur, this Act confirms Congressional intent to favor resource protection.

Relationship of the NPS and FAA

As stated in 1987 Overflights Act section 3(b)(1), the Secretary of the Interior is responsible for providing the NPS recommendation to the FAA Administrator regarding "actions necessary for the protection of resources in the Grand Canyon from adverse impacts associated with aircraft overflights. The recommendations shall provide for substantial restoration of the natural quiet and experience of the park and protection of public health and safety from adverse effects associated with aircraft overflight." Section 3(b)(2) of the Overflights Act directs the FAA Administrator to implement the recommendations of the Secretary of the Interior without change unless the Administrator determines that implementing the recommendations would adversely affect aviation safety. FAA will provide safety concern/risk analyses to NPS, along with suggestions on ways to avoid adverse aviation safety effects as soon as potential problems have been identified.

In 2006 NPS and FAA released a Notice of Intent to prepare this EIS as joint lead agencies. However, in 2010 the agencies clarified their roles and responsibilities under the Overflights Act. The FAA has withdrawn as a joint lead agency in the EIS. The NPS is solely responsible for the NEPA documentation including the environmental analysis and impact determinations to support its recommendations to FAA under the Overflights Act. The analyses and impact determinations in the EIS have been made by NPS, and are specific to the Overflights Act and have no broader application.

The FAA's implementation of the NPS recommendation is a non-discretionary ministerial action under the Overflights Act. The FAA will propose a rule and other necessary actions to regulate air tour operations over the Grand Canyon National Park in accordance with the NPS's recommendations in the EIS and Record of Decision without change unless there are potential adverse effects on aviation safety—in which case FAA, in consultation with NPS, will eliminate those adverse effects and implement the revised recommendations.

GUIDANCE FOR THIS DOCUMENT

Direction for Alternatives considered in this EIS is based on applicable legislative mandates, agency policies, administrative commitments, and Grand Canyon Working Group input and recommendations.

Legal and Policy Framework

The **National Environmental Policy Act of 1969** (NEPA) and its implementing regulations establish a broad national policy to protect and enhance the quality of the human environment and develop programs and measures to meet national environmental goals.

The **1987 National Parks Overflights Act** (Public Law 100-91) (the 1987 Overflights Act) requires restoration of natural quiet in Grand Canyon National Park. Section 3(b) mandates the Secretary of the Interior submit to the FAA Administrator recommendations "regarding actions necessary for the protection of resources in the Grand Canyon from adverse impacts associated with aircraft overflights. The recommendations shall provide for substantial restoration of the natural quiet and experience of the park and protection of public health and safety from adverse effects associated with aircraft overflight."

Section 804 of the **National Parks Air Tour Management Act of 2000** (Public Law 106-181) requires a rule establish routes or corridors for commercial air-tour operations that employ quiet-aircraft technology for Grand Canyon tours originating in Clark County, Nevada, and local-loop tours originating at Grand Canyon National Park Airport[14] in Tusayan, Arizona. These routes or corridors can be designated only in areas that will not negatively impact substantial restoration of natural quiet, tribal lands, or safety. Commercial air-tour operations by fixed-wing or helicopter aircraft that employ quiet-aircraft technology and replace existing aircraft, or were in an operator's fleet on the date of enactment of this Act, or were subsequently modified to meet quiet-technology requirements, shall not be subject to use of an annual allocation as applies to other commercial air-tour operations flying over the park—provided the cumulative impact of such operations does not increase noise at Grand Canyon or negatively affect achieving Substantial Restoration of Natural Quiet at the park.

The **Wilderness Act** states Wilderness must be managed in a manner that leaves it unimpaired for future use and enjoyment as Wilderness. In 1993, the NPS prepared an update to the original 1980 Final Wilderness Recommendation that proposed that 1,139,077 acres in the park (94% of the park's total area) be designated as wilderness. Of this total area, 1,109,257 acres were proposed for immediate designation and 29,820 acres were proposed as potential wilderness (NPS 1993). NPS Management Policies 2006 and Director's Order 41, Wilderness Preservation and Management, stipulate the NPS will take no actions that would diminish Wilderness eligibility of lands proposed for Wilderness designation until Congress and the President have taken final action. Thus, most of the park is being managed as *de facto* Wilderness.

Section 7 of the **Endangered Species Act** charges all Federal agencies aid in conservation of listed species (Section 7[a][1]), and requires Federal agencies ensure their activities are not likely to jeopardize continued existence of listed species or adversely modify designated critical habitats (Section 7[a][2]).

Section 106 of the **National Historic Preservation Act** (NHPA) requires Federal agencies take into account effects of their undertakings on historic properties, including traditional cultural properties, either listed in, or eligible to be listed in, the National Register of Historic Places. The National Register includes districts, sites, buildings, structures, and objects important for their significance in American history, architecture, archeology, engineering, and culture. Historic properties listed in the National Register can be significant to a local community, state, tribe, or the nation as a whole.

NPS Management Policies 2006 sets policy for topics addressed in this EIS including public participation, environmental analysis, Wilderness, natural and cultural resource management, and use of national parks. Additionally, Management Policies directs NPS take all necessary steps to avoid or mitigate unacceptable impacts

[14] Grand Canyon National Park Airport is located outside Grand Canyon National Park in the town of Tusayan, Arizona, and is also referred to in this document as Grand Canyon Airport

from aircraft overflights and work cooperatively with FAA, national defense, and other agencies to ensure authorized aviation activities affecting national park system units occur in a safe manner and do not cause unacceptable impacts on park resources and values and visitor experiences (Section 8.4).

NPS Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision Making, establishes guidance by which the NPS carries out its responsibilities under the National Environmental Policy Act.

NPS Director's Order 28, NPS Cultural Resource Management Guideline, provides basic guidance and procedures for NPS managers, planners, and cultural resource specialists to effectively carry out cultural resources research, planning, and stewardship. In accordance with applicable laws and policies, NPS Director's Order 28 provides specific guidance for management of archeological resources, historic/prehistoric structures, cultural landscapes, Ethnographic Resources, and museum collections.

NPS Director's Order 47, Soundscape and Noise Management, sets NPS guidance and procedures regarding Soundscape management. The order states NPS policies will "require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural Soundscape resource in a condition unimpaired by inappropriate or excessive noise sources." The order further states that in planning for Soundscape preservation and noise management, park managers "must use the best science available to determine the impact of existing or proposed noise sources on the Soundscape, wildlife…, cultural resources, other resources and values, and the visitor experience, as appropriate."

Title 14 of the Code of Federal Regulations, Part 93, Subpart U, Special Flight Rules in the Vicinity of Grand Canyon National Park, Arizona, prescribes special operating rules for all persons operating aircraft in airspace in the vicinity of the park. Although certain provisions could change if an Alternative considered in this EIS was implemented, other provisions would not change including: general operating procedures (section 93.309), minimum terrain clearance requirement (section 93.311), requirements for commercial SFRA operations (section 93.315), most provisions regarding transfer and termination of annual allocations (section 93.321), and procedures for determining quiet-aircraft technology designation status for each aircraft (Appendix A to Subpart U).

COURT-MANDATED DIRECTION

In 2002, the U.S. Circuit Court of Appeals denied the U.S. Air Tour Association's challenge to the Air Tour Limitation Rule. However, the Court ruled the NEPA document's[15] use of an average annual day for measuring Substantial Restoration of Natural Quiet is inconsistent with the NPS definition. The Court held that, in the absence of any reasonable justification, excluding non-tour aircraft from the noise model methodology was arbitrary and capricious, requiring reconsideration (See Appendix A for GCNP restoration of natural quiet history).

SPECIAL MANDATES AND ADMINISTRATIVE COMMITMENTS

Special mandates and administrative commitments related to this document include

The **Grand Canyon Working Group** was established under authority of the National Parks Overflights Advisory Group,[16] and consisted of representatives from NPS, FAA, air-tour operators, environmental groups, tribes, commercial and general aviation, recreational interests, and other Federal agencies. The Working Group developed recommendations for proposed actions to meet the statutory mandate contained in the 1987 Overflights Act. Specifically, the purpose was to: review data and analysis, identify and review issues related to overflight noise, and consider a variety of Alternatives to address the issues. (Information on the Grand Canyon Working Group is available at

[15] Federal Aviation Administration issued the Final Supplemental Environmental Assessment Special Flight Rules in the Vicinity of the Grand Canyon National Park and Finding of No Significant Impact 2000

[16] National Parks Overflights Advisory Group (NPOAG) Advisory group of representatives of FAA, NPS, general aviation, air-tour operators, environmental concerns, and Indian tribes established by the Air-tour Management Act of 2000 to provide continuing advice and counsel on commercial air-tour operations over and near national parks

http://www.faa.gov/about/office_org/headquarters_offices/arc/programs/grand_canyon_overflights/documents/documents_list.cfm

An April 22, 1996, **Presidential Memorandum,** Earth Day Initiative, Parks for Tomorrow, called for Substantial Restoration of Natural Quiet in GCNP to be achieved by April 22, 2008.

BACKGROUND

Grand Canyon National Park Description

Map 1.1 shows the Grand Canyon National Park vicinity. The park, established in 1919, encompasses approximately 1,216,000 acres of public land on the Colorado Plateau's southern end, and is a globally significant natural resource containing scenic vistas known throughout the world. In recognition of its significant values, GCNP was designated a World Heritage Site on October 26, 1979.

A 277-mile stretch of the Colorado River runs through GCNP, and thousands of miles of tributary side canyons are included in the boundaries. The exposed geologic strata—layer upon layer from the bedrock Vishnu Schist to the capping Coconino Limestone—rise more than a mile above the Colorado River, representing one of the most complete geologic records seen worldwide.

Eleven American Indian tribes attach traditional cultural significance to Grand Canyon, the Colorado River, and various sites and resources in Grand Canyon's landscape. Many GCNP sites and resources are considered sacred by tribal communities and integral to maintaining beliefs, ancestral ties, and cultural identities of these communities. Among Grand Canyon's culturally affiliated tribes, land of the Havasupai Tribe, Hualapai Tribe, and Navajo Nation adjoin GCNP's boundary.

GCNP contains several major ecosystems—from the lower canyon's Sonoran Desert to North Rim's coniferous forest. Many plant and animal species make up these diverse ecosystems. Although many wild creatures live their entire lives in the protected park, migratory species also benefit from park sanctuary.

More than four million recreational visits are recorded each year, primarily on South Rim. Recreational pursuits include sightseeing, .river running, hiking, photography, and nature study. However, a Grand Canyon vacation can become more than a recreational or scenic venture. The canyon's grandeur and awesome physical forces can transform a perceptive visitor's experience from a casual trip to one that influences stewardship responsibilities.

PARK PURPOSE AND SIGNIFICANCE

Purpose of Grand Canyon National Park

Park purpose is based on enabling legislation and legislation governing the NPS. As a place of national and global importance, the park will be managed to

- preserve and protect its natural and cultural resources and ecological processes, as well as its scenic, aesthetic, and scientific values
- provide opportunities for visitors to experience and understand environmental interrelationships, resources, and values without impairing resources

Significance of Grand Canyon National Park

Grand Canyon's national and international significance includes

- Designation as a World Heritage Site, a place of universal value, containing superlative natural and cultural features preserved as the heritage of all people
- Grand Canyon is an ecological refuge, with relatively undisturbed remnants of dwindling ecosystems (such as boreal forest and desert riparian communities), and numerous rare, endemic, or specially protected (threatened/endangered) plant and animal species
- A natural gene pool due to biological diversity and unique conditions

- Grand Canyon's geologic record is particularly well exposed and includes a rich and diverse fossil record, and a great diversity of geological features and rock types
- Numerous caves contain extensive and significant geological, paleontological, archeological, and biological resources
- Eleven American Indian tribes have identified cultural ties to Grand Canyon, with some considering the canyon their original homeland and place of origin
- More than 12,000 years of human occupation resulted in an extensive archeological record, hundreds of miles of established prehistoric and historic routes and trails, and nationally significant examples of rustic architecture
- Grand Canyon has internationally recognized scenic vistas, qualities, and values
- Grand Canyon is recognized as a place with unusual and noticeable natural quiet and direct access to numerous opportunities for solitude
- All of the natural, cultural, and scenic qualities of the Grand Canyon, coupled with the canyon's vast size, give rise to inspirational/spiritual values and a sense of timelessness
- The vast majority of the park provides opportunities for Wilderness experiences
- The Colorado River, as it flows through the park, provides opportunities for one of the world's premier river experiences, including one of the longest stretches of navigable whitewater on earth

SCOPE OF ANALYSIS

Geographical Boundary of the Study Area

The Study Area (Map 1.2) for this EIS includes the park boundary and the entire Special Flight Rules Area. The Study Area's size is identical to the Study Area for the 2000 Supplemental EA, and defined by the smallest rectangular box encompassing the whole SFRA—about 140 miles east-west and about 85 miles north-south, and encompasses GCNP as well as adjacent tribal and other Federal lands. Within the Study Area, the NPS administers Grand Canyon National Park, Lake Mead National Recreation Area, Glen Canyon National Recreation Area, and Grand Canyon-Parashant National Monument. Owners and managers of other lands within the Study Area are specified in Chapter 3.

This EIS focuses primarily on the SFRA in describing the Affected Environment and analyzing impacts of Alternatives. However, to assess Cumulative Effects of noise from flights and other sources outside the SFRA that may be affecting GCNP, the Study Area is larger than the Special Flight Rules Area.

Altitude Boundary and Types of Flights Included in Analysis

Airspace at and above 18,000 feet MSL is considered Class A airspace, and aircraft operations must be in accordance with Federal Aviation Regulation Part 91. Federal Aviation Regulation 91.135, among other things, requires pilots be in contact with FAA air traffic controllers. Airspace at 17,999 feet MSL and below is divided into four categories identified as Class B, C, D, or E. Class G airspace (with no air traffic controller requirements) also exists in some parts of the U.S. below 14,499 feet MSL—primarily in the western U.S. Each of these airspace classes has separate requirements, contained in Federal Aviation Regulation Part 91, to which a pilot must adhere. Requirements for pilots operating in the SFRA in the vicinity of GCNP are contained in Federal Aviation Regulation Part 93, Subpart U.

All aircraft categories shown below were analyzed to assess effects on Substantial Restoration of Natural Quiet and other impact topics. All air-tour and air-tour-related operations *below* 18,000 feet MSL and within the SFRA are analyzed in this EIS. All aircraft operating at or *above* 18,000 feet MSL in the Study Area's lateral boundaries including military, high-altitude commercial, and general-aviation overflights, are included in analysis of Cumulative Effects, but not in assessment of substantial restoration of natural quiet. For the purpose of this EIS, overflights are divided into the following categories

Air-Tour and Related Operations Categories

Air Tours	Advertised air-tour flights and charter flights offered by commercial air-tour operators
Grand Canyon West	Helicopter and fixed-wing air-tour flights that land at the Hualapai Reservation. Helicopter flights generally fly between the Las Vegas area and Grand Canyon West Airport on the reservation and/or helipads on Hualapai lands along the Colorado River. Most fixed-wing flights fly between the Las Vegas area and Grand Canyon West Airport. Flights are exempt from using an annual allocation according to Federal Aviation Regulations Part 93
Over the Edge/ Elevator Flights	Helicopter flights between Grand Canyon West Airport and helipads on Hualapai land along the Colorado River
Transportation, Repositioning, Maintenance, etc.	Aggregate category of all flight operations supporting air tours. Transportation is non-tour, commercial transportation flights only, which typically occur between Las Vegas and Grand Canyon National Park Airport, but could occur between any two points. Repositioning refers to a non-tour operation by an air-tour operator moving an aircraft for logistical reasons
Brown Routes	Non-tour routes used with enough regularity and consistency they have been charted for pilot awareness and general safety. Most Brown route activity supports various Native American operations, such as river-related traffic in and out of Bar Ten and Whitmore Wash, and travel to and from Supai Village
Other Aircraft Overflights	Military, general aviation, and administrative flights operating at or below 17,999 feet MSL in the Study Area

Time Frame

This EIS analyses conditions for a ten-year period.

Hualapai Tribe Exemption

The Federal government granted the Hualapai Tribe an exemption from commercial air-tour annual allocations requirement per the April 4, 2000, FAA commercial air-tour limitation rule in the Grand Canyon National Park Special Flight Rules Area (14 CFR Part 93.319). This rule was issued by the FAA as one part of an overall strategy to control aircraft noise, and assist the NPS in achieving its statutory mandate to substantially restore natural quiet at GCNP. The Federal government granted the exemption to the Hualapai Tribe based on general trust-responsibility concepts and the Tribe's economic dependence on commercial air tourism. Per the 2000 FAA rulemaking's economic evaluation, the Hualapai receive substantial economic benefits from air tours, and the Tribe's economic development and self-sufficiency could be adversely affected by limitations. The exemption allows air-tour operators with a tribal contract to take-off and land at the reservation's airport without adherence to the commercial air-tour annual allocation on total air-tour operations. However, this exemption does not relieve operators associated with the Tribe from other restrictions while flying over GCNP and within the SFRA.

Quiet-Technology Allocation Exemption

Section 804 of the National Parks Air Tour Management Act (Public Law 106-181) addresses quiet-aircraft technology requirements for Grand Canyon National Park. Section 804(b) requires establishment of routes or corridors for commercial air-tour operations employing quiet technology, provided the routes or corridors can be located in areas that will not negatively impact substantial restoration of natural quiet, tribal lands, or safety. Sections 804(c) and (d) provide that commercial air-tour operations at GCNP employing quiet-aircraft technology that replace or modify an existing aircraft shall not be subject to annual flight allocations that apply to other commercial air-tour operations provided the cumulative impact of such operations does not increase noise at Grand Canyon. Section 804(e), states that nothing in the National Parks Air Tour Management Act shall be construed to relieve or diminish the statutory mandate under Public Law 100-91 to achieve Substantial Restoration of Natural Quiet and experience at GCNP and obligations of the Secretary and Administrator to promulgate regulations to achieve substantial restoration.

The NPS Preferred Alternative would provide one route (in Marble Canyon) immediately open only to quiet-technology aircraft, with a phase-in over time of additional quiet-technology routes until all routes may be used only by quiet-technology aircraft after ten years. This would include a long-loop route, phased in over a four-year period,

which would allow quiet-technology aircraft to travel routes between Zuni Point and Dragon Corridors over North Rim year-round (see Chapter 2). The NPS Preferred Alternative would provide a quiet-technology annual allocation exemption period January through March (but the NPS Preferred Alternative's daily cap would still apply). The NPS would continue to monitor and collect data regarding quiet-technology operations, and could phase-in additional periods for the quiet-technology annual allocation exemption if found consistent with Section 804.

Alternative E would provide 1.5 hours at the beginning of each flight day and 2.5 hours at the end when only aircraft using best available quiet technology would be allowed to fly. At the end of a time period to be agreed upon, all routes would be open only to aircraft using best available quiet technology.

Alternative F would immediately provide two routes open only to quiet-technology aircraft, with all routes open only to quiet-technology aircraft after 10 to 12 years. It also would forgive air-tour fees for operations using quiet technology, and would eliminate the requirement to use an annual allocation for quiet-technology operations if the additional flights did not adversely impact substantial restoration of natural quiet.

Alternative A does not include quiet-technology incentives, routes, or conversion requirements.

Administrative Flights

Administrative flights are conducted by the park, tribes, U.S. Forest Service (USFS), and Bureau of Land Management (BLM), that administer lands within the SFRA, as well as non-Federal entities (e.g., law enforcement agencies). These flights are managed under FAA 7711-1 waivers, and are not subject to measures considered in the Alternatives. FAA 7711-1 waivers are issued by the FAA Administrator to allow regulatory deviations when the Administrator determines a proposed operation can be safely conducted. In the context of this EIS, 7711-1 waivers or special authorizations allow for deviations from certain operational SFRA requirements. They are issued to safely accommodate certain operations by governmental, tribal, or other entities that could not otherwise be accomplished within the existing regulatory framework.

Associated Transport Flights of River Passengers

Whitmore river-passenger exchanges occur April through September generally by 10 a.m. River passenger exchanges (helicopter flights) are exempt under subsection 3(c) of the 1987 Overflights Act. FAA regulates associated transport flights on Brown routes to/from Bar Ten Airstrip. Thus, these flights are not subject to measures considered in Alternatives such as use of an annual allocation or daily cap.

Relationship with Other Rules, Plans, or Documents

Several plans that have or may influence this EIS are described briefly here, along with relationship to this EIS.

1995 General Management Plan for Grand Canyon

Grand Canyon's1995 General Management Plan provides management objectives and park vision. The GMP indicates the NPS would discourage changes at Grand Canyon National Park Airport in Tusayan that would result in increased noise pollution in the park. The GMP also designated park Management Zones and recognized the importance of park natural quiet and scenic resources.

Colorado River Management Plan

The 2006 Colorado River Management Plan (CRMP) determines Colorado River recreational use management. Helicopter transport of river passengers from the designated helipad on the Hualapai Reservation near Whitmore Wash to a point on the north rim outside GCNP (Bar Ten Airstrip) is exempt from provisions of the 1987 Overflights Act, per section 3(c). The Hualapai determine which helicopters fly in and out of Whitmore; however, the NPS regulates number and timing of Whitmore river passenger exchanges. The CRMP spread number of launches by day of week and throughout the week, reduced trip size, and expanded use season thereby reducing the number of people on the river at one time.

The Hualapai Tribe also manages helicopter use carrying passengers to and from helicopter pads on Hualapai land in the Quartermaster Canyon area and Grand Canyon West airport. These helicopters allow access and egress for day trips and short pontoon trips. The trips provide a viewing opportunity, and sometimes refreshments, before transporting passengers out of the canyon. While the CRMP regulates river use, the NPS does not regulate helicopter use across tribal lands.

South Rim Visitor Transportation Management Plan

South Rim Visitor Transportation Management Plan (NPS 2008e) implementation is underway in 2010. The Transportation Management Plan's purpose is to provide a transportation system that addresses the park's most pressing transportation issues. The Plan affects how visitors access South Rim and circulate among points of interest. In addition, the Plan is expected to affect GCNP visitation distribution, improve South Rim transportation, and benefit overall visitor experience. Although the Plan does not address aircraft overflights, it is considered in analyzing cumulative impacts in this EIS.

Grand Canyon-Parashant National Monument Management Plan and Environmental Impact Statement

The Resource Management Plan and Environmental Impact Statement for the Arizona Strip Field Office, the Vermilion Cliffs National Monument and the Bureau of Land Management portion of Grand Canyon-Parashant National Monument, and General Management Plan and Environmental Impact Statement for the NPS portion of Grand Canyon Parashant National Monument (BLM 2007) addresses land-use desired conditions on the Bureau of Land Management public domain, as well as within the national monument. Changes in aircraft routes proposed in this EIS could affect portions of Grand Canyon-Parashant National Monument, and thus are considered in analysis of impacts in this EIS.

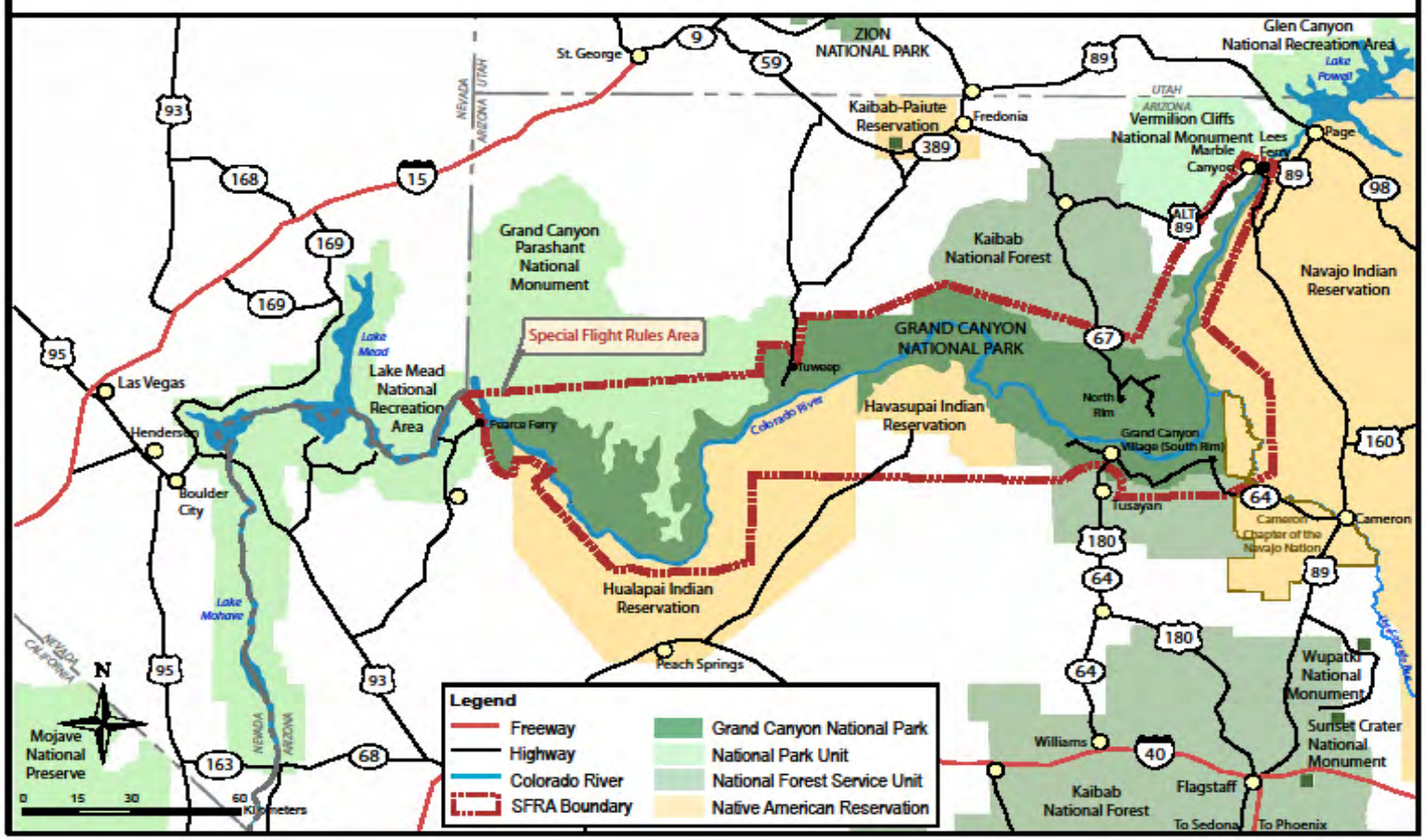
Kaibab National Forest Management Plan

The U.S. Forest Service manages lands on the Kaibab National Forest near and adjacent to GCNP on both North and South Rims, including Ten X Campground, Coconino Rim Semi-primitive Non-motorized Use Area, Kanab Creek Wilderness, and Saddle Mountain Wilderness. A 1988 Forest Management Plan, amended in 2008 (USFS 2008), provides guidance for forest resource management, recreation and other activities. In 2010, the U.S. Forest Service initiated an EIS while developing a revised land management plan for the Kaibab National Forest. The revised plan will address desired conditions, including resources such as natural quiet that may be affected by GCNP overflights. Changes in aircraft routes proposed in this EIS could affect portions of the Kaibab National Forest, and thus are considered in analysis of impacts in this EIS.

U.S. Fish and Wildlife Service Biological Opinion on Proposed Revisions to Flight Rules in the Vicinity of Grand Canyon National Park (2000)

The U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) (USFWS 2000) in response to the November 8, 1999 NPS Biological Assessment (BA) on proposed new flight rules in the vicinity of GCNP, as required under the Endangered Species Act's Section 7. Formal consultation addressed only proposed flight rules changes in the 1999 Supplemental EA. Formal consultation will be conducted as required, prior to issuance of a ROD, with the USFWS under the Endangered Species Act and 50 CFR 402.16 due to proposed modifications in flight routes and operations.

Map 1.1 Grand Canyon National Park and Vicinity



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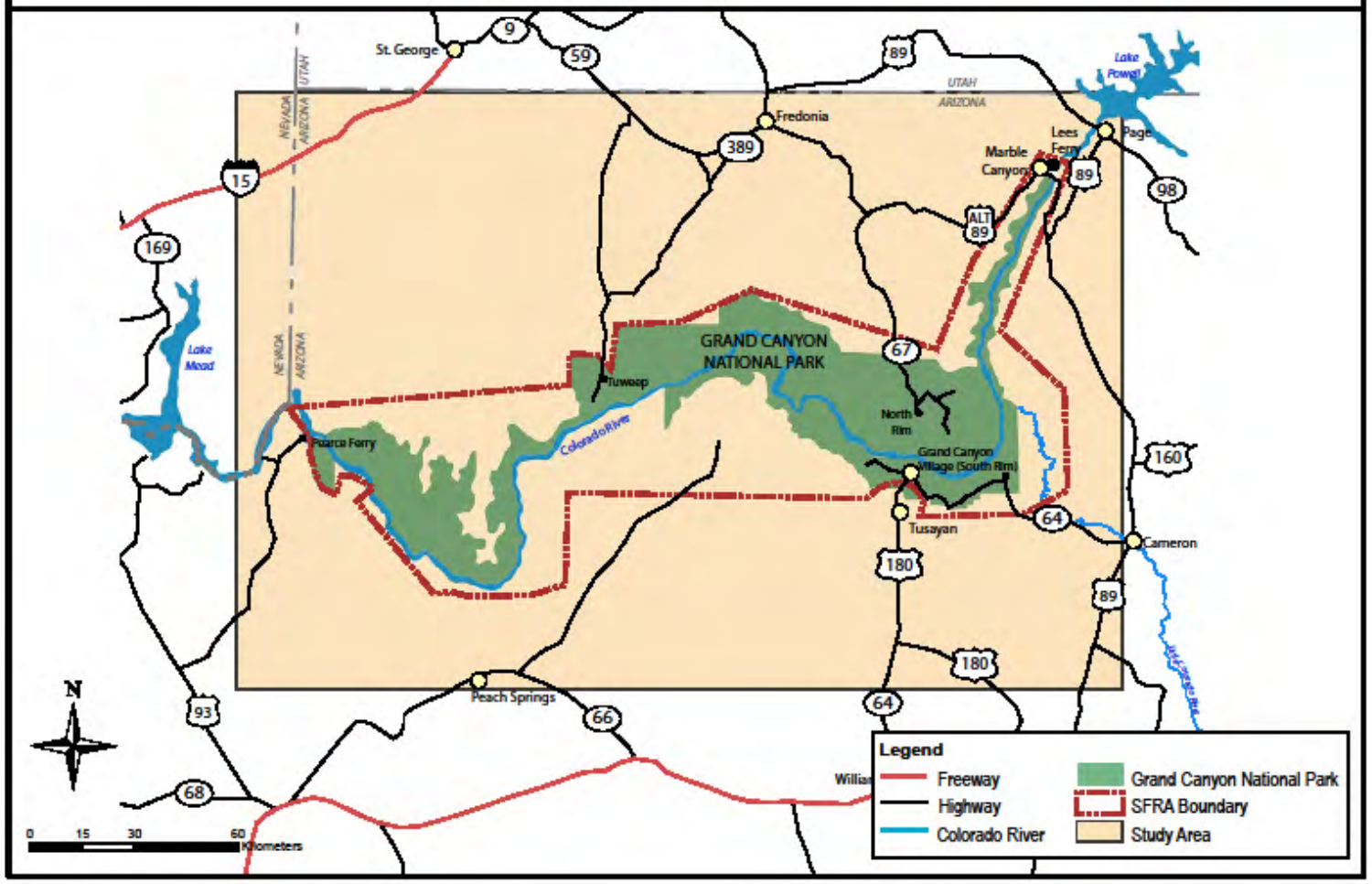
Map 1.2 Study Area



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PUBLIC AND INTERNAL SCOPING

Description of Scoping Process

Scoping is the early and open process for determining the range of issues to be addressed during the planning process. The general public; NPS and FAA staff; representatives from state, tribal, and Federal agencies; and representatives from various organizations identified issues and concerns during scoping for this EIS. Comments were solicited during a series of public meetings, through planning newsletters, and from stakeholders. An account of the public scoping process is provided in Chapter 5 and Appendix C.

Summary of Key Issues and Concerns

This section summarizes general issues and concerns identified during the public and internal scoping process. A detailed summary of public scoping comments may be found in Chapter 5 and Appendix C.

Cultural Resources
Eleven American Indian tribes are culturally affiliated with GCNP. The Federally recognized tribes for which Grand Canyon and its resources hold significant cultural, spiritual, and (in some instances) ancestral associations are the Havasupai Tribe, Hualapai Tribe, Hopi Tribe, Navajo Nation, Kaibab Band of Paiute Indians, Paiute Indian Tribe of Utah (representing the Shivwits Band of Paiutes), Las Vegas Tribe of Paiute Indians, Moapa Band of Paiute Indians, San Juan Southern Paiute Tribe, Yavapai-Apache Tribe (representing the White Mountain Tribe, San Carlos Tribe, Yavapai-Apache Nation, and Tonto Apache Tribe), and Pueblo of Zuni. Among tribal concerns is protection of (and continued access to) cultural and Ethnographic Resources having particular significance in sustaining tribal heritage and identity. Concerns have been raised by tribal representatives that noise and disturbances associated with air tours intrude on tranquility and settings of sacred places, disrupting traditional rituals and other activities.

In addition to tribal issues regarding Ethnographic Resources and traditional cultural properties (Ethnographic Resources listed in or eligible for listing in the National Register of Historic Places), other cultural resource issues were raised during scoping concerning potential adverse impacts on archeological sites and historic structures. It was noted that motorized noise may potentially diminish setting and character of significant historic properties listed or eligible for listing on the National Register.

Adjacent Lands
Lands of the Hualapai Tribe, Havasupai Tribe, and Navajo Nation are adjacent to GCNP. Tribal issues relating to adjacent lands include noise impacts, varying land management practices, and overlapping jurisdictions. Other issues include respect for tribal sovereignty, development of tribal enterprises, tourism, and government-to-government relations and consultation. Also during the scoping period, the Hualapai Tribe stressed the importance of retaining their air-tour flight exemption to sustain tribal objectives for economic development. The Navajo Nation also expressed interest in providing air tours on their adjacent lands.

Noise associated with Grand Canyon aircraft overflights is also a concern on adjacent lands located in the Kaibab National Forest's Tusayan Ranger District, Lake Mead National Recreation Area, Glen Canyon National Recreation Area, Vermilion Cliffs National Monument, Grand Canyon-Parashant National Monument, and the Bureau of Land Management's Arizona Strip District.

Natural Resources
Natural resource issues include how overflights affect soundscape, air quality, potential for collisions between aircraft and threatened and endangered species, and disturbance of wildlife and threatened and endangered species.

Visitor Use and Experience
Key Visitor Use and Experience issues include providing a diverse range of quality visitor experiences compatible with protection of resources and values; protecting opportunities for solitude, natural conditions, primitiveness, remoteness, and inspiration; and providing a quality aerial-viewing experience while protecting park resources (including natural quiet) and minimizing conflicts with other park visitors.

Wilderness
Aircraft flights over Wilderness areas are a concern due to potential impacts on Wilderness Character, opportunities for solitude, natural quiet, and enjoyment of a Wilderness experience.

Socioeconomic Conditions
Socioeconomic conditions, such as potential effects on income from tourism, fuel consumption, employment, and logistical costs, are concerns.

Air-tour Industry
Issues affecting the air-tour industry include changes in regulations that impact Flight-free Zones, flight routes, altitudes, curfews, number of daily operations, seasonal restrictions, zoning, safety, and quiet-aircraft technology implementation. A significant concern pertained to minimizing economic impact to air-tour operators.

General Aviation
General-aviation concerns encompass changes to general-aviation corridors and how changes could lead to longer flights.

IMPACT TOPICS

An important part of planning is seeking to understand consequences of making one decision over another. Environmental impact statements identify anticipated impacts of possible actions on resources, park visitors, and neighbors. Impacts are organized by topic, such as "impacts on the visitor experience" or "impacts on vegetation and soils." Impact topics focus environmental analysis and ensure relevance of impact evaluation. Impact topics identified for analysis are outlined in this section; they were identified based on Federal laws and other legal requirements, Council on Environmental Quality regulations, NPS policies and guidelines, staff subject-matter expertise, and issues and concerns expressed by the public, tribes, and other agencies early in the planning process (see previous section). Also included is a discussion of some impact topics considered but not analyzed in detail in this EIS for the reasons given below.

Impact Topics Retained for Analysis

Impact topics or components of the human environment possibly affected by the Alternatives and analyzed in detail in this EIS include

Soundscape
NPS Management Policies 2006 and NPS Director's Order 47, Sound Preservation and Noise Management (NPS 2000), recognize natural Soundscapes are a park resource, and call for the NPS to preserve, to the greatest extent possible, the park's natural Soundscapes. NPS Management Policies and Director's Orders further state NPS staff will restore degraded Soundscapes to the natural condition whenever possible, and will protect natural Soundscapes from degradation due to noise (undesirable human-caused sound). Noise can adversely affect, directly and indirectly, natural Soundscape, Wildlife, and other park resources. Noise can also adversely impact Visitor Experience. Visitors have opportunities to experience tranquility in an environment of natural sounds in many park areas. Alternative actions that could potentially increase or decrease sound level in GCNP due to aircraft overflights within the SFRA at or below 17,999 feet MSL are of concern to visitors, tribes, businesses, the public, private landowners, adjacent land managers, other Federal agencies, and NPS managers and are analyzed in this EIS.

(Note: Soundscape is only analyzed for Grand Canyon National Park and other NPS units within the Special Flight Rules Area. Effects of noise on Visitor Use and Experience, Wildlife, Special Status Species, and Wilderness Character are addressed under those impact topics.)

Wilderness Character
Ninety-four percent of Grand Canyon National Park is proposed for Wilderness designation. In accordance with NPS policies, lands proposed for Wilderness designation are managed as Wilderness until Congress acts to designate Wilderness or remove it from consideration. Wilderness Character, including opportunities for solitude and/or primitive, unconfined recreation, and apparent naturalness, are key to many visitors' experiences and to park management. In addition, several existing and proposed Wilderness areas exist outside GCNP, but within the Study

Area, including designated Wilderness in Grand Canyon-Parashant National Monument, Kaibab National Forest, and in Lake Mead National Recreation Area's Arizona and Nevada portions. Alternatives under consideration could result in changes in sound level, sound presence, and visual appearance (i.e., low-flying aircraft) over existing or proposed Wilderness areas. Impacts on existing or proposed Wilderness areas are of concern to visitors, the public, and managing Federal agencies.

Ethnographic Resources

An ethnographic resource is "a 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" (NPS 1998). Ethnographic Resources traditionally significant to Grand Canyon's culturally affiliated tribes may be affected by actions proposed in this EIS regarding air-tour overflights. Therefore, potential impacts on Ethnographic Resources are analyzed in this EIS.

Visitor Use and Experience

One of the purposes of national parks is to provide for public enjoyment, education, and inspiration. GCNP's high-quality visitor experiences attract visitors from around the world. River running, backpacking, day hiking, sightseeing, camping, and wildlife viewing are some of the many opportunities offered. Commercial air-tour aircraft flying over GCNP have noise, visual, and potentially related aesthetic effects that can affect the experience of ground-based visitors. Changes in flight routes and/or air-tour operations could affect the experience of ground-based visitors in different parts of the park. These changes are of concern to visitors, NPS managers, and the public.

GCNP offers superlative opportunities for visitors to see the park from ground or air. Air tours attract visitors worldwide who want to see Grand Canyon from the air. As with ground-based visitors, changes in flight routes and/or air-tour operations could affect the experience of air-tour visitors. These changes would be of concern to visitors, air-tour operators, NPS managers, and the public and are thus analyzed in this EIS.

Wildlife

Grand Canyon supports a diverse wildlife population, including insects, birds, reptiles, amphibians, and mammals. The park's wildlife populations are an important resource and one of the attractions that add to the quality of visitor experience. Some of GCNP's birds (e.g., golden eagles and other nesting raptors) and mammals (e.g., bighorn) are susceptible to disturbance from noise. Potential impacts of concern would be modification of animal behavior in response to overflights, and alteration of feeding, breeding, and socializing habits. Indirect effects of concern would be accidental injury, energy loss, and impacts to offspring survival (NPS 1994). Adverse impacts on wildlife would be of concern to visitors, the public, and NPS managers and are analyzed in this EIS.

Special Status Species

The Endangered Species Act of 1974, as amended, requires examination of impacts on all Federally listed threatened or endangered species. NPS Management Policies 2006 repeats this requirement and adds the stipulation that analysis examine impacts on state-listed species and Federal species proposed for listing. Federally listed threatened and endangered species of concern include the Mexican spotted owl (*Strix occidentalis lucida*) and California condor (*Gymnogyps californianus*). Another special status species, the American peregrine falcon (*Falco peregrinus anatum*), is also of concern. Changes in flight routes and/or aircraft operations, noise, visual effects, and proximity to species are evaluated in this EIS, including potential for collisions between birds and aircraft, whether low-level flights over species and habitat would result in harassment, disruption of normal behavior patterns, and other effects. Any actions that would adversely affect these species are of concern to the USFWS, NPS managers, other agencies, tribes, and the public and are thus analyzed in this EIS.

Socioeconomic Environment

NEPA requires examination of social and economic impacts caused by Federal actions as part of a complete analysis of potential impacts on the human environment. Consideration will be given to potential economic effects on air-tour operators, general aviation, commercial carriers, tribal enterprises, and local and regional economies. Issues for consideration include income from tourism, fuel consumption, employment, intrinsic value, and logistical costs. Therefore, potential impacts on socioeconomic environment are analyzed in this EIS.

Impact Topics Considered and Dismissed from Detailed Analysis

Council on Environmental Quality Regulations for Implementing the National Environmental Policy Act (40 CFR Part 1500-1508), and NPS Director's Order 12 require an EIS to identify and focus on significant environmental issues and de-emphasize and eliminate from detailed review insignificant or non-applicable issues. Accordingly, the following issues are not analyzed in this EIS.

Air Quality and Climate Change

Grand Canyon National Park is classified as a mandatory Class I area under the Clean Air Act (42 United States Code 7401 et seq.). Under this most stringent air quality classification, it is mandated GCNP be protected against degradation of air quality and an increase in air pollution. Furthermore, the Clean Air Act sets the goal of natural visibility conditions, free of human-caused haze. NPS Management Policies 2006 provide guidance for protection of air quality under both the 1916 NPS Organic Act and the Clean Air Act to ensure the best possible air quality in parks and actively promote and pursue measures to protect air-quality-related values. Current park air quality is generally good, with pollution levels generally below those established by the U.S. Environmental Protection Agency (EPA) to protect human health. However, the EPA has proposed ranges of more stringent national health and welfare standards for ozone. Depending on levels of the final standards, measured ozone at GCNP could violate the new standards, and the park could be designated as a nonattainment area for ozone. Although conformity requirements would apply in an ozone nonattainment area, estimated emissions from this project are expected to be below the minimum threshold for which a conformity determination must be performed. In addition, visibility is usually worse than natural levels due to regional haze originating outside GCNP boundaries and smoke from local and regional wildland fires. In-park air pollutant emissions are dominated by wildland fire and motor vehicles, including visitor vehicles, commercial tour buses, and park-operated shuttle buses, with lesser contributions from watercraft, aircraft, boilers, generators, campfires, woodstoves, and other sources (NPS 2002).

Using data from the above micro-inventory, the park's air quality specialist determined that although aircraft emit air pollutants within Grand Canyon National Park, minor changes in pollutant production resulting from the Alternatives considered in this EIS would not make an appreciable difference in park haze or ozone levels. These changes would not make an appreciable difference in air quality or climate change in the Study Area. Consequently, air quality and climate change are not a determining factor in selecting among the Alternatives, and were dismissed from further analysis.

Prime and Unique Agricultural Farmlands

No prime or unique agricultural soils occur in the Study Area. Thus, this topic was dismissed from further consideration.

Consistency with Land Use Plans, Policies, and Controls

Commercial air tours are an established use over Grand Canyon National Park and are generally consistent with the park's General Management Plan and other related park plans. Several landowners adjacent to GCNP, including but not limited to Grand Canyon-Parashant National Monument, Lake Mead National Recreation Area, Kaibab National Forest, and Navajo Nation, may be affected by changes in air tours being proposed in the Alternatives. Resources and visitor experiences on these adjacent lands could be affected and are analyzed as part of the impact topics being considered in this EIS. However, none of the changes being proposed would be expected to alter existing land uses, given that general aviation flights, air-tour flights, military flights, and commercial jets are already flying over the areas. Based on conversations between park staff and these adjacent landowners, none of the proposed actions in the Alternatives is believed to conflict with existing land use plans, policies, and controls used by these landowners. Thus, this impact topic was dismissed from further consideration.

Wild, Scenic, and Recreational Rivers

Although the Colorado River and its tributaries have been studied for Wild and Scenic River eligibility, no decision has been reached on whether or not to propose river segments for designation. The Little Colorado River was included in the eligibility study for inclusion in the National Wild and Scenic River system. Aircraft overflights were taken into account in determining the eligibility of the Colorado River, the Little Colorado River, and other tributaries as Wild and Scenic Rivers. Any changes in aircraft routes or air-tour operations would not have more than a minor impact on either river's outstanding remarkable values (e.g., recreation). Thus, the Alternatives would not affect the decision to propose Wild and Scenic Designation or river management, and the topic was dismissed from further analysis.

Other Specially Designated Areas
Grand Canyon National Park is a World Heritage Site, designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

In addition, six administratively designated Research Natural Areas (RNA) exist in GCNP, and one National Natural Landmark (NNL) extends from USFS land into the park. However, no actions are being taken as a result of Alternatives being considered that would affect purposes of the designations or substantially alter use and management of these areas. Air tours were being conducted in large numbers at the time of World Heritage Site designation in 1979. While aircraft overflights are mentioned as a management problem in the World Heritage nomination (http://whc.unesco.org/archive/advisory_body_evaluation/075.pdf), aircraft overflights did not affect sufficiently the character of the Grand Canyon World Heritage Site at the time of nomination and do not currently threaten its designation. Likewise, air tours have flown over GCNP for many years with no adverse effects of a magnitude that would threaten its RNAs or NNL. Therefore, this topic was dismissed from further consideration.

Archeological Resources
Archeological resources are "material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment" (NPS 1998). Actions proposed in this EIS do not have potential to significantly affect the park's archeological resources (Brumbaugh n.d.; King 1996). None of the aircraft overflights actions in the Alternatives would be expected to result in ground disturbance or cause noise-generated vibrations sufficient to damage archeological resources. Archeological resources were therefore dismissed from further analysis.

Prehistoric/Historic Buildings and Structures
Prehistoric and historic buildings are enclosed structures constructed principally to shelter any form of human activity (e.g., residential, industrial, commercial, agricultural, or other human use). None of the aircraft overflights actions in the Alternatives would be expected to result in ground disturbance or cause noise-generated vibrations sufficient to damage prehistoric or historic structures. This topic was therefore dismissed from further analysis.

Cultural Landscapes
According to the NPS Cultural Resource Management Guideline, a cultural landscape is "a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions." Historic landscapes exist at several park locations, but none of the aircraft overflights actions in the Alternatives would be expected to result in ground disturbance or cause noise-generated vibrations sufficient to damage prehistoric or historic structures. Likewise, none of the Alternatives would affect character-defining elements of park cultural landscapes, such as vegetation, structures and buildings, and patterns of circulation. Therefore, cultural landscapes were dismissed from further analysis.

Museum Collections
Museum collections can include a diverse range of items such as prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens. None of the Alternatives would affect how museum collections are acquired, accessioned and cataloged, preserved, protected, or made available for access and use. Thus, this topic was dismissed from further analysis.

Indian Trust Resources
Indian trust resources are land, water, minerals, timber, and other natural resources held in trust by the United States for the benefit of a tribe or an individual tribal member. No Indian trust resources are located in Grand Canyon National Park. Impacts on tribal lands within the Study Area but outside the park are discussed in specific resource topics in Chapters 3 and 4. Therefore, this topic was dismissed from further analysis.

Aquatic Habitat and Species
The Colorado River and its tributaries contain a variety of native and nonnative fish. No changes are being proposed in uses of the river, and no actions are proposed that would affect in-stream flows, water quantity and quality, or aquatic biota, which in turn could affect fish populations. None of the Alternatives will affect fish populations. No

changes are being proposed that would affect management of fish in the river. Thus, this topic was dismissed from further analysis.

Vegetation
None of the Alternatives being considered would result in developments, actions, or uses that would result in new ground disturbance, fires, development of social trails, trampling of vegetation, or spread of nonnative or invasive species, all of which could affect plant populations and distributions. Aircraft flying over GCNP do not affect the park's plants. No changes would occur in management of park vegetation. Thus, none of the Alternatives will affect park plants. This topic was therefore dismissed from further consideration.

Special Status Species (Other Than Those Identified Above)
Several threatened, endangered, or special status species would not be affected by the Alternatives including the bald eagle (*Haliaeetus leucocephalus*), southwestern willow flycatcher, (*Empidonax traillii extimus*), western yellow-billed cuckoo (*Coccyzus americanus*),Yuma clapper rail (*Rallus longirostris yumanensis*), Mexican long-tongued bat (*Choeronycteris Mexicana*), spotted bat (*Euderma maculatum*), western red bat (*Lasiurus borealis*), Hualapai Mexican vole (*Microtus mexicanus hualpaiensis*), southwestern river otter (*Lontra canadensis sonora*), black-footed ferret (*Mustela nigripes*), northern leopard frog (*Rana pipiens*), bonytail chub (*Gila elegans*), Virgin River chub (*Gila seminude*), razorback sucker (*Xyrauchen texanus*), woundfin (*Plagopterus argentissimus*), Little Colorado spinedace (*Lepidomeda vittata*), Kanab ambersnail (*Oxyloma haydeni kanabensis*), and eight species of listed plants. Aircraft overflights do not affect populations of listed plants or aquatic species mentioned above. (See also earlier dismissal of vegetation and aquatic species.) The Hualapai Mexican vole does not occur in the park. The southwestern river otter and black-footed otter have been extirpated. Bat species are not active during times air-tour flights would occur, and thus would not be affected. It is also likely overflights are not affecting populations of southwestern willow flycatcher and Yuma clapper rail. Both the flycatcher and rail occur in riparian habitats which air-tour routes largely avoid or fly over at altitudes greater than 4,000 feet above ground level. Former southwestern flycatcher habitat on the park's West End has been altered due to river downcutting. Individual rails may find their way to the canyon rim, where aircraft are flying at lower altitudes, but this would be very unlikely. Thus, effects of Alternatives on these listed species are dismissed from further analysis.

Coastal Resources
This impact topic was dismissed because GCNP does not have coastal resources.

Wetland Resources and Floodplains
Although wetlands and floodplains occur in the Study Area, no new developments, actions, or uses are proposed in the Alternatives that would result in loss or disturbance of wetlands or floodplains. Likewise, no changes are proposed that would affect the area's hydrology or change NPS-management of wetlands or floodplains. Because none of the Alternatives would affect these resources, they were dismissed from further analysis.

Water Resources (Surface and Subsurface Water Quality and Quantity)
No new developments, actions, or uses proposed in the Alternatives would result in water pollution, a change in quantity of water flowing through GCNP, or a change in other hydrological conditions. No changes are being proposed that would affect NPS management of park water resources. This impact topic was dismissed from further analysis.

Soils
No new developments, actions, or uses are proposed in the Alternatives that would result in new ground disturbance or possibly change soil erosion, the area's productivity, or drainage patterns. No changes are proposed that would affect NPS management of soils. Thus, this topic was dismissed from further consideration.

Caves
Although caves occur in the Study Area, no new actions or uses are proposed in the Alternatives that would affect caves, including changes to hydrology, cave formation, mineral formation, or wildlife habitat. No changes are proposed that would affect NPS management of caves. Consequently this topic was dismissed from further analysis.

Paleontological Resources
GCNP has a variety of paleontological resources. However, no new developments, actions, or uses are proposed in the Alternatives that could affect these resources, including changes to hydrology, soil erosion, or collection of and research on paleontological resources. No changes are being proposed that would affect NPS management of paleontological resources. Thus, this impact topic was dismissed from further analyses.

Construction Impacts
None of the Alternatives will involve construction of new facilities, thus there will be no construction impacts and this topic is dismissed from further analysis.

Energy Requirements and Conservation Potential/Natural or Depletable Resource Requirements and Conservation Potential
Aircraft expend fuel flying over the park and surrounding lands. However, none of the Alternatives being considered would appreciably increase overall number of air tours flying over the park, and thus none would result in a substantial change in energy consumption. Therefore, this topic was dismissed from further analysis.

Environmental Justice
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs Federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low-income populations. Guidelines for implementing this executive order under NEPA are provided by the Council on Environmental Quality, Environmental Justice, Guidance under the National Environmental Policy Act (1997). 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." (http://www.epa.gov/compliance/environmentaljustice/basics/index.html)

The NPS Preferred Alternative responds to several requests from tribal governments and communities including

- rerouting an existing helicopter support route that services Supai Village on the Havasupai Reservation (this rerouting was requested by the Havasupai Tribe to lessen impacts present under the current condition [current condition is defined in Alternative A])
- incorporating new East End routing options for possible flight operations as requested by the Navajo Nation
- changing a notch in the Special Flight Rules Area boundary around the Grand Canyon West Airport, located on Hualapai tribal lands, at the request of the Hualapai Tribe

The NPS Preferred Alternative would also eliminate the Blue Direct South air-tour route. In the absence of the Blue Direct South route, some tour operations would be expected to travel outside the SFRA, while others would be expected to travel on the Blue Direct North air-tour route. Some of the flights displaced from Blue Direct South may fly north of Peach Springs on the Hualapai Reservation on existing Victor Airways V208-210, V235, and V562 to and from the Peach Springs VOR.[17] No changes are proposed to these airways, and a significant increase in the number of flights in this area is not anticipated.

The NPS Preferred Alternative implementation would not result in significant noise or other environmental impacts on minority or low-income populations in the Study Area. In working toward substantially restoring natural quiet, in the context of visitor activity, including air-tour activity, in Grand Canyon National Park, the NPS and FAA have worked with American Indian tribes adjacent to or associated with Grand Canyon. This effort is intended to reduce or avoid adverse impacts, especially from noise, and make changes requested by the tribes related to tribal economic development.

The NPS Preferred Alternative implementation would have no disproportionately high and adverse human health or environmental effects on low-income populations or minority groups. Therefore, this topic is dismissed from further

[17] Very High Frequency Omnidirectional Range A navigation tool used by pilots operating under visual flight conditions. Each VOR throughout the national airspace system is named for identification purposes, and each operates on a unique radio frequency. Aircraft navigate on victor airways and jet airways using VORs

analysis. Analyses of other impacts to American Indian tribes that inhabit and have ties to areas in and around GCNP are found in Chapters 3 and 4, Socioeconomic and Ethnographic Resources. Information about involvement of American Indian tribes and sovereign governments during EIS development are in Chapter 5.

Public Health and Safety

Consistent with NPS Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision-making, and other mandates, the NPS has responsibilities for park visitor safety, and the agency includes public health and safety as an impact topic in its NEPA documents. The NPS requested additional information from the FAA regarding safety of park ground visitors with respect to potential accidents by air-tour aircraft. FAA researched 25 years (1982-2006) of National Transportation Safety Board (NTSB) accident data involving Parts 91, 135, and 121 air-tour operations over the national park system in its entirety, not just Grand Canyon National Park. In the 390 accidents recorded over the 25-year period, fatalities involved only aircraft passengers and operational personnel. During the same 1982-2006 time period, NTSB recorded five accidents involving commercial air-tour aircraft in GCNP. Four of these were minor accidents involving a single aircraft, and occurred prior to 1986. The last accident occurred on June 18, 1986, in which two aircraft collided. There was no air-traffic management plan in place at the time of these accidents. On September 22, 1988, the FAA promulgated a Special Federal Aviation Regulation 50-2, creating a controlled airspace affecting all commercial air-tour operations in Grand Canyon. Since then, over 2.5 million commercial air tours have been conducted in the park without a commercial air-tour accident. No one on the ground has been injured or killed in any of the 25-year history at Grand Canyon National Park or in any of the 390 accidents that occurred over the entire national park system. An estimated five million air-tour operations were conducted during that time frame over all national parks. Based on these historical statistics, the risk of death or injury to a ground visitor at Grand Canyon National Park from a commercial air-tour accident is in the zero to remote range.

To the extent possible, NPS administrative flights are routed away from developed areas for noise abatement and to avoid increased risk to visitors, residents, facilities, and park resources (including historic buildings and districts listed in the National Register). All Alternatives fully evaluated in this EIS are consistent with this practice, and locate air-tour routes over less populated areas of the park and Study Area.

FAA's primary mandate is aviation safety. Under Part 49 U.S. Code 40103(b)(2), the FAA Administrator shall prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes) for

- navigating, protecting, and identifying aircraft;
- protecting individuals and property on the ground;
- using the navigable airspace efficiently; and
- preventing collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects

Public safety is built into the legislative mandate governing Grand Canyon. Consistent with the 1987 Overflights Act, the FAA Administrator has responsibility to implement recommendations of the Secretary of the Interior/National Park Service without change unless the Administrator determines implementing the recommendations would adversely affect aviation safety. If the Administrator determines implementing the recommendations would adversely affect aviation safety, the Administrator is responsible, in consultation with the Secretary of the Interior and after notice and opportunity for hearing, for reviewing the recommendations to eliminate adverse effects on aviation safety. The Final EIS and rulemaking will reflect any changes made to the NPS Preferred Alternative for reasons of mitigating and reducing aviation risks.

Accidents involving air-tour aircraft are rare, and the probability of an accident low. After considering potential effects, and based on environmental conditions, air-tour characteristics, and visitor use patterns that exist specifically at Grand Canyon National Park, the NPS has determined that risks to public health and safety would be negligible under NPS NEPA criteria. Since, by definition, implementation of an Alternative must be safe, and since the remote nature of potential impacts would not vary among Alternatives, the topic of public health and safety was dismissed from further analysis.

Hazardous Materials, Pollution Prevention, and Solid Waste

None of the overflight routes or air-tour operations in the Alternatives would result in an appreciable change in amount of waste produced, or a change in generation or disposal of hazardous materials or solid waste. Thus, this impact topic was dismissed.

Lightscape and Light Emissions
None of the air-tour operations in the Alternatives would occur at night. Thus, none of the Alternatives would affect the park's lightscape or light emissions. Therefore, this topic was dismissed.

Park Operations and Management
NPS Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision-making, provides guidance to national parks on inclusion of park operations as an impact topic. Although NPS Management Policies 2006 does not specifically address park operations, virtually every action or proposal evaluated in the NEPA process has either a direct or indirect effect on park operations. Although management of air-tour overflights may have varying degrees of impact on personnel, funding, and time, there would not be a discernable difference in effects among the four Alternatives (including No Action) evaluated in this EIS. In addition, NPS air-tour management includes planning, coordination with the FAA and other agencies and stakeholders, noise monitoring, and fee collection. It is estimated that approximately 2.5 to 3 full-time equivalent employees (FTEs) could be necessary to address effects from overflights and conduct a broader Soundscape management program. This projection is based on past staffing efforts for monitoring and managing overflights and Soundscapes at Grand Canyon National Park. If there needed to be changes in staffing in the future to manage overflights, these effects would be minor or less, and would not result in any unacceptable impacts.

Because there would be no discernable difference in impacts among Alternatives, and effects from impacts of Alternatives would be minor or less, park operations and management was dismissed from further analysis.

Urban Quality and Design Built Environment
NEPA regulations at 40 CFR 1502.16 require urban quality and design of the built environment be considered if potentially affected. None of the Alternatives require construction of new facilities. Therefore this impact topic was dismissed from further analysis.

NEXT STEPS

After distribution of this Draft Environmental Impact Statement, there will be a 120-day public review and comment period. After this period, the EIS Planning Team will evaluate comments from other Federal agencies, tribes, organizations, businesses, and individuals regarding the Draft document, and incorporate appropriate changes into a Special Flight Rules in the Vicinity of Grand Canyon National Park Final Environmental Impact Statement. The Final EIS will include letters from governmental agencies, tribes, public officials, and substantive public comments on the Draft EIS, and NPS responses to those comments. Following distribution of the Final EIS and a 30-day no-action period, a Record of Decision will be signed. The Record of Decision will document the NPS selection of an Alternative for implementation.

The NPS will present the selected Alternative as a recommendation to the FAA for implementation through rulemaking that addresses any changes in the airspace configuration or procedures affecting SFAR 50-2 including any SFRA boundary changes; route changes; and/or Flight-free Zone dimensions and altitudes (which also define air-tour corridors and general-aviation corridors).

FAA will regulate overflights of Grand Canyon National Park in accordance with the NPS recommendation in the EIS and ROD "without change," unless there are potential adverse effects on aviation safety that are credible and verifiable, in which case the FAA in consultation with NPS will mitigate those adverse effects and implement the revised recommendation. The process is outlined in Figure 4.5.

Changes in commercial air-tour route structure to substantially restore natural quiet in GCNP at and above 18,000 feet MSL are not subject to FAA rulemaking, but will be implemented in the future in accordance with commitments made by FAA. However, all proposed actions will be included as part of the Alternative selected in the Record of Decision.

CHAPTER 2 ALTERNATIVES

INTRODUCTION

The National Environmental Policy Act requires an EIS consider a range of reasonable Alternatives, including a No Action Alternative. NEPA requires the No Action Alternative be evaluated as a baseline for comparison for other Alternatives, even if a No Action Alternative may not be implemented due to legal, regulatory, or other considerations, including a legislative command to act.

As required in Council on Environmental Quality regulations (40 CFR 1502.14), agencies must "rigorously explore and objectively evaluate all reasonable Alternatives" in an EIS. CEQ defines reasonable Alternatives as those technically and economically feasible. Alternatives must also: meet project objectives, resolve needs, and alleviate potentially significant impacts on important resources. CEQ is also clear that agencies should not pare Alternatives to only those that are cheap, easy, or the agency's favorite. Rather, feasibility is an initial measure of whether the Alternative makes sense and is achievable (DO 12, page 20).

Through the EIS process, eight Alternatives (A, B, C, D, E, F, G, and the NPS Preferred Alternative) were considered for management of commercial air-tour and general-aviation operations over Grand Canyon in the SFRA. For reasons defined in Alternatives and Actions Considered and Dismissed from Further Consideration, Alternatives B, C, D, and G were dismissed from further consideration. In 2009 the NPS, in consultation with the FAA and stakeholders, worked to refine the NPS Preferred Alternative. During that process much iteration of Alternatives E, G, and elements of Alternative A were explored. The outcome of those efforts is the NPS Preferred Alternative. As a result, four Alternatives have been retained for further evaluation

Alternative A No Action/Current Condition Map 2.2

- continue current management and current helicopter and fixed-wing air-tour routes
- long and short-loop air-tours operate in Zuni Point and Dragon Corridors year-round
- annual allocation of 93,971 air-tour flights
- no quiet-technology incentives or conversion requirement
- four existing General Aviation corridors
- Flight-free Zone ceilings at 14,499 feet, except Sanup at 7,999 feet

Alternative E Alternating Seasonal Use Map 2.3

- short-loop air-tours alternate use of Zuni Point and Dragon Corridors seasonally
- no long-loop tours over North Rim; no routes over Marble Canyon; dogleg in Dragon Corridor
- annual allocation of 93,971 air-tour and air-tour related flights
- daily cap of 364 air-tour and air-tour-related flights
- full conversion to quiet-technology aircraft by date to be determined
- only quiet-technology aircraft allowed on East End routes early and late hours of flight day
- three modified general-aviation corridors
- all Flight-free Zone ceilings raised to 17,999 feet, and three zone boundaries enlarged

Alternative F Modified Current Condition Map 2.4

- similar to current routes and altitudes, except seasonal shift in Dragon Corridor, and changes in West End routes
- annual allocation of 93,971 air-tour flights
- incentives for quiet-technology aircraft; conversion to quiet-technology aircraft in 10 to 12 years
- One general-aviation corridor eliminated; three general-aviation corridors as in Alternative A
- Flight-free Zone ceilings same as current; Flight-free Zone boundaries changed to accommodate seasonal shift in Dragon Corridor

NPS Preferred Alternative Map 2.5

- short-loop air-tours alternate between Zuni Point and Dragon Corridors on a seasonal basis
- long-loop air-tour routes over North Rim open year-round, phased-in for quiet-technology only
- dogleg in Dragon Corridor; increased altitudes for some air-tour route segments

- annual allocation of 65,000 air-tour and air-tour-related flights
- daily cap of 364 air-tour flights
- air-tour route changes to better protect Nankoweap area, Little Colorado River confluence, Marble Canyon
- incentives for quiet-technology aircraft; conversion to quiet-technology aircraft required within ten years
- four general-aviation corridors with modifications in two
- Flight-free Zone ceilings raised to 17,999 feet with exceptions for aircraft in transit on Victor airways or under positive control of an air-traffic control center or tower

Alternatives Components

All Alternatives apply to aircraft operating in the GCNP SFRA (Map 1.2). Within this area, Alternatives include requirements such as

- Flight-free Zones where air-tour operations and general-aviation aircraft are not allowed. These zones extend from ground surface up to a specified altitude such as 14,499 feet MSL
- General aviation corridors that allow all aircraft to cross Grand Canyon in relatively narrow alignments between Flight-free Zones
- Specified routes and altitudes that air-tour operators must follow when operating in the SFRA
- Time limitations on when air-tour flights may be conducted, such as operating hours of commercial air tours or seasonal air-tour route use
- Limitations on numbers of flights conducted by commercial air-tour operators on a daily or annual basis

As described in Chapter 1, all Alternatives apply to airspace between the ground surface and an altitude of 17,999 feet MSL.

Mitigation measures that apply to Action Alternatives (E, F, and the NPS Preferred Alternative) appear in Chapter 2, Mitigation Provisions to Manage Aircraft Noise under Action Alternatives

Formulation of Alternatives

Alternatives for managing the SFRA were developed to meet EIS objectives. Alternatives also consider public scoping comments, and tribal, agency, and Grand Canyon Working Group input.

As described in Chapter 1, the Grand Canyon Working Group was established under authority of the National Parks Overflights Advisory Group, and consists of representatives from NPS and FAA, air-tour operators, environmental groups, tribes, commercial and general aviation, recreational interests, and other Federal agencies. The working group was tasked with assisting the agencies in meeting the statutory mandate contained in Public Law 100-91. As a result, Alternatives incorporate many Working Group recommendations and ideas.

Participants in Alternatives Formulation Process

The Grand Canyon Working Group began assisting agencies developing preliminary EIS Alternatives in early 2006. Over the course of numerous Working Group meetings, March 2006 through December 2007, several options for managing aircraft overflights were proposed by Working Group members and stakeholder groups. An additional Working Group meeting was held to discuss a Draft NPS Preferred Alternative in July 2009.

In spring 2006, as part of the EIS process, the EIS Planning Team[18] reviewed more than 1,200 public scoping comments to identify options (which were of varying scope and complexity) to meet the goal of substantial restoration of natural quiet. Key elements suggested by the Grand Canyon Working Group, and those submitted during public scoping, were developed into a reasonable range of Alternatives to be analyzed in this EIS.

[18] The EIS Planning Team included representatives from the NPS (Grand Canyon National Park, AZ; Natural Sounds Program, Ft. Collins, CO; Denver Service Center {DSC}, Denver, CO; Intermountain Regional Office, Denver, CO); FAA, Bureau of Indian Affairs (BIA), U.S. Department of Transportation, Volpe Center, Cambridge, MA; Parsons Corporation (DSC subcontractor)

ELEMENTS COMMON TO ALL ALTERNATIVES

Several elements to manage aircraft over the park and in the SFRA are common to all Alternatives, including Alternative A, as described below. As clarified in the Federal Register April 9 and September 24, 2008,

- Substantial Restoration of Natural Quiet at Grand Canyon National Park will be achieved when reduction of noise from aircraft operations at or below 17,999 feet MSL within the Special Flight Rules Area results in 50% or more of the park achieving restoration of natural quiet (i.e., no aircraft audible) for 75% to 100% of the day, each and every day. 50% of the park is the *minimum* restoration goal
- Substantial Restoration of Natural Quiet from all aircraft above 17,999 feet MSL means there will be an overall reduction in aviation noise generated above 17,999 feet MSL above the park over time through implementation of measures in accordance with FAA commitments
    - The FAA's commitments, which have previously been informally conveyed to the NPS and the Grand Canyon Working Group, are
        - Aircraft noise reduction The FAA will actively pursue efforts to continue to reduce aircraft source noise throughout the aviation system
        - Airspace redesign When the FAA is engaged in airspace redesign that affects a national park and there are alternative choices consistent with safety, operational, and environmental parameters, we will give favorable consideration to alternative routes away from sensitive park resources
        - Advanced navigational capability

Although this EIS does not propose Alternatives to manage administrative flights or aircraft operating at or above 18,000 feet MSL, noise impacts generated by these aircraft are considered in Cumulative Effects analyses.

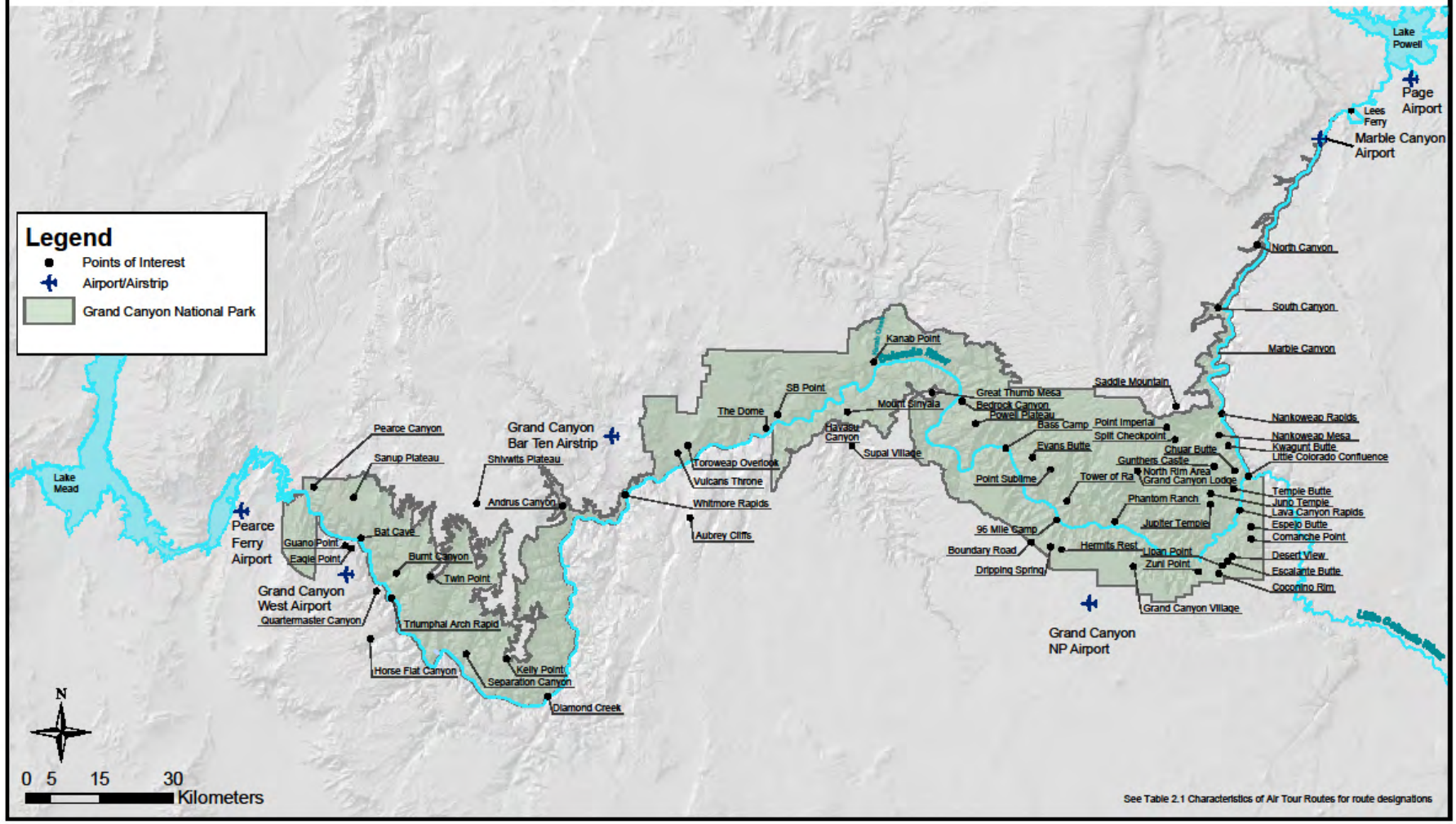
Unless otherwise noted in Alternatives, existing SFRA regulations, 14 Code of Federal Regulations (CFR) Part 93 Subpart U, would continue to apply and be enforced.

Weather and safety route segments may be created or modified by the FAA as needed to address prospective safety concerns of regular SFRA routes. Deviation Reports will be filed with the FAA Las Vegas Flight Standards District Office any time deviations from an existing SFRA route occur, as currently required.

Monitoring and noise modeling will be conducted as part of an Adaptive Management approach to ensure noise provisions of sections 804 of Public Law 106-181 would be met.

Grand Canyon place names commonly mentioned in Alternatives are shown in Map 2.1.

Map 2.1 Locations



ALTERNATIVE A NO ACTION, CURRENT CONDITION

Concept

Alternative A (Map 2.2), would continue current commercial air-tour management practices in the airspace above GCNP. It is included to provide an understanding of current practices and what would occur if no action is taken based on this EIS. In Chapter 4, Environmental Consequences, Alternative A provides a baseline against which other Alternatives are compared to determine impacts.

Special Flight Rules Area (SFRA)

Alternative A would maintain the existing Special Flight Rules Area shown in Map 2.2. The SFRA extends about 135 miles on an east-west axis and is generally about 30 miles north to south (about ten miles at the narrowest locations). It also includes a 45-mile-long and 6- to 10-mile-wide extension to the northeast over the Marble Canyon area.

The SFRA is an airspace established by the FAA to manage aircraft, including air tours, over and around GCNP. In some areas, the northern SFRA boundary corresponds with GCNP's northern boundary, but SFRA boundaries were generally drawn to be at least five miles outside the park boundary. Within its boundary, the SFRA extends up to 17,999 feet MSL.

Flight-free Zones

The four SFRA Flight-free Zones are shown in Map 2.2, from east to west they include

Desert View Flight-free Zone extends about six miles east-west, and seven miles north-south. Park features in this zone include Comanche Point, Desert View Watchtower, Escalante Butte, and Lipan Point, which is on the boundary of Zuni Point Corridor. No flights are allowed below 14,500 feet MSL in Desert View Flight-free Zone except administrative use under an appropriate written waiver approved by both the FAA and the manager(s) of the over-flown land(s).

Bright Angel Flight-free Zone is separated from Desert View Flight-free Zone by Zuni Point Corridor. Bright Angel Flight-free Zone extends about 17 miles on each side. Park features in this zone are the most heavily visited park areas and include Grand Canyon Village, North Rim developed area, and the Cross-Canyon Corridor trails and campgrounds. No flights are allowed below 14,500 feet MSL in Bright Angel Flight-free Zone except administrative use under an appropriate written waiver approved by both FAA and the manager(s) of over-flown land(s).

Toroweap/Shinumo Flight-free Zone is separated from the Bright Angel Flight-free Zone by Dragon Corridor. It also is crossed by Fossil Canyon and Tuckup General-Aviation Corridors. Toroweap/Shinumo Flight-free Zone is a long, crescent-shaped area, generally extending about 60 miles along the Colorado River. Park features in this zone east to west include Point Sublime, Bass Camp, Kanab Point, Mount Sinyala, the Dome, Toroweap Overlook, and Vulcans Throne. The Flight-free Zone's southern, west, and northwest boundaries generally correspond to the park boundary. Except in general-aviation corridors, flights are not allowed below 14,500 feet MSL in Toroweap/ Shinumo Flight-free Zone except administrative use under an appropriate written waiver approved by both FAA and the manager(s) of over-flown land(s).

Sanup Flight-free Zone is almost 20 miles southwest of Toroweap/Shinumo Flight-free Zone's western boundary. This wide gap between Flight-free Zones, in which general aviation is allowed, is not a formally designated flight corridor. The irregularly shaped Sanup Flight-free Zone, on the SFRA's west side, is about 22 miles east-west, and 17 miles north-south. Features in this zone include remote areas in western Grand Canyon National Park, and eastern Lake Mead National Recreation Area (also part of Grand Canyon-Parashant National Monument), including Separation Canyon, Sanup Plateau, and Kelly Point on the Shivwits Plateau. The Flight-free Zone's southern and eastern boundaries generally correspond to the park boundary. No flights are allowed below 8,000 feet MSL in Sanup Flight-free Zone (the same as the minimum sector altitude for general aviation in that area) except administrative use under an appropriate written waiver approved by both FAA and the manager(s) of over-flown land(s).

General Aviation Corridors

The four SFRA general-aviation corridors are shown in Map 2.2. In these corridors, northbound general-aviation aircraft fly at 11,500 feet MSL or 13,500 feet MSL, and southbound aircraft fly at 10,500 feet or 12,500 feet MSL.

From east to west, flight corridors are

Zuni Point Corridor provides general aviation opportunity to cross GCNP between Desert View and Bright Angel Flight-free Zones. The corridor is about 4.5-miles wide along its entire six-mile length. Aircraft using this corridor overfly South Rim's Zuni and Moran Points. Air-tour operations also occur in this flight corridor below altitudes available for general aviation.

Dragon Corridor, between Bright Angel and Toroweap/Shinumo Flight-free Zones, is about 15-miles long. It is about 4.5-miles wide along its northern half widening to about 9.5 miles at its southern end. Park features overflown by aircraft using this corridor include Hermits Rest, Hermit Trail, The Dragon, and Tower of Ra. Air-tour operations also occur in this flight corridor below altitudes available for general aviation.

Fossil Canyon Corridor crosses the park through Toroweap/Shinumo Flight-free Zone, and is about 4.5-miles wide along its entire 18-mile length. Park features overflown by aircraft using this corridor include Great Thumb Mesa, Bedrock Canyon, and Powell Plateau.

Tuckup Corridor crosses GCNP through Toroweap/Shinumo Flight-free Zone, and is about 4.5-miles wide, but due to the surrounding Flight-free Zone's irregular shape, the corridor is about ten-miles long on its east side and 15-miles long along its west site. Aircraft using this corridor overfly SB Point.

Air-tour Routes

Multiple SFRA air-tour routes are shown in Map 2.2. The following colors clarify pilot understanding about aircraft routes

- **Black**: fixed-wing aircraft
- **Green**: helicopters
- **Brown**: tribal support operations. The Supai Brown-6 route is primarily used by helicopters to ferry supplies and passengers to and from Supai Village in support of the Havasupai Tribe. Brown-1, -2, -4, and -5 routes are for fixed-wing aircraft to access Bar Ten Ranch airstrip, which in part, is in support of helicopter access to Hualapai tribal lands in the canyon for river passenger transport
- **Blue**: Direct fixed-wing routes between the Las Vegas area and Grand Canyon National Park Airport in Tusayan. Blue-2 route is between the Las Vegas area and Grand Canyon West Airport

Each includes a specified path and altitude. Pilots are not allowed to deviate from routes by more than 0.5 miles laterally and 300 feet vertically. Conformance is critical as multiple aircraft can use a route simultaneously.

Table 2.1 presents route characteristics. Route designation abbreviations in parenthesis correspond to route designations found on Alternative maps.

Map 2.2 Alternative A No Action/Current Condition

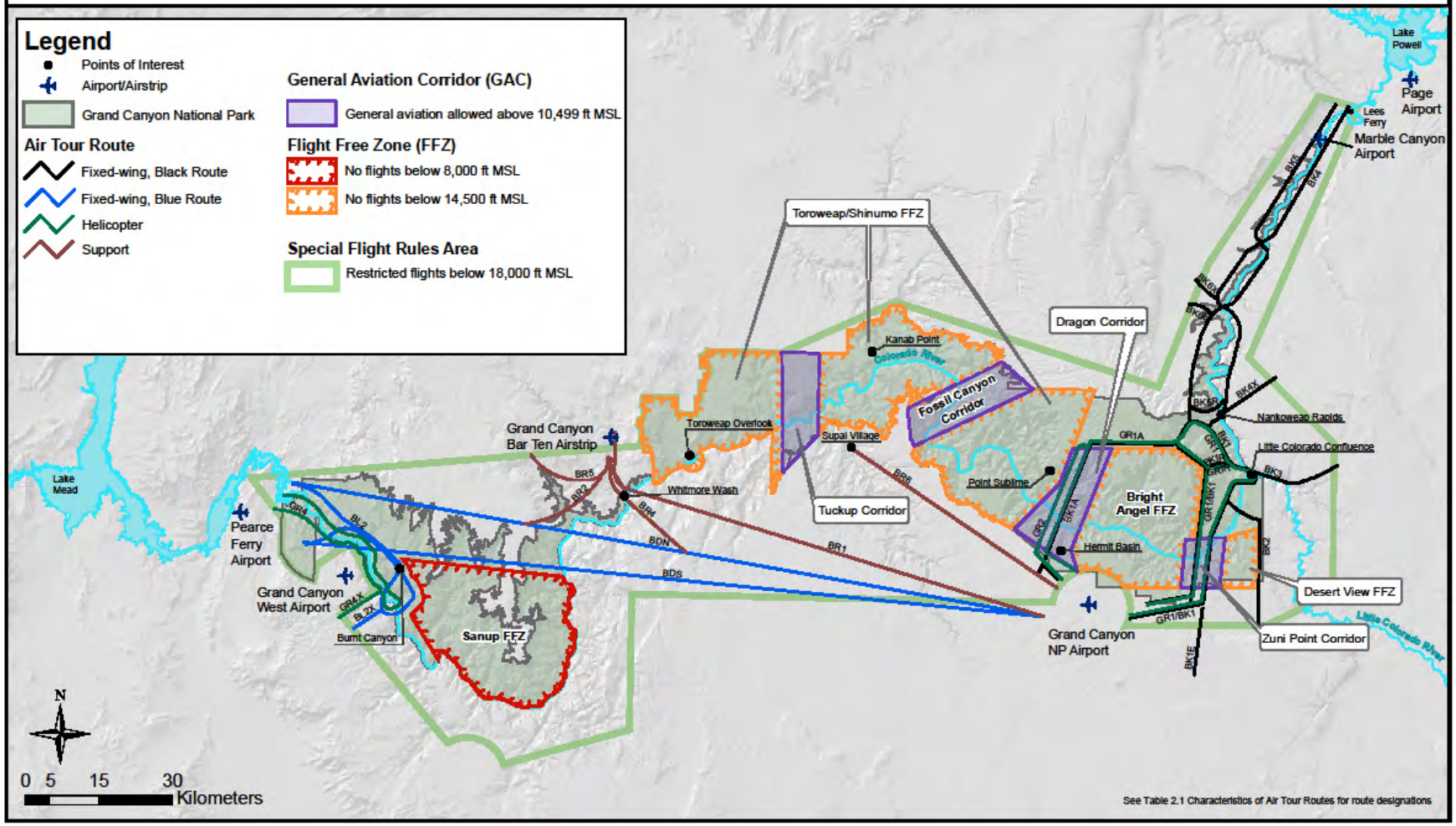


TABLE 2.1 ALTERNATIVE A CHARACTERISTICS OF AIR-TOUR ROUTES IN THE GCNP SFRA

Route Designation	Start and End Points	General Description	Altitude (feet MSL)
Black Routes Fixed-wing Only			
Black-1 (BK1)	Begins and ends at the SFRA south boundary Most flights originate at Grand Canyon National Park Airport	Loop route travels north along east side of Zuni Point Corridor, loops over Little Colorado/Colorado River confluence, loops north around Nankoweap area, turns south at Split checkpoint south of Point Imperial, returns toward SFRA southern boundary along west side of Zuni Point Corridor, then turns westbound to return to Grand Canyon Airport or exit SFRA. Bad weather option: return to south at Gunthers Castle via **Black-1R**	Northbound aircraft at 8,000 feet or 9,000 feet Southbound aircraft at 8,500 feet or 9,500 feet
Black-1A (BK1A)	Begins at Split checkpoint south of Point Imperial; ends at south end of SFRA	At Split checkpoint south of Point Imperial, flights from Zuni Point Corridor travel west across North Rim to Dragon Corridor, then south the length of Dragon Corridor, then turn east to Grand Canyon Airport or other destinations outside the SFRA	Aircraft at 9,500 feet westbound beginning at the Split checkpoint south of Point Imperial. Southbound leg through Dragon Corridor flown at 8,500 feet
Black-1E (BK1E)	Begins at south SFRA boundary to **enter Black-1**. Ends at **Black-1** where it turns north to enter Zuni Point Corridor	Route enters SFRA from south about ten miles east of Grand Canyon National Park Airport. Flight travels north to join **Black-1** northbound	9,000 feet northbound along entire length
Black-2 (BK2)	Begins at south SFRA boundary; ends at **Black-1**	Route enters SFRA from south about 20 miles east of Grand Canyon National Park Airport. Flight route is north along east side of Desert View Flight-free Zone, turns to northwest and proceeds toward Espejo Butte and Lava Canyon Rapids, and merges with **Black-1** southwest of Temple Butte	8,000 feet northbound along entire length
Black-3 (BK3)	Begins at east SFRA boundary; ends at **Black-1** near river confluence	Westbound route enables tour operators to enter SFRA from east along Little Colorado River merging with **Black-1** where it crosses Little Colorado River	8,500 feet along entire length
Black-4 (BK4)	Starts at **Black-1** north of Nankoweap Mesa; ends at SFRA north boundary near Lees Ferry	Northbound route along Marble Canyon. Departs from **Black-1** north of Nankoweap Mesa. Travel on east side of Marble Canyon until South Canyon, crosses to west side. At North Canyon, aircraft cross to east side of Marble Canyon and remain on east side until exiting SFRA north of Lees Ferry	7,500 feet or 9,000 feet from Nankoweap Mesa to North Canyon 7,500 feet or 5,500 feet from North Canyon to the SFRA north boundary
Black-4X (BK4X)	Starts at **Black-4** north of Nankoweap Mesa; ends at SFRA east boundary	Escape route if bad weather encountered on North Rim. Aircraft fly to northeast to exit SFRA and return to starting point (usually Grand Canyon National Park Airport) by route of their choosing outside SFRA	First three miles at 9,000 feet or 7,500 feet. No altitude specified for remainder of distance to SFRA boundary
Black-5 (BK5)	Starts at SFRA north boundary near Lees Ferry; ends at **Black-1** route south of Saddle Mountain	Southbound route along Marble Canyon. Enters SFRA north of Lees Ferry. Travel on west side of Marble Canyon until North Canyon, crosses to east side. At South Canyon, aircraft cross to west side of Marble Canyon and remain on west side until merging with **Black-1** or looping via **Black-5R** to **Black-4** to return northbound	5,000 feet or 6,500 feet from SFRA north boundary to North Canyon; 6,500 feet from North Canyon to South Canyon, climb to 8,500 feet from South Canyon to **Black-1**. Bad weather escape route (**Black-5R**) eastbound along Saddle Canyon to merge with **Black-4** at 7,500 feet or 9,000 feet
Black-6 (BK6)	Enters and exits SFRA at South Canyon confluence with Marble Canyon	Enables tour operators from airports to the west to enter SFRA and Marble Canyon routes, and provides exit route for all pilots flying Marble Canyon routes. Entry route on south rim of South Canyon; exit route along north rim of South Canyon	Eastbound (entry) at 8,500 feet. Westbound (exit) at 7,500 feet or 9,000 feet

TABLE 2.1 ALTERNATIVE A CHARACTERISTICS OF AIR-TOUR ROUTES IN THE GCNP SFRA

Route Designation	Start and End Points	General Description	Altitude (feet MSL)
Green Routes Helicopter Only			
Green-1 (GR1)	Same as **Black-1**	Same as **Black-1**	Altitude is 7,500 feet throughout route
Green-1A (GR1A)	Same at **Black-1A**, except ends at north end of Dragon Corridor	Same at **Black-1A**, except ends at north end of Dragon Corridor	9,000 feet westbound throughout route
Green-2 (GR2)	Begins and ends at SFRA south boundary. Most flights originate at Grand Canyon Airport	Loop route travels north along west side of Dragon Corridor, turns south just before North Rim, and returns to SFRA south boundary along east side of Dragon Corridor	7,500 feet throughout route, except short climb to clear terrain at north end of route
Green-4 (GR4)	Begins and ends at SFRA west boundary at Lake Mead's east end	Loop route travels eastbound along south side of Colorado River, turns west between Quartermaster and Horse Flat Canyons, and returns westbound to SFRA west boundary along north side of river	5,000 feet throughout route
Green-4X (GR4X)	Starts from **Green-4** at Quartermaster Canyon; ends at SFRA southwest boundary	Helicopters travel up Quartermaster Canyon (to the southwest) to exit the SFRA, then travel by a route of their choosing outside the SFRA	Flights exit SFRA on southwest bound route at 5,000 feet
Brown Routes Support Operations			
Brown-1 (BR1)	Begins at SFRA south boundary; ends near Bar Ten airstrip	Fixed-wing only westbound route between SFRA boundary near Grand Canyon Airport and Bar Ten airstrip	8,500 feet from SFRA south boundary to National Canyon, 8,000 feet or 7,000 feet National Canyon to Bar Ten airstrip
Brown-2 (BR2)	Begins at Blue Direct North Route; ends near Bar Ten airstrip	Fixed-wing northeast-bound route for aircraft that enter SFRA at west boundary to Bar Ten airstrip	6,500 feet descending to Bar Ten airstrip
Brown-4 (BR4)	Begins near Bar Ten airstrip; ends at Blue Direct North Route	Fixed-wing southeast-bound route for aircraft traveling from Bar Ten airstrip toward SFRA south boundary, including Grand Canyon Airport	7,500 feet climbing to merge with Blue Direct North
Brown-5 (BR5)	Begins near Bar Ten airstrip; ends at SFRA north boundary	Fixed-wing northbound route leaving Bar Ten airstrip first travels south then west before exiting SFRA to north at Andrus Canyon	8,500 feet throughout route
Brown-6 (BR6)	Begins at SFRA south boundary; ends near Supai Village	Helicopter-only west and eastbound route between Grand Canyon National Park Airport and Supai Village	Aircraft both directions travel at 300 feet above ground level (AGL)
Blue Routes Fixed-Wing Only			
Blue Direct North (BDN)	Las Vegas airports to/from Grand Canyon Airport	Fixed-wing only route between Las Vegas area and Grand Canyon Airport	Varies by segment, 8,500 feet or 10,500 feet westbound, 7,500 feet or 9,500 feet eastbound
Blue Direct South (BDS)	Las Vegas airports to/from Grand Canyon Airport	Fixed-wing only between Las Vegas area and Grand Canyon Airport	Varies by segment: 10,500 feet westbound, 9,500 feet eastbound from SFRA west boundary, descending to 7,500 feet on approach to Grand Canyon National Park Airport
Blue-2 (BL2)	Las Vegas airports to/from Grand Canyon West Airport	Enters SFRA eastbound at Pearce Canyon, travels eastbound north of river, turns south at Burnt Springs Canyon, crosses river east of Quartermaster Canyon. Turns and crosses back over river west of Horse Flat Canyon proceeds northwest on north side of river. Flights turn west after passing Bat Cave checkpoint to cross south of river and exit SFRA	5,500 feet or 7,500 eastbound, and 6,500 feet or 8,500 feet westbound
Blue-2X (BL2X)	Leaves **Blue-2** south of river east of Quartermaster Canyon to exit SFRA	Travels southwest between Quartermaster and Horse Flat Canyons to exit SFRA then travel by a route of their choosing outside the SFRA	Flights exit SFRA on southwest bound route at 5,500 feet or 7,500 feet

Allowable Times of Operation

Under Alternative A, flights would continue to be limited by season and time of day. Specifically, commercial flights through East End's Zuni Point and Dragon Corridors would continue 8 a.m. to 6 p.m., May through September, allowing ten hours flight time. October through April, flights would continue 9 a.m. to 5 p.m., allowing eight hours flight time.

There are no limitations on allowable times of daily or seasonal operation for Marble Canyon or West End air-tour routes.

Numbers of Flights Allowed

Under Alternative A, there would continue to be no maximum flight operations daily cap. Commercial air-tour operations annual allocation would continue at 93,971 flights. See Chapter 1, History Leading Up to This EIS, for how the annual allocation was established. Each air-tour operator has a specified number of annual allocations available for their use. Each commercial air tour requires use of an allocation; however, the annual allocation does not apply to transportation, repositioning, and other air-tour-related flights. Tour operators are responsible for reporting number of flights to the FAA quarterly. FAA generally provides this data to GCNP on a delayed-quarterly basis. GCNP uses this data for fee management and monitoring purposes. Air-tour operations on Brown routes and those in support of the Hualapai Tribe would continue exempt from daily caps and annual allocations.

Quiet-Technology Incentives and Conversion

Alternative A does not include quiet-technology incentives or conversion provisions. There are no additional mitigation provisions to manage aircraft noise under Alternative A.

ALTERNATIVE E ALTERNATING SEASONAL USE

Concept

Alternative E (Map 2.3) would alternate use of Zuni Point and Dragon Corridors seasonally, and eliminate a long-loop tour between Zuni Point and Dragon Corridors over North Rim, providing areas of GCNP with no air-tour noise during portions of the year. Dragon Corridor air-tour routes could be used September 16 through June 30. Zuni Point Corridor routes could be used July 1 through September 15. There would be an annual allocation of 93,971, and a daily cap of 364 for flights classified as air tours, transportation, repositioning, and other air-tour-related flights. Operations on Brown routes and those in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Other major features include eliminating one of the four general-aviation corridors (Fossil Canyon), expanding East End Flight-free Zones, changing direct-flight routes to/from Las Vegas to either avoid or fly over less of the park, raising Flight-free Zone upper boundaries, expanded curfews, and conversion to best available quiet technology over time.

Special Flight Rules Area

Alternative E would not include any changes to Special Flight Rules Area boundaries. Operations in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Flight-free Zones

The upper boundary of all Flight-free Zones would be increased to 17,999 feet MSL. No flights would be allowed below 18,000 feet MSL except administrative use under an appropriate written waiver approved by both the FAA and the manager(s) of the over-flown land(s).

Desert View Flight-free Zone would be enlarged by extending its boundary north to about twice its current length.

Bright Angel Flight-free Zone would be substantially enlarged by extending its boundary north to include all of the SFRA surrounding Marble Canyon. The Flight-free Zone's southwest corner would be expanded west to accommodate the Dragon Corridor dogleg to reduce aircraft noise at popular Hermits Rest and Hermit Trail visitor-use areas. The Flight-free Zone would be expanded east to include features such as Jupiter and Juno Temples and Gunthers Castle.

Toroweap/Shinumo Flight-free Zone would be increased in size by extending its northern boundary east of Tuckup Corridor from the GCNP boundary to the SFRA boundary and west of Tuckup Corridor by extending its southern boundary south of the park boundary to encompass some Hualapai tribal lands.

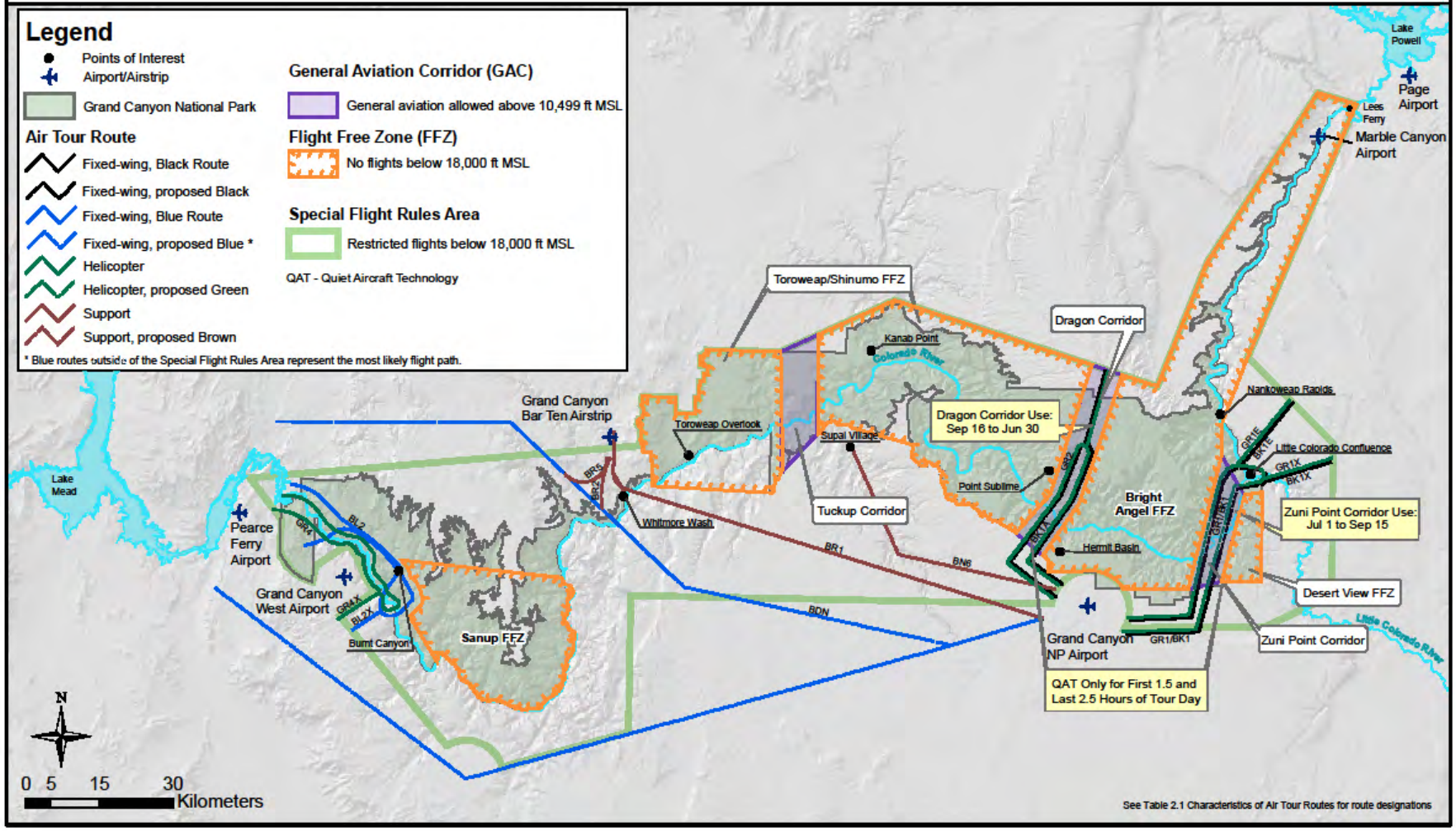
Except for the increase in its upper boundary, no changes would be made in **Sanup Flight-free Zone**.

General-Aviation Corridors

Three corridors would be open for year-round general-aviation use (Map 2.3). Corridor use would be the same as Alternative A (Current Condition); northbound aircraft would continue to fly at 11,500 feet or 13,500 feet MSL; southbound aircraft would fly at 10,500 feet or 12,500 feet MSL.

The **Zuni Point Corridor** would be extended northeast to about twice its current length, with the northernmost extent near Kwagunt Butte. Its alignment would be shifted east to accommodate eastern expansion of **Bright Angel Flight-free Zone.**

Map 2.3 Alternative E Alternating Seasonal Use



Dragon Corridor would be extended north to the SFRA boundary. The corridor's southwest corner would be narrowed to match the width of the rest of the corridor. Its southeastern boundary would be moved west to create a dogleg beginning north of the Tower of Ra on the east, and south of Point Sublime on the west. This action would reduce width of the southern part of this corridor to approximately 4.5 miles.

Tuckup Corridor width and southern boundary would remain unchanged. Its northern boundary would be extended to the SFRA boundary.

Fossil Canyon Corridor would be eliminated, and the area would become part of the Toroweap/Shinumo Flight-free Zone.

Air-tour Routes

Except as noted in Table 2.2, air-tour routes would be the same as described in Table 2.1 for Alternative A.

TABLE 2.2 ALTERNATIVE E CHANGES FROM CURRENT (ALTERNATIVE A) AIR-TOUR ROUTES

Route Designation	General Description
Black Routes Fixed-wing Aircraft Only	
Zuni Point Corridor Routes	Zuni Point Corridor routes would be used by air-tour aircraft only July 1 to September 15 (closed to air-tour aircraft remainder of year). Aircraft would travel at 8,000 or 8,500 feet MSL. **Black-1A** would only be used September 16 to June 30 (closed remainder of year). Fixed-wing aircraft required to travel above highest rim on route (8,000 or 9,000 feet MSL depending on route and terrain). Only fixed-wing aircraft considered best available quiet-technology aircraft allowed to use **Black-1** and **Black-1A** during first 90 minutes and last 150 minutes of the tour day. See Allowable Times of Operation below
Black-1 (BK1)	Moved east, shortened and narrowed slightly on north end. Flights on **Black-1** would travel eastbound from Grand Canyon Airport until south of Zuni Point where flights would turn northeast and travel at 8,000 or 9,000 feet MSL. After passing Temple Butte, flights would turn east to cross the Little Colorado River approximately two miles east of the confluence. Flights then turn west to cross the Colorado River and proceed past Gunthers Castle, then southbound along Zuni Point Corridor's west side to return to South Rim. An entrance and exit route would be provided at northeast corner of **Black-1** (**BK1E and BK1X**). Nankoweap loop, as described in Alternative A, would be eliminated. Route would continue to be flown counterclockwise, entering and exiting South Rim at the current location and altitudes along the SFRA boundary
Dragon Corridor Routes	Only fixed-wing aircraft considered best available quiet-technology aircraft allowed to use **Black-1** and **Black-1A** during first 90 minutes and last 150 minutes of the tour day. See Allowable Times of Operation below
Black-1A	Route across North Rim and down Dragon Corridor eliminated. However, **Black-1A** segment that follows Dragon Corridor would be converted to a loop route entering and exiting Dragon Corridor from the south and be flown clockwise. A dogleg in the route to the southwest would be created to reduce aircraft noise at Hermits Rest and Hermits Trail popular visitor use areas. Exit route provided at north end with aircraft climbing to 10,000 feet MSL to avoid terrain and helicopters below
Other East End Routes	
Black-2	Eliminated
Black-3	Eliminated
Black-4	Along Marble Canyon eliminated
Black-5	Along Marble Canyon eliminated
Black-6	Along Marble Canyon eliminated
Green Routes Helicopters	
Zuni Point Corridor Routes	Only helicopters considered best available quiet-technology aircraft would be allowed to use **Green-1** and **Green-2** routes during first 90 minutes and last 150 minutes of tour day. See Allowable Times of Operation below
Green-1	**Green-1** would be moved east and shortened on its north end to match the relocated **Black-1** and Zuni Point Corridor. Helicopters would travel in this corridor July 1 to September 15 (closed remainder of year) at a constant 7,500 feet MSL, same as Alternative A. Route alignment would provide a flyover of the confluence. Nankoweap loop eliminated. Entrance/exit route provided in the northeast corner of **Green-1 (GR1E** and **GR1X**)

TABLE 2.2 ALTERNATIVE E CHANGES FROM CURRENT (ALTERNATIVE A) AIR-TOUR ROUTES

Route Designation	General Description
Dragon Corridor Routes	
Green-1A	Across North Rim eliminated
Green-2	Would continue as a loop route entering and exiting Dragon Corridor from south. **Green-2** open September 16 to June 30 (closed remainder of year). Exit route provided at north end. Altitude throughout **Green-2** would be 7,500 feet MSL, but exit route would be 300 feet above ground level (AGL)
Brown Routes Support Operations	
Brown-1	Configuration and altitude same as Alternative A
Brown-2	Follow existing route south to intersect realigned **Blue Direct North** that would cross Grand Canyon near Twin Peaks and Andrus Canyon. Route altitudes same as Alternative A
Brown-4	Eliminated
Brown-5	Follow existing route south to intersect realigned **Blue Direct North** that would cross Grand Canyon near Twin Peaks and Andrus Canyon. Route altitudes same as Alternative A
Brown-6	Realigned so aircraft from Grand Canyon Airport would travel predominantly west to Havasu Canyon then northwest directly over this canyon. Limited to operations in support of the Havasupai Tribe at Supai Village. Flights continue at 300 feet AGL
Blue Routes Fixed-Wing Only	
Blue Direct North	Alignment changed to reduce length in SFRA and shorten length of Grand Canyon overflown. Route would cross Grand Canyon near Twin Peaks, where it would proceed northwest out of SFRA then due west. Anticipated route outside SFRA is depicted in Map 2.3. Northwest segment flown at 9,500 feet MSL eastbound, and 10,500 feet MSL westbound; segment through park and southeast segment flown eastbound at either 9,500 feet or 7,500 feet MSL, and westbound at either 8,500 feet or 10,500 feet MSL
Blue Direct South	Eliminated. Anticipated travel to/from Las Vegas on existing Victor airways depicted in Map 2.3. For this analysis, it was estimated aircraft would fly at 9,500 feet MSL eastbound, and 10,500 feet MSL westbound

Allowable Times of Operation

Alternative E would place curfews on commercial operations in Zuni Point and Dragon Corridors that change daily relative to sunrise and sunset to ensure at least 150 minutes of quiet time after sunrise and 100 minutes of quiet time before sunset. The following examples illustrate length of tour day for air-tour aircraft using Zuni Point Corridor July 1 to September 15, and Dragon Corridor September 16 to June 30. Mid-point in the corridor use period was used for the examples.

Example 1: Mid-August, sunrise is approximately 6 a.m., and sunset 7 p.m. Aircraft could be present on Zuni Point Corridor air-tour routes 8:30 a.m. to 5:20 p.m. Only best available quiet-technology aircraft would be permitted to fly routes in the corridor during the first 90 minutes and last 150 minutes of the tour day (i.e., 8:30 to 10:00 a.m., and 2:50 to 5:20 p.m. in this example). In addition, there would be a 60-minute mid-day curfew to create a noise-free interval. Length of the tour day for best available quiet-technology aircraft would be nearly seven hours, 8:30 a.m. to 5:20 p.m. Time allowed for non-quiet-technology aircraft would be nearly four hours, 10:00 a.m. to about 2:50 p.m.

Example 2: Mid-February, sunrise is approximately 7:30 a.m., and sunset 6 p.m. Aircraft could be on air-tour routes in Dragon Corridor 10:00 a.m. to approximately 4:20 p.m. Only best available quiet-technology aircraft would be permitted to fly routes during the first 90 minutes and the last 150 minutes of the tour day, and there would be a 60-minute mid-day curfew. Length of the tour day for best available quiet-technology aircraft would be approximately 5.5 hours, 10:00 a.m. to 4:20 p.m. Time allowed for non-quiet-technology aircraft would be nearly 1.5 hours, 11:30 a.m. to approximately 1:50 p.m.

West End routes would continue without daily or seasonal flight times and curfews.

Numbers of Flights Allowed

Alternative E would allow a daily cap 364 total operations by air-tour and air-tour-related flights in the SFRA, based on peak-day use data for commercial operations from 2004 to 2006.

Alternative E would allow an annual allocation 93,971 operations by air-tour and air-tour-related flights.

Commercial operations on Brown routes and those in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Quiet-Technology Incentives and Conversion

Alternative E quiet-technology incentives would include allowing only air-tour aircraft using best available quiet technology to fly in designated corridors during the designated season. This incentive would be implemented after an agreed date for full conversion to aircraft using best available quiet technology. Until the full-conversion date, only best available quiet-technology aircraft would be allowed to fly in Zuni Point or Dragon Corridors (whichever is open) during the first 90 minutes and the last 150 minutes of the tour day. Also, all new or replacement aircraft must use best available quiet technology.

ALTERNATIVE F MODIFIED CURRENT CONDITION

Concept

Alternative F (Map 2.4) meets Chapter 1 objectives by minimizing changes from current practices. Changes include modification of West End air-tour routes at the request of the Hualapai Tribe, as well as a seasonal shift to Dragon Corridor routes. February 1 through November 30, Dragon Corridor would be open as currently configured. December 1 through January 31, Dragon Corridor air-tour routes would be relocated seven miles west to reduce air-tour noise during part of the year near the current Dragon Corridor. Operations in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Special Flight Rules Area

The notch[19] in the SFRA boundary near Grand Canyon West Airport would be modified to reduce aircraft noise at Eagle and Guano Points. This boundary change would include Hualapai Over the Edge flights in the SFRA; such flights are currently outside the SFRA. These flights in support of the Hualapai Tribe would continue exempt from annual allocation and daily cap requirements.

Flight-free Zones

Alternative F would not result in any changes to **Desert View or Bright Angel Flight-free Zones**.

Toroweap/Shinumo Flight-free Zone's eastern boundary would be moved west to accommodate Dragon Corridor modifications, as described below.

Sanup Flight-free Zone's northern boundary would be moved south to accommodate modifications of Blue Direct routes, as described below.

Flight-free zone ceilings would be the same as Alternative A. No flights would be allowed below Flight-free Zone ceilings except administrative use under an appropriate written waiver approved by both the FAA and the manager(s) of the over-flown land(s).

General Aviation Corridors

Three corridors would be open for year-round general-aviation use, as shown on Map 2.4, and one would be eliminated.

Zuni Point Corridor would remain the same as Alternative A.

Dragon Corridor size and boundary would change. The corridor's west side would be narrowed to the east, the north boundary would be extended slightly, and the southeast corner would be eliminated. This configuration would be in use year-round for general aviation.

Fossil Canyon Corridor would be eliminated.

Tuckup Corridor would remain the same as Alternative A.

[19] The SFRA boundary forms a notch around Grand Canyon West Airport so that the airport area is outside the SFRA to facilitate traffic to and from the airport. The notch is entirely over Hualapai tribal lands south of the Colorado River. In Alternatives A and E, it is approximately 6-statute-miles long and 6.5-miles wide at its northeastern end narrowing to approximately 5-miles wide at its southwestern end. In Alternative F and the NPS Preferred Alternative, the notch is narrowed to approximately 5-miles wide throughout to include visitor areas at Eagle and Guano Points inside the SFRA

Air-tour Routes

Except as noted in Table 2.3, air-tour routes would be the same as described in Table 2.1 for Alternative A.

TABLE 2.3 ALTERNATIVE F CHANGES TO CURRENT (ALTERNATIVE A) AIR-TOUR ROUTES

Route Designation	General Description
Black Routes Fixed-wing Aircraft Only	
Zuni Point Corridor Routes	
Black-1 (BK1)	Same as Alternative A. Route flown at 8,000 feet MSL for quiet-technology aircraft; 9,000 feet MSL for non-quiet-technology aircraft
Dragon Corridor Routes	December 1 through January 31, Dragon Corridor's north end would shift seven-miles west of current location. Aircraft would travel west at 9,500 feet MSL beginning south of Point Imperial across North Rim until approximately Evans Butte, then turn south at 8,500 feet MSL. During this period, present Dragon Corridor would become flight-free for all commercial operations
Black-1A	Seasonal shift of **Black-1A**. February 1 through November 30, **Black-1A** same as Alternative A. Route across North Rim flown at 9,500 feet MSL; southbound portion at 8,500 feet MSL, same as Alternative A
Green Routes Helicopter	
Dragon Corridor Routes	December 1 through January 31, Dragon Corridor's north end would shift seven-miles west of current location. Helicopters would travel west at 9,000 feet MSL beginning south of Point Imperial across North Rim until approximately Evans Butte, then turn south at 7,500 feet MSL. During this period, present Dragon Corridor would become flight-free for all commercial operations
Green-1A	December 1 through January 31, route extended west across North Rim to Evans Butte, where helicopters would turn southwest to merge with **Green-2**. Flights on **Green-1A** would be at 9,000 feet MSL, as in Alternative A, merging with **Green-2** heading southbound at 7,500 feet MSL
Green-2	Seasonal shift in helicopter use would occur on **Green-2**. February 1 to November 30, route would be same as Alternative A. December 1 through January 31, Dragon Corridor's north end would shift seven-miles west of its current location. Helicopters would start the clockwise loop at 7,000 feet MSL near Grand Canyon Airport, climbing to 7,500 feet MSL before crossing South Rim to travel the loop, and descend to 7,000 feet MSL when returning to the airport. During this period, the present Dragon Corridor would be flight-free
West End Routes	
Green-4	Southern portion eliminated. Northern portion would allow two-way traffic, but westbound route component would be used by quiet-technology aircraft only. Helicopters would travel at 4,000 feet MSL eastbound, and westbound quiet-technology aircraft could loop north at 5,000 feet MSL. Quiet-technology aircraft would thus offer a longer route over the canyon entirely in the park. Non-quiet-technology aircraft would exit route using **Green-4X** at Horse Flat Canyon at 5,000 feet MSL
Brown Routes Support Operations	
Brown-2	Eliminated
Blue Routes Fixed-Wing Only	
Blue Direct North	Becomes a one-way, eastbound, quiet-technology route allowing an improved river tour. From a junction at Burnt Springs Canyon to allow two entry/exit access points from Las Vegas area, route would cross Shivwits Plateau at 7,500 feet MSL, turn northeast along the river at 6,500 feet MSL toward Twin Peaks, then resume current route at Aubrey Cliffs at 7,500 feet MSL until reaching Grand Canyon Airport
Blue Direct South	Serves as a more direct, two-way, non-quiet-technology route. Moves south of Grand Canyon West Airport to avoid Eagle and Guano Points; split at Burnt Springs Canyon to allow access to/from Las Vegas area. Eastbound aircraft 9,500 feet MSL across Shivwits Plateau, descending to 7,500 feet toward Grand Canyon Airport. Westbound aircraft at 10,500 feet MSL after climbing out of Grand Canyon Airport

Allowable Times of Operation

Alternative F would have the same curfew times as Alternative A. There would continue to be no daily or seasonal flight times or curfews for West End routes. East End flights May through September would continue 8 a.m. to 6 p.m., allowing ten hours flight time. Flights October through April would continue 9 a.m. to 5 p.m., allowing eight hours flight time.

Dragon Corridor routes and alignment would be used February 1 to November 30. December 1 to January 31, air-tour flights would be routed as in Table 2.3, with the northern end seven-miles west of current Dragon Corridor.

Numbers of Flights Allowed

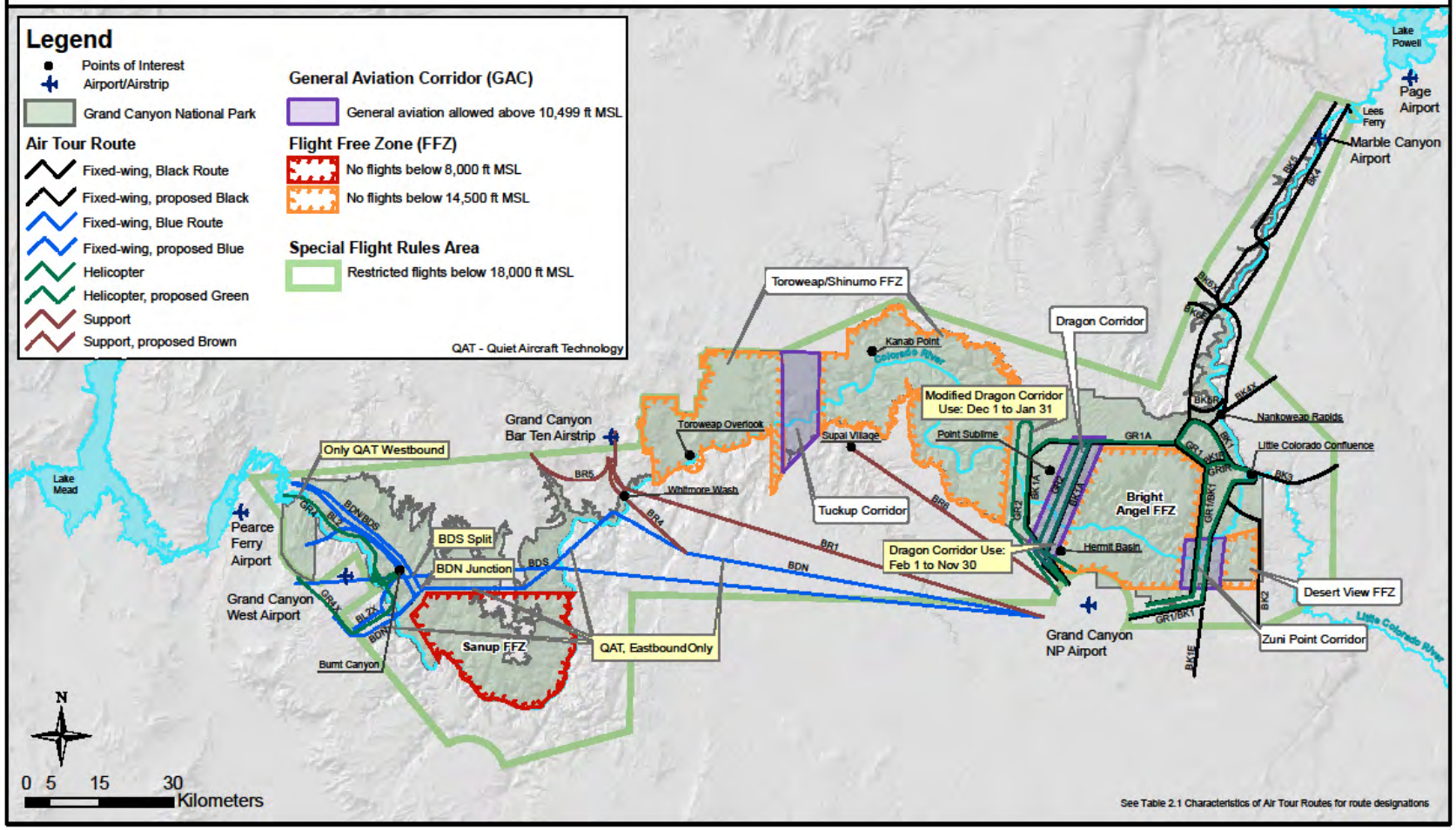
Alternative F would have the same annual allocation provision (93,971 commercial air-tour operations) as Alternative A. There would be no daily cap under this Alternative.

Quiet-Technology Incentives and Conversion

A variety of incentives would be offered to air-tour operators who convert to quiet technology, including

- Forgiveness of fees charged for SFRA flights
- Additional flights, as long as the cumulative impact of such flights does not increase noise in the park, and does not adversely impact substantial restoration of natural quiet
- Provision of a West End quiet-technology helicopter route on westbound portion of Green-4. Blue Direct North eastbound route would be used by quiet-technology aircraft only
- On Black-1, quiet-technology aircraft would be allowed to fly at 8,000 feet MSL while non-quiet-technology aircraft would be required to fly at 9,000 feet MSL
- Over a 10- to 12-year period, flight operations would convert to quiet-technology aircraft

Map 2.4 Alternative F Modified Current Condition



NPS PREFERRED ALTERNATIVE

Concept

The NPS Preferred Alternative (Map 2.5) would seasonally alternate use of Zuni Point and Dragon Corridors for short-loop air tours, while long-loop tour routes over North Rim beginning in Zuni Point Corridor and ending in Dragon Corridor would be open year-round, but only to quiet-technology aircraft after a four-year phase in. Short-loop tour routes in Dragon Corridor would be open May 1 through October 31. Short-loop tour routes in Zuni Point Corridor would be open November 1 through April 30. There would be an annual allocation of 65,000 commercial air-tour and air-tour-related operations, and a daily cap of 364 flights classified as commercial air tours. All flights on SFRA routes would be classified as commercial air tours with limited exceptions for maintenance and training flights. Operations in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.

Other major features of this Alternative include raising Flight-free Zone upper boundaries, curfew changes, and, after ten years, all SFRA routes would be open only to quiet-technology aircraft.

Special Flight Rules Area

The notch in the SFRA boundary near Grand Canyon West Airport would be modified to reduce aircraft noise at Eagle and Guano Points, the same as Alternative F. This boundary change would include Hualapai Over the Edge flights in the SFRA; such flights are currently outside the SFRA. These flights in support of the Hualapai Tribe would continue exempt from annual allocation and daily cap requirements.

Flight-free Zones

The upper boundary of all Flight-free Zones would be increased to 17,999 feet MSL. No flights would be allowed below 18,000 feet MSL except for 1) aircraft in transition on Victor airways V210, V257, and V293 at or above 14,500 feet, 2) aircraft under the positive control of an air-traffic control center or tower when necessary for safety, 3) administrative use under an appropriate written waiver approved by both the FAA and the manager(s) of the over-flown land(s).

Except for the upper boundary increase, there would be no changes in **Desert View Flight-free Zone**.

Bright Angel Flight-free Zone would be modified by expanding the southwest corner west to the park boundary. This action would accommodate creation of a dogleg in Dragon Corridor that would reduce aircraft noise at the popular visitor-use areas Hermits Rest and Hermit Trail.

Toroweap/Shinumo Flight-free Zone would be decreased in size by moving the southeast corner slightly west to accommodate the Dragon Corridor dogleg.

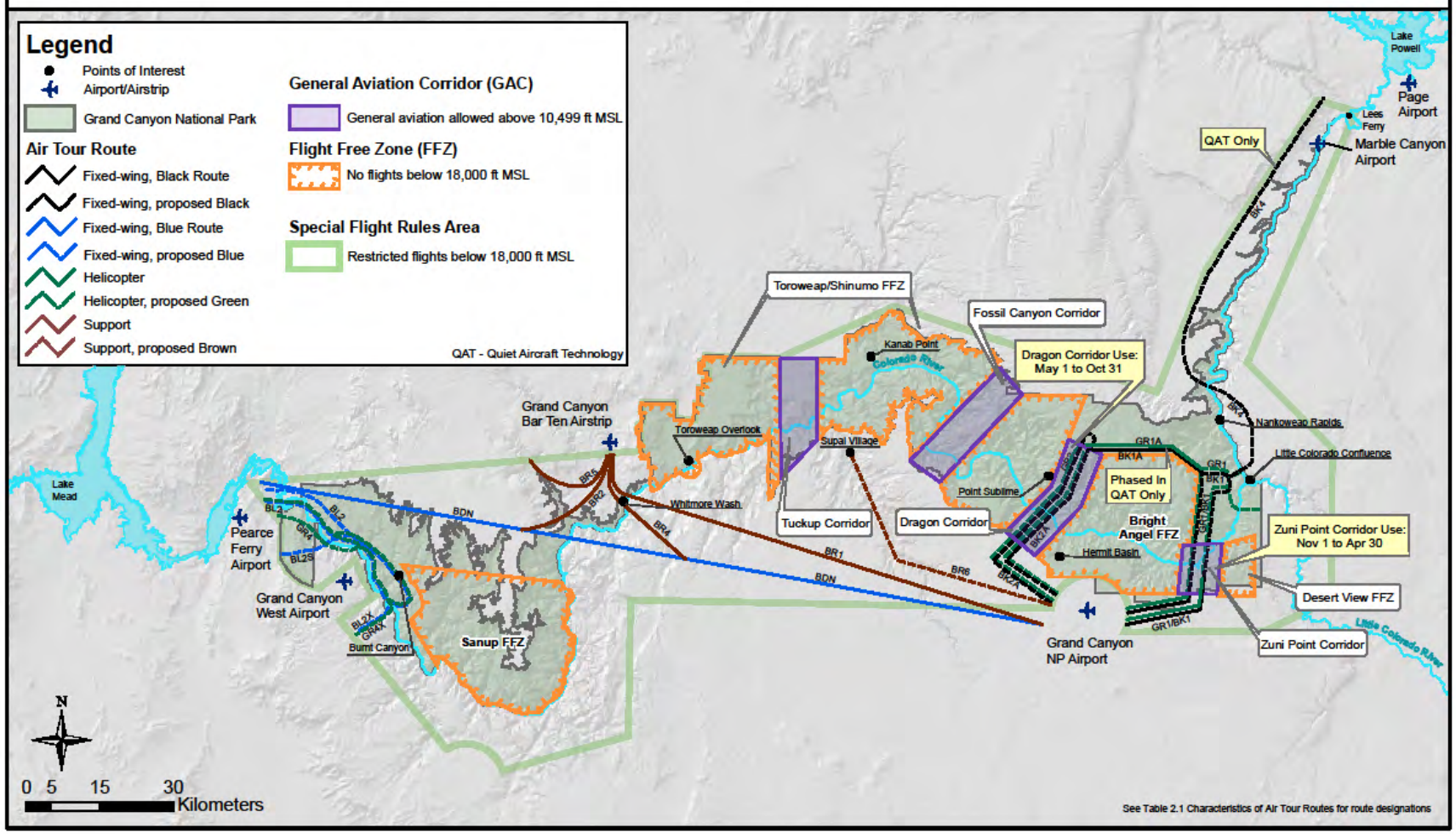
Except for the upper boundary increase, no changes would be made to **Sanup Flight-free Zone**.

General Aviation Corridors

There would continue to be four corridors for year-round general-aviation use, as shown in Map 2.5. Corridor use by general-aviation aircraft would be the same as described for Alternative A; northbound aircraft would continue to fly at 11,500 feet or 13,500 feet MSL and southbound aircraft would fly at 10,500 feet or 12,500 feet MSL.

Zuni Point Corridor would remain the same as Alternative A.

Map 2.5 NPS Preferred Alternative



The southwest corner of **Dragon Corridor** would be reduced in width to match the width of the rest of the corridor. The southeastern boundary would be moved west to create a dogleg that would begin north of the Tower of Ra on the east and south of Point Sublime on the west. This action would reduce the width of the southern part of this corridor to approximately 4.5 miles.

Fossil Canyon Corridor would be rotated 28 degrees to the southeast to move the corridor away from Great Thumb Mesa and Supai Village.

Tuckup Corridor would remain the same as Alternative A.

Air-tour Routes

Except as noted in Table 2.4, air-tour routes would be the same as described in Table 2.1 for Alternative A.

TABLE 2.4 NPS PREFERRED ALTERNATIVE CHANGES TO CURRENT (ALTERNATIVE A) AIR-TOUR ROUTES

Route Designation	General Description
Black Routes Fixed-wing Aircraft Only	
Zuni Point Corridor Routes	A short-loop East End route would be available in Zuni Point Corridor November 1 to April 30 (closed remainder of year except for long-loop tours between Zuni Point and Dragon Corridors)
Black-1/ Black-1A	**Black-1** would be moved east, shortened, and narrowed slightly on its north end. Aircraft traveling northbound along Zuni Point Corridor's east side would ascend from 8,000 feet MSL crossing South Rim to 9,000 feet MSL after passing Temple Butte, then remain at 9,000 feet MSL for turns to view the confluence. Aircraft would turn west at the north end of Chuar Butte (approximately one-mile west of the confluence), and climb to 9,500 feet MSL. At the intersection of **Black-1** and **Black-1A**, which would move south to near Gunthers Castle, aircraft would either cross North Rim on **Black-1A** at the current location and altitude (9,500 feet MSL), or proceed southbound along Zuni Point Corridor's west side on **Black-1** at 9,500 feet MSL, descending to cross South Rim at 8,500 feet MSL. Nankoweap loop described in Alternative A would be eliminated, and the loop confluence flyover moved west of the confluence. Route would continue to be flown counterclockwise, entering and exiting near Grand Canyon Airport
Dragon Corridor Routes	A new short-loop route (**Black-2A**) would be available for air-tour fixed-wing aircraft May 1 to October 31 (closed remainder of year except for long-loop tours between Zuni Point and Dragon Corridors)
Black-2A	**Black-2A** would follow Dragon Corridor in a clockwise direction entering and exiting the Corridor from the south. Aircraft would enter route at 8,500 feet MSL crossing South Rim and traveling north along Dragon Corridor's west side climbing to 9,500 feet MSL at the dogleg north of Tower of Ra. Aircraft would loop over North Rim to safely merge with aircraft westbound on **Black-1A** from Zuni Point Corridor. Aircraft would travel southbound along Dragon Corridor's east side, descending after the turn in the dogleg from 9,500 feet to 8,500 feet MSL as the route crosses South Rim. Dragon Corridor entry and exit points would move west creating dogleg to reduce aircraft noise at Hermits Rest and Hermit Trail visitor use areas
Other East End Routes	As incentive for quiet-technology conversion, use of year-round long-loop tour route over North Rim between Zuni Point and Dragon Corridors by non-quiet-technology aircraft would be phased out over a four-year period; after the four-year period only quiet-technology aircraft could travel long-loop tour routes
Black-1E	Eliminated
Black-2	Eliminated
Black-3	Eliminated
Black-4	**Black-4** would provide northbound travel by quiet-technology fixed-wing aircraft in Marble Canyon. Route would begin by exiting **Black-1** at the north end of Chuar Butte at 9,000 feet MSL, exit the park east over Navajo Nation lands, and descend to 7,500 feet MSL before crossing to west of Colorado River away from Marble Canyon rim toward SFRA's western boundary, then continue northbound at 7,500 feet MSL to exit SFRA near Lees Ferry
Black-4X	Eliminated
Black-5	Eliminated
Black-6	Eliminated
Green Routes Helicopter Routes	
Zuni Point Corridor Routes	A short-loop East End route would be available in Zuni Point Corridor November 1 to April 30 (closed remainder of year except for long-loop tours between Zuni Point and Dragon Corridors)

TABLE 2.4 NPS PREFERRED ALTERNATIVE CHANGES TO CURRENT (ALTERNATIVE A) AIR-TOUR ROUTES

Route Designation	General Description
Green-1/ Green-1A	Modified similar to **Black-1** and **Black-1A**. **Green-1** altitude would continue at 7,500 feet MSL northbound when crossing South Rim, climbing to 8,500 feet MSL by Temple Butte, then remaining at 8,500 feet MSL for turns to view the confluence. Aircraft would turn west at north end of Chuar Butte and climb to 9,000 feet MSL. At intersection of **Green-1** and **Green-1A**, which would move south to near Gunthers Castle, aircraft could turn right to cross North Rim on **Green-1A** at 9,000 feet MSL, or turn left to continue south on **Green-1** at 9,000 feet MSL along Zuni Point Corridor's west side, descending to cross South Rim at 7,500 feet MSL. Nankoweap loop described in Alternative A eliminated, and loop confluence flyover moved west of the confluence as for fixed-wing aircraft
Dragon Corridor Routes	A short-loop route (**Green-2**) would be available for helicopter use May 1 to October 31 (closed remainder of year except for long-loop tours between Zuni Point and Dragon Corridors)
Green-2	Aircraft would enter **Green-2** at 7,500 feet MSL crossing South Rim and travel north along Dragon Corridor's west side climbing to 8,500 feet MSL at the dogleg north of Tower of Ra. At Dragon Corridor's north end, helicopters would remain at 8,500 feet MSL and merge with helicopter traffic on **Green-1A** from Zuni Point Corridor as route turns south along Dragon Corridor's east side, then descend from 8,500 feet MSL at the dogleg south of Tower of Ra to 7,500 feet MSL crossing South Rim. **Green-2** entry and exit points would move west to create a dogleg to reduce aircraft noise at Hermits Rest and Hermit Trail visitor use areas
Other East End Routes	As incentive for quiet-technology conversion, use of year-round long-loop tour route over North Rim between Zuni Point and Dragon Corridors by non-quiet-technology aircraft would be phased out over a four-year period; after the four-year period only quiet-technology helicopters would be allowed to travel long-loop tour routes. A new entry route from the Navajo Nation would be created south of the Little Colorado River entering the SFRA at 7,500 feet MSL climbing to 8,500 feet MSL to merge with **Green-1** south of Chuar Butte. A new exit route would also be created to exit **Green-1** at Chuar Butte's north end at 8,500 feet MSL in the same footprint as northbound **Black-4**
West End Routes	
Green-4	**Green-4** would enter the park at 5,000 feet MSL eastbound on its current route location south of the river. Route would cross north of the river just east of current Bat Cave checkpoint, staying north of the river at 5,000 feet MSL past Grand Canyon West Airport until the current turning point for West End routes between Quartermaster and Horse Flat Canyons. Route would then turn left and climb to 5,500 feet MSL until joining current **Blue-2** route footprint westbound and staying north of and parallel to eastbound **Green-4** until just west of Bat Cave checkpoint. At that point, it would descend to 5,000 feet MSL and join current **Green-4** route footprint westbound to exit the SFRA. At the **Green-4** eastbound left turn between Quartermaster and Horse Flat Canyons, pilots would have option to turn right instead and stay at 5,000 feet MSL to exit the SFRA south on **Green-4X** at the current location of **Blue-2X**. Also, while eastbound on **Green-4** crossing north of the river east of Bat Cave checkpoint, pilots would have option to turn back west on **Green-4R** (reverse) and continue westbound at 5,000 feet MSL north of the river on current **Green-4** route footprint to exit the SFRA to the west
Brown Routes Support Operations	
Brown-6	Realigned so aircraft from Grand Canyon Airport would travel predominantly west to Havasu Canyon then northwest directly over this canyon, same as Alternative E. Route would continue to allow two-way traffic at 300 feet AGL. **Brown-6** would be limited to operations in support of the Havasupai Tribe at Supai Village
Blue Routes Fixed-Wing Only	
Blue-2	**Blue-2** would enter the park at 6,000 feet MSL eastbound on the current **Green-4** westbound route footprint, staying north of the river past the current Bat Cave checkpoint and Grand Canyon West Airport. At the current turning point for West End routes between Quartermaster and Horse Flat Canyons, **Blue-2** would turn left and climb to 7,000 feet MSL until joining the current **Blue-2** westbound route footprint. Just west of Bat Cave checkpoint, route would turn southwest to exit the SFRA south of the river in the current **Blue-2** location. At **Blue-2** eastbound left turn between Quartermaster and Horse Flat Canyons, pilots would have option to turn right and stay at 6,000 feet MSL to exit the SFRA south on **Blue-2X** in its current location. Also, while westbound on **Blue-2** just west of Bat Cave checkpoint, pilots would have option to continue straight on **Blue-2's** northern portion at 7,000 feet MSL, staying north of the river to exit the SFRA west
Blue Direct South	Eliminated

Allowable Times of Operation

For all East End routes, including Marble Canyon, May 1 through September 30 allowed air-tour flight times would be nine hours (8 a.m. to 5 p.m.); October 1 through April 30, flight time would be seven hours (9:00 a.m. to 4:00 p.m.). This modification would ensure at least one hour of flight-free time after sunrise and before sunset.

West End routes would continue free from daily or seasonal flight times and curfews.

Numbers of Flights Allowed

The NPS Preferred Alternative would implement a daily cap of 364 commercial air-tour operations in the SFRA, based on Peak Day use data for commercial air-tour operations 2004 to 2006. A new annual allocation of 65,000 air-tour and air-tour-related operations in the SFRA would be implemented, based on the maximum annual number of operations reported for each operator 2004 to 2008.

The daily cap would apply to total commercial air-tour operations, not to individual air-tour operators and not to non-air-tour operations. It is intended that air-tour operators would cooperate with each other to avoid exceeding the daily cap. Each non-exempt operation in the SFRA would require use of an annual allocation. Current exemptions would remain in place for operations solely over tribal lands, operations in support of the Hualapai Tribe on SFRA routes, limited training and maintenance flights, and other operations specifically exempted by law (Whitmore and Bar Ten). Quiet-technology aircraft operations would not be required to annual allocations three months each year (January 1 to March 31).

Adaptive Management

A key to successful NPS Preferred Alternative implementation would be appropriate and effective monitoring and reporting. The NPS Preferred Alternative would require reporting of daily operations by air-tour operators on as close to a daily basis as is reasonable. This reporting would be enforceable by the FAA as part of revised SFRA regulations. Reported and validated data are essential for verifying compliance with both the daily cap and annual allocation, and to provide data for ongoing GCNP noise modeling and monitoring.

The NPS Preferred Alternative would also involve a communication-based adaptive management process involving the NPS, FAA, commercial air-tour operators, and other stakeholders to achieve the NPS Preferred Alternative's goals and intents. This process would address any problems encountered in implementing the NPS Preferred Alternative such as exceeding the daily cap, and route deviations that become more than a rare occurrence. Using proactive communication among stakeholders and agencies, the intent of the process would be to search for solutions within the approved plan or with only minor changes. However, if the nature and severity of a problem requires changing the plan or regulations to solve the problem, a new NEPA process may be necessary. The adaptive management process would also identify and address potential opportunities if monitoring indicates the plan's objectives can be met in a less restrictive way (for example, increasing the daily cap for quiet-technology operations).

Quiet-Technology Incentives and Conversion

The NPS Preferred Alternative would require all commercial aircraft flying on SFRA routes to be quiet-technology aircraft within ten years of implementation. Commercial operations in support of the Hualapai Tribe would continue exempt from this requirement.

Quiet-technology incentives would include allowing only quiet-technology aircraft (fixed-wing and helicopters) to fly a long-loop route year-round between Zuni Point Corridor and Dragon Corridor via North Rim. Use of this long-loop route by non-quiet-technology aircraft would be phased out within four years of plan implementation. Also, the Marble Canyon fixed-wing route (Black-4) would be available for use only by quiet-technology aircraft as soon as the plan is implemented.

MITIGATION PROVISIONS TO MANAGE AIRCRAFT NOISE AND REDUCE IMPACT TO RESOURCES UNDER ACTION ALTERNATIVES

Under any selected Action Alternative, the following measures would be taken to help avoid or minimize aircraft impacts

- Park staff would continue to work with applicable Military Airspace/Range Councils to minimize GCNP overflights
- Pilot education would be conducted to help prevent collisions with California condors and other birds. Incident reporting procedures are presently in place and would be refined as needed
- Compliance with terms and conditions of applicable Biological Opinions for protection of threatened, endangered, or sensitive listed species would be required for all commercial operations, and would include procedures for reporting any aircraft-animal collisions or near-collisions as well as airport safety incidents
- NPS would educate park visitors on Soundscape conditions to help them find the type of recreational opportunity and visitor experience they seek. Brochures, maps, and educational literature could show where aircraft noise is expected, areas and times of day expected to be dominated by natural sounds, and areas and times of day expected to experience the greatest amount of non-natural noise

ALTERNATIVES AND ACTIONS CONSIDERED AND DISMISSED FROM FURTHER CONSIDERATION

Several Alternatives and Alternative elements were considered during the planning process but not included in this EIS for detailed study. These are described here, along with dismissal justification.

Lower Ceiling Elevation on All East End Green Routes to 6,500 Feet MSL

Eliminated from further consideration because PL 100-91 does not allow flights below the canyon rim.

Reduce Overflight Numbers to Pre-1987 Levels

Eliminated because NPS and FAA could not provide sufficient data to quantify number of flights and flight types prior to 1987.

Eliminate Helicopters from Entire Canyon

Scoping comments and consultations with the Grand Canyon Working Group, other stakeholders, and interested persons made it clear the primary issue of this EIS was aircraft noise, not aircraft type. Eliminating one aircraft type would not necessarily address a major portion of the noise issue, but would have significant adverse effect on air-tour operators and variety of air-tour experiences available to visitors. The EIS analysis demonstrates that laws, policies, and EIS objectives can be met by Alternatives that include quiet-technology requirements and other elements without eliminating helicopters or any other any specific aircraft type. Alternative D considered this element for the heart of the park (see Alternative D discussion below).

Move Whitmore Helicopter Exchange to a Location Across the River from Diamond Creek or to Nearby Points Upstream Between Mile 220 and 224

Whitmore helicopter pad is on Hualapai tribal land, exempted in PL 100-91 from prohibitions on helicopter flights directly between a point on North Rim outside the park and locations on the reservation. Also, flights between Bar Ten airstrip and the Diamond Creek area would be much longer with noise impacts over a much greater area.

Require Flight-following

Requiring flight-following (such as Capstone II) was considered but dismissed because it would not change the noise footprint nor contribute to substantial restoration of natural quiet. Acquiring necessary radar capabilities to conduct flight-following would involve significant costs for equipment, installation, maintenance, and land acquisition, and costs for associated environmental studies for siting equipment. Impacts from equipment installation throughout the park's remote areas, managed as Wilderness, might not be acceptable. Therefore, although NPS

conducts flight-following for administrative flights, and flight-following may be encouraged, requiring it as a component of an Alternative in this EIS was considered infeasible and not necessary to accomplish EIS objectives. Future technological advances may make flight-following more desirable to be considered through adaptive management to enhance monitoring efforts.

Exclude General Aviation from Analysis of How Each Alternative Meets the Substantial Restoration of Natural Quiet Mandate

PL 100-91 requires NPS and FAA consider all aircraft. Additionally, the August 16, 2002 court decision, relative to the 2000 Final Supplemental EA stated "in the absence of any reasonable justification for excluding non-tour aircraft from its noise model, we must conclude that this aspect of the FAA's methodology is arbitrary and capricious and requires reconsideration by the agency." Therefore, noise from all aircraft, including general-aviation aircraft, must be included in the Alternative analyses, and is considered in cumulative effects.

Alternative B Unimplemented 2000 Environmental Assessment

This Alternative included actions discussed in the FAA's Final Supplemental EA, February 2000, Special Flight Rules in the Vicinity of Grand Canyon National Park. Some elements from that EA were modified to address safety concerns raised in late 1999 and 2000, which resulted in not implementing most East End actions. Only West End airspace changes were implemented. As much of the original proposal as possible was retained. To meet the 2000 National Parks Air Tour Management Act, incentives for quiet technology were incorporated as mitigation to further reduce noise impacts.

Alternative B was dismissed from further evaluation primarily because other Alternatives receiving further evaluation contained almost all Alternative B provisions with minor modifications that provide greater advantages in meeting EIS objectives.

Alternative B, if implemented, would have restored 54% of the park to natural quiet Base Year, and 53% Ten-Year Forecast. Compared to restoration achieved with Alternative A (55% and 53% in Base Year and Ten-Year Forecast, respectively), Alternative B did not provide a substantial improvement over current conditions. Alternative B did not meet the EIS objective to improve natural quiet in the park and provide for enhanced visitor experience. Due to these factors, Alternative B was dismissed from further study.

Alternative C Consolidated Use

Alternative C expanded Flight-free Zones, concentrated air-tour routes closer to park developed areas, and removed annual allocation limits. The Alternative also changed allowable flight times, provided an incentive route for quiet technology, and required eventual full conversion to quiet technology for all commercial air-tour aircraft flying in the SFRA. This Alternative eliminated Dragon Corridor and associated air-tour routes, Black-1A and Green-2. It created a new Developed Area Corridor across the canyon over popular visitor use-areas that, particularly on the rim, often experience substantial levels of human-caused noise from other sources. These included South Rim's Grand Canyon Village area, Phantom Ranch on the Colorado River, and North Rim's Grand Canyon Lodge. Alternative C was developed to be most consistent with park management zoning, in that motorized visitation (i.e., air tours) would be routed over Developed Zones, roads, and other areas zoned for motorized visitation. Thus, it had less impact on undeveloped and Wilderness areas where motorized use is not consistent with zoning and management objectives.

In Alternative C, Dragon Corridor was replaced with a Developed Area Corridor, something very different from remaining Alternatives. Even though the Developed Area Corridor seemed to be more consistent with park management zoning by routing mechanized use and associated noise over developed areas, it impacted most park visitors and was inconsistent with park administrative flight practices. (To the extent possible, administrative flights are routed away from developed areas for noise abatement and to avoid the possibility of increased risk to visitors, residents, facilities, and park resources including listed National Register historic buildings and districts).

Alternative C did not meet EIS objective 6 (limited aircraft intrusions for visitors at rim developed areas and major frontcountry destination points), and objective 8 (minimize conflicts with other park visitors). Alternative C maximized conflicts with other park visitors by routing air tours over the highest-use areas for ground visitors.

Because Alternative C routed air tours over developed areas (hotels, visitor centers, residences) and the highest concentrations of ground-based visitors, it caused air-tour noise directly over the vast majority of park visitors, facilities, National Register buildings, and National Historic Landmarks. This guaranteed the majority of park visitors and facilities were exposed to the highest sound levels.

Alternative C also routed air tours directly over the Cross-Canyon Corridor, which includes heavily used backcountry trails and campgrounds. Even though the Corridor is not Proposed Wilderness, it sees most of the park's backcountry visitation (by design, visitation to the rest of backcountry is limited much more than in the Corridor).

Alternative C had the greatest number of flight hours between curfews (11) of any Alternative, thereby providing the least protection for visitors during sensitive morning and evening hours. The greatest remaining number of daily flight hours after dismissing Alternative C is ten hours under Alternative A.

In Alternative C, Blue Direct North followed the Colorado River for 20 miles near Twin Peaks and Whitmore, something no other Alternative does. This was not entirely consistent with objectives 1, 5, and 8. Due to the above factors, Alternative C was dismissed from further study in this EIS.

Alternative D Modified 1995 Report to Congress

Alternative D was based primarily on recommendations provided in Chapter 10 of the NPS 1995 Report to Congress, with some modifications. Under this Alternative, two of the four general-aviation corridors across Grand Canyon and the easternmost Flight-free Zone would have been eliminated; the other three existing Flight-free Zones would have been expanded; and air-tour flights on Marble Canyons west side would have been eliminated. The Alternative included operational changes, such as curfews and quiet-technology incentives.

Recommendations were based on the general concepts of simplifying the commercial tour route structure, expanding Flight-free Zones, accommodating air-tour industry forecast growth, and phasing in use of quiet-aircraft technology.

The Zuni Point Corridor was eliminated, with aircraft routed east of Desert View one-way northbound, and west of Desert View one way southbound. This is very different from remaining Alternatives. On East End canyon routes, flight time over the canyon was found to be less than the time over forest and sagebrush, which greatly reduced quality of aerial viewing experience (EIS Objective 8) compared to other Alternatives. Alternative D also closed Dragon Corridor, except for quiet-technology fixed-wing aircraft, 25% or less of the day. The combination of these two features, although providing substantial noise reduction, greatly reduced time over the canyon, and thus the quality aerial viewing experience. These factors contributed to Alternative D's dismissal.

D was the only Alternative with a noise budget. However, the agencies were not able to describe exactly how to implement a noise budget; noise budgets have been implemented in very limited fashion at a few airports. A noise budget appeared to be very complex and infeasible to address park noise concerns, with other, more practical mechanisms available in remaining Alternatives. This feature contributed to dismissal of this Alternative.

The Navajo Nation, during government-to-government consultation, strongly objected to having a Marble Canyon route on the east (i.e., Navajo) side of the river, and also objected to routes east of Desert View over Navajo lands. In response to these concerns, the agencies agreed to dismiss proposed changes to the Marble Canyon route (as contained in Alternative D) from further study.

In Alternative D, Fossil and Dragon General-Aviation Corridors were eliminated, the only Alternative to do so. This made it more difficult for general aviation to navigate Grand Canyon airspace, another factor contributing to dismissal of this Alternative. Due to all above factors, Alternative D was dismissed from further study in this EIS.

Alternative G

Major features included two quiet-technology-only tour routes and lower air-tour operator fees to encourage quiet-technology aircraft use, with full quiet-technology conversion within 15 years. The annual allocation limit would have been modified to account for all air-tour and air-tour-related flights over the park while continuing to provide opportunities for the peak number of operations per operator. Air-tour altitudes would have been raised and/or air-tour routes moved away from sensitive resources and visitor-use areas. Quiet times would have been provided each day, with no air-tour or air-tour-related flights occurring at least one hour before sunset to one hour after sunrise for the entire East End all year. The current route structure would have been modified to add access and egress points to air-tour routes in response to stakeholder requests for additional ways into and out of the SFRA. Alternative G allowed potential growth in air-tour flight operations for quiet-technology aircraft if growth did not increase noise or negatively impact substantial restoration of natural quiet.

Alternative G was dismissed primarily because it was superseded by the NPS Preferred Alternative, which improved Alternative G by adding features that increase Substantial Restoration of Natural Quiet and by addressing several concerns (e.g., changes to annual allocation, Dragon Corridor short-loop tour options, altitudes, improved confluence views on both sides of aircraft, and route adjustments over Navajo lands) raised in the Grand Canyon Working Group.

Alternative G's annual allocation system was not found in any other Alternative, due in large part to its complexity, which goes to zero as aircraft convert to quiet technology. This system was considered impractical after discussion with the Grand Canyon Working Group.

The Marble Canyon Minimum Sector Altitude for general-aviation aircraft would have been raised to keep air tours separate from general aviation. The NPS Preferred Alternative addresses the issue by lowering tour-route altitude but placing additional limits on Marble Canyon flights. No remaining Alternative proposes raising a minimum sector altitude anywhere to avoid potential airspace concerns with general-aviation traffic. This would not be entirely consistent with the intent of EIS Objective 2. Due to the above factors, Alternative G was dismissed from further study in this EIS.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The Environmentally Preferred Alternative is defined as the Alternative that best meets the following criteria or objectives, as set out in Section 101(b) of the National Environmental Policy Act (42 USC 4331)

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
2. Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences
4. Preserve important historical, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice
5. Achieve a balance between population and resource use which 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 depletable resources

Alternatives for managing air-tour overflights at GCNP differ in their abilities to meet these criteria. Aspects of the EIS that address each criteria are described below, and effects of Alternatives relative to these criteria are presented in Table 2.5. A more detailed evaluation of effects is provided in Chapter 4, Environmental Consequences.

Criteria

Fulfill the Responsibilities of Each Generation as Trustee of the Environment for Succeeding Generations
The primary concern for natural and cultural resources from aircraft overflights is the effect of noise generated during flights. As trustees of the environment for future generations, Federal government objectives include improving on and maintaining substantial restoration of natural quiet, enhancing visitor experience, protecting Wilderness Character in Wilderness, and protecting sensitive wildlife habitat and cultural resources.

Assure for All Americans Safe, Healthful, Productive, and Esthetically and Culturally Pleasing Surroundings
When this criterion is met, aircraft overflight sight and sound would be minimized, and primitive recreation opportunities would be provided without aircraft intrusions in most backcountry areas, most Colorado River locations, and destination points accessed by both backcountry and river users. Aircraft intrusions would also be limited for visitors at developed areas and major front-country destinations. Alternatives meeting or exceeding this criterion would provide large areas free of day-to-day experiences common to urban areas, such as aircraft sights and sounds, so visitors would have ample opportunities to experience resources and special qualities of Grand Canyon's environment, consistent with management zoning and the intent behind establishing Grand Canyon National Park.

Attain the Widest Range of Beneficial Uses of the Environment without Degradation, Risk to Health or Safety, or Other Undesirable and Unintended Consequences
To attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences, a wide range of opportunities must be provided for ground-based visitor experiences with limited aircraft intrusions, as well as a wide range of opportunities for quality aerial viewing experiences for air-tour visitors, while protecting and reducing impacts to park resources and minimizing conflicts with other park visitors. The range of beneficial uses without degradation is reduced when the range (variety and amount) of opportunities for ground-based and air-tour visitors are reduced, when conflicts between air-tour and ground-based visitation increase, and/or when resource impacts increase. In terms of risk to health and safety, a major reason for establishing the SFRA was to provide a safe environment for air-tours and other aviation.

Preserve Important Historical, Cultural, and Natural Aspects of our National Heritage, and Maintain, Wherever Possible, an Environment which Supports Diversity and Variety of Individual Choice
To preserve important aspects of our national heritage, and maintain diversity and variety of individual choice, impacts to these resources must be reduced while providing a diverse range of recreational opportunities to ground-based and air-tour visitors and minimizing conflicts among visitors. To meet this criterion, reductions in aircraft noise impacts must be balanced against diversity and variety of choices for air-tours, and ground-based visitor experiences without aircraft noise impacts.

Achieve a Balance between Population and Resource Use which Will Permit High Standards of Living and a Wide Sharing of Life's Amenities
A balance would be achieved when park resources are protected, reasonable access to a variety of quality aerial viewing and ground-based experiences is provided, and conflicts among different types of visitor use are minimized. In doing so, a balance would be achieved for both ground-based and air-tour visitors, while minimizing aircraft noise impacts on park resources.

Enhance the Quality of Renewable Resources and Approach the Maximum Attainable Recycling of Depletable Resources
Alternatives that best enhance resources or best reduce impacts or energy/fuel use would contribute to meeting this criterion.

Conclusion
Based on analysis presented in Table 2.5, the NPS Preferred Alternative best achieves requirements of NEPA Section 101(b) criteria and is the Environmentally Preferred Alternative

TABLE 2.5 ANALYSIS OF ALTERNATIVES IN MEETING SECTION 101(B) CRITERIA OF THE NATIONAL ENVIRONMENTAL POLICY ACT (42 USC 4331)*

Criteria	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations	**Meets** 53% of the park would achieve SRNQ, barely more than the minimum to meet the law	**Exceeds** 84% of the park would achieve SRNQ, greatly improving SRNQ	**Exceeds** 66% of the park would achieve SRNQ, substantially improving SRNQ	**Exceeds** 67% of the park would achieve SRNQ, substantially improving SRNQ
	Aircraft Percent Time Audible would be 50% or more in 33% of the park	Aircraft Percent Time Audible would be 50% or more in 6% of the park	Aircraft Percent Time Audible would be 50% or more in 16% of the park	Aircraft Percent Time Audible would be 50% or more in 16% of the park
	Aircraft Average Sound Level of 35 dBA or more in 22% of the park	Aircraft Average Sound Level of 35 dBA or more in 5% of the park	Aircraft Average Sound Level of 35 dBA or more in 13% of the park	Aircraft Average Sound Level of 35 dBA or more in 11% of the park
Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings	**Does not Meet** Provides fewest opportunities for ground-based visitors to experience areas without air-tour aircraft sights and sounds	**Exceeds** Reduces aircraft sights and sounds, and provides greatest opportunities for enjoyment of surroundings for many ground-based visitors	**Meets** Reduces aircraft sights and sounds, and provides increased opportunities for enjoyment of surroundings for some ground-based visitors	**Meets** Reduces aircraft sights and sounds, and provides increased opportunities for enjoyment of surroundings for some ground-based visitors.
	No quiet-technology conversion requirement	Best available quiet technology required along with full quiet-technology conversion	Quiet-technology conversion incentives	Full quiet technology conversion required
	Aircraft sights and sounds would increase with growth in aircraft operations, and no net change in flight-free zone area	Seasonal closures occur in Zuni Point and Dragon Corridors, and flight-free zone area would increase	Except for a reduction in Sanup Flight-free Zone size, there would be no net change in flight-free zone area	Raising Flight-free Zone ceilings provides greater resource protection and improves conditions for ground-based visitors No net change in flight-free zone area
	Aircraft would be audible less than 5% of the day in 37% of the park	Aircraft would be audible less than 5% of the day in 68% of the park	Aircraft would be audible less than 5% of the day in 46% of the park	Aircraft would be audible less than 5% of the day in 46% of the park

TABLE 2.5 ANALYSIS OF ALTERNATIVES IN MEETING SECTION 101(B) CRITERIA OF THE NATIONAL ENVIRONMENTAL POLICY ACT (42 USC 4331)

Criteria	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences	**Meets** Provides wide range of opportunities for air-tour visitors, but fewest opportunities for ground-based visitors without aircraft impacts due to large number and distribution of air-tour routes and no quiet-technology conversion requirement. Generally has highest level of undesirable and unintended consequences	**Meets** Provides smallest range of opportunities for air-tour visitors, but largest range of opportunities for ground-based visitors without aircraft impacts. Air-tour routes reduced and vary by season, and quiet-technology conversion with best-available technology implemented	**Meets** Provides wide range of opportunities for air-tour visitors, and limited opportunities for ground-based visitors without aircraft impacts due to large number and distribution of air-tour routes, Dragon Corridor seasonal shift, and quiet-technology conversion requirement	**Exceeds** Provides widest range of beneficial uses, including wide range of opportunities for air-tour visitors due to number and distribution of air-tour routes, and a wide range of opportunities for ground-based visitors without aircraft impacts due to seasonal route shifts, quiet-technology conversion requirement, and quiet-technology-only routes
	Flight-free Zone ceilings maintained at 14,500 feet except Sanup FFZ at 8,000 feet continuing levels of intrusion from other aircraft	Flight-free Zone ceilings increase to 18,000 feet reducing intrusions from other aircraft	Flight-free Zone ceilings remain at 14,500 feet except Sanup FFZ at 8,000 feet continuing intrusions from other aircraft	Flight-free Zone ceilings increase to 18,000 feet reducing intrusions from other aircraft
Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment which supports diversity and variety of individual choice	**Meets** Provides diversity and variety of air-tour route choices but provides fewest choices for ground-based visitors desiring experiences free of aircraft noise impacts	**Meets** Provides least diversity and variety of individual choice for air-tour visitors in flight route number and location. Provides greatest diversity and variety of individual choices for ground-based visitors desiring experiences free of aircraft noise impacts	**Meets** Provides same diversity and variety of air-tour route choices as Alternative A. Increases diversity and variety of choices for ground-based visitors desiring experiences free of aircraft noise impacts	**Meets or Exceeds** Provides a wide diversity and variety of air-tour route choices, but fewer than Alternatives A and F. However, it provides a greater diversity and variety of choices than Alternatives A and F for ground-based visitors desiring experiences free of aircraft noise impacts
	Lowest protection of natural and cultural resources due to air-tour route number and distribution	Greatest protection of natural and cultural resources due to air-tour route number and distribution	Improvement compared to Alternative A in protection of natural and cultural resources due to air-tour route number and distribution	Better than Alternatives A and F in protection of natural and cultural resources due to air-tour route number and distribution

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TABLE 2.5 ANALYSIS OF ALTERNATIVES IN MEETING SECTION 101(B) CRITERIA OF THE NATIONAL ENVIRONMENTAL POLICY ACT (42 USC 4331)

Criteria	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities	**Meets** Four general-aviation corridors retained, providing general-aviation flexibility and opportunities	**Meets** Closes one general-aviation corridor reducing general-aviation flexibility	**Meets** Closes one general-aviation corridor reducing general-aviation flexibility	**Exceeds** Retains four general-aviation corridors maintaining general aviation flexibility and opportunities
	Air-tour operations essentially unlimited although annual allocation of 93,971 flights; no daily cap	Implements daily flight cap (364) in addition to annual allocation of 93,971 flights	Retains same annual allocation as Alternative A (93,971); no daily cap	Implements both a daily cap (364 flights) and a lower annual allocation (65,000)
	No quiet-technology implementation required	Costs associated with required quiet-technology implementation	Costs associated with quiet-technology implementation	Costs associated with required quiet-technology implementation
Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources	**Meets** Greatest adverse impacts on Soundscape, Wildlife, Ethnographic Resources	**Exceeds** Least adverse impacts on Soundscape, Wildlife, Ethnographic Resources	**Meets** Less adverse impacts than Alternative A on Soundscape, Wildlife, Ethnographic Resources	**Meets or Exceeds** Less adverse impacts than Alternatives A or F on Soundscape, Wildlife, Ethnographic Resources
	Minimally meets this criterion due to lack of change in route lengths and fuel use	Las Vegas-Grand Canyon routes slightly longer, requiring more fuel use	No change in route lengths, so no change in fuel use	Zuni Point Corridor short- and long-loop routes over North Rim shorter due so potentially less fuel use
	Quiet-technology conversion not required	Quiet-technology conversion requirement would also reduce energy usage as larger aircraft carry more passengers per flight	Quiet-technology conversion would also reduce energy usage as larger aircraft carry more passengers per flight	Quiet-technology conversion requirement would also reduce energy usage as larger aircraft carry more passengers per flight
	Does not enhance resources or reduce impacts or fuel use due to lack of quiet-technology conversion requirement	Best enhances resources, best reduces impacts and fuel use, in part due to quiet-technology conversion requirement and fewest number of flights	Enhances resources and reduces impacts and fuel use, in part due to quiet-technology conversion	Enhances resources and reduces impacts and fuel use, in part due to quiet-technology conversion requirement

*Table data is for the Ten-Year Forecast
SRNQ=Substantial Restoration of Natural Quiet

TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Annual Allocations	Annual allocation for commercial air-tours of 93,971	Annual allocation for commercial air-tour and air-tour-related operations of 93,971	Annual allocation for commercial air-tours of 93,971	Annual allocation for commercial air-tour and air-tour-related operations of 65,000
Daily Cap	None	Air-tour and air-tour-related operations capped at 364	None	Air-tours capped at 364
East End Seasonal Curfew	Curfew applies to aircraft in Zuni Point and Dragon Corridors	Curfew applies to aircraft in Zuni Point and Dragon Corridors Curfew times based on sunrise and sunset times, rather than the clock	Same as Alternative A	Curfews apply to entire East End, including Marble Canyon
	Allowable operation times May-September 8am-6pm October-April 9am-5pm	Tour day adjusted to provide 100 minutes of quiet time before sunset, and 150 minutes from sunrise until the tour day starts. There would also be a one hour mid-day curfew	Same as Alternative A	Allowable operation times May 1 - September 30 8:00 am-5:00 pm October 1 – April 30 9:00 am-4:00 pm
Seasonal Route Scheduling of East End Tours	None	September 16 to June 30, air tours permitted in Dragon Corridor only	December 1 to January 31, north end of Dragon Corridor, Black-1A, and Green-2 shifted seven-miles west	May 1 to October 31, short-loop air tours permitted in Dragon Corridor only
		July 1 to September 15, air tours permitted in Zuni Point Corridor only		November 1 to April 30, short-loop air tours permitted in Zuni Point Corridor only
				Zuni and Dragon long-loop tour route across North Rim open all year, but open only for quiet-technology aircraft after four years
Quiet-technology Routes and Incentives	None	Only best available quiet-technology aircraft allowed in the first 1.5 and last 2.5 hours of the tour day on East End routes	Forgiveness of overflight fees as incentive. Use of annual allocation not required for quiet-technology operations as long as no adverse impact to goal of Substantial Restoration of Natural Quiet and no noise increase. Green-4 westbound quiet-technology only route. Blue Direct North open only to quiet-technology aircraft	After four-year phase-in, year-round routes across North Rim open only to quiet-technology aircraft. Only quiet-technology fixed-wing northbound route in Marble Canyon (no phase-in) Use of an annual allocation not needed for quiet-technology operations January 1-March 31 (subject to monitoring to ensure noise provisions of law met)
Quiet-technology Conversion Requirements	None	All new aircraft are best-available quiet technology. Full conversion required by date to be determined	Over 10- to 12-year period, all commercial operations converted to quiet-technology aircraft	Over ten-year period, all commercial operations required to convert to quiet-technology aircraft

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Black Routes (Fixed Wing)	**Black-1** short-loop tour route in Zuni Point Corridor open year-round to all fixed-wing aircraft, includes loop around Little Colorado River confluence and Nankoweap, with altitude at 8,000 feet or 9,000 feet MSL unless climbing to join **Black-1A** route across North Rim at 9,500 feet MSL	**Black-1** route in Zuni Point Corridor open July 1 to September 15. Nankoweap loop on **Black-**1 route eliminated. Altitude from 8,000 feet or 8,500 feet MSL. Entry/exit points modified to avoid popular visitor-use area near Hermit Basin	**Black-1** same as Alternative A	**Black-1** short-loop tour route open November 1 to April 30. Nankoweap loop and Little Colorado River confluence flyover eliminated. Northbound **Black-1** altitude starts at South Rim at 8,000 feet, climbs to 9,000 feet by Temple Butte, and to 9,500 feet past Gunthers Castle. Southbound **Black-1** descends from 9,500 feet to cross South Rim at 8,500 feet MSL
	Black-1A across North Rim at 9,500 feet MSL then continues down Dragon Corridor's east side at 8,500 feet MSL	**Black-1A** route in Dragon Corridor open September 16 to June 30. Dogleg to southwest created. **Black-1A** altitude 8,000 feet to 8,500 feet MSL. **Black-1A** entry/exit points modified to avoid popular visitor-use areas near Hermit Basin. B**lack-1A** along North Rim eliminated	**Black-1A** route across North Rim at 9,500 feet MSL. Dragon Corridor configuration same as Alternative A February 1 through November 30. December 1 through January 31, north end of route shifts seven-miles west. Altitude decreases from 9,500 feet MSL at Dragon Corridor north end to 8,500 feet MSL southbound through the corridor	**Black-1A** continues at 9,500 feet MSL across North Rim, open all year but, after four-year phase-in, open only to quiet-technology aircraft
	Black-1E allows entry to SFRA at south end of Zuni Point Corridor	**Black-1E** and **Black-1X** allow entry and exit to/from SFRA near Colorado River confluence	**Black-1E** same as Alternative A	**Black-1E** eliminated
	Black-2 entry route east of Desert View at 8,000 feet MSL. Long-loop tour route from Zuni Point Corridor to Dragon Corridor across North Rim using **Black-1 to Black-1A** open year-round to all fixed-wing aircraft	**Black-2** eliminated	**Black-2** same as Alternative A Long-loop **Black-1** to **Black-1A** same as Alternative A	**Black-2** eliminated **Black-2A** short loop route in Dragon Corridor open May 1 to October 31 to all fixed-wing aircraft. Long-loop **Black-1** to **Black-1A** to **Black-2A** open all year, but after four years only open to quiet-technology aircraft **Black-2A** dogleg created to south-west, with aircraft at 9,500 feet MSL north of dogleg, and 8,500 feet MSL south of dogleg

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Black Routes (Fixed Wing)	**Black-3** entry route along Little Colorado River at 8,500 feet MSL. Bad weather reverse **Black-1R** near Gunthers Castle	**Black-3 and Black-1R** eliminated	**Black-3** and **Black-1R** same as Alternative A	**Black-3** eliminated **Black-1** changed to include current **Black-1R**
	Black-4 route northbound along Marble Canyon at 7,500 feet or 9,000 feet MSL to North Canyon, then 7,500 feet or 5,500 feet MSL to north end of SFRA	**Black-4** eliminated	**Black-4** same as Alternative A	**Black-4** northbound only beginning at **Black-1** route at 9,000 feet MSL, descending to 7,500 feet MSL. Quiet-technology aircraft only and moved away from rim
	Black-5 southbound along Marble Canyon at 5,000 feet or 6,500 feet MSL to North Canyon, then 6,500 feet MSL to South Canyon, then climb to 8,500 feet to merge with **Black-1** near Saddle Mountain	**Black-5** eliminated	**Black-5** same as Alternative A	**Black-5** eliminated
	Black-6 entry and exit routes at South Canyon, eastbound at 8,500 feet MSL, westbound at 7,500 feet or 9,000 MSL	**Black-6** eliminated	**Black-6** same as Alternative A	**Black-6** eliminated
Brown Routes (Support Operations)	**Brown-1** continues as river support route to/from Bar Ten airstrip	**Brown-1** same as Alternative A	**Brown-1** same as Alternative A	**Brown-1** same as Alternative A
	Brown-2 continues as river support route to/from Bar Ten airstrip **Brown-4** continues as river support route to/from Bar Ten airstrip	**Brown-2** shortened and modified to accommodate modification of Blue Direct North route **Brown-4** eliminated	**Brown-2** route eliminated **Brown-4** same as Alternative A	**Brown-2** same as Alternative A **Brown-4** same as Alternative A
	Brown-5 continues as river support route to/from Bar Ten airstrip	**Brown-5** shortened and modified to accommodate modification of Blue Direct North route	**Brown-5** same as Alternative A	**Brown-5** same as Alternative A
	Brown-6 continues as support route to Supai Village	**Brown-6** dogleg inserted into route to Supai Village	**Brown-6** same as Alternative A	**Brown-6** dogleg inserted into route to Supai Village

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Green Routes (Helicopter)	**Green-1** short-loop tour route in Zuni Point Corridor open year-round to helicopters, includes loop around confluence and Nankoweap, with altitude at 7,500 feet MSL unless climbing to join **Green-1A** route across North Rim at 9,000 feet MSL. No entry/exit routes to/from Navajo lands. Bad weather reverse **Green-1R** near Gunthers Castle	**Green-1** route in Zuni Point Corridor open July 1 to September 15 Nankoweap loop on **Green-1** route eliminated. **Green-1** altitude 7,500 feet MSL	**Green-1** same as Alternative A Altitude continues at 7,500 feet MSL	**Green-1** short-loop route open November 1 to April 30. Nankoweap loop and Little Colorado River confluence flyover eliminated. **Green-1** northbound altitude climbs from 7,500 feet at South Rim to 9,000 feet MSL by Temple Butte descends in reverse southbound
	See above	**Green-1A** route along North Rim eliminated	**Green-1A** configuration same as Alternative A February 1 to November 1; however, December 1 to January 31 extended west to accommodate relocation of **Green-2**. Altitude 9,000 feet MSL	**Green-1A** continues at 9,000 feet MSL across North Rim, and open all year, but after a four-year phase-in open only to quiet-technology aircraft
	Green-2 short-loop tour route in Dragon Corridor open year-round to all helicopters at 7,500 feet MSL. Long-loop tour route from Zuni Point Corridor to Dragon Corridor using **Green-1** to **Green-1A** to **Green-2** open year-round to all helicopters	**Green-2** route in Dragon Corridor open September 16 to June 30. Dogleg to the southwest created. **Green-2** altitude 7,500 MSL	**Green-2** Dragon Corridor same as Alternative A February 1 through November 30. December 1 through January 31, route shifts seven-miles west. Altitude ranges from 7,000 feet MSL at South Rim to 7,500 feet MSL over the canyon	**Green-2** short-loop route open May 1 to October 31 to all helicopters. Long-loop **Green-1** to **Green-1A** to **Green 2** open all year; after four years open to quiet-technology aircraft only. **Green-2** dogleg created to southwest with aircraft at 8,500 feet MSL north of dogleg, and 7,500 feet MSL south of dogleg
	Green-4 route eastbound south of river at 5,000 feet MSL, reversing between Quartermaster and Horse Flat Canyons to westbound north of river at 5,000 feet MSL	**Green-4** same as Alternative A	**Green-4** route stays north of Colorado River with portions south of the river eliminated. Westbound route for quiet-technology helicopters only at 5,000 feet MSL, and eastbound altitudes for all helicopters at 4,000 feet MSL	**Green-4** route eastbound south of river at 5,000 feet MSL at current location, crossing north of river to avoid Grand Canyon West Airport, climbing to 5,500 feet MSL westbound, turning left near Bat Cave and descending to 5,000 feet MSL to rejoin current helicopter westbound route to exit the SFRA. **Green-4R** reverse option where route crosses river near Bat Cave
	Green-4X at 5,000 feet MSL at Quartermaster Canyon	**Green-4X** same as Alternative A	**Green-4X** near Horse Flat Canyon at 5,000 feet MSL	**Green-4X** at 5,000 feet MSL between Quartermaster and Horse Flat Canyons

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Blue Routes	**Blue-2** current configuration flown at 5,500 feet or 7,500 feet MSL eastbound; 6,500 feet or 8,500 feet MSL westbound **Blue-2X** leaves Blue-2 south of river east of Quartermaster Canyon at 5,000 feet MSL or 7,500 feet MSL to exit SFRA	**Blue-2** and **Blue-2X** same as Alternative A	**Blue-2** route same as Alternative A	**Blue-2** eastbound north of river at 6,000 feet MSL, turning north past Burnt Springs Canyon climbing to 7,000 feet MSL westbound, with option to exit SFRA north of river at 7,000 feet MSL **Blue-2X** exit option at current fixed-wing route location or to exit SFRA north of river at 7,000 feet MSL. Exit option to south at 6,000 feet MSL between Quartermaster and Horse Flat Canyons
	Blue Direct North current configuration flown at 7,500 or 9,500 feet MSL eastbound; 8,500 or 10,500 feet MSL westbound	**Blue Direct North** shortened to cross canyon near Twin Peaks, with north-west segment at 9,500 feet MSL southeastbound and 10,500 feet MSL northwestbound, and the segment south of the canyon eastbound at 9,500 feet or 7,500 feet MSL, and westbound at 8,500 feet or 10,500 feet MSL	**Blue Direct North** one-way, eastbound, quiet-technology only. Configuration modified with junction at Burnt Springs Canyon allowing access from North or South Las Vegas. Crosses Shivwits Plateau at 7,500 feet MSL, turns along river toward Twin Peaks at 6,500 feet MSL, then resumes current route at Aubrey Cliffs at 7,500 feet MSL	**Blue Direct North** same as Alternative A
	Blue Direct South current configuration at 9,500 feet MSL eastbound and 10,500 feet MSL westbound	**Blue Direct South** eliminated Any traffic displaced outside SFRA expected to travel on existing Victor airways as shown on Map 2.3	**Blue Direct South** modified to a non-quiet technology route moved south of Grand Canyon West Airport. Split at Burnt Springs Canyon allows access to/from Las Vegas area. Eastbound aircraft at 9,500 feet across Shivwits Plateau, descending to 7,500 feet MSL toward the airport. Westbound aircraft 10,500 feet MSL after climbing from airport area	**Blue Direct South** eliminated Any traffic displaced outside SFRA expected to travel on existing Victor airways as shown on Map 2.3

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

Elements	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
General-Aviation Corridors	**Fossil Canyon Corridor** in current configuration	**Fossil Canyon Corridor** closed. Three Corridors remain open with altitudes same as Alternative A	**Fossil Canyon Corridor** closed. Three Corridors remain open with altitude same as Alternative A	**Fossil Canyon Corridor** rotated 28 degrees southeast. Four Corridors remain open with altitudes same as Alternative A
	Dragon Corridor in current configuration	**Dragon Corridor** modified to include dogleg as proposed for air-tour routes and narrowed at south end	**Dragon Corridor** narrowed along southern boundary	**Dragon Corridor** modified to include dogleg as proposed for air-tour routes
	Zuni Point Corridor in current configuration	**Zuni Point Corridor** extended north and shifted east to accommodate expansion of Bright Angel Flight-Free Zone	**Zuni Point Corridor** same as Alternative A	**Zuni Point Corridor** same as Alternative A
	Tuckup Corridor in current configuration	**Tuckup Corridor** same as Alternative A	**Tuckup Corridor** same as Alternative A	**Tuckup Corridor** same as Alternative A
	All corridors 11,500 feet MSL or 13,500 feet MSL (northbound) and 10,500 or 12,500 feet MSL (southbound); all open year-round	Allow use above Zuni Point and Dragon Corridors year-round	Allow use above Zuni Point and Dragon Corridors year-round	Allow use above Zuni Point and Dragon Corridors year-round
Flight-free Zones				
Sanup Flight-free Zone	Ceiling at 7,999 feet MSL Current configuration No flights under 8,000 feet except under written waiver	Ceiling raised to 17,999 feet MSL Configuration same as Alternative A No flights under 18,000 feet except under written waiver	Ceiling at 7,999 feet MSL Northern boundary moved south to accommodate modified Blue Direct routes No flights under 8,000 feet except under written waiver	Ceiling raised to 17,999 feet MSL Configuration same as Alternative A No flights below 18,000 feet except when under positive control of air-traffic control for safety or under a written waiver
Toroweap/ Shinumo Flight-free Zone	Ceiling at 14,499 feet MSL Current configuration No flights under 14,500 feet except under written waiver	Ceiling raised to 17,999 MSL East of Tuckup Corridor adjust several miles to northern SFRA boundary; west of Tuckup Corridor extend boundary south to include some Hualapai tribal lands. Modify southeast edge of boundary to reflect inclusion of Dragon Corridor dogleg No flights under 18,000 feet except under written waiver	Ceiling at 14,499 feet MSL Eastern boundary moved west to accommodate modified Dragon Corridor No flights under 14,500 feet except under written waiver	Ceiling raised to 17,999 feet MSL Modify southeast edge of boundary to reflect inclusion of Dragon Corridor dogleg No flights below 18,000 feet except 1) on Victor airway V257 at or above 14,500 feet, 2) under positive control of air traffic control for safety, 3) under written waiver

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TABLE 2.6 ELEMENTS OF THE ALTERNATIVES

	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Bright Angel Flight-free Zone	Ceiling at 14,499 feet MSL Current configuration No flights under 14,500 feet MSL except under written waiver	Ceiling raised to 17,999 feet MSL Extend north to incorporate Marble Canyon Modify southwest edge to reflect Dragon Corridor dogleg No flights under 18,000 feet MSL except under written waiver	Same as Alternative A, except southwest corner extended to Dragon Corridor	Ceiling raised to 17,999 feet MSL Modify southwest edge to reflect Dragon Corridor dogleg No flights below 18,000 feet MSL except 1) on Victor airways (V257, V293, V210) at or above 14,500 feet MSL, 2) under positive control of air traffic control for safety, 3) under written waiver
Desert View Flight-free Zone	Ceiling at 14,499 feet MSL Current configuration No flights under 14,500 feet MSL except under written waiver	Raise ceiling to 17,999 feet MSL Extend north No flights under 18,000 feet MSL except under written waiver	Same as Alternative A	Raise ceiling to 17,999 feet MSL Configuration same as Alternative A No flights below 18,000 feet MSL except 1) on Victor airway V210 at or above 14,500 feet, 2) under positive control of air traffic control for safety, 3) under written waiver
Changes to SFRA	None	None	Modify notch around Grand Canyon West Airport to protect Eagle and Guano Points	Modify notch around Grand Canyon West Airport to protect Eagle and Guano Points

IMPACTS DETERMINATION COMPARISON OF ALL ALTERNATIVES TEN-YEAR FORECAST

TABLE 2.7 SOUNDSCAPE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Substantial Restoration of Natural Quiet is Achieved in Percent of Park	53% of park	84% of park Major beneficial change from Alternative A	86% of park Major beneficial change from Alternative A	66% of park Moderate beneficial change from Alternative A	75% of park Moderate beneficial change from Alternative A	67% of park Moderate beneficial change from Alternative A	77% of park Moderate beneficial change from Alternative A
Percent of Management Zone in Which Substantial Restoration of Natural Quiet is Achieved							
Developed Zone (2% of park)	Moderate to major adverse in 95-98% of Developed Zone	Moderate to major adverse in 12-58% of Developed Zone with major beneficial change from Alternative A	Moderate to major adverse in 5-49% of Developed Zone with moderate to major beneficial change from Alternative A	Moderate to major adverse in 24-55% of Developed Zone with major beneficial change from Alternative A	Moderate to major adverse in 9-39% of Developed Zone with major beneficial change from Alternative A	Moderate to major adverse in 19-44% of Developed Zone with major beneficial change from Alternative A	Moderate to major adverse in 16-39% of Developed Zone with major beneficial change from Alternative A
Non-Wilderness Zone (4% of park)	Moderate to major adverse in 87-90% of Non-Wilderness Zone	Moderate to major adverse in 15-39% of Non-Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 11-32% of Non-Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 36-49% of Non-Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 18-28% of Non-Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 24-50% of Non-Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 21-46% of Non-Wilderness Zone with major beneficial change from Alternative A
Wilderness Zone (94% of park)	Moderate to major adverse in 48-55% of Wilderness Zone	Moderate to major adverse in 11-24% of Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 10-20% of Wilderness Zone with major beneficial change from Alternative A	Moderate to major adverse in 28-46% of Wilderness Zone with minor beneficial change from Alternative A	Moderate to major adverse in 25-42% of Wilderness Zone with minor to moderate beneficial change from Alternative A	Moderate to major adverse in 24-46% of Wilderness Zone with minor to moderate beneficial change from Alternative A	Moderate to major adverse in 22-40% of Wilderness Zone with moderate beneficial change from Alternative A
Percent of Park Area in Which Substantial Restoration of Natural Quiet is Achieved							
Marble Canyon	Negligible to minor adverse	Negligible with negligible to minor beneficial change from Alternative A	Negligible with negligible to minor beneficial change from Alternative A	Negligible to minor adverse with negligible change from Alternative A	Negligible with negligible to minor beneficial change from Alternative A	Negligible with negligible to minor beneficial change from Alternative A	Negligible with negligible to minor beneficial change from Alternative A

TABLE 2.8 SOUNDSCAPE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End	Major adverse under and near East End air-tour routes in **Zuni Point** and **Dragon Corridors** and across **North Rim**	Negligible to minor adverse under and near **Dragon Corridor** with major beneficial change from Alternative A Major adverse under and near **Zuni Point Corridor** negligible change from Alternative A Negligible impacts across **North Rim** moderate to major beneficial change from Alternative A	Major adverse under and near **Dragon Corridors** with negligible change from Alternative A Negligible to minor **adverse under and near Zuni Point Corridor** major beneficial change from Alternative A negligible impacts across **North Rim** moderate to major beneficial change from Alternative A	Moderate to major adverse under and near **Zuni Point** and **Dragon Corridors** and across **North Rim** with moderate to major beneficial change from Alternative A	Moderate to major adverse under and near **Zuni Point** and **Dragon Corridors** and across **North Rim** with moderate to major beneficial change from Alternative A in areas Dragon Corridor shifted from; Moderate to Major Adverse change in areas Corridor shifted to	Moderate to major adverse under and near **Zuni Point** and **Dragon Corridors** and across **North Rim** with major beneficial change from Alternative A	Moderate adverse under and near **Dragon** and **Zuni Point Corridors** and across **North Rim** with major beneficial change from Alternative A
	Negligible to minor adverse away from routes and amid **Bright Angel Flight-free Zone**	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** negligible with change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse away from routes and amid **Bright Angel Flight-free Zone** with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse away from routes and amid **Bright Angel Flight-free Zone** with negligible to moderate beneficial change from Alternative A
Central	Negligible to moderate adverse	Negligible to minor adverse with minor beneficial change from Alternative A	Negligible to moderate adverse with negligible change from Alternative A	Negligible to minor adverse with negligible to minor beneficial change from Alternative A	Negligible to minor adverse with negligible to minor beneficial change from Alternative A	Negligible with negligible change from Alternative A	Negligible with negligible change from Alternative A

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TABLE 2.9 SOUNDSCAPE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
West End	Major Adverse in **northern area** near air-tour routes	Moderate to major adverse in **northern area** near air-tour routes with minor beneficial change from Alternative A	Moderate to major adverse in **northern area** near air-tour routes with minor beneficial change from Alternative A	Moderate to major adverse **in northern area** near air-tour routes with minor beneficial change from Alternative A	Moderate to major adverse in **northern area** near air-tour routes with minor beneficial change from Alternative A	Moderate to major adverse in **northern area** near air-tour routes with negligible to minor beneficial change from Alternative A	Moderate to major adverse in **northern area** near air-tour routes with negligible to minor beneficial change from Alternative A
	Negligible to minor adverse in **southern area** away from routes	Negligible to minor adverse in **southern area** away from routes with negligible change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to minor beneficial change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to minor beneficial change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to minor beneficial change from Alternative A
Noise Outside GCNP but within SFRA	Moderate to major adverse **under Blue Direct route**s	Moderate to major adverse **under shifted Blue Direct routes** outside SFRA with moderate adverse change from Alternative A in areas where routes shift to, and moderate to major beneficial change in areas where routes shifted from	Moderate to major adverse **under shifted Blue Direct routes** outside SFRA with moderate adverse change from Alternative A in areas where routes shift to, and moderate beneficial change in areas where routes shifted from	Moderate to major adverse **under shifted Blue Direct routes** with moderate beneficial change from Alternative A	Moderate to major adverse **under shifted Blue Direct route**s with moderate beneficial change from Alternative A	Moderate to major adverse **under Blue Direct route**s with moderate beneficial change from Alternative A	Moderate to major adverse **under Blue Direct route**s with moderate beneficial change from Alternative A
	Negligible **in Marble Canyon** area	Negligible in **Marble Canyon** area with moderate beneficial change from Alternative A	Negligible in **Marble Canyon** area with moderate beneficial change from Alternative A	Negligible in **Marble Canyon** area with negligible to minor beneficial change from Alternative A	Negligible in **Marble Canyon** area with negligible to minor beneficial change from Alternative A	Negligible in **Marble Canyon** area with negligible to minor beneficial change from Alternative A	Negligible in **Marble Canyon** area with negligible to minor beneficial change from Alternative A

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TABLE 2.8 WILDERNESS IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Negligible to minor adverse in **GCNP and Paria Canyon-Vermilion Cliffs Wilderness Area** Minor to major adverse in **Saddle Mt. Wilderness Area**	**In GCNP** negligible with negligible to minor beneficial change from Alternative A Negligible in **Saddle Mt.** and **Paria-Vermilion Cliffs Wilderness Areas** with moderate to major beneficial change from Alternative A	**In GCNP** negligible with negligible to minor beneficial change from Alternative A Negligible in **Saddle Mt.** and **Paria-Vermilion Cliffs Wilderness Areas** with moderate to major beneficial change from Alternative A	**In GCNP** negligible to minor adverse with negligible change from Alternative A Moderate adverse at **Saddle Mt. Wilderness** Area with negligible to moderate beneficial change from Alternative A Negligible to minor adverse in **Paria Canyon-Vermilion Cliffs Wilderness** Area with negligible to minor beneficial change from Alternative A	**In GCNP** negligible with negligible to minor beneficial change from Alternative A Minor to moderate adverse at **Saddle Mt. Wilderness** Area with negligible to moderate beneficial change from Alternative A negligible to minor adverse in **Paria Canyon-Vermilion Cliffs Wilderness** with negligible to minor beneficial change from Alternative A	**In GCNP** negligible with negligible to minor beneficial change from Alternative A Negligible to minor adverse in **Saddle Mt. and Paria Canyon-Vermilion Cliffs Wilderness** Area with minor adverse to minor beneficial change from Alternative A	**In GCNP** negligible with negligible to minor beneficial change from Alternative A Negligible to minor adverse in **Saddle Mt. and Paria Canyon-Vermilion Cliffs Wilderness** Area with minor adverse to minor beneficial change from Alternative A
East End	Moderate to major adverse under and near East End air-tour routes in **Zuni Point and Dragon Corridors** and across **North Rim**	Negligible to minor adverse under and near **Dragon Corridor** with moderate to major beneficial change from Alternative A Moderate to major adverse under and near **Zuni Point Corridor** with minor beneficial change from Alternative A Negligible impacts across **North Rim** with moderate to major beneficial change from Alternative A	Moderate to major adverse under and near **Dragon Corridor** with minor to major beneficial change from Alternative A Negligible to minor adverse under and near **Zuni Point Corridor** with moderate beneficial to moderate adverse change from Alternative A Negligible across **North Rim** with moderate to major beneficial change from Alternative A	Moderate to major adverse under and near East End air-tour routes in **Zuni Point** and **Dragon Corridors** and across **North Rim** with moderate to major beneficial change from Alternative A	Negligible to moderate adverse under and near **Zuni Point** and **Dragon Corridor** and across **North Rim** with moderate to major beneficial change from Alternative A in areas where Dragon Corridor shifted from, but moderate to major adverse change in areas Corridor shifted to	Minor to major adverse under and near East End air-tour routes in **Zuni Point** and **Dragon Corridors** and across **North Rim**, with minor to major beneficial change from Alternative A (depending on location with respect to active short-loop tour routes)	Minor to major adverse under and near East End air-tour routes in **Zuni Point and Dragon Corridors** and across **North Rim** with minor to major beneficial change from Alternative A (depending on location with respect to active short-loop tour routes)

TABLE 2.8 WILDERNESS IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End (continued)	Negligible to minor adverse away from routes and amid **Bright Angel Flight-free Zone**	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A	Negligible to moderate adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A	Negligible to minor adverse away from active routes and amid **Bright Angel Flight-free Zone** with negligible to major beneficial change from Alternative A
Central	Mostly negligible but up to moderate adverse in a few locations	Negligible to minor adverse with negligible to moderate beneficial change from Alternative A	Negligible with minor to moderate beneficial change from Alternative A	Negligible to minor adverse with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse with negligible to moderate beneficial change from Alternative A
West End	Moderate to major adverse in **northern area** near air-tour routes	Moderate to major adverse in **northern area** near air-tour route**s** with minor adverse to moderate beneficial change from Alternative A depending on location	Moderate to major adverse in **northern area** near air-tour routes with minor adverse to moderate beneficial change from Alternative A depending on location	Moderate to major adverse in **northern area** near air-tour routes with moderate adverse to moderate beneficial change from Alternative A depending on location	Moderate to major adverse in **northern area** near air-tour routes with moderate adverse to moderate beneficial change from Alternative A depending on location	Moderate to major adverse in **northern area** near air-tour routes with negligible to minor beneficial change from Alternative A	Moderate to major adverse in **northern area** near air-tour routes with negligible to moderate beneficial change from Alternative A
	Negligible to minor adverse **in southern area** away from routes	Negligible to minor adverse **in southern area** away from routes with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse in **southern area** away from routes with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse **in southern area** away from routes with moderate adverse to moderate beneficial change from Alternative A depending on location	Negligible to minor adverse in **southern area** away from routes with moderate adverse to moderate beneficial change from Alternative A depending on location	Negligible to minor adverse in **southern area** away from routes with negligible to moderate beneficial change from Alternative A	Negligible to minor adverse **in southern area** away from routes with negligible to moderate beneficial change from Alternative A
NPS Units in SFRA Outside GCNP	Moderate to major adverse **under Blue Direct routes** (LMNM & GCPNM)*	Moderate to major adverse **under shifted Blue Direct routes** (LMNM & GCPNM) with moderate adverse change from Alternative A where routes shift to, and moderate to major beneficial change where routes shifted from	Moderate to major adverse under **shifted Blue Direct routes** (LMNM & GCPNM) with moderate adverse change from Alternative A where routes shift to, and moderate to major beneficial change where routes shifted from	Moderate to major adverse **under shifted Blue Direct routes** (LMNM & GCPNM) with moderate adverse change from Alternative A where routes shift to, and moderate beneficial change where routes shifted from	Moderate to major adverse **under shifted Blue Direct routes** (LMNM & GCPNM) with moderate adverse change from Alternative A where routes shift to, and moderate beneficial change where routes shifted from	Moderate to major adverse **under Blue Direct routes** (LMNM & GCPNM) with negligible to moderate beneficial change from Alternative A	Moderate to major adverse **under Blue Direct routes** (LMNM & GCPNM) with negligible to moderate beneficial change from Alternative A

*Lake Mead National Recreation Area and Grand Canyon-Parashant National Monument

TABLE 2.10 ETHNOGRAPHIC RESOURCES IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative							
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Negligible to minor adverse	Negligible impacts with minor long-term beneficial change from Alternative A		Negligible impacts with negligible change from Alternative A		Negligible impacts with minor long-term beneficial change from Alternative A	
East End	Moderate adverse impacts in **areas near the Little Colorado confluence** Minor adverse impacts in areas represented by **Little Colorado, Nankoweap River, and Pasture Wash** Location Points Minor to moderate adverse impacts at **Tusayan Museum and Bright Angel Point** Location Points	Negligible impacts in **Bright Angel Point, Little Colorado** and **Nankoweap River** Location Points Minor adverse impacts at **Pasture Wash** Location Point Moderate adverse impacts at **Temple Butte and Little Colorado River** Location Points Negligible to moderate beneficial change from Alternative A for **all areas**	Negligible impacts **in all areas other than Pasture Wash** Location Point where impacts would be minor to moderate adverse with minor to moderate beneficial change in all areas from Alternative A	Negligible impacts in areas represented by **Little Colorado** and **Nankoweap** Location Points with negligible to minor beneficial change from Alternative A Minor adverse impacts at **Bright Angel Point and Pasture Wash** Location Points with minor to moderate beneficial change from Alternative A Minor to moderate adverse impacts at **Little Colorado River** and **Temple Butte** Location Points with minor beneficial change from Alternative A	Minor adverse impacts at **Pasture Wash** Location Point with minor to moderate beneficial change from Alternative A Minor adverse impacts at **Little Colorado River** and **Temple Butte** Location Points with minor to moderate beneficial change from Alternative A Negligible impacts at **Bright Angel Point** Location Point with minor to moderate beneficial change from Alternative A	Negligible to minor adverse impacts at **Little Colorado, Little Colorado River, and Nankoweap River** Location Points with negligible to moderate beneficial change from Alternative A Minor to moderate adverse impacts near **Temple Butte, Pasture Wash** and **Bright Angel Point** Location Points with minor to moderate beneficial change from Alternative A	Minor adverse impacts at **Pasture Wash** Location Point with moderate to major beneficial change from Alternative A Minor to moderate adverse impacts at **Temple Butte, Little Colorado River** and **Bright Angel Point** Location Points with negligible to moderate beneficial change from Alternative A
Central	Negligible	Negligible impacts with negligible change from Alternative A		Negligible impacts with negligible change from Alternative A		Negligible impacts with negligible change from Alternative A	
West End	Negligible impacts in areas away from air-tour routes (**Meriwhitca and Granite Peak** Location Points) Moderate adverse impacts under **Green-4 and Black-2** routes	Negligible impacts away from air-tour routes and moderate adverse impacts under air-tour routes with negligible to minor beneficial change in all areas from Alternative A		Negligible impacts except at **Burnt Springs Canyon** Location Point where impacts would be moderate adverse with negligible change from Alternative A		Negligible impacts except at **Burnt Springs Canyon** Location Point where impacts would be moderate adverse with negligible change from Alternative A	

TABLE 2.11 VISITOR USE AND EXPERIENCE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative							
	A	E		F		NPS Preferred		
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	
Marble Canyon	Negligible to minor adverse impacts	Negligible impacts with negligible to minor beneficial change from Alternative A		Negligible impacts with negligible change from Alternative A	Negligible impacts with minor beneficial change from Alternative A	Negligible impacts with negligible to minor beneficial change from Alternative A		
	Negligible impacts **Outside the Park within the SFRA**	Negligible impacts **Outside the Park within the SFRA** with negligible change from Alternative A		Negligible impacts **Outside the Park within the SFRA** with negligible change from Alternative A	Negligible impacts **Outside the Park within the SFRA** with negligible change from Alternative A	Negligible impacts **Outside the Park within the SFRA** with negligible change from Alternative A		
East End	Moderate adverse impacts in **South Rim Developed Zone**	Negligible to major adverse impacts in **South Rim Developed Zone** with negligible to major beneficial change from to Alternative A	Minor adverse impacts in **South Rim Developed Zone** with moderate beneficial change from Alternative A	Minor to major adverse impacts in **South Rim Developed Zone** with negligible to moderate beneficial change from Alternative A	Negligible to moderate adverse impacts in **South Rim Developed Zone** with moderate beneficial change from Alternative A	Negligible to moderate adverse impacts in **South Rim Developed Zone** with minor to moderate beneficial change from Alternative A	Negligible impacts in the **South Rim Developed Zone** with moderate beneficial change from Alternative A	
	Negligible impacts in **Phantom Ranch Developed Zone**	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	Negligible impacts in **Phantom Ranch Developed Zone** with negligible change from Alternative A	
	Moderate adverse impacts in **North Rim Developed Zone**	Negligible to Moderate adverse impacts in **North Rim Developed Zone** with minor to moderate beneficial change from Alternative A	Negligible to moderate adverse impacts in **North Rim Developed Zone** with minor to moderate beneficial change from Alternative A	Moderate adverse impacts in **North Rim Developed Zone** with minor beneficial change from Alternative A	Negligible to minor to adverse impacts in **North Rim Developed Zone** with minor to moderate beneficial change from Alternative A	Minor to moderate adverse impacts in **North Rim Developed Zone** with minor to moderate beneficial change from Alternative A	Minor to moderate adverse impacts in **North Rim Developed Zone** with negligible to moderate beneficial change from Alternative A	
	Moderate to major adverse impacts in **Non-Wilderness Zone**	Negligible impacts in **Non-Wilderness Zone** with minor to major beneficial change from Alternative A	Negligible impacts in **Non-Wilderness Zone** with minor to major beneficial change from Alternative A	Negligible impacts in **Non-Wilderness Zone** with moderate to major beneficial change from Alternative A	Negligible impacts in **Non-Wilderness Zone** with moderate to major beneficial change from Alternative A	Negligible to Minor adverse impacts in **Non-Wilderness Zone** with major beneficial change from Alternative A	Minor adverse impacts in **Non-Wilderness Zone** with major beneficial change from Alternative A	

TABLE 2.11 VISITOR USE AND EXPERIENCE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
West End (continued)	Minor to major adverse impacts in the **Wilderness Zone**	Negligible to moderate adverse impacts in **Wilderness Zone** with negligible to major beneficial change from Alternative A	**Wilderness Zone** Negligible to major adverse impacts with minor to major beneficial change from Alternative A	Minor to major adverse impacts in **Wilderness Zone** with minor beneficial change from Alternative A	Negligible to moderate adverse impacts in **Wilderness Zone** with moderate to major beneficial change from Alternative A	Negligible to major adverse impacts in **Wilderness Zone** with negligible to major beneficial change from Alternative A	Negligible to major adverse impacts in **Wilderness Zone** with minor to major beneficial change from Alternative A
	Minor to moderate adverse impacts **Outside the Park within the SFRA**	Minor to moderate adverse impacts **Outside the Park within the SFRA** with minor to moderate adverse change compared to Alternative A	Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible to moderate beneficial change compared to Alternative A	Minor to moderate adverse impacts **Outside the Park within the SFRA** with negligible change compared to Alternative A	Minor to moderate adverse impacts **Outside the Park within the SFRA** with negligible change compared to Alternative A	Minor to moderate adverse impacts **Outside the Park within the SFRA** with negligible change compared to Alternative A	Minor to moderate adverse impacts **Outside the Park within the SFRA** with negligible change compared to Alternative A
Central	Negligible impacts in most areas	Negligible impacts with negligible change in impacts compared to Alternative A in **Wilderness Zone** and **Non-Wilderness Zones**		Negligible impacts with change in impacts compared to Alternative A in **Wilderness Zone** and **Non-Wilderness Zone**	Negligible impacts with negligible change in impacts compared to Alternative A in **Wilderness Zone** and **Non-Wilderness Zone**	Negligible impacts with negligible change in impacts compared to Alternative A in **Wilderness Zone** and **Non-Wilderness Zone**	
	Negligible to moderate adverse impacts **Outside the Park within the SFRA**	Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible change in impacts compared to Alternative A		Negligible to moderate impacts **Outside the Park within the SFRA** with Negligible to Minor adverse change in impacts compared to Alternative A	Negligible to moderate impacts **Outside the Park within the SFRA** with negligible to minor adverse change in impacts compared to Alternative A	Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible change in impacts compared to Alternative A	
West End	Minor to major adverse impacts in the **Wilderness Zone**	Negligible to major adverse impacts in the **Wilderness Zone** with negligible change in impacts compared to Alternative A		Negligible to major adverse impacts in the **Wilderness Zone** with negligible change in impacts compared to Alternative A		Negligible to minor adverse impacts in the **Wilderness Zone** except at Bat Cave where impacts would be major adverse with negligible to minor beneficial change in impacts compared to Alternative A	
	Negligible to moderate adverse impacts **Outside the Park within the SFRA**	Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible change in impacts compared to Alternative A		Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible change in impacts compared to Alternative A		Negligible to moderate adverse impacts **Outside the Park within the SFRA** with negligible to minor beneficial change in impacts compared to Alternative A	

TABLE 2.11 VISITOR USE AND EXPERIENCE IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Air-tour Visitors	Provides a wide range of opportunities year-round. Scenic views from a variety of routes	Provides least variety of air-tour choices. Many current options eliminated (no long-loop or Marble Canyon tours)		Provides similar level of opportunities as Alternative A. Blue Direct routes provide different opportunities than other Alternatives		Provides similar level of opportunities as Alternative A. Marble Canyon northbound only route crosses river once, and views of Little Colorado River confluence still available	

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TABLE 2.12 WILDLIFE IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Negligible to minor adverse	Negligible impacts with negligible to minor beneficial change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	Negligible to minor adverse impacts with negligible to minor beneficial change from Alternative A	Negligible to minor adverse impacts with negligible to minor beneficial change in impacts from Alternative A, although at points close to the new route location minor adverse impacts with minor adverse change from Alternative A	
East End	**Zuni Point and Dragon Corridors** moderate to major adverse impacts under and near heavily used air-tour routes	Moderate to major adverse impacts under and near **Zuni Point Corridor** minor beneficial change from Alternative A	Negligible impacts under and near **Zuni Point Corridor** with major beneficial change from Alternative A	**Zuni Point and Dragon Corridors** moderate to major adverse impacts under and near heavily used air-tour routes with minor to major beneficial change from Alternative A	**Zuni Point Corridor** moderate adverse impacts with major beneficial change from Alternative A	Moderate to major adverse impacts under and near **Zuni Point Corridor** with moderate beneficial change from Alternative A, negligible change at Grid Location Points 14 and 15	Moderate to major adverse impacts under and near **Zuni Point Corridor** with negligible to moderate beneficial change from Alternative A
		Under and near **Dragon Corridor** negligible to minor adverse impacts with major beneficial change co from Alternative A	Under and near **Dragon Corridor** moderate adverse impacts with moderate to major beneficial change from Alternative A		**Dragon Corridor** moderate to major adverse impacts with moderate to major beneficial change from Alternative A in areas where routes shift from, but up to major adverse changes in areas where routes shift to	Under and near **Dragon Corridor** moderate to major adverse impacts with minor to moderate beneficial change from Alternative A	Under and near **Dragon Corridor** minor to moderate adverse impacts with minor to major beneficial change from Alternative A

TABLE 2.12 WILDLIFE IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End (continued)	Near routes in **Bright Angel Flight Free Zone** and **eastern portion of Toroweap/ Shinumo Flight-Free Zone** moderate to major adverse	Near routes in western **Bright Angel Flight-Free Zone** and **eastern portion of Toroweap/ Shinumo Flight-free Zone** negligible to minor adverse impacts with moderate to major beneficial change from Alternative A	Near routes in western **Bright Angel Flight-Free Zone** and **eastern portion of Toroweap/Shinumo Flight-free Zone** moderate adverse impacts with moderate to major beneficial change from Alternative A	Near routes in western **Bright Angel Flight-Free Zone** and **eastern portion of Toroweap /Shinumo Flight-free Zone** moderate adverse impacts with moderate to major beneficial change from Alternative A	Near routes in western **Bright Angel Flight-free Zone** and **eastern portion of Toroweap /Shinumo Flight-free Zone** negligible to moderate adverse impacts with up to major beneficial change from Alternative A in areas where routes shift from. Moderate to major adverse impacts with moderate to major adverse change where routes shift to	Near routes in western **Bright Angel Flight-free Zone** and **eastern portion of Toroweap /Shinumo Flight-free Zone** moderate adverse impacts with moderate to major beneficial change from Alternative A	Near routes in western **Bright Angel Flight-free Zone** and **eastern portion of Toroweap /Shinumo Flight-free Zone** moderate adverse impacts with minor to major beneficial change from Alternative A
	Amid **Bright Angel Flight-free Zone** and **eastern portion of Toroweap/Shinumo Flight-free Zone** negligible Outside park boundary along **SFRA eastern boundary**, east of **Desert View Flight-free Zone**, and areas south of **Toroweap/ Shinumo Flight-free Zone** minor to moderate adverse	Amid **Bright Angel Flight-free Zone** and eastern portion of **Toroweap/Shinumo Flight-Free Zone** negligible impacts with negligible change from Alternative A		Amid **Bright Angel Flight Free Zone** and eastern portion of **Toroweap/Shinumo Flight-Free Zone** negligible to minor adverse impacts with negligible to major beneficial change from Alternative A	Amid **Bright Angel Flight Free Zone** and eastern portion of and T**oroweap/ Shinumo Flight-free Zone** negligible to minor adverse impacts with up to major beneficial change from Alternative A	Amid **Bright Angel Flight-free Zone** eastern portion of and T**oroweap/Shinumo Flight-free Zone** negligible impacts with negligible change from Alternative A	
						North Rim moderate to major adverse impacts with moderate to major beneficial change from Alternative A	

TABLE 2.12 WILDLIFE IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Central	Negligible to minor adverse with impacts up to moderate adverse close to air-tour routes	Negligible impacts with negligible change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	Mostly negligible impacts with negligible change from Alternative A	Negligible to minor adverse impacts with negligible change from Alternative A	
West End	**Under and near Green-4 and Blue-2** moderate to major adverse	**Under and near Green-4 and Blue-2,** major adverse impacts with minor to major beneficial change from Alternative A		**Under and near Green-4 and Blue-2** moderate to major adverse impacts with minor adverse to minor beneficial from Alternative A		**Under and near Green-4 and Blue-2** major adverse impacts with minor beneficial change from Alternative A	
	Brown routes minor to moderate adverse impacts	**Brown routes** moderate adverse impacts with negligible to minor adverse change from Alternative A		**Brown routes** minor to moderate adverse impacts with negligible change from Alternative A		**Brown routes** minor to moderate adverse impacts with negligible change from Alternative A	
		At the SFRA's northern boundary, major adverse impacts with moderate to major adverse change from Alternative A					
West End	Near **Blue Direct routes** moderate to major adverse	**Under and near new Blue Direct location** major adverse impacts with moderate to major adverse change from Alternative A. Areas near where Blue Direct moved from major beneficial change from Alternative A		Moderate to major adverse impacts under **Blue Direct routes** with negligible to minor adverse change from Alternative A		**Blue Direct routes** moderate adverse impacts with negligible change from Alternative A	
	Under **Sanup Flight-free Zone** and south toward the SFRA boundary negligible impacts	Under **Sanup Flight-free Zone** negligible impacts with negligible change from Alternative A		In **Sanup Flight-free Zone** negligible impacts with negligible change from Alternative A		Under **Sanup Flight-free Zone** negligible impacts with negligible change from Alternative A	

TABLE 2.13 PEREGRINE FALCON IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative							
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Short-term, negligible to minor adverse	Negligible to minor adverse impacts with short-term negligible to minor beneficial change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	No analysis due to species not present December through January	Negligible to minor adverse impacts with short-term negligible to minor beneficial change from Alternative A Points closer to new route location (**Grid Location Points 4 and 5,** and **Cliff Dwellers Lodge** Location Points**)** negligible to minor adverse change from Alternative A	Negligible impacts with negligible to minor beneficial change from Alternative A
East End	Short-term, negligible to minor adverse	Moderate to major adverse impacts under and near **Zuni Point Corridor** with short term minor beneficial change from Alternative A	Negligible impacts under and near **Zuni Point Corridor** with short-term major beneficial change from Alternative A	**Zuni Point Corridor** moderate to major adverse impacts under air-tour routes with short-term moderate to major beneficial change from Alternative A	No analysis due to species not present December through January	Moderate to major adverse impacts under **Zuni Point Corridor**, with generally short-term moderate to major beneficial change from Alternative A	**Zuni Point Corridor,** moderate to major adverse impacts with short-term negligible to moderate beneficial change from Alternative A
	Short- and long-term moderate to major adverse impacts in areas beneath air-tour routes	**Dragon Corridor** negligible to minor adverse impacts with short-term major beneficial change from Alternative A	**Dragon Corridor** moderate adverse impacts with a short-term moderate to major beneficial change from Alternative A	**Dragon Corridor mo**derate to major adverse impacts under air-tour routes with short-term moderate to major beneficial change from Alternative A	No analysis due to species not present December through January	Moderate to major adverse impacts under and near **Dragon Corridor** with short-term minor to major beneficial change from Alternative A	Minor to moderate adverse impacts under and near **Dragon Corridor** with short-term minor to major beneficial change from Alternative A

TABLE 2.13 PEREGRINE FALCON IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative							
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End (continued)		Negligible to minor adverse impacts with short-term moderate to major beneficial change from Alternative A in **Bright Angel Flight-free Zone** Middle of **Bright Angel Flight-free Zone** quiet with negligible impacts and negligible change from Alternative A	**Bright Angel Flight-free Zone** represent minor to moderate adverse impact with moderate beneficial change from Alternative A Middle of **Bright Angel Flight-free Zone** quiet with negligible change from Alternative A	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term negligible to major beneficial changes due to quiet-technology incentives and conversion requirements from Alternative A	No analysis due to species not present December through January	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term moderate to major beneficial change from Alternative A in areas near air-tour routes Middle of **Bright Angel Flight-free Zone** quiet with negligible impacts and negligible change from Alternative A	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term minor to major beneficial change from Alternative A
Central	Short-term, negligible to minor adverse	Negligible impacts with negligible change from Alternative A		Negligible impacts with short-term negligible to minor beneficial change from Alternative A	No analysis due to species not present December through January	Negligible to minor adverse impacts with negligible change from Alternative A	
West End	Short- and long-term moderate to major adverse impacts due to noise persistence at high sound levels in areas close to **Green-4** and **Blue-2**	**Green-4** and **Blue-2** major adverse impacts with generally minor to major beneficial change from Alternative A	Impacts major adverse under **Green-4 and Blue-2** with negligible change from Alternative A	**Green-4** and **Blue-2** major adverse impacts with minor to moderate beneficial change from Alternative A	No analysis due to species not present December through January	**Green-4** and **Blue-2** short-term moderate to major adverse impacts with negligible to minor beneficial change from Alternative A	
	Blue Direct routes impacts in areas under and near air-tour routes short-term moderate adverse	**Blue Direct route**s Minor adverse impacts with short- and long-term moderate beneficial change from Alternative A	**Blue Direct routes** Minor adverse impacts with short- and long-term moderate beneficial change from Alternative A	**Blue Direct routes** Major adverse impacts with short-term negligible to minor adverse change from Alternative A		**Blue Direct routes**, Minor to moderate adverse impacts with negligible change from Alternative A	

TABLE 2.13 PEREGRINE FALCON IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
West End (continued)	**Brown routes** impacts short term minor to moderate adverse	**Brown routes** minor to moderate adverse impacts with short-term negligible to minor adverse change from Alternative A	**Brown routes** minor to moderate adverse impacts with short-term negligible to moderate adverse change from Alternative A	**Brown routes** negligible to minor adverse impacts with negligible change from Alternative A		**Brown routes** minor to moderate adverse impacts with negligible change from Alternative A	
	Negligible impact of air-tour aircraft in **Sanup Flight-free Zone**	**Sanup Flight-free Zone** negligible with negligible change from Alternative A	**Sanup Flight-free Zone** negligible with negligible change from Alternative A	**Sanup Flight-free Zone** negligible, with negligible change from Alternative A		**Sanup Flight-free Zone** negligible with negligible change from Alternative A	

TABLE 2.13 CALIFORNIA CONDOR IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Short term negligible to minor adverse	Negligible effect, long-term negligible to minor beneficial change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	Negligible impacts with long-term negligible to minor beneficial change from Alternative A	Negligible to minor adverse impacts with generally short-term negligible to minor beneficial from Alternative A Due to reconfiguration of **Black-4** along **Marble Canyon's** west SFRA boundary minor adverse impacts with negligible to minor adverse change from Alternative A	Location Points **North Canyon, South Canyon, Marble Canyon Dam Site, and Grid Location Points 4 and 5**, negligible to minor beneficial change from Peak Season and Alternative A
East End	**Under and near tour routes** short term moderate to major adverse In **areas away from air-tour routes** negligible impacts	Moderate to major adverse impacts under and near **Zuni Point Corridor** with short-term minor beneficial change from Alternative A	Negligible impacts under and near **Zuni Point Corridor** with short-term major beneficial change from Alternative A	**Zuni Point Corridor** moderate to major adverse impacts with long-term moderate beneficial change from Alternative A	**Dragon Corridor** negligible to moderate adverse impacts with moderate to major beneficial change from Alternative A	Moderate to major adverse impacts under and near **Zuni Point Corridor** air-tour routes with mixed results, short-term minor adverse change to moderate to major	**Zuni Point Corridor**, moderate to major adverse impacts with short-term negligible to moderate beneficial change from Alternative A

TABLE 2.13 CALIFORNIA CONDOR IMPACTS (TEN-YEAR FORECAST) BY PARK AREA

Impact Category	Alternative							
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End (continued)						beneficial change from Alternative A	
		Dragon Corridor negligible to minor adverse impacts with short-term major beneficial change from Alternative A	**Dragon Corridor** moderate adverse impacts with short-term moderate to major beneficial change from Alternative A	**Dragon Corridor** moderate to major adverse impacts with long-term moderate beneficial change from Alternative A	**Dragon Corridor** route shift, negligible to moderate adverse impacts with short-term negligible to moderate adverse change from Alternative A	Moderate to major adverse impacts under and near **Dragon Corridor** with short-term minor to major beneficial change from Alternative A	Minor to moderate adverse impacts under and near **Dragon Corridor** with short-term major beneficial change from Alternative A
		Negligible impacts would continue and there would be a short-term moderate to major beneficial from Alternative A in **Bright Angel Flight-free Zone** in areas west of routes due to high reduction in time air-tour aircraft audible	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term moderate beneficial change from Alternative A	**Bright Angel Flight-free Zone** negligible impacts with negligible change from Alternative A	**Bright Angel Flight-free Zone** negligible impacts with negligible change from Alternative A	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term minor to major beneficial change from Alternative A	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term minor to major beneficial change from Alternative A
		Middle of **Bright Angel Flight-free Zone** quiet with negligible impacts and negligible change from Alternative A				Middle of **Bright Angel Flight-free Zone** quiet with negligible impacts and negligible change from Alternative A	
		Cedar Ridge Location Point negligible impacts with major beneficial change from Alternative A					
Central	Negligible	Negligible to minor adverse impacts with negligible change from Alternative A		Negligible impacts with negligible change compared to Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	
West End	Current data on condor presence suggests the birds do not use West End and, therefore, would not be affected by air-tours in this area. Thus, West End is not analyzed for impacts to California condor						

TABLE 2.14 MEXICAN SPOTTED OWL IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative							
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Marble Canyon	Short-term negligible to minor adverse	Negligible impact with negligible to minor long-term beneficial change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	Negligible impacts with long-term minor to moderate beneficial change from Alternative A	Negligible to minor adverse impacts with short-term negligible to minor beneficial change from Alternative A	
						Due to reconfiguration of **Black-4** along the western SFRA boundary negligible impacts and negligible change from Alternative A	
East End	Short-term moderate adverse impacts particularly in **areas beneath and adjacent to air-tour routes** In **areas away from air-tour routes** impacts short-term negligible to minor adverse	Moderate adverse impacts under and near **Zuni Point Corridor** air-tour routes with short-term minor beneficial change from Alternative A	Negligible to minor adverse impacts under and near **Zuni Point Corridor** air-tour routes with short-term moderate to major beneficial from Alternative A	**Zuni Point Corridor** moderate adverse impacts with long-term minor to moderate beneficial change from Alternative A		Moderate adverse impacts under and near **Zuni Point Corridor** with minor beneficial change from Alternative A	**Zuni Point Corridor** moderate adverse impacts with short-term minor to moderate beneficial change from Alternative A
		Dragon Corridor negligible to minor adverse impacts with short-term moderate to major beneficial change from Alternative A	**Dragon Corridor** moderate adverse impacts with short-term moderate to major beneficial change in impacts from Alternative A	**Dragon Corridor** moderate adverse impacts with long-term minor to moderate beneficial change from Alternative A	**Dragon Corridor** minor to moderate adverse impacts with moderate to major beneficial change from Alternative A **Dragon Corridor** route shift, negligible to minor adverse impacts with minor to moderate adverse change from Alternative A	Moderate adverse impacts under and near **Dragon Corridor** with short-term minor to moderate beneficial change from Alternative A	Minor adverse impacts under and near **Dragon Corridor** with short-term moderate to major beneficial change from Alternative A

TABLE 2.14 MEXICAN SPOTTED OWL IMPACTS (TEN-YEAR FORECAST)

Impact Category	Alternative						
	A	E		F		NPS Preferred	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
East End (continued)		Negligible impacts with short-term moderate beneficial change in **Bright Angel Flight-free Zone** in areas away from active air-tour routes due to high reduction in air-tour aircraft Percent Time Audible	**Bright Angel Flight-free Zone** short-term minor to moderate adverse impacts with minor to moderate beneficial change from Alternative A	**Bright Angel Flight-free Zone** negligible to minor adverse impacts with negligible change from Alternative A		**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term minor to moderate beneficial change from Alternative A	**Bright Angel Flight-free Zone** minor to moderate adverse impacts with short-term minor to moderate beneficial change from Alternative A
		Middle of **Bright Angel Flight-free Zone** would remain quiet with negligible impacts and negligible change from Alternative A	Middle of **Bright Angel Flight-free Zone** would remain quiet with negligible impacts and negligible change from Alternative A			Middle of **Bright Angel Flight-free Zone** would remain quiet represented by **Grid Location Points 12 and 13** with negligible impacts and negligible change from Alternative A	
Central	Negligible	Negligible impacts with negligible change from Alternative A		Negligible impacts with short-term negligible to minor beneficial change from Alternative A		Negligible to minor adverse impacts with negligible change from Alternative A	
West End	Moderate adverse in areas near West End **Blue Direct** routes. In areas away from routes, impacts negligible to minor adverse	Minor adverse impacts with short-term minor to moderate beneficial change from Alternative A		Moderate adverse impacts with negligible to moderate adverse changes from Alternative A		Minor to moderate adverse impacts with negligible to minor beneficial change from Alternative A	

1 **TABLE 2.15 SOCIOECONOMIC ENVIRONMENT IMPACTS (TEN YEAR FORECAST)**

	Alternative A	Alternative E	Alternative F	NPS Preferred Alternative
Air-tour Operators	Baseline for comparison	Long-term moderate to major adverse impacts compared to Alternative A	Long-term minor to moderate adverse impacts compared to Alternative A	Long-term minor to moderate adverse impacts compared to Alternative A
Indian Tribes				
Hualapai Tribe	Baseline for comparison	Long-term negligible to minor beneficial impacts compared to Alternative A	Long-term negligible to minor beneficial impacts compared to Alternative A	Long-term negligible to minor beneficial impacts compared to Alternative A
Havasupai Tribe	Baseline for comparison	Long-term negligible to minor beneficial impacts compared to Alternative A	Long-term negligible to minor beneficial impacts compared to Alternative A	Long-term negligible to minor beneficial impacts compared to Alternative A
Navajo Nation	Baseline for comparison	Negligible impacts compared to Alternative A	Negligible impacts compared to Alternative A	Long-term minor to moderate beneficial impacts compared to Alternative A
General Aviation	Baseline for comparison	Long-term negligible to minor adverse impacts compared to Alternative A	Long-term negligible to minor adverse impacts compared to Alternative A	Long-term negligible to minor adverse impacts compared to Alternative A
Regional Economy	Baseline for comparison	Negligible impacts compared to Alternative A	Negligible impacts compared to Alternative A	Negligible impacts compared to Alternative A
Intrinsic Park Values	Baseline for comparison	Negligible impacts compared to Alternative A	Negligible impacts compared to Alternative A	Negligible impacts compared to Alternative A

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CHAPTER 3 AFFECTED ENVIRONMENT

INTRODUCTION

Chapter 3 describes conditions of those impact topics (Soundscape, Wilderness Character, Ethnographic Resources, Visitor Use and Experience, Wildlife, Special Status Species, and Socioeconomic Environment) potentially affected by Alternatives to manage air-tour flight operations and routes in the Grand Canyon National Park Special Flight Rules Area. The Affected Environment for this EIS includes the entire Special Flight Rules Area as described in Chapter 1's Scope of the Analysis. However for some topics, the Study Area is larger than the Special Flight Rules Area because impacts from air-tour management actions extend beyond the SFRA boundary. Discussion of each topic includes an overview of information and issues relevant to management of air-tour flight operations.

Impact topic descriptions provided in this Chapter serve as the baseline from which to compare potential effects of management actions considered in this EIS. Topics presented in this Chapter, and their organization, correspond to the impact analysis in Chapter 4, Environmental Consequences. Specific locations in the SFRA referred to in this Chapter are depicted in Map 2.1.

SOUNDSCAPE

This section provides an overview of Grand Canyon's affected Soundscape, the foundation for evaluating effects of Alternatives in Chapter 4 of this EIS. Natural Soundscape a national park resource, and provides a description of both natural and existing Soundscape in this section as they form the affected environment baseline for Chapter 4's impact analysis.

Soundscape Characteristics

Soundscape is defined by the NPS as the aggregate of all sounds in an area, both natural and human-made; the park's total acoustic environment. Contributing human-made sounds include cars traveling on roads, tourist buses idling, aircraft flying, visitors talking, hotel air conditioners humming, and so forth.

The natural Soundscape is the subset of the total Soundscape composed completely of natural sounds without human-made sounds (NPS 2006d). Physical and biological components such as wind, water, weather, birds, and insects create the natural Soundscape. The natural Soundscape can vary considerably among locations or times in a single location. At one end of the natural spectrum may be sounds associated with a severe thunderstorm; at the other, the absence of perceptible sound. Between these extremes an array of sound conditions varies moment to moment, season to season. These variations result from contributions of wind and its interaction with vegetation and irregular terrain; water as a result of movement in streams, rivers, rapids, and waterfalls; animals, whose sound can be nearly continuous, such as insects, or intermittent, such as birds and coyotes; and, more rarely, geological activity in the movement of earth and rock, such as landslides or rock falls.

Noise is sound that can degrade or mask the natural Soundscape. Sound can be perceived as noise due to loudness, frequency, duration, and occurrence at unwanted times or from an unwanted source, or because it interrupts or interferes with a desired activity. In a national park setting, noise is a subset of human-made sounds that may adversely affect park resources or visitor experiences by modifying or intruding on the natural Soundscape or by impeding or masking natural sounds (NPS 2006d). Noise may vary in character moment to moment, day to night, and season to season. Noise can distract visitors from enjoying park resources, purposes, and values; affect traditional cultural properties and the tranquility of historic park settings; and affect wildlife use patterns and daily life activities.

Sound is usually measured in a logarithmic scale using units called decibels (dB). Sound is composed of various frequencies, but the human ear does not respond to all frequencies. The A-weighted decibel scale (dBA) takes this into account by emphasizing frequencies between 1 kilo Hertz (kHz) and 6.3 kHz to simulate the relative response of human hearing. As an example, Table 3.1 shows a range of A-weighted decibel levels for recognizable sounds. The Soundscape also includes many sounds humans cannot hear, some of which must be measured using metrics other than A-weighted decibels.

TABLE 3.1 COMMON SOUND LEVELS

Sound Sources Measured in Parks	Other Common Sound Sources	dBA
Volcano crater, Haleakala National Park	Human breathing at 3m	10
Leaves rustling, Canyonlands National Park	Whispering	20
Crickets at five meters, Zion National Park	Residential area at night	40
Conversation at five meters, Whitman Missions National Historic Site	Busy restaurant	60
Snowcoach at thirty meters, Yellowstone National Park	Curbside of busy street	80
Thunder, Arches National Park	Jackhammer at 2m	100
Military jet at one hundred meters AGL, Yukon-Charley Rivers National Preserve	Automobile horn at 1m	120

Sound level of busy street (80 dBA), American Speech-Language Hearing Association, at http://www.asha.org/public/hearing/disorders/noise.htm
Whisper/normal breathing (20 dBA/10 dBA), residential area at night (40 dBA), automobile horn (Berger and Kladden 2005)
Busy restaurant (60 dBA): http://www.engineeringtoolbox.com/sound-power-level-d_58.html, and http://www.hearingclearly.com/audiograms-sound/; Jackhammer: http://www.hearingclearly.com/audiograms-sound/

Human hearing can usually perceive differences in sound levels of 3 dBA. A 10 dBA increase in sound level is typically perceived as being twice as loud, and a 10 dBA decrease as half as loud (Minnesota Pollution Control Agency 1999). For example, a 70 dBA sound level would be perceived by an average person as twice as loud as a 60 dBA sound. Individual dBA levels for different noise sources cannot be directly added to provide a combined sound level. For example, two noise sources producing equal dBA levels at a given location would produce a combined Average Sound Level 3 dBA greater than either sound alone. When two noise sources differ by 10 dBA, the combined Average Sound Level would be 0.4 dBA greater than the louder source alone (USFS 2007a).

Many factors affect how an individual responds to noise. Primary acoustical factors include sound level, its frequency and duration, whether the sound is steady or varying in frequency and sound level, and whether the sound carries information of interest to the individual. Non-acoustical factors also play a role in how an individual responds to sound. These factors vary from past experience and individual adaptability to the predictability of when a noise may occur. The listener's activity also affects how he/she responds to noise (Mestre Greve Associates 2005).

Natural Soundscape and Natural Quiet

The concept of **natural quiet** as applied to Grand Canyon is discussed in Chapter 1. Natural quiet is synonymous with the terms **Natural Soundscape** and the more technical **natural ambient sound;** natural ambient sound is the more appropriate term because nature is often not quiet (i.e., thunderstorms, wind, etc.). Natural Soundscape protection in national parks is required by law and policy.[20] Grand Canyon is noted for its rich sound environment and unusual and noticeable natural quiet. A management objective in Grand Canyon National Park's 1995 General Management Plan states, "Protect the natural quiet and solitude of the park, and mitigate or eliminate the effects of activities causing excessive or unnecessary noise in, over, or adjacent to the park."

An important part of the NPS mission is preserving park resources and values unimpaired, including natural Soundscapes (NPS 2006b Section 1.4.6). As defined by NPS Management Policies 2006, Section 4.9, park natural Soundscape resources encompass all natural sounds that occur in parks, including the physical capacity for transmitting natural sounds and the interrelationships among park natural sounds of different frequencies and volumes. Natural sounds occur within and beyond the range of sounds humans can perceive, and they can be transmitted through air, water, and solid materials. Management policies require NPS to preserve, to the greatest extent possible, the natural Soundscapes of the national parks, and to restore to the natural condition wherever possible those park Soundscapes that have become degraded by unnatural sounds (i.e., noise). The policy also requires NPS to protect natural Soundscapes from unacceptable impacts. According to NPS Management Policies 2006, Section 1.4.7.1, these are impacts that, individually or collectively, would unreasonably interfere with the atmosphere of peace and tranquility, or the natural Soundscape maintained in Wilderness and natural, historic, or commemorative park locations.

[20] The 1975 Grand Canyon National Park Enlargement Act, the 1987 National Parks Overflights Act, the 1995 Grand Canyon General Management Plan, the National Parks Air Tour Management Act of 2000, and NPS Management Policies 2006 (Sections 1.4.6, 1.4.7.1, 4.9, and 8.2.3)

In addition to being considered a park resource and value, natural sounds are also a key contributor to the visitor experience (e.g., visitors listening to elk bugling or waterfalls or simply sitting quietly watching sunrise or sunset). Thus, Soundscape preservation and noise management are important components of achieving the NPS mission of preserving park resources unimpaired for the enjoyment of future generations.

NPS Management Policies 2006, Section 4.9, requires the NPS identify what levels and types of unnatural sound constitute acceptable impacts on park natural Soundscapes, and take action to prevent or minimize all noise that through frequency, magnitude, or duration adversely affects natural Soundscape or other park resources or values, or that exceeds levels identified through monitoring as being acceptable to or appropriate for visitor uses at monitored sites (NPS 2006d). Grand Canyon offers a wide range of natural and human-influenced Soundscapes that vary widely in a complex interaction of factors such as sound source, distance, park location, timing, and physical conditions (such as weather and terrain). For example, sound conditions are very different between remote backcountry locations and the visitor center parking lot.

Natural Ambient Sound Levels

Natural ambient sound levels include all natural sounds in a given area, excluding all mechanical, electrical and other human-caused sounds.

Existing ambient sound levels include all natural and non-natural sounds.

To assess progress in substantial restoration of natural quiet, Grand Canyon National Park has been the subject of numerous studies, investigations, and monitoring efforts to identify and characterize natural ambient and existing sound levels throughout the park.[21] These studies show natural ambient sound levels vary considerably throughout the SFRA by location and time, but there are areas with similar acoustic qualities (i.e., acoustic zones) that correspond to major vegetation types in the area. Map 3.1 shows acoustic zones corresponding to major SFRA vegetation types, along with natural ambient sound levels corresponding to these acoustic zones.

Maps 3.1 and 3.2 show the 127 SFRA Location Points[22] used in noise modeling referred to in Table 3.2 and Chapter 4's impact analysis.[23]

Additionally, Map 3.1 shows natural ambient sound levels that form the basis of the Percent Time Audible calculations performed in Chapter 4's noise modeling; dBA values shown are based on best available data in 2005 (the Base Year for data used in noise modeling (including aircraft operations) for this EIS).[24] The 2005 natural

[21] Studies include Ambrose 2006, HMMH 1993, NPS 2007c, NPS 2007d, NPS 2008a

[22] As further described in Appendix D, 127 Location Points were selected by the NPS for EIS noise modeling. NPS selected 25 Location Points (GC008-GC033) corresponding to monitoring sites where acoustic data was collected. Other named points were selected as representative locations for visitor experience and/or park resources (e.g., Wilderness Character, Ethnographic Resources, and Wildlife). Additionally, Location Points GRID01 through GRID36 were selected based on a ten-kilometer grid to provide spatial coverage throughout the park

[23] Chapter 4's impact analysis is based, to large extent, on noise modeling results conducted for this EIS by the Department of Transportation, Volpe Center, using FAA's Integrated Noise Model (INM). See Appendix D for further discussion of the noise model and modeling performed for this EIS. As part of noise modeling, both a Location Point analysis and a Contour Analysis were performed. Contour Analysis involved additional GIS analysis of modeling results to provide percentages of the entire park and SFRA within specified results for Percent Time Audible and Average Sound Level from the model. Location Point results were calculated directly in noise model software using geographical coordinates of the points, and represent specific points rather than broad areas (e.g., the point may be at the bottom of a narrow canyon which would probably not be similar to results from a point on a nearby ridge). Contour data represents broad areas rather than specific points (i.e., data for a specific point within a contour area may not show the same result as the contour area due to size and level of resolution of contour area). The analyses are used together in considering the complex noise environment in Grand Canyon

[24] Base Year 2005 is the Base Year for noise modeling in this EIS. The best available data as of the end of 2005 is used as the base for noise modeling for the Alternatives. Since 2005, the 2005 database has been checked against data from subsequent years, and although there are some differences, given all factors contributing to those differences, the 2005 database has proven consistent enough to continue as a reasonable base for evaluating impacts of the Alternatives in this EIS

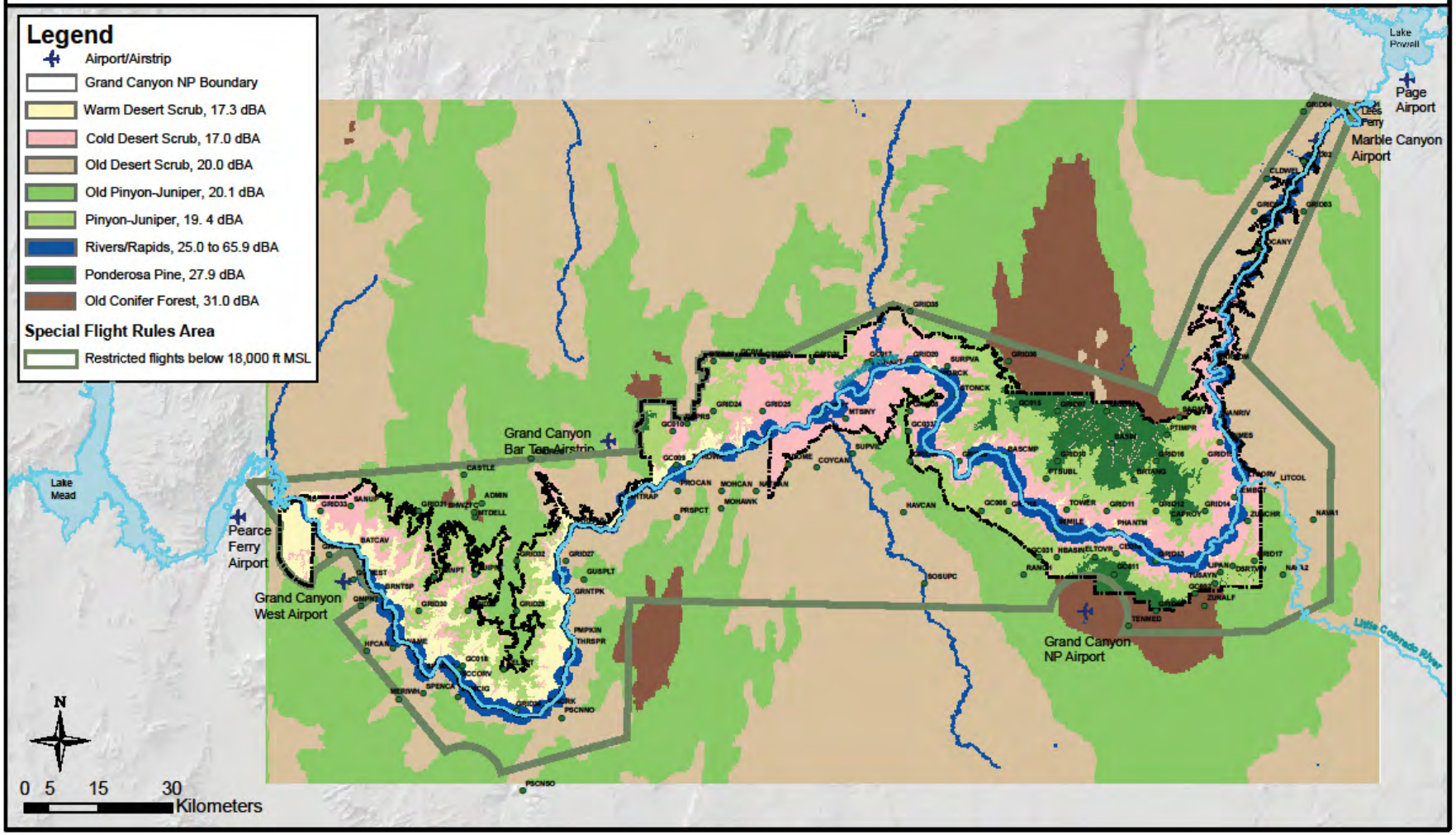
ambient data are shown for the four most common park vegetation types: piñon-juniper (33% of the park), cold desert scrub (30% of the park), warm desert scrub (12% of the park), and ponderosa pine forests (10% of the park) (NPS 2007d). A river/rapids acoustic zone is also shown in Map 3.1 with a range of sound levels related to the Colorado River in GCNP (the river/rapids area shown is approximately 12% of the park). In addition, there are three vegetation types shown on Map 3.1 outside GCNP (i.e., old piñon-juniper woodland, old desert scrub, and old conifer forest).

Table 3.2 shows, under the heading Natural Ambient Used in EIS Noise Modeling, natural ambient sound levels from Map 3.1 were adjusted[25] for use in EIS noise modeling. The 2005 database was used to ensure consistency and avoid the very substantial time and expense needed to re-run noise modeling for already-modeled Alternatives as new data accrued and new Alternatives were developed.

During EIS preparation, park staff collected additional data on natural ambient sound levels and human noise sources in Grand Canyon's backcountry areas (NPS 2006a, 2007c and 2007d). Results of the backcountry sound monitoring are shown in Table 3.2 under the heading Updated Natural Ambient. Chapter 4's noise modeling results are interpreted with differences between 2005 and updated data sets in mind.

[25] As noted in Table 3.2, 10dB were added to natural ambient levels in approximately one-third of the park as explained further in Chapter 4, Methodology and 64 Federal Register 3969. Park Management Zones are an important part of context for some impact topics. As described in Chapter 3, Visitor Use and Experience, park Management Zones considered in this EIS are Wilderness, Non-Wilderness, and Developed. In general, impact analyses take into consideration that more noise sources are present and that more noise impact from all sources (including aircraft) is accepted in the Developed Zone (about 2% of the park) than other zones based on zone management objectives. Noise modeling for this EIS uses a Dual-zone System (Audibility and Detectability) that generally addresses different management objectives for different park Management Zones. Specifically, for Detectability Zone areas (approximately 66% of the park), natural ambient sound levels were used directly in computing audibility in the noise model. For areas in the Noticeability Zone (approximately 34% of the park), 10 dB were added to natural ambient sound levels in the noise model to account for factors such as increased visitor activity and presence of non-natural sound sources. For reasons explained in the 1999 Federal Register Notice, when NPS and FAA agreed to use the Dual-zone System for modeling at GCNP, the Developed Zone (including South and North Rim developed areas), GCNP's West End, and Marble Canyon are in the Noticeability Zone

Map 3.1 Natural Ambient Sound Levels and Location Points



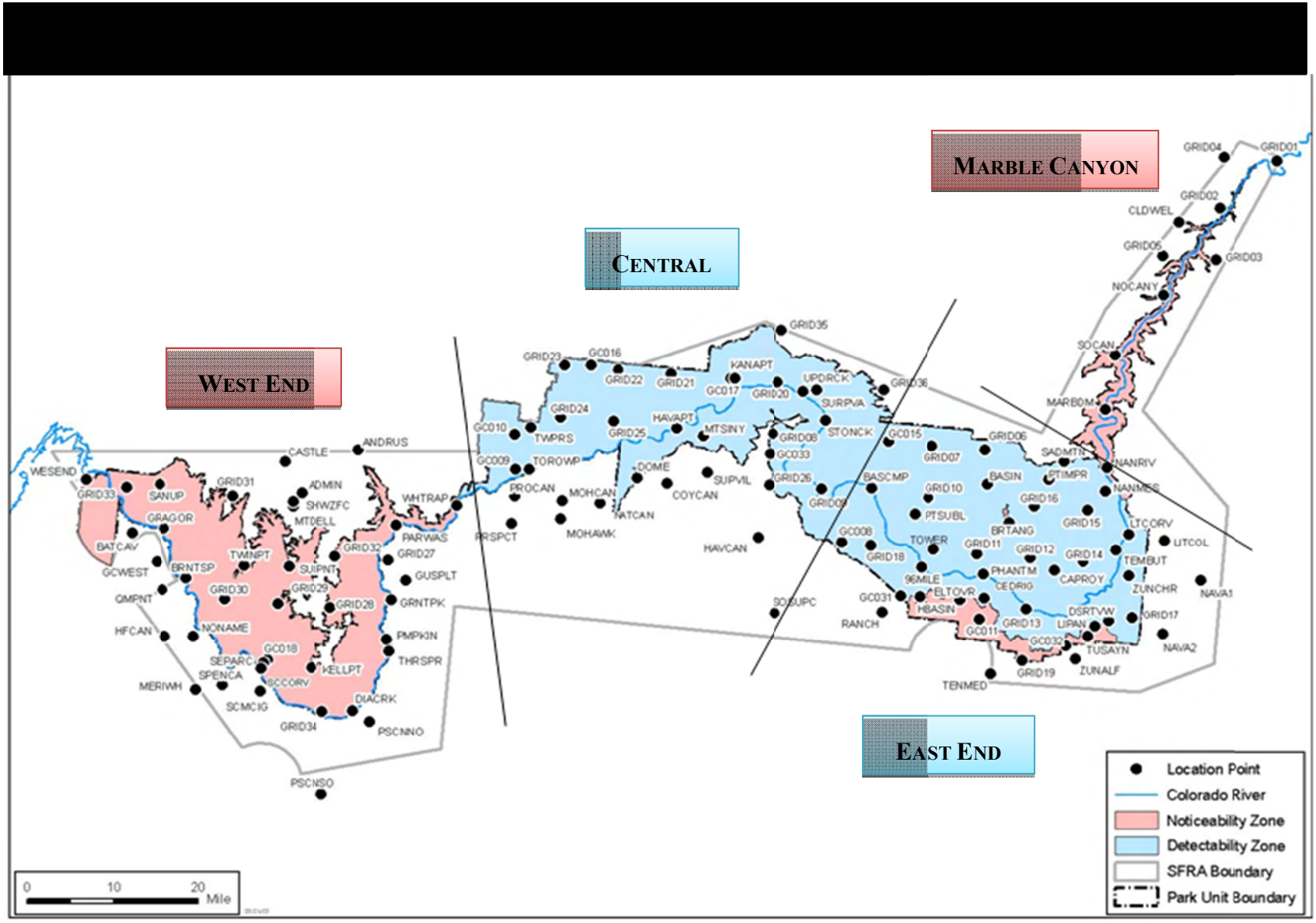

MARBLE CANYON
CENTRAL
WEST END
EAST END
Location Point
Colorado River
Noticeability Zone
Detectability Zone
SFRA Boundary
Park Unit Boundary
0
10
20
Mile

TABLE 3.2 NATURAL AMBIENT SOUND LEVELS BY LOCATION POINT

Location Point Name	Point ID[a]	Vegetation/Ambient Type[bc]	Natural Ambient Used in EIS Noise Modeling (dBA)[de]	Updated Natural Ambient[f] (dBA)
96 Mile Camp	96MILE	River/rapids	25.0 to 65.9	Same
NPS Administration site*	ADMIN	Old PJ	20.1 (+ 10 dBA)*	20.0
Andrus Canyon*	ANDRUS	Old PJ	20.1 (+ 10 dBA)*	20.0
Bass Camp	BASCMP	River	25.0 to 65.9	Same
The Basin	BASIN	CDS	17.0	18.2
Bat Cave*	BATCAV	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Burnt Springs Canyon*	BRNTSP	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Bright Angel Point	BRTANG	Ponderosa	27.9	22.8
Cape Royal	CAPROY	Ponderosa	27.9	22.8
Castle Peak*	CASTLE	Old PJ	20.1 (+ 10 dBA)*	20.0
Cedar Ridge	CEDRIG	PJ	19.4	20.0
Cliff Dwellers Lodge	CLDWEL	WDS	17.3	18.5
Coyote Canyon	COYCAN	ODS	20.0	Same
Diamond Creek*	DIACRK	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Desert View*	DSRTVW	PJ	19.4 (+ 10 dBA)*	20.0
El Tovar*	ELTOVR	Ponderosa	27.9 (+ 10 dBA)*	22.8
Pasture Wash	GC008	CDS/PJ	17.0 to 19.6	18.2 to 20.0
Tuweep	GC009	WDS	17.3	18.5
Tuweep	GC010	CDS	17.0	18.2
South Rim*	GC011	Ponderosa	27.9 (+ 10 dBA)*	22.8
Rainbow Plateau	GC015	Ponderosa	27.9	22.8
Hancock Knolls	GC016	PJ	19.4	20.0
1 km W of Kanab Point	GC017	CDS	17.0	18.2
Separation Canyon*	GC018	WDS	17.3 (+ 10 dBA)*	18.5
Eremita Mesa	GC031	PJ	19.4	20.0
1.5 km SE of Moran Point*	GC032	PJ	19.4 (+ 10 dBA)*	20.0
Fossil Canyon	GC033	PJ	19.4	20.0
Grand Canyon West*	GCWEST	ODS	20.0 (+ 10 dBA)*	Same
Granite Gorge*	GRAGOR	ODS	20.0 (+ 10 dBA)*	Same
Grid Location Point 1*	GRID01	River/Rapids or ODS	25.0 to 65.9, or 20.0 (+ 10 dBA)*	Same
Grid Location Point 2*	GRID02	River/Rapids or ODS	25.0 to 65.9, or 20.0 (+ 10 dBA)*	Same
Grid Location Point 3*	GRID03	ODS	20.0 (+ 10 dBA)*	Same
Grid Location Point 4*	GRID04	ODS	20.0 (+ 10 dBA)*	Same
Grid Location Point 5*	GRID05	ODS	20.0 (+ 10 dBA)*	Same
Grid Location Point 6	GRID06	CDS/Ponderosa	17.0 to 27.9	18.2 to 22.8
Grid Location Point 7	GRID07	Ponderosa	27.9	22.8
Grid Location Point 8	GRID08	CDS	17.0	18.2
Grid Location Point 9	GRID09	CDS/WDS	17.0 to 17.3	18.2 to 18.5
Grid Location Point 10	GRID10	Ponderosa	27.9	22.8
Grid Location Point 11	GRID11	CDS	17.0	18.2
Grid Location Point 12	GRID12	PJ	19.4	20.0
Grid Location Point 13	GRID13	River/Rapids	25.0 to 65.9	Same
Grid Location Point 14	GRID14	PJ	19.4	20.0
Grid Location Point 15	GRID15	CDS/PJ	17.0 to 19.4	18.2 to 20.0
Grid Location Point 16	GRID16	PJ/Ponderosa/PJ	19.4 to 27.9	20.0 to 22.8
Grid Location Point 17	GRID17	PJ	19.4	20.0
Grid Location Point 18	GRID18	PJ	19.4	20.0
Grid Location Point 19*	GRID19	Ponderosa/Old Conifer Forest	27.9 or 31.0 (+ 10 dBA)*	22.8
Grid Location Point 20	GRID20	River/Rapids	25.0 to 65.9	Same
Grid Location Point 21	GRID21	CDS	17.0	18.2
Grid Location Point 22	GRID22	CDS	17.0	18.2
Grid Location Point 23	GRID23	CDS/PJ	17.0 to 19.4	18.2 to 20.0
Grid Location Point 24	GRID24	PJ	19.4	20.0

TABLE 3.2 NATURAL AMBIENT SOUND LEVELS BY LOCATION POINT

Location Point Name	Point ID[a]	Vegetation/Ambient Type[bc]	Natural Ambient Used in EIS Noise Modeling (dBA)[de]	Updated Natural Ambient[f] (dBA)
Grid Location Point 25	GRID25	CDS	17.0	18.2
Grid Location Point 26	GRID26	PJ/Old PJ	19.4 or 20.1	20.0
Grid Location Point 27*	GRID27	ODS	20.0 (+ 10 dBA)*	Same
Grid Location Point 28*	GRID28	Old PJ	20.1 (+ 10 dBA)*	20.0
Grid Location Point 29*	GRID29	CDS/PJ	17.0 to 19.4 (+ 10 dBA)*	18.2 to 20.0
Grid Location Point 30*	GRID30	PJ	19.4 (+ 10 dBA)*	20.0
Grid Location Point 31*	GRID31	Old PJ	20.1 (+ 10 dBA)*	20.0
Grid Location Point 32*	GRID32	Old PJ	20.1 (+ 10 dBA)*	20.0
Grid Location Point 33*	GRID33	CDS	17.0 (+ 10 dBA)*	18.2
Grid Location Point 34*	GRID34	River	25.0 to 65.9 (+ 10 dBA)*	Same
Grid Location Point 35	GRID35	ODS	20.0	Same
Granite Peak*	GRNTPK	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Gus Plateau*	GUSPLT	Old PJ	20.1 (+ 10 dBA)*	20.0
Havasu Point	HAVAPT	River/Rapids	25.0 to 65.9	Same
Havatagvitch Canyon	HAVCAN	ODS	20.0	Same
Hermit Basin*	HBASIN	PJ	19.4 (+ 10 dBA)*	20.0
Horse Flat Canyon*	HFCAN	ODS	20.0 (+ 10 dBA)*	Same
Kanab Point	KANAPT	CDS/PJ	17.0 to 19.4	18.2 to 20.0
Kelly Point*	KELLPT	Old PJ	20.1 (+ 10 dBA)*	20.0
Lipan Point*	LIPAN	PJ	19.4 (+ 10 dBA)*	20.0
Little Colorado	LITCOL	ODS	17.0	18.2
Little Colorado River	LTCORV	River/Rapids	25.0 to 65.9	Same
Marble Canyon Dam Site*	MARBDM	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Meriwhitca*	MERIWH	ODS	17.0 (+ 10 dBA)*	Same
Mohawk Canyon	MOHAWK	ODS	17.0	Same
Mohawk Canyon	MOHCAN	ODS	17.0	Same
Mt. Dellenbaugh*	MTDELL	Old Conifer Forest	31.0 (+ 10 dBA)*	22.8
Mt. Sinyala	MTSINY	CDS	17.0	18.2
Nankoweap Mesa	NANMES	CDS	17.0	18.2
Nankoweap River	NANRIV	River/Rapids	25.0 to 65.9	Same
National Canyon	NATCAN	ODS	17.0	Same
Navajo 1	NAVA1	ODS	17.0	Same
Navajo 2	NAVA2	Old PJ	20.1	20.0
North Canyon*	NOCANY	CDS	17.0 (+ 10 dBA)*	18.2
Jackson Canyon*	NONAME	ODS	20.0 (+ 10 dBA)*	Same
Parashant Wash*	PARWAS	River	25.0 to 65.9 (+ 10 dBA)*	Same
Phantom Ranch	PHANTM	WDS	17.3	18.2
Pumpkin Springs*	PMPKIN	River/rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Prospect Canyon	PROCAN	ODS	20.0	Same
Prospect Canyon	PRSPCT	ODS	20.0	Same
Peach Spring Canyon N*	PSCNNO	ODS	20.0 (+ 10 dBA)*	Same
Peach Spring Canyon S*	PSCNSO	ODS/Old PJ	20.0 or 20.1 (+ 10 dBA)*	20.0
Point Imperial	PTIMPR	Ponderosa	27.9	22.8
Point Sublime	PTSUBL	PJ	19.4	20.0
Quartermaster Point*	QMPNT	ODS	17.0 (+ 10 dBA)*	Same
The Ranch	RANCH	Old PJ	20.1	20.0
Saddle Mountain*	SADMTN	Old Conifer Forest	31.0 (+ 10 dBA)*	22.8
Sanup*	SANUP	CDS	17.0 (+ 10 dBA)*	18.2
Separation Canyon 1km N of Colorado River*	SCCORV	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Spencer/Meriwhitca Canyons*	SCMCIG	ODS	20.0 (+ 10 dBA)*	Same
Separation Canyon at Colorado River*	SEPARC	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same

TABLE 3.2 NATURAL AMBIENT SOUND LEVELS BY LOCATION POINT

Location Point Name	Point ID[a]	Vegetation/Ambient Type[bc]	Natural Ambient Used in EIS Noise Modeling (dBA)[de]	Updated Natural Ambient[f] (dBA)
Shivwits Fire Camp*	SHWZFC	Old Conifer Forest	31.0 (+ 10 dBA)*	22.8
South Canyon*	SOCAN	CDS	17.0 (+ 10 dBA)*	18.2
South Supai Canyon	SOSUPC	ODS	20.0	Same
Spencer Canyon*	SPENCA	ODS	20.0 (+ 10 dBA)*	Same
Stone Creek	STONCK	River/Rapids	25.0 to 65.9	Same
Suicide Point*	SUIPNT	Old PJ	20.1 (+ 10 dBA)*	20.0
Supai Village	SUPVIL	ODS	20.0	Same
Surprise Valley	SURPVA	CDS	17.0	18.2
Temple Butte	TEMBUT	CDS	17.0	18.2
Three Springs*	THRSPR	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Toroweap Overlook	TOROWP	WDS	17.3	18.5
Tower of Ra	TOWER	PJ	19.4	20.0
Tusayan Museum *	TUSAYN	PJ	19.4 (+ 10 dBA)*	20.0
Twin Point*	TWINPT	ODS	20.0 (+ 10 dBA)*	Same
Tuweep Ranger Station	TWPRS	CDS	17.0	18.2
Upper Deer Creek	UPDRCK	WDS	17.3	18.5
West End*	WESEND	WDS	17.3 (+ 10 dBA)*	18.5
Whitmore Rapids*	WHTRAP	River/Rapids	25.0 to 65.9 (+ 10 dBA)*	Same
Zuni Alpha	ZUNALF	Old Conifer Forest	31.0	22.8
Zuni Charlie	ZUNCHR	CDS	17.0	18.2

[a]Point ID shows identification codes for Location Points, and are the same codes shown in Map 3.1. The codes were also used in EIS noise modeling

[b]As shown also in Map 3.1, River/Rapids Location Points have a dBA range because the database used for River/Rapids did not identify which points are close to large noisy rapids and which are near quieter running water. Some other Location Points show a range because the point is on the edge of two vegetation/ambient types

[c]Codes used for vegetation/ambient types are ponderosa pine forest (Ponderosa); piñon-juniper woodland (PJ); old piñon-juniper woodland (Old PJ); warm desert scrub (WDS); cold desert scrub (CDS); old desert scrub (ODS); old conifer forest (Old Conifer Forest); River/Rapids

[d]In the column Natural Ambient Used in EIS Noise Modeling, the values shown were used in EIS audibility calculations in the integrated noise model (INM), and are based on best available data in 2005, with the following exception: points identified with an asterisk (*) had 10 dBA added in the noise model calculation as shown in the table and as explained in Footnote 20 and Chapter 4, Methodology

[e]dBA is A-weighted decibels. A-weighting is commonly used where human hearing is important as it emphasizes the same portions of the sound frequency spectrum as does the human ear

[f]Updated values are from 2007 monitoring reports (NPS 2007c, NPS 2007d), except for River/Rapids which those studies did not update. Also, ODS was not updated since the vegetation map outside the park was not split into cold and warm desert scrub, and there was no new data to update ambient for those areas. However, Old Conifer Forest and Old PJ vegetation types were known to the NPS EIS team to be essentially the same vegetation respectively as Ponderosa and PJ inside the park. So natural ambient values for Old Conifer Forest and Old PJ were updated to the same as the Ponderosa and PJ vegetation types inside the park

[*]For noise modeling purposes, 10 dBA was added to 2005 natural ambient sound levels for Location Points marked with an asterisk (*), as part of dual-zone modeling explained in Footnote 29 and Chapter 4, Methodology

Existing Noise Environment (Existing Ambient Soundscape)

As mentioned above, Soundscape can include both natural and non-natural (i.e., human) components. The above discussion described natural Soundscape, which NPS policy considers the baseline condition against which current conditions in a Soundscape will be measured and evaluated (NPS 2006b, 8.2.3). However, NPS policy (NPS Director's Order 2, Park Planning) also requires NPS to divide the park into Management Zones, and to define zone management objectives in such a way that different types and levels of impact are considered acceptable in different zones. In the case of Soundscape, the zone definition for the Developed Zone (approximately 2% of the park) allows many more human noise sources, and considers much more noise impact acceptable than in the Wilderness Zone (approximately 94% of the park), with the Non-Wilderness Zone (approximately 4% of the park) in between the other two but closer to Wilderness Zone than Developed Zone objectives.

During summer and winter 2007 to 2008, NPS monitored sound in GCNP frontcountry areas (NPS 2008a). Existing ambient sound levels in Table 3.3 are L_{50} (median)[26] sound levels at those sites, and include natural sounds plus non-natural sounds (i.e., human-caused noise), including aircraft overflights.

TABLE 3.3 EXISTING AMBIENT SOUND LEVELS (NATURAL PLUS NON-NATURAL) FOR SUMMER AND WINTER AT SELECTED GCNP FRONTCOUNTRY LOCATIONS 2007–2008[a]

Location[b]	L_{50} (Median) Sound Levels (dBA)[c] 7a.m – 7p.m.		L_{50} (Median) Sound Levels (dBA)[c] Midnight-Midnight		Activity Type
	Summer	Winter	Summer	Winter	
Mather Campground	41.3	37.9	39.7	34.1	Campground
Village Loop Rd, West End	56.6	55.8	51.6	51.2	High-use Area
Yaki Point	31.8	29.0	31.4	26.8	Overlook
South Kaibab Trailhead	35.4	32.3	36.7	30.4	Overlook/Trailhead
Mather Point Parking Lot	52.3	52.9	48.1	46.5	Overlook
Desert View Drive, Mile 251	41.3	32.6	36.9	28.7	Road
Bright Angel Trail, 3.7 Mile	23.7	22.3	27.3	21.3	Corridor Trail
Desert View, Parking Lot	47.3	40.2	41.9	36.1	High-use Area
South Rim, Residential Area (NPS)	36.7	36.3	35.2	34.7	Residential
North Kaibab Trailhead	42.7	NA	50.5	NA	Trailhead
North Rim Campground	35.9	NA	34.8	NA	Campground
Cape Royal	27.3	NA	27.9	NA	Overlook
Point Imperial	31.4	NA	32.0	NA	Overlook
North Rim Entrance Road	37.3	25.5	33.2	24.1	Road
Tuweep Campground/ Overlook	28.3	22.7	30.7	21.6	Campground

Source: NPS 2008a

[a]With the exception of the Bright Angel Trail, 3.7 Mile location, all frontcountry locations in this table are in the Developed Zone as defined for this EIS

[b]Locations shown in these tables are not necessarily the same location as any Location Points with similar name in Table 3.2 due to different times Location Points (Map 3.2) were selected and studies conducted

[c]L_{50} dBA values represent sound pressure level, in A-weighted decibels, of all sounds (L) (natural plus non-natural) exceeded 50% of the time during the studied time period (i.e., the median)

During busy visitation periods in Developed Zones, it can be difficult to find times and places when and where natural Soundscape is not affected by human noise sources to some extent, even if aircraft are excluded as a human noise source. However, even the Developed Zone is diverse enough that natural Soundscape can be experienced unaffected by human noise sources some times in some places, especially if aircraft are excluded. The studies cited above (NPS 2007 c,d) along with a later study (NPS 2008a) determined natural ambient sound levels when human noise sources were not present, and when they were. Study results, in terms of both natural and human sounds, are shown in Tables 3.3 to 3.6. Results show types of human noise sources and times when human noise sources were present were generally much more numerous in the Developed Zone than in the Wilderness Zone. Results also show there are probably no places, even in the most remote portions of the Wilderness Zone, where aircraft noise does not affect natural Soundscape at least some of the time.

In the GCNP frontcountry study (NPS 2008a), non-natural sounds (vehicles, buildings operations, construction, and maintenance) were audible nearly all the time during the day at high-use frontcountry sites, and about half the day at low-use frontcountry sites. It should be noted that frontcountry sites are less than 6% of the park. Sound levels were loudest in high-use areas such as Village Loop Road, near the popular Bright Angel Lodge and Hermit Road interchange. Sound levels were lowest in less visited areas, such as below the rim 3.7-miles down Bright Angel

[26] In acoustics, L_x values are called exceedance values because they are values exceeded x percent of the time of interest. L_{50} values in these tables are values exceeded 50% of the time during the measurement period(s) at the site. As such, L_{50} values are also the median value of the data

Trail. Winter sound levels were lower than summer levels in park frontcountry and backcountry areas. In frontcountry areas, vehicles were the single sound source contributing most to higher sound levels and higher percent time non-natural sounds were audible (Table 3.4). At low-use frontcountry sites, aircraft were the single source contributing the most non-natural sounds to the Soundscape (Table 3.5). At backcountry sites, aircraft contributed almost all non-natural sounds (Table 3.6).

In high-use frontcountry areas, non-natural sounds were audible 79.5% of the 24-hour day in summer, and 72.9% in winter. In low-use frontcountry areas, non-natural sounds were audible 42.1% of the 24-hour day in summer, and 31.2% in winter. At locations with the highest number of visitors and activities, human-caused sounds were audible nearly 100% of the time summer and winter. The most common audible human-caused sounds were vehicle-related (driving, idling, horns, and alarm systems). Other audible human-caused sounds were aircraft, people (talking, walking), buildings (doors, air conditioners, and heating units), ground-care activities (trash can lids), other mechanized sounds (generators), and domestic animals. The most common natural sounds in both high-use and low-use frontcountry areas were wind-related (wind through vegetation) and birds and insects (primarily in summer). Other audible natural sounds included mammals, water (rain, snow), and thunder.

Outside GCNP within the SFRA, sound sources in NPS, USFS, BLM, and tribal lands are expected to be similar to ambient conditions presented in Tables 3.3 to 3.6 for similar frontcountry and backcountry sites in the park.

TABLE 3.4 AVERAGE PERCENT TIME AUDIBLE OF SOUND SOURCES HIGH-USE FRONTCOUNTRY AREAS

Audible Sound Sources		Percent Time Audible 7a.m.-7p.m.		Percent Time Audible Midnight-Midnight	
		Summer	Winter	Summer	Winter
No Sound Audible		0.1	1.2	0.5	4.3
Total Aircraft		14.1	22.1	11.7	19.6
	Aircraft	0.9	1.5	0.5	0.8
	Jet Aircraft	9.0	17.7	8.7	17.0
	Propeller Aircraft	2.1	1.2	1.2	0.8
	Helicopter	2.3	1.9	1.3	1.0
Total Road Vehicles		77.1	66.3	58.5	46.1
Total Non-Natural		92.1	88.2	79.5	72.9
	People	40.5	18.7	28.3	10.9
	Building Sounds	3.9	0.6	10.4	4.6
Total Natural		81.4	65.8	82.4	63.1
	Wind	36.3	41.6	45.3	48.0
	Water (rain, snow)	2.0	15.5	2.6	12.6
	Thunder	1.4	0.0	0.8	0.0
	Bird	70.2	28.5	46.9	16.9
	Insect	7.3	5.3	17.9	7.2

Source: NPS 2008a

Noise Effects Associated with Aircraft Overflights

Although GCNP includes a wide variety of human noise sources, aircraft sound is the dominant human noise source present in the park because, unlike any other noise source, aircraft move quickly over the entire park while most other noise sources are confined to limited areas such as developed areas or roads. Natural Soundscapes throughout GCNP are affected by aircraft noise from a variety of overflight sources. These include high-altitude, commercial jet traffic; military aircraft traffic; general aviation; NPS administrative operations, such as emergency response and facility maintenance; and commercial air tours. In the 1987 Overflights Act (Public Law 100-91), Section 3(a), Congress found that "[n]oise associated with aircraft overflights at the Grand Canyon National Park is causing a significant adverse effect on the natural quiet and experience of the park."

TABLE 3.5 AVERAGE PERCENT TIME AUDIBLE OF SOUND SOURCES AT TWO LOW-USE FRONTCOUNTRY AREAS (BRIGHT ANGEL TRAIL AND TUWEEP CAMPGROUND)

Audible Sound Sources		Percent Time Audible 7a.m.-7p.m.		Percent Time Audible Midnight-Midnight	
		Summer	Winter	Summer	Winter
No Sound Audible		0.3	13.4	0.3	21.9
Total Aircraft		30.3	36.9	23.3	25.7
	Aircraft	4.4	0.8	2.8	0.5
	Jet Aircraft	19.7	32.2	16.5	23.3
	Propeller Aircraft	5.8	2.6	3.8	1.3
	Helicopter	0.3	1.5	0.2	0.7
Total Road Vehicles		4.5	1.3	3.3	0.6
Total Non-Natural		53.5	47.5	42.1	31.2
	People	29.3	13.1	21.6	6.5
	Building Sounds	1.1	0.2	1.6	0.1
Total Natural		94.1	57.8	96.6	59.0
	Wind	74.7	45.0	62.9	51.3
	Water (rain, snow)	1.9	0.0	0.9	0.0
	Thunder	0.0	0.0	0.0	0.0
	Bird	52.6	29.1	42.3	16.5
	Insect	28.0	3.4	59.2	1.9

Source: NPS 2008a

TABLE 3.6 PERCENT TIME AUDIBLE FOR NON-NATURAL AND NATURAL SOUNDS, DAYTIME HOURS (7A.M.-7P.M.), FOR SUMMER 2006 REPLICATE AND 2005 ORIGINAL SITES

Site	Non-Natural Sounds 2006 (2005)	All Aircraft 2006 (2005)	Jets 2006 (2005)	Propeller and/or Helicopter 2006 (2005)	Natural Sounds 2006 (2005)
Ponderosa Pine	34.7 (47.7)	34.7 (36.7)	30.5 (21.8)	3.3 (11.9)	99.6 (99.8)
Piñon-Juniper*	NA (51.9)	NA (49.4)	NA (43.0)	NA (4.9)	NA (95.1)
Cold Desert Scrub	43.2 (40.0)	43.0 (39.4)	39.2 (33.6)	2.8 (4.2)	89.6 (95.0)
Warm Desert Scrub	38.5 (33.4)	38.4 (33.1)	32.7 (22.2)	3.5 (9.7)	99.8 (92.9)

*No recordings were available for the 2006 piñon-juniper site due to monitoring equipment problems
Source: NPS 2007d

As shown in Table 3.4, at high-use frontcountry sites road vehicles were the greatest audible non-natural sound source, followed by aircraft (jets, propeller planes, and helicopters). At low-use frontcountry sites (Table 3.5), total aircraft sounds were by far the most frequent non-natural sound source (NPS 2008a).

While aircraft are still audible in most frontcountry areas (high commercial jet traffic at all locations plus air tour aircraft in some locations), at many frontcountry locations aircraft sounds were often masked by the higher sound levels of road vehicles and other sources. Many aircraft sounds occur in the same frequency bands as motor and vehicle sounds, which tend to add to the masking effect. In addition, while aircraft were more audible in winter than summer, this is not due to a higher number of flights, but rather due to lower existing ambient sound levels in winter allowing aircraft to be audible more often (NPS 2008a).

At all of the backcountry sites (Table 3.6), almost all non-natural sounds were caused by aircraft during daytime hours (NPS 2007d). At all sites, natural sounds were heard a majority of the time (89.6% to 99.8% of daytime

hours), despite non-natural sounds audible 33.4% to 51.9% of daytime hours.[27] Aircraft (specifically jets and propeller planes) were the only non-natural sounds heard at all backcountry sites. Commercial high altitude jet aircraft were audible at all frontcountry and backcountry locations in all three Management Zones (Developed, Non-Wilderness, and Wilderness). Even at locations in Flight-free Zones, air tour aircraft are often audible due to the distances aircraft noise can travel in the Grand Canyon environment.

See Chapter 4 for a discussion of current impacts from aircraft overflights in Alternative A, No Action.

WILDERNESS CHARACTER

Introduction

The 1964 Wilderness Act defines Wilderness as

> *A Wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of Wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.*

The 1964 Wilderness Act does not set expectations for Soundscape conditions in Wilderness areas. However, Wilderness Character is expressed through suitability criteria in section 6.2.1.1 of Management Policies (NPS 2006b) used by the NPS to determine whether lands are eligible for Wilderness designation.

Management Policies also directs that

> *The National Park Service will take no action that would diminish the Wilderness suitability of an area possessing Wilderness Characteristics until the legislative process of Wilderness designation has been completed. Until that time, management decisions pertaining to lands qualifying as Wilderness will be made in expectation of eventual Wilderness designation.*

Grand Canyon National Park Wilderness

Ninety-four percent of GCNP has been proposed for inclusion in the National Wilderness Preservation System (NPS 1993). The GCNP Proposed Wilderness is primarily inner canyon and rim areas, and does not include developed areas or the Cross-Canyon (trail) Corridor. Map 3.3 shows areas proposed for Wilderness designation in relation to current air-tour routes.

The 1993 Final GCNP Wilderness Recommendation included two units totaling 1,139,077 acres. Of this, 1,109,257 acres were proposed for immediate Wilderness designation; and 29,820 acres were proposed for designation as Potential Wilderness. Potential Wilderness areas include places that do not qualify for immediate designation as Wilderness due to temporary, nonconforming, or incompatible conditions. GCNP Proposed Wilderness are in the park's GMP-defined Natural Zone, managed to conserve natural resources and ecological processes and to provide for their use and enjoyment by the public in ways that do not adversely affect these resources and processes (NPS Management Policies).

[27] Percent Time Audible in Tables 3.3 to 3.6 often adds to more than 100%, because more than one sound source was audible at the same time during measurement periods. However, although natural sounds can often be heard in the presence of non-natural sounds (e.g., aircraft), the natural Soundscape is adversely impacted whenever a non-natural sound is present

GCNP Proposed Wilderness is defined by the following qualities consistent with the 1964 Wilderness Act

- **Untrammeled** Ecological systems unhindered and free from modern human control or manipulation

- **Natural** Ecological systems are substantially free from effects of modern civilization

- **Undeveloped** Without permanent improvements or modern human occupation. This quality pertains to the presence and development level of trails, structures, and facilities in the park's backcountry areas

- **Outstanding Opportunities for Solitude or a Primitive and Unconfined Type of Recreation**

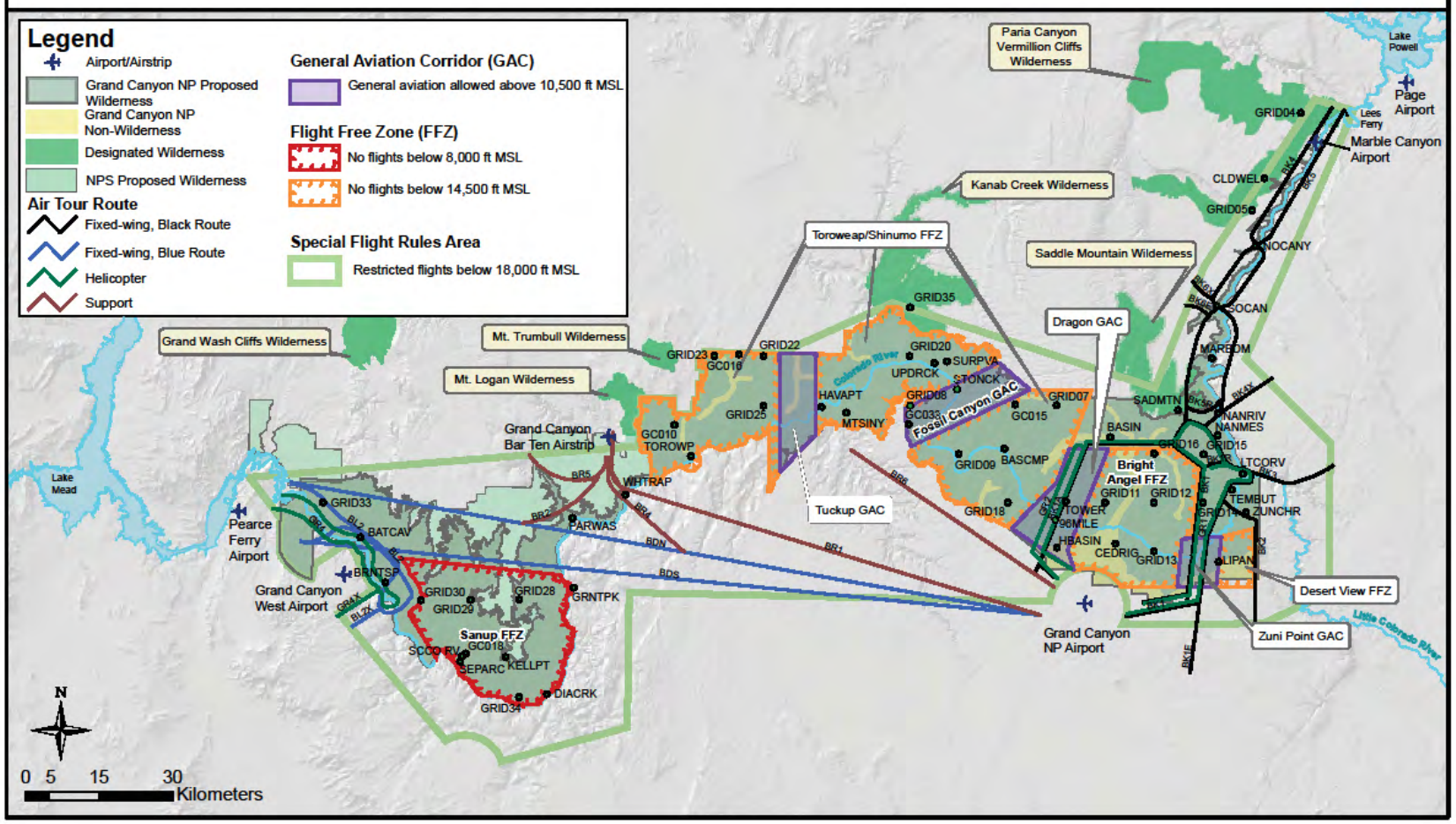
People can experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge. This quality pertains to visitor opportunities to experience a primitive setting that may include solitude and sights and sounds of nature on its own terms

Designated and Proposed Wilderness Outside the Park

There are six Designated Wilderness areas in the Study Area, and seven Proposed Wilderness areas adjacent to GCNP and/or in the SFRA. These areas are included in the Study Area, as depicted on Map 3.3. For example, Mount Logan and Mount Trumbull are outside the SFRA, and several others are mostly outside the SFRA, but within the Study Area.

Proposed Wilderness Areas	
Grand Canyon-Parashant National Monument Wilderness Areas	GCPNM NPS-managed portion contains seven Proposed Wilderness areas totaling 190,475 acres. GCPNM's BLM-managed portion contains designated wilderness of 93,109 acres. Total BLM and NPS Designated and Proposed Wilderness Areas total 283,584 acres These proposed lands would continue to be managed as Wilderness as required by NPS Management Policies and Director's Order 41, Wilderness Preservation and Management. No actions would be taken by the NPS that diminish Wilderness eligibility of these areas until the legislative process of Wilderness designation has been completed
Designated Wilderness Areas	
Paria Canyon-Vermilion Cliffs Wilderness	This 112,500-acre Wilderness is managed by the BLM, and is located at the northeast section of the SFRA predominantly west of Marble Canyon
Saddle Mountain Wilderness	This 40,539-acre Wilderness is located in the Kaibab National Forest managed by the USFS, and is located west of Marble Canyon, abutting the Kaibab Plateau's eastern edge. The Nankoweap Rim forms the southern boundary (USFS 2007b)
Kanab Creek Wilderness	This Wilderness is also located in the Kaibab National Forest, totals 75,300 acres, and is jointly managed by the BLM, which administers 6,700 acres, and the USFS, which manages 68,600 acres. The entire Wilderness is located north of the canyon rim above Kanab Canyon and abuts Kaibab Plateau's western edge. The Wilderness contains Kanab Creek, the largest tributary canyon system on Grand Canyon's north side (BLM 2006)
Mount Trumbull Wilderness	This BLM-managed 7,880-acre Wilderness is located in the Grand Canyon-Parashant National Monument just north of Grand Canyon (BLM 2006)
Mount Logan Wilderness	This BLM-managed 14,650-acre Wilderness lies in the Grand Canyon-Parashant National Monument north of Grand Canyon and east of Whitmore Canyon
Grand Wash Cliffs Wilderness Area	This remote, BLM-managed 37,030-acre Wilderness is a 12-mile long stretch of Grand Wash Cliffs in Grand Canyon-Parashant National Monument north of Grand Canyon

Map 3.3 Wilderness Areas with Current Flight Routes*



*Current flight routes correspond to Alternative A

ETHNOGRAPHIC RESOURCES

Introduction

In this document, Ethnographic Resources include traditional cultural properties, tribal concerns, and various intangible and tangible resources valued by GCNP-associated native people.

Ethnographic Resources may include traditional arts and native languages, structures with historic associations, natural materials, sacred or ceremonial places, and spiritual concepts and subsistence activities supported by special places in the natural world. Ethnographic Resources may also include archeological sites and other physical evidence of human activity considered important to a culture for historic, traditional, religious, or other reasons. Ethnographic Resources are the foundation of traditional societies, and form the basis for their cultural continuity.

Traditional cultural properties are defined as a property associated with cultural practices or beliefs of a living community rooted in that community's history or important in maintaining its cultural identity. American Indian groups in the Grand Canyon region recognize certain tangible properties as important in their traditional tribal histories. These traditional cultural properties may or may not correspond to archeological sites. Traditional cultural properties are Ethnographic Resources eligible for listing in the National Register of Historic Places (NPS 2006b).

The term historic properties refers to cultural resources listed in, or eligible for listing in, the National Register of Historic Places. For this EIS, potentially eligible and unevaluated resources (that is, Ethnographic Resources that have not been evaluated for National Register of Historic Places eligibility) would be afforded the same level of protection as listed or eligible historic properties.

Sacred places are natural and cultural resources having established religious meaning and as locales of private ceremonial activities (Management Policies 5.3.5.3.2).

Because American Indians have a strong concern for privacy and protection of traditional cultural properties, site-specific descriptions of cultural sites or details of traditional practices are not included in this EIS.

Some native people believe that the Grand Canyon region was their place of origin or that they have occupied this area from time immemorial. As recorded by archeological research, human history in the Colorado Plateau Region extends back nearly 12,000 years, a time that has been divided into four broad periods: Paleoindian, Archaic, Formative, and Historic. All periods are represented in Grand Canyon. The presence of Paleoindian peoples is suggested by very limited evidence, while later Archaic occupations are sparse but include campsites, rock art, and diagnostic artifacts such as split-twig figurines dating to 3,000 to 4,000 years before present.

Most prehistoric sites in the eastern Grand Canyon are associated with the Formative period (circa AD 500-1200) and typically include Puebloan characteristics: an economy based on farming and trading and villages with similar architectural styles. Populations diminished after the early 1200s as some prehistoric peoples moved eastward. These prehistoric peoples are believed to be ancestors of modern Puebloan peoples. The ancestors of the Pai (Havasupai, Hualapai, and Yavapai), Paiute, and Puebloan peoples occupied the Grand Canyon area as far back as AD 1300 (Euler 1979), and Pai peoples are thought to have occupied downstream areas along the Colorado River as early as AD 700 (Gilpin and Phillips 1998).

Status of Ethnographic Resources Information

The topic of archeological resources has been dismissed from discussion in this EIS (see Chapter 1). However, because of the role archeological sites play in the cultural history and traditional cultural practices of the American Indian groups associated with GCNP, they are briefly discussed as part of the area’s Ethnographic Resources.

Numerous archeological investigations and ethnographic studies have been completed in GCNP, but only about 5% of the park has been formally surveyed for cultural sites. Areas that receive heavy visitor use or management that have been surveyed include the Colorado River corridor, the southern extension of the Walhalla Plateau on North Rim (Walhalla Glades), portions of Grand Canyon Village, the Cross-Canyon Corridor, and segments of Desert View Drive.

Most archeological work has been project-specific, but an archeological overview of the park was completed by Ahlstrom et al. in 1993. Coder (2000) prepared an introduction to the park's prehistory. Other recent publications include Fairley et al. (1994) which documents sites along the Colorado River between Glen Canyon Dam and Separation Canyon. A synthesis of cultural resources data was conducted in 2000 (Neal and Gilpin 2000).

Ethnographic studies include Euler's 1979 publication on 4,000 years of human history in the Grand Canyon, T.J. Ferguson's ethnohistory of the Hopi people (1998), and Richard E. Hart's 1995 publication on the Zuni and Grand Canyon.

The Hualapai Tribe, acting as its own Tribal Historic Preservation Office, inventoried historic properties in the Hualapai Reservation, and produced three reports that identified and evaluated traditional cultural properties, including a Draft preliminary report dated November 2, 1998, and two final ethnographic study reports dated March 31 and December 3, 1999. These ethnographic studies focused on major canyons, critical and sensitive areas, and the most accessible areas closest to proposed flight patterns over Hualapai tribal lands.

Summaries of Hualapai traditional cultural properties along the Colorado River include Jackson (1997), Jackson et al. (2001, 2002), Glassco (2003a and 2003b), and Stevens (1996).

Roberts et al. (1995) described Navajo history and cultural resources of Grand Canyon.

An ethnographic resource inventory and assessment for the Colorado River corridor was conducted for the Paiute by Stoffle et al. (1994).

Plants play an important role in traditional cultural practices and ceremonies. Several reports document ethnobotanical resources in the Study Area and include a report on monitoring of Hualapai ethnobotanical resources by Phillips and Jackson (1997). To help protect culturally sensitive plants, several tribes, including the Hopi Tribe, Hualapai Tribe, Navajo Nation, Pueblo of Zuni, and Southern Paiute Consortium, conducted ethnobotanical studies along the Colorado River in Grand Canyon to determine where such plants are located. A list of the plants identified by these groups except the Pueblo of Zuni is on file at the park; the Pueblo of Zuni list is confidential (NPS 2005a).

Tribal History and Ethnographic Resources and Concerns

A number of Federally recognized American Indian tribes in the region attach cultural significance to historic properties located in GCNP, and have expressed or claimed cultural affiliation and/or ancestral ties to the park. Tribes with close cultural ties to Grand Canyon include

- Havasupai Tribe
- Hopi Tribe
- Hualapai Tribe
- Kaibab Band of Paiute Indians
- Las Vegas Tribe of Paiute Indians
- Moapa Band of Paiute Indians
- Navajo Nation
- Pueblo of Zuni
- Paiute Indian Tribe of Utah (representing the Shivwits Band of Paiutes)
- San Juan Southern Paiute Tribe
- Yavapai-Apache Nation (representing the White Mountain Apache, San Carlos Apache, and Tonto Apache Tribes)

Havasupai Tribe

The Yuman-speaking Havasupai Indians (the *Havasu 'Baaja'* or people of the blue-green waters) are one of 14 bands of Pai Indians, and the only tribe that resides in Grand Canyon. The Havasupai share a common language and ancestry with two other local Pai tribes, the Hualapai and Yavapai-Apache. Once, Yuman speakers occupied the lower Colorado River valley and adjacent areas in western Arizona, as well as southern California, northern Baja California, and northwestern Sonora. Yuman speaking groups who inhabited the area along the Colorado River from the Bill Williams River in northwestern Arizona to Grand Canyon were known as Upland Yumans, or Pai (the

people). When these peoples were first encountered by Euroamericans, there were three major Pai groups, made up of 14 bands. Each band occupied distinct but overlapping ranges.

An 1880 Executive Order restricted the Havasupai Tribe to 38,000 acres; this was further reduced to around 500 acres in 1882. At the time of establishment of GCNP in 1919, the Havasupai Tribe was restricted to a 518-acre, 5-mile-wide, 12-mile-long corridor in a side canyon (Havasu Canyon). Congress reallocated 185,000 acres of the original hunting grounds to the Tribe in 1975 as part of the Grand Canyon Enlargement Act. Havasu Canyon and areas to the east and west lie in the Tribe's reservation, which also includes land on the Coconino Plateau from the Little Colorado River west to the Aubrey Cliffs, and from the vicinity of Bill Williams Mountain northward to the Colorado River. The Havasupai Reservation borders the park on the west and south. Today, there are approximately 700 enrolled tribal members living in the village of Supai at the bottom of the canyon.

The native flora and fauna of the canyon and the adjacent Coconino Plateau are traditionally important to the Havasupai for both economic and traditional cultural purposes. Historically, the Havasupai hunted and gathered wild foods over a large area, at a great altitudinal range, from the bottom of the canyon to more than 7,000 feet MSL. During the winter, the Havasupai subsisted by using plateau regions, dividing into bands, extended family, or family units, and returning to areas belonging to these groups. They hunted all over the Coconino Plateau, and collected mescal (*Fabaceae*) and edible wild plants such as agave (*Agavaceae*) on canyon benches.

In summer, they moved into brush and mud-covered wicki-ups (small structures or shelters constructed of wood poles) in Havasu Canyon where they irrigated crops of squash, beans, and corn. In the late summer, the Havasupai gathered to collect piñon nuts. Bright Angel Trail, Hermit Basin Trail, Mystic Springs Trail, and other long-established trails used by the Havasupai and other native people to access the plateau were rebuilt during the 1890s by Anglos. Moqui Trail was a trade route between the Hopi mesas and Havasupai Canyon, but had been almost completely abandoned by 1910 (FAA 2000b). Many of these trails led to water sources, including Rain Tank (now part of Grand Canyon National Park Airport), used as a subsistence camp and water stop during long-distance travel. A route east from Rain Tank passes through Long Jim Canyon. An area near Hance Trailhead is known to be sacred to the Havasupai people (FAA 2000b). Indian Garden was the home of several Havasupai families until well into the 20th century, and remains important to the native people. The Havasupai creation story tells that "this region is the place where they began, and has always been home to their ancestors" (FAA 2000b). The Havasupai consider themselves traditional guardians of Grand Canyon, and revere the Colorado River as the backbone of their lifeline (NPS 2005a).

In the 1930s the National Park Service constructed residences at the area known as Supai Camp west of Grand Canyon Village on South Rim, and relocated Havasupai tribal members who had been living at Indian Garden and around Grand Canyon Village to those residences. The NPS, in developing the camp, established a residential area for use of the Havasupai people living and working on South Rim. The total number of residences originally constructed at Supai Camp is unclear, but currently four historic cabins, one community building-turned-residence, and one community bathroom and laundry facility exist in this location. Many updates to Supai Camp were completed in 2010, including connecting facilities to the park's wastewater treatment plant, installation of overhead utilities including electricity and telephone, and construction of three duplexes with additional units to be constructed as funding becomes available. Existing housing units are being rehabilitated to meet health and safety codes, including connections to water and sewer. Road expansion and improvements will occur to allow safe, year-round access to Supai Camp. The Havasupai Tribe and NPS have a general agreement to recognize historic use and occupancy of Supai Camp by tribal members. Under terms of this agreement, the Tribe is allowed to use and occupy the Camp for 50 years, from June 2, 2008, the date of signature, to June 2, 2058. Upon expiration of this term, the general agreement will automatically renew for an additional 50 years.

Hopi Tribe

Hopi traditions tell their place of origin was through the *Sipapuni*, a travertine dome located in the Little Colorado River gorge, outside GCNP. According to Hopi tradition, some of their clans migrated into Grand Canyon, a claim supported by archeological investigations that found Hopi use of the canyon since about AD 700. These early peoples (*Hisatsinom* or people of long ago) lived in small pit-house settlements where they cultivated crops such as corn, beans, and cotton. They occupied a large area that extended roughly from Grand Canyon to Navajo Mountain. The first substantial settlement in the Hopi Mesa area came about AD 700.

Eventually, masonry structures replaced pit houses, small clusters of families consolidated into larger villages in the Black Mesa area of Arizona, and by the AD 1500s, the Hopi had developed a complex social organization, elaborate ceremonial cycles, and advanced agricultural systems that used mesa runoff to irrigate crops. In 1540, the Hopi were encountered by part of the Coronado Entrada, and later, by Spanish explorers and missionaries. Over the next four centuries the Hopi strove to retain their traditions and lands.

Contact with the U.S. Government began during the mid-1800s, and the first Hopi Indian agent was appointed in 1870. A 2.5-million-acre Hopi Reservation was established by Executive Order in 1882. Today, the Hopi Reservation is surrounded by the Navajo Reservation, and is bisected by Dinnebito and Polacca Washes as they drain toward the Little Colorado River. Population on the reservation is about 6,946 people, and its economy is based largely on small-scale farms and livestock raising (Tiller 2005).

Grand Canyon is very significant to the cultural and traditional life of the Hopi people, and they continue to use the canyon for important ceremonial and ritual purposes. Some of their most sacred sites are inside and adjacent to the park, such as the Hopi Salt Mines (by the Colorado River, but closed to public use). The Hopi people consider Grand Canyon to be their place of emergence into the present world, and the source of their life.

The canyon's archeological sites, shrines, springs, places where medicinal herbs are found, and other sacred places are significant because they help perpetuate Hopi life and culture by providing a vital physical and spiritual link between the past, present, and future. Springs have spiritual importance, and may have provided holy water used by Spanish priests at Oraibi and Awatovi Catholic missions. Traditional cultural properties also include elements of art appearing on rocks, the Mount Trumbull area near Tuweep, archeological sites, shrines, and pilgrimage routes. The Hopi also believe Grand Canyon is dangerous, requiring proper spiritual preparation and respectful demeanor (NPS 1995). Unintentional disrespect of visitors to these various cultural sites is believed to have the potential to erode the spiritual well-being of all people.

Hualapai Tribe

Hualapai Tribe ancestral lands covered millions of acres in and around Grand Canyon, with the Colorado River's rugged canyons marking the northern boundary. Origin stories link the Hualapai to a place on the west bank of the Colorado River (McGuire 1983). Archeological evidence suggests the Hualapai are related to the Cerbat branch of the prehistoric Upland Patayan tradition, found in the Grand Canyon area as early as AD 655.

Franciscan missionary Francisco Garcés met the Hualapai during his 1776 expedition, who apparently remained isolated from Euroamerican incursions for another three quarters of a century until encountered by U.S. Army explorations seeking a railroad route through Arizona. Conflict between the Hualapai and Anglo road builders, settlers, and miners resulted in internment of the Hualapai during the 1870s. When the Hualapai returned to their homeland, they found much of the area occupied by non-Indians. The land had been overgrazed during Hualapai absence, destroying many of the native plants and making the land unproductive (McGuire 1983).

A 900,000-acre reservation was established in 1883 along South Rim of Grand Canyon and the Colorado River on a portion of ancestral lands. One third of the reservation is on the Coconino Plateau, and two-thirds is at a lower elevation of the Hualapai Plateau. The terrain covers a wide elevation span, from 7,000 feet MSL on the plateaus to 2,000 feet at the base of Grand Canyon. The reservation extends along 108 miles of the Colorado River, from River Mile (RM) 165 to RM 273. Most of the Hualapai Reservation is undeveloped. By tribal law, development of any kind is prohibited in canyons considered sacred to the Hualapai people. Non-Hualapai may not enter these canyons. *Hualapai* means People of the Tall Pines, and this vegetative cover is found on the central and eastern portions of the reservation near the canyon rim.

The Hualapai Tribe manages its lands for wildlife protection, cultural resources preservation, and forestry. The Tribe has set aside an area along the southern rim of Grand Canyon for tourism and recreation such as sightseeing, hunting, and river rafting, etc. This area includes Grand Canyon West Airport (FAA 2000b).

Approximately 1,800 people reside on the Hualapai Reservation, including about 1,000 enrolled tribal members out of the 2,200 total enrolled tribal memberships. Most live in the tribal capital, Peach Springs, situated on Highway 66 on the southern edge of the reservation.

The Hualapai people also revere the Colorado River, considering it "the backbone of their lifeline" (NPS 2005a). The river (*Ha'yitad*) is a significant physical and spiritual landmark, and some canyons (such as Meriwhitica Canyon) along the river are also considered sacred. Names of sacred canyons in Grand Canyon are derived from important historical events recounted through oral traditions (NPS 1995).

Like the Havasupai, the Hualapai traditionally moved seasonally between canyon and plateau, and hunted game, gathered seeds, and cultivated gardens wherever water was available. Their major wild vegetation foods were derived from cactus fruit and seeds of grasses. Desert bighorn (*Ovis canadensis*) were one of the Hualapai's prime sources of survival, along with other animals such as mule deer (*Odocoileus hemionus*), chuckwallas (*Sauromalus* spp.), elk (*Cervus elaphus*), cottontail rabbits (*Sylvilagus spp.)*, and pronghorn (*Antilocapra americana*). They captured eagles, hawks, and, falcons. Significance is accorded to these and other species because of their historically great importance to the Hualapai for food and use in ceremonies.

The Hualapai also identified plants of special concern traditionally used for food, medicinal purposes, and ceremonies. These include ponderosa pine (*Pinus ponderosa*), piñon pine (*Pinus edulis*), Gooding's willow (*Salix gooddingii*), sage brush (*Artemisia tridentata*), agave (*Agave spp*.), mesquite (*Prosopis spp*.), and other species known only to the Hualapai. Minerals of importance are also used for several purposes, and include hematite, used for ceremonial activities (FAA 2000b).

The Hualapai continue to use traditional ceremonial sites, and regularly monitor the condition of six traditional cultural properties located near heavily visited areas. These include Diamond Creek, Bridge Canyon, Spencer Canyon, Travertine Canyon, Travertine Falls, and Burnt Springs Canyon. The Hualapai Tribe has documented numerous traditional cultural properties within the Lower Colorado River gorge (Glassco 2003b; NPS 1995). Based on ethnographic studies documenting archeological and ethnographic sites, the Hualapai identified about 40 traditional cultural properties they feel are especially critical and sensitive (FAA 2000b).

Navajo Nation

There is no clear agreement on when the Athabaskan-speaking ancestors of the people now known as the Navajo migrated into the American southwest. However, archeological and linguistic evidence suggests Navajo ancestors came into this area between AD1000 and AD1525 (Brugge 1983). Their traditional homeland is symbolized by four sacred mountains: Blanca Peak and La Plata Mountains in Colorado, Mount Taylor in New Mexico, and San Francisco Peaks in Arizona. However, their use area extended beyond these landmarks.

Navajo views of the origin of their people and their world begin with a journey upward through a subterranean domain, encountering world after world, before emerging onto the surface of a fifth world at a place centered in Navajo sacred geography and history, and bounded by the four sacred mountains. This is a created world that is the responsibility of Navajo people to care for by means of careful stewardship and ceremonies (Gill 1983).

Historic records document Navajo peoples presence in the Grand Canyon area by at least AD 1600. When first encountered by Spanish explorers, the large and powerful Athabaskan-speaking group in the Grand Canyon vicinity was called *Apache de Nabajó.* These semi-nomadic people planted maize and other crops but also moved to other, more distant areas for hunting, trading, and mineral procurement. Over the next three centuries, the Navajo came to occupy the region east of the Colorado River and north of the Little Colorado River, farming, grazing livestock, gathering plants, hunting, and performing traditional cultural activities in the canyon vicinity.

After AD 1600, a number of factors affected Navajo culture, including European influences such as introduction of sheep and metalworking, the arrival of Puebloan refugees during and after the Pueblo Revolt of 1680, and conflict with New Mexicans and other groups. U.S. military decisions led to what is known as the Long Walk to Bosque Redondo (Fort Sumner) in the winter of 1864, in which thousands of Navajo were forcibly removed from their land. After their return in 1868, the Navajo found that the reservation decreed by treaty contained no more than ten percent of the land they had occupied earlier. Over the more than 150 years since that time, numerous changes have been made in the reservation boundaries, so that today it occupies more than 17 million acres (Tiller 2005).

The Navajo Nation borders GCNP on the east, stretching from Lees Ferry to the park's southern boundary, south of Desert View. The Cameron and Gap-Bodaway Chapters (local government divisions) are adjacent to the park. As of

2005, the Navajo Reservation population was estimated at 180,462 (Tiller 2005), with greater than 255,000 enrolled members of the Navajo Nation.

The Navajo view the Colorado and Little Colorado Rivers as sacred female and male entities, respectively, and these rivers and their engulfing canyons provide protection to the Navajo people. These sacred beings are inseparable from the larger sacred landscape of which they are an integral part. Canyon visits must be preceded by ceremonial rituals. Secret sacred places must be visited and rituals performed whenever one goes into the canyon. Salt mined from the canyon is sacred, and proper ceremonies must be observed to obtain it (NPS 2005a).

Sacred sites and traditional use areas include ancestral village sites, shrines, plant collection areas, and places where prayers are offered or herbs gathered. The Navajo have a tradition of using park resources for sacred purposes such as the gathering of medicinal herbs and rock salt. Nuts and berries are routinely harvested from the park. Many areas of traditional cultural and economic significance to the Navajo are in the park, and the many trails used to access the canyons are used for both sacred and secular uses (NPS 1995).

Southern Paiute

The Southern Paiute include the San Juan Southern Paiute Tribe, the Kaibab Band of Paiute Indians, the Paiute Indian Tribe of Utah (representing the Shivwits Band of Paiutes), the Las Vegas Tribe of Paiute Indians, and the Moapa Band of Paiutes (Nuwuvi). These are separate tribes; however, their beliefs, ties to Grand Canyon, and concerns are similar. Therefore, they are discussed as one people, the Southern Paiute (FAA 2000b).

Archeological evidence of Southern Paiute use of the area indicates they have lived in northern Arizona, Nevada, and southern Utah for hundreds of years, from as early as AD 1150. Their language, Uto-Aztecan, is related to languages spoken by peoples living in Great Basin and southward to Mexico, and the Southern Paiute share a common heritage with Paiute tribes in the surrounding states.

For the last several hundred years, the San Juan Southern Paiute Tribe has lived in an area east of the Grand Canyon bounded by the San Juan and Colorado Rivers, and were recorded in the area when John Wesley Powell boated the Colorado in 1869. A traditional boundary for the Southern Paiute in Grand Canyon extends from the junction of the Paria and Colorado Rivers downstream to Kanab Creek (FAA 2000b). This area is part of *Puaxant Tuvip*, a larger sacred land that the Southern Paiute believe was given to them with the "supernatural mandate to protect and manage…." (NPS 1995). The Paiute practiced limited agriculture and horticulture, leaving evidence of irrigated gardens of maize, beans, and squash near permanent water sources.

The first European contact with the Southern Paiute occurred when Fathers Escalante and Domínguez came across the people during the Spaniards' failed attempt in 1776 to locate an overland route to the California missions. Over the next 75 years, numerous Southern Paiute women and children were taken and sold as slaves. The Old Spanish Trail, cut through Southern Paiute territory during the 1830s and 1840s, contributed to loss of Southern Paiute lifeways and territory. In the mid-1800s, Mormon settlers occupied Paiute water sources, creating a dependency relationship with the Tribe. By the early part of the 20th century, most of the Southern Paiute ancestral territory had been lost to incoming settlers. The Kaibab-Paiute Reservation is located in northwestern Arizona, about 23 miles northwest of Grand Canyon, in rolling grasslands and mesa country. Tribal enrollment is 212 members. The Shivwits Paiute, with about 233 enrolled members, have a reservation near St. George, Utah. The San Juan Southern Paiute Tribe, a newly recognized tribe of approximately 265 members, does not occupy a land base, and most members live in two separate communities, Willow Springs near Tuba City and a second community near Paiute Canyon/Navajo Mountain. Subsistence farming of a small number of crops and livestock husbandry, along with sale of hand-woven traditional baskets, help support tribal economy. The Moapa Band of Paiutes (population 295) resides on the Moapa River Reservation, situated in the upper Muddy Valley in northeast Clark County, Nevada, 55 miles northeast of Las Vegas (Tiller 2005).

To the Paiute people, Grand Canyon's symbolic landscape is filled with places to farm, hunt, gather, live, and worship. The Colorado River and Grand Canyon are seen as a homeland where their people have lived and died for over a thousand years. This sacred land for the Paiute, *Puaxant Tuvip*, is full of culturally meaningful human artifacts and natural elements such as water, minerals, animals, plants, artifacts, and burials, each having their own human-like life force (NPS 1995).

The living natural environment is perceived as liking certain types of human interactions and disliking other behaviors. In return for proper human behavior, the Colorado River and canyon feed, protect, and support Southern Paiute (and other human) life and culture. Grand Canyon itself is a source of great power and has a powerful spiritual aspect. For example, those wishing to become medicine men go to high places along the rim to learn to sing, a form of prayer. Seeps, springs, falls, and rock formations may be sacred to the Southern Paiute, and often are part of Southern Paiute Pilgrimage routes (NPS 1995; Stoffle and Van Vlack 2006).

Modern Southern Paiute continue to use canyon resources in traditional ways. In particular, because of overgrazing in other areas, some plants and herbs necessary for medicine and food are only available in Grand Canyon. Native flora used by the Paiute include 32 families encompassing at least 96 species of edible plants, including cacti, grasses, berries, piñon, and juniper. Many more plants are used for medicinal purposes.

Yavapai-Apache Nation

The Yavapai-Apache Indian Nation reflects the amalgamation of these two historically and linguistically distinct tribes. The Yavapai-Apache Reservation is located south of Grand Canyon in Yavapai County, Arizona. Today the tribe has about 159 members occupying a little less than 1,500 acres.

The term Yavapai-Apache includes the White Mountain Tribe, San Carlos Tribe, Yavapai-Apache Nation, and Tonto Apache Tribe. The Yavapai and Apache have lived in central and western Arizona for many centuries, using a migratory hunting and gathering subsistence pattern that may have included lands now occupied by the park. Traditionally, the Western or Tonto Apache (Dilzhe'e) used lands south, east, and north of the Upper Verde River, while the Yavapai (Wipukyipaya) used country south, west, and north of the river (their traditional areas overlapped).

Until the discovery of gold in central Arizona in the 1860s, the Yavapais had little contact with Euroamericans. As settlers and gold seekers began to encroach onto their lands, conflicts increased. Eventually, in 1871, General George Crook ordered all the "roving Apaches" to a reservation or be considered hostile. To enforce this order, a large band of Yavapais was killed by the military in the Salt River Canyon (Tiller 2005). Warfare with the U.S. military ended with establishment of a 900-mile square military reserve in 1871. However, a presidential order in 1875 rescinded the reserve, and all the people (both Yavapai and Apache) were forcibly marched to the San Carlos agency near Phoenix. Beginning in the early 1900s small family groups, survivors of the removal effort, drifted back to their traditional home country. A tiny reservation was established in 1909 at Camp Verde, followed by later designation of additional parcels that make up the present reservation.

Praying for one another, especially to encourage good health, is a crucial feature of Yavapai religion. Individuals also may call on various forces of nature for help, and they feel the land that sustains them is sacred.

Pueblo of Zuni

Although they do not currently reside in or near Grand Canyon, the Zuni retain ancestral ties to Grand Canyon. Their area of traditional use lies between the San Francisco Peaks on the south and portions of the Little Colorado River on the north. Like the Hopi, the Zuni believe they entered this world through Grand Canyon before beginning their journey through the canyons of Arizona and New Mexico, finally settling at Zuni. Written accounts suggest the origin place is near the main Colorado River, south of its confluence with the Little Colorado at Ribbon Falls (NPS 2005a). Archeological sites, traditional cultural properties, and other sacred locations along the Colorado River corridor and Little Colorado River are important to Zuni traditional and cultural values, providing important spiritual linkages to the place of emergence for the Zuni people (NPS 1995).

The Zuni and their ancestors occupied the Colorado and Little Colorado River valleys for more than 2,000 years. They first encountered Europeans when Francisco de Coronado stopped at Zuni in 1540; the first Spanish mission was established at Zuni in 1629. Following the 1848 Treaty of Guadalupe Hidalgo, the U.S. assumed control of New Mexico, including the 15.2 million-acre Zuni aboriginal territory (Tiller 2005).

The U.S. Government policy of encouraging non-Indian settlement of the West led to Zuni loss of control of about nine million acres. Additional losses resulted when the Atlantic Pacific Railroad bisected Zuni territory, and when tens of millions of board feet of timber were cut from the Zuni Mountains, resulting in severe environmental

damage. Eventually, the Zuni received some compensation, both for land and land rehabilitation. Presently, more than 9,500 tribal members occupy the 463,271-acre Zuni Reservation (Tiller 2005).

Archeological sites, traditional cultural properties, and other sacred locations along the Little Colorado River and Colorado River corridors are important to Zuni traditional and cultural values, providing important spiritual linkages to the place of emergence for the Zuni people. The Pueblo of Zuni considers Grand Canyon the place of emergence into the present world. Soil, rocks, water, plants, and other materials are gathered for ceremonies conducted to ensure rainfall for crops and a balanced universe. They pray and leave offerings at various locations. Water from the bottom of Grand Canyon carried in sacred gourds has special significance to Zuni ceremonies and special meaning to the Zuni people. The Zuni pray not only for their own lands but for all people and all lands (NPS 1995). Trails used by the Zuni for traditional cultural purposes also carry special meaning and are cared for by means of particular blessings and prayers. Thus, the Zuni people have important concerns about the ancient Zuni Trail from their village to the bottom of Grand Canyon (NPS 1995).

Aircraft Overflights Concerns for Traditional Cultural Practices and Properties

American Indian groups usually do not make a distinction between secular and sacred. Their religion is an inextricable part of their lives, integrated into all other traditional aspects of their culture. Places of worship and veneration may be natural features such as mountains, springs, rivers, and canyons. Grand Canyon and the river within are valued by the native people as a type of reference point in their beliefs, and the natural features form a crucial part of their world view.

In most cases, it is difficult to separate traditional cultural properties and their uses from subsistence activities because to most native people, the physical world and spiritual world are tightly interrelated and cannot be separated. Traditional cultural properties and traditional activities potentially affected by actions proposed by Alternatives for managing aircraft overflights may include sacred sites (sometimes with an archeological component); ancestral habitations; shrines; burials; ceremonial plant gathering; healing ceremonies; sites where prayers are offered; hunting; trails; traditional cultural activities that include prayer, song, vision quest, and pilgrimages by foot and through dreams; and even the husbandry of livestock and other subsistence uses. For tribal practices to be successful, the site, habitat, or particular resource and its context must remain undisturbed.

Human burials are also of special concern to American Indians, and burial areas are considered sacred places.

In addition to specific locations and resources, American Indians in the area feel many broader attributes such as the canyons, water, minerals, plants, and animals of Grand Canyon are of traditional sacred importance. Tribal oral traditions reveal a strong spiritual relationship to Grand Canyon as a whole.

The following excerpt from the Colorado River Management Plan (NPS 2005a) aptly illustrates this broad view of Ethnographic Resources in the Grand Canyon area

> *On a broader scale, the whole river corridor can be viewed as an ethnographic landscape in which American Indians have for millennia farmed, hunted, gathered plants and minerals, and performed rituals. Ancient trails, remnants of stone structures, traces of fields, and prayer objects enshrined in travertine and sAlternative Are enduring evidence of a subtly altered landscape. Integral to this landscape are the animals, plants, and minerals traditionally used and valued by American Indians.*

During a Bureau of Reclamation project related to Glen Canyon Dam operations, five tribes identified cultural resources of importance in the river corridor. A total of 324 known archeological sites were identified as traditional cultural properties by one or more tribal groups (NPS 1995; Glassco 2003a). Of these 324 sites and traditional cultural properties, the Hopi Tribe identify with 256 sites, the Hualapai Tribe with 118, the Pueblo of Zuni with 99, the Navajo Nation with 31, and the Southern Paiute Consortium with two.

Tribal members have strong expectations of quiet at traditional cultural sites. When practitioners are engaged in ceremonies at traditional cultural sites, quiet is needed for proper performance of traditional activities. For example, lengthy prayers are memorized and passed down orally from one spiritual leader or practitioner to another, generation by generation. Remembering the correct words, song, or prayer sequence is crucial to success of the prayers, and any interruption can have negative results.

Many prayers are tied to a specific time and place, and special ceremonies may mark special times of year such as the solstice. Ceremonies may accompany the coming of age of children. Traditional hunting and plant gathering often incorporate prayer and quiet contemplation. Prayers may be offered for healing while gathering medicinal herbs from special places. Traditional cultural activities are believed essential to restoration or maintenance of the health of individuals and the well-being of the tribal community. If such ceremonies are interrupted visually or by intrusive sound, the activities may be unsuccessful. If practitioners are unable to conduct their ceremonies or pray at a particular time and in a particular place, the prayers may not have the desired effect.

For the Hualapai, traditional cultural and ceremonial activities undertaken at traditional cultural properties depend on an uninterrupted viewshed and a clear line of sight for prayers to travel uninterrupted from one site to another. If aircraft flights are too low to the ground, flights may block prayers. Practitioners feel that failure to complete these traditional cultural obligations appropriately can lead to dire consequences.

Privacy for Traditional Cultural Practitioners

Flights visible from the ground during ceremonies or prayers can be highly disruptive of traditional cultural practices by introducing an intrusive visual element.

Tribal members have strong expectations of privacy from outsiders, and are concerned about passengers viewing or photographing private ceremonies from the air. The Hualapai have stated that disclosure of the location or character of the traditional cultural properties and associated archeological sites would likely result in vandalism, theft, desecration, and unauthorized public visitation of these sites.

Many practitioners worship at personal shrines or other places in private, and require solitude to successfully complete their worship. Often tribal traditional cultural practices are the secret, exclusive province of a practitioner, and are shared only in prescribed ways with specified individuals having particular relationships with the practitioner. Holders of traditional American Indian beliefs may even feel misfortune may come to those who share this information with inappropriate parties. Even knowledge not considered secret is likely to be private to the native community. Noise from helicopters or other aircraft can intrude on these communications with holy beings, interrupting prayers, invading privacy, and causing distress to the practitioners.

The Hualapai indicate quiet, privacy, and natural viewscape of traditional cultural properties on the Hualapai Reservation are important characteristics of these sites, and are considered to contribute to their eligibility for listing in the National Register of Historic Places (FAA 2000b). Members of other tribes have expressed similar concerns.

Overflights and Areas of Traditional Cultural Significance

Some park areas carry great traditional cultural importance to several tribes. In these areas, overflights could be considered sacrilegious. One area of particular concern to multiple tribes is the confluence of the Colorado and Little Colorado Rivers.

Special Circumstances by Tribe

The FAA's 2000 EA for Special Flight Rules contains an extensive discussion of the tribal consultation process and documentation of consultation with tribes (see Section 3.6.4 and Appendix H of that document). In 1996, the Hualapai Tribal Historic Preservation Officer assumed responsibilities of the State Historic Preservation Officer, including those for Section 106 of the National Historic Preservation Act, for the Hualapai Reservation.

In March 1998, the Hualapai entered into an agreement whereby the Hualapai Department of Cultural Resources would conduct ethnographic and archeological studies to identify traditional cultural properties on the Hualapai Reservation in areas potentially affected by the proposed special flight rules. Over the next two years, these resources were recorded, and the data used to provide FAA with information on sensitive sites. Data from those studies are still relevant and are considered in this EIS.

National Register of Historic Places

As described above, the Colorado River, Grand Canyon, the landscape within which these occur, and numerous park resources are considered sacred by many American Indian communities. Within this larger landscape are sites, resources, and locations that are, in some cases, of traditional significance to all tribes, and to only some tribes in other cases. These traditional cultural properties are important in maintaining the cultural identity of American Indian communities (FAA 2000b).

These traditional cultural properties are tangible properties potentially eligible for listing on the National Register of Historic Places due to their association with beliefs and cultural practices rooted in history. In this EIS, all traditional cultural properties identified by tribes are considered potentially eligible for the National Register pending completion of Section 106 consultation.

VISITOR USE AND EXPERIENCE

Introduction

GCNP receives approximately 4.5 million visitors annually, and annual visitation has remained relatively unchanged for more than a decade (NPS 2006c). Visitor experience is directly related to park significance statements presented in the General Management Plan (NPS 1995). That is, visitors come to GCNP to enjoy resources the park was established to protect and preserve. Visitor experience can be summarized by

- Scenic qualities and scientific values represented by vistas of internationally significant geological forms, a variety of ecosystems, night-sky viewing, and Class I air quality that allows appreciation of these resources
- Natural quiet and solitude available in a place with unusual and noticeable natural quiet, along with access to numerous sites for solitude
- Spiritual/inspirational qualities of the canyon's natural, cultural, and scenic resources coupled with the landscape's vastness
- Recreational opportunities offered by the diversity of park resources and settings in the park's undeveloped and developed areas

Most visitors come in summer (39%) followed by spring (27%) and fall (23%). Only 11% visit in winter. Visitors come from all 50 U.S. states, the District of Columbia (D.C.) Puerto Rico, and 41 foreign countries. A total 83% originate in the U.S. while 17% are international visitors. Among U.S. residents, California is the source of the most visitors at 12.2%, followed by residents of Arizona at 9%. Over 58% of Grand Canyon visitors are visiting for the first time (Northern Arizona University 2005).

Most visitors view the park along South and North Rims in developed areas and access corridors. Of the 4.5 million GNCP annual visitors, approximately 90,000 stay overnight in the backcountry, while approximately 25,000 run the river (NPS 2005b, NPS 2005a).

For most visitors, visiting Grand Canyon is the primary reason for their trip (Northern Arizona University 2005). Visitors to developed areas most often sight-see, take scenic drives, take a guided walk to the rim, and shop (University of Idaho 2003). For some visitor categories, specifically river users and fall backcountry visitors, natural quiet is almost as important a reason for visiting Grand Canyon as viewing the scenery. Enjoying natural quiet is extremely important to many visitors (Baumgartner et al. 1994).

Management Zones

Three Management Zones modified from the GCNP General Management Plan (NPS 1995) are used in this EIS to discuss a range of visitor experiences. These include the 1) Wilderness Zone, 2) Non-Wilderness Zone, and 3) Developed Zone (see Map 3.4).

In the Wilderness Zone, visitors can expect a remote experience with little or no infrastructure, amenities, or services, and opportunities for solitude and primitive, unconfined recreation. The Non-Wilderness Zone offers access to less crowded park areas where an infrastructure level higher than the Wilderness Zone provides basic

services and wayfinding. Corridor trails are often considered transitional areas between developed and nondeveloped areas. The Developed Zone includes visitor centers, major roads, and most visitor services. The frontcountry, while not a formally designated zone, provides a common description for the park's developed areas and transition to Non-Wilderness or Wilderness Zones including main developed areas, viewpoints, and trailheads. Descriptions of the three park zones follow.

Wilderness Zone Includes remote backcountry areas and the Colorado River Corridor. Backcountry use areas fall in three subzones: Threshold, Primitive, or Wild. These backcountry Management Zones are based on type and amount of use, current resource conditions, and opportunities for solitude. Threshold subzones are backcountry areas with designated camping, compared to more remote Primitive and Wild subzones with at-large camping and fewer encounters with other visitors. The Colorado River experience varies by season. During summer months, there may be up to 60 trips on the river at one time with visitors traveling on motorized and oar-powered rafts. During non-summer use periods, there are as few as ten trips on the river at one time, and motors are prohibited to enhance opportunities for a Wilderness experience. Backcountry and river use are managed through permit systems and are limited by season and backcountry use area (subzone).

Non-Wilderness Zone Includes the Cross-Canyon Corridor, the Tuweep area, and forested areas on North and South Rims. The Cross-Canyon Corridor consists of Bright Angel, South Kaibab, and North Kaibab Trails. There are developed campgrounds, ranger stations, water, and composting toilets in the Non-Wilderness Zone. Unpaved road corridors in the Non-Wilderness Zone provide access to scenic overlooks, dispersed camping areas, and Wilderness trailheads. The Tuweep area is in a remote section of western Grand Canyon. Facilities are limited to a ranger station, undeveloped campground, and composting toilets. Day use in the Non-Wilderness Zone is unlimited. Overnight use is managed by permit.

Developed Zone Developed areas on South Rim include Grand Canyon Village, scenic roads west to Hermits Rest and east to Desert View, and a number of scenic overlooks, visitor services, and amenities. On North Rim, the Developed Zone includes the highway corridor to North Rim Village, roads to Cape Royal and Point Imperial, camper services, lodging, and other visitor amenities. Tuweep ranger station, its water catchment system, out-buildings, and the area between these facilities, the campground, and the unpaved road into Tuweep are considered Developed Zone. Also included in the Developed Zone is Phantom Ranch bounded on the east and west by canyon walls, on the north by the hiker dorm, and south by the Colorado River.

GROUND-BASED VISITORS

Frontcountry Use

Map 3.5a-c and Table 3.8 presents distribution of visitor days. The majority of visitors experience GCNP from the frontcountry. Frontcountry generally includes the Developed Zone and transitions at overlooks and trailheads between Developed and Non-Wilderness Zones. Frontcountry visitors experience highest densities of, and encounters with, other visitors, including sights and sounds of vehicles such as buses, trucks, and automobiles.

Backcountry Use

Day Hikers While most visitors view the canyon from rim overlooks, a considerable portion (303,958) day-hike into the backcountry. The visitor experience for the day hiker unfolds in two phases. The first phase is the sense of arrival and viewing the canyon, and all visitors participate in this experience. The second phase is exploring the canyon below the rim. Visitors below the rim on a short or long day-hike experience different canyon views, come in closer contact with the canyon's natural resources, and move away from the rim's developed setting and associated sounds and crowds.

Day-use accounts for a large portion of backcountry use along trails accessible from South and North Rim developed areas (NPS 2006a). Seven primary trails used by day hikers are shown in Table 3.7.

TABLE 3.7 PRIMARY TRAILS USED BY DAY HIKERS

South Rim	North Rim
Grandview	Widforss
Hermit	Ken Patrick
Bright Angel Trail	North Kaibab Trail
South Kaibab Trail	

The three corridor trails are most used by day hikers. The busiest trail is Bright Angel, with number of day hikers averaging 464 to 787 per day. South Kaibab is the next most used, with 302 to 567 hikers per day, and North Kaibab receives 146 to 208 hikers daily. The other trails received one to 76 visitors per day. The busiest day is Saturday, and mid-day sees the most traffic on the trails.

Overnight Hikers NPS visitation statistics show Grand Canyon visitors spent about 90,000 person-days in the backcountry (each person multiplied by number of days in the backcountry), with about 51,000 of those in the Cross-Canyon Corridor campgrounds and about 39,000 in proposed Wilderness (Map 3.5a-c and Table 3.8). This represents 20% of the total 1.2 million overnight stays reported (including concession lodging and campgrounds, and NPS campgrounds) (NPS 2006c). Going on a hike deep into the canyon is wonderful way to experience some of the park's rich natural beauty and immense size. Even for avid hikers, hiking Grand Canyon is very different from, and more demanding than, most other hiking experiences. Hiking beyond the canyon rim into the backcountry offers hikers a powerful and inspiring landscape that, through its immense size, can overwhelm the senses.

River Runners (Motorized and Non-Motorized) A river trip through Grand Canyon is one of the most sought-after backcountry experiences in the country, and nearly 25,000 visitors run the river annually between Lees Ferry and Diamond Creek, for a total 228,986 person-days (i.e., each person multiplied by number of days on the river), plus an estimated additional 300,000 or more user-days between Diamond Creek and Lake Mead National Recreation Area [28] (Map 3.5a-c and Table 3.8) (NPS 2005a). The 277-mile Colorado River section in the park provides a unique combination of thrilling whitewater adventure and magnificent vistas of remarkable geologic landscape. Most visitors begin their trips at Lees Ferry, below Glen Canyon Dam, and most trips end at Diamond Creek or on Lake Mead National Recreation Area. Visitors participate on an outfitter-guided (commercial) trip or a self-guided (noncommercial) trip. River trips are both motorized (40%) and non-motorized (60%). Noncommercial trips are 90% non-motorized and 10% motorized. Commercial-service providers offer river trips to private groups and individuals, both motorized (72%) and non-motorized (28%). River trips vary from one day to several weeks.

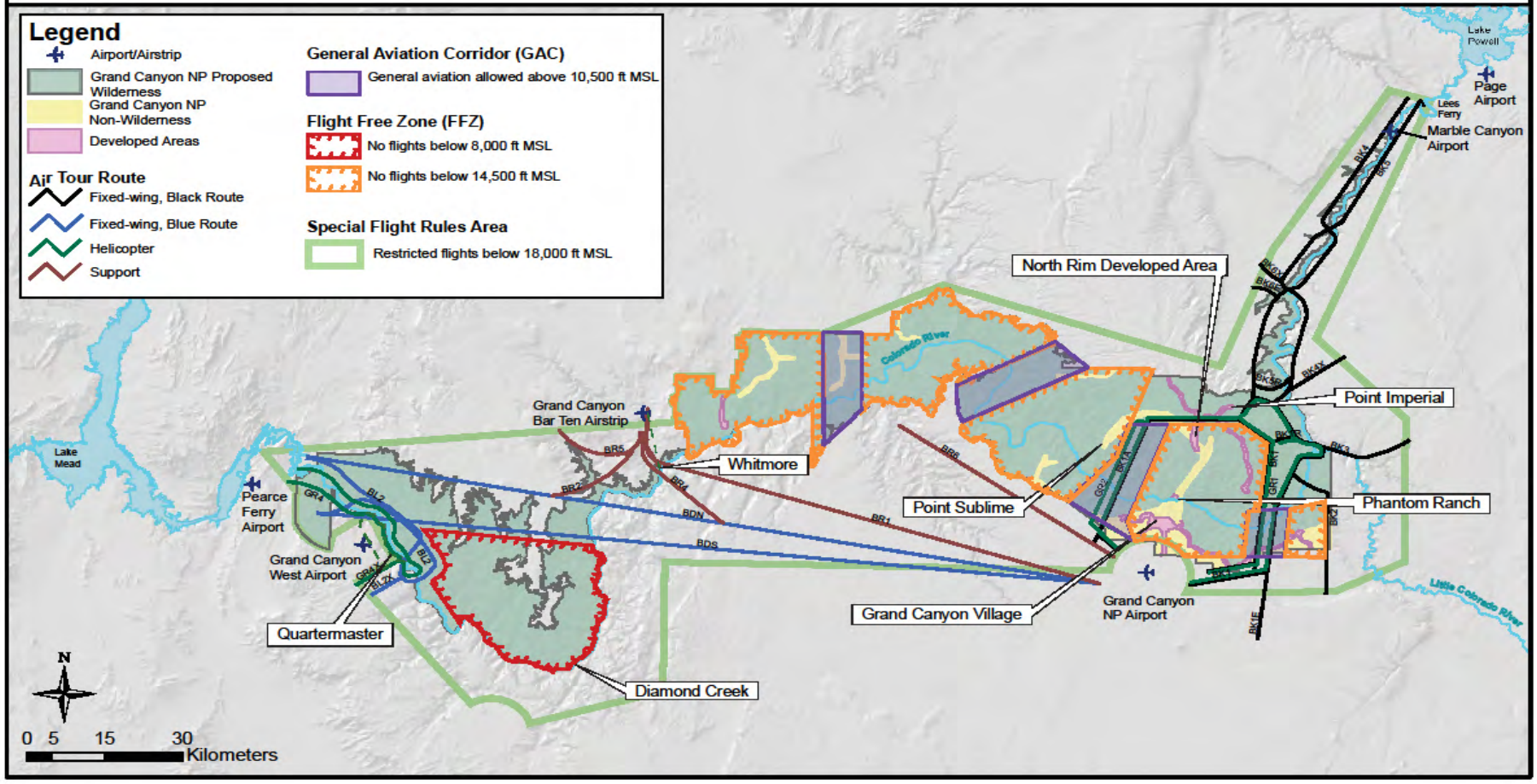
Whitmore Helicopter Exchanges Some commercial outfitters offer river trips that include helicopter transport in or out of the canyon near RM187. The Whitmore helicopter pad is on Hualapai tribal lands adjacent to the river. This use is allowed under the 1987 Overflights Act (P.L. 100-91).

Hualapai Tribe One-Day River Tours The NPS and Hualapai Tribe share an approximate 108-mile boundary along the river corridor. The Hualapai Tribe provides commercial river tours beginning at Diamond Creek and ending near the Quartermaster use area where visitors helicopter from tribal lands. Overnight tours continue to Lake Mead National Recreation Area.

[28] Many river users between Diamond Creek and Lake Mead are not required to obtain permits, so only estimates of user-days in that section are available

1

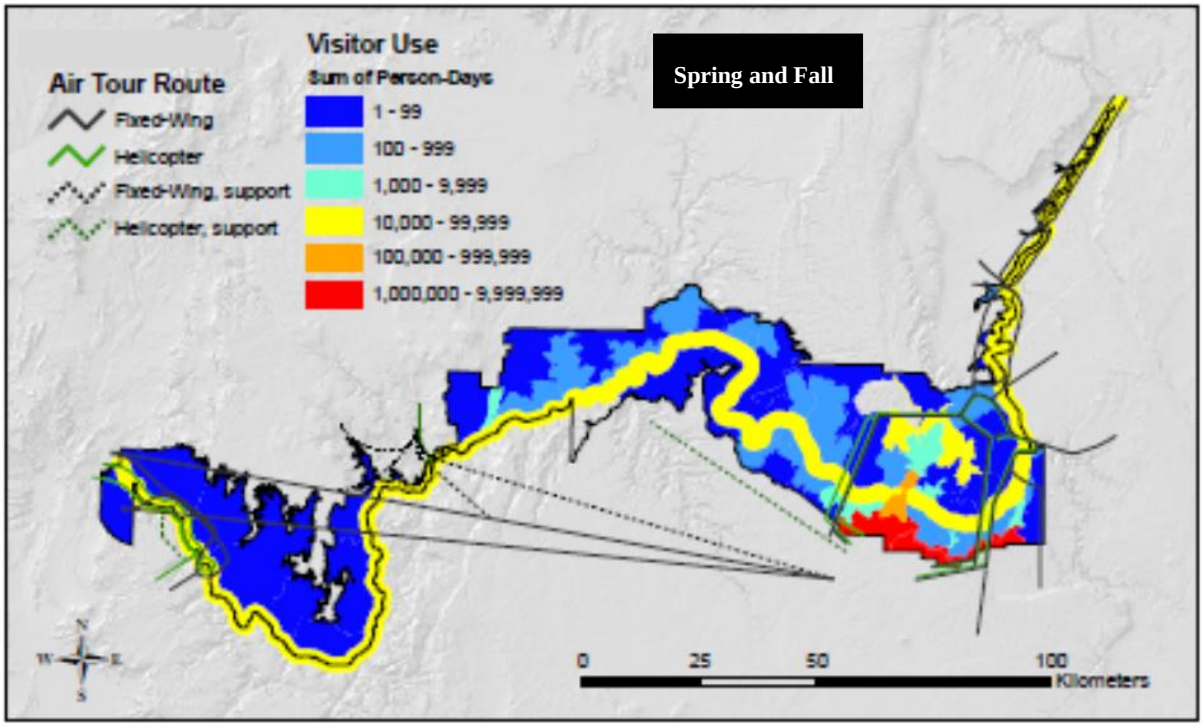
Map 3.4 Management Zones and Airspace*



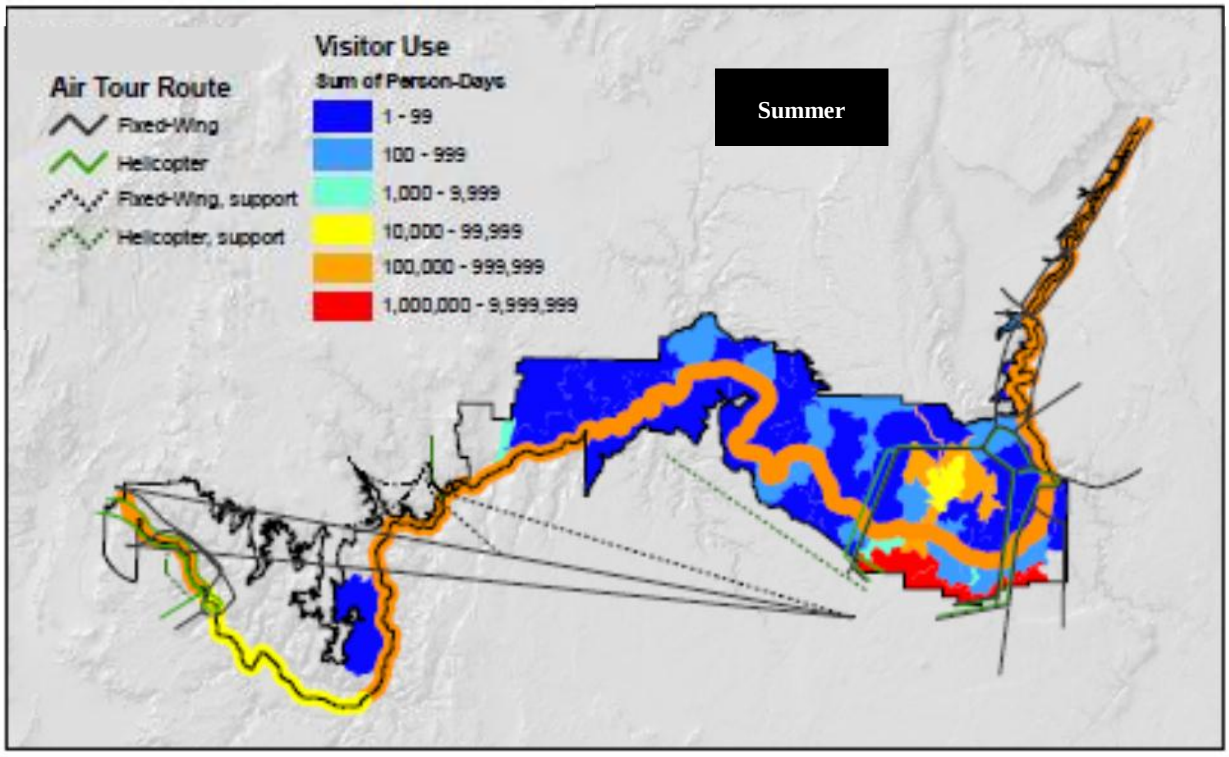
2

3 *Routes shown correspond to current air tour routes (Alternative A)

Map 3.5a Visitor Use and Air-Tour Routes



Map 3.5b and c Visitor Use and Air-Tour Routes, continued



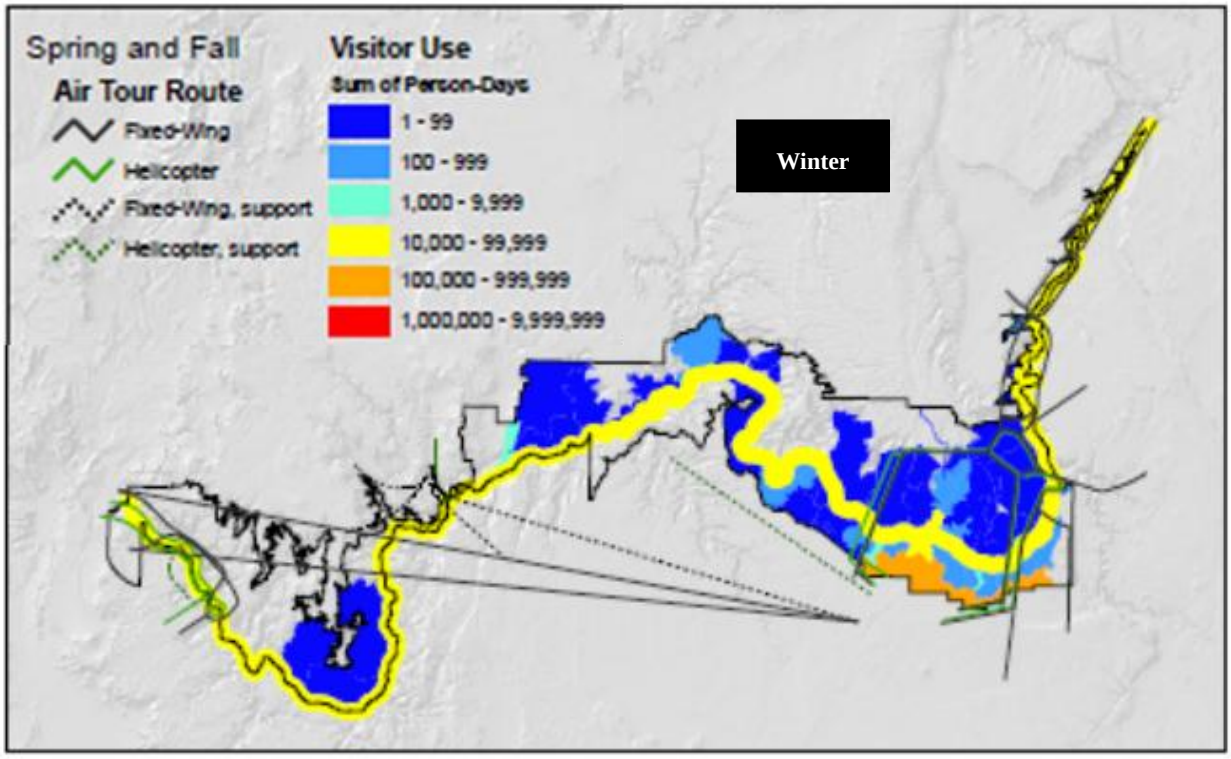


TABLE 3.8 SEASONAL PERSON-DAYS

Seasonal Person-Days	Front-country[a] South Rim	Front-country[a] North Rim	Colorado River			Back-country[d]	Day-hikers[e]
			Lees Ferry to Diamond Creek[b]	Diamond Creek to Quartermaster[c]	Quartermaster to Lake Mead[c]		
Spring and Fall March/April & September/October	1,700,723	94,973	70,583	28,832	98,388	43,953	92,369
Summer May-August	2,373,967	352,918	124,316	39,168	104,040	30,237	164,612
Winter November-February	830,051	0	34,087	14,416	49,184	15,366	46,977
Annual Total	4,904,741	447,891	228,986	82,416	251,592	89,556	303,958

[a]Frontcountry numbers are based on 2005 entrance gate data adjusted to exclude local traffic and business deliveries. Overnight guest counts from lodges and campgrounds are included
[b]Estimated user-days based on the 2006 Colorado River Management Plan EIS Alternative H (pg. 60) for calendar year 2007 and later
[c]Maximum allowable user-days based on the 2006 Colorado River Management Plan EIS Alternative 4 (pg. 89); does not include continuation river trips from Lees Ferry past Diamond Creek or Grand Canyon West Elevator Flight river trips
[d]User-nights based on 2005 backcountry permit data; use without permits is not reflected
[e]Estimates based on data collected for the NPS in 2004 by the University of Illinois

Other Federal Lands in the Study Area

Grand Canyon-Parashant National Monument
- 1,048,316 acres in Mohave County
- 808,744 acres BLM-administered lands
- 208,447 acres NPS-administered lands
- 23,205 acres Arizona State Trust lands
- 7,920 acres private lands (BLM 2008c)

Vermilion Cliffs National Monument
- 279,566 acres BLM-administered lands
- 13,438 acres Arizona State Trust lands
- 683 acres private lands (BLM 2008b)

BLM Arizona Strip Field Office

Encompasses roughly 1.98 million acres located in both Coconino and Mohave Counties, including
- 1,679,896 acres BLM-administered lands
- 170,165 acres Arizona State Trust lands
- 130,962 acres private lands (BLM 2008a)

These public lands provide a wide range of recreation opportunities including vehicular exploration, sightseeing, backcountry hiking, and backpacking. Exploring or sightseeing constitutes the primary activity for many visitors, and can involve various modes of transportation, such as sports-utility vehicle, equestrian, small aircraft, walking, off-highway vehicle, hiking, motorcycle, bicycle, sedan, or motor home.

These areas, as well as the Kaibab National Forest discussed below, contain existing and proposed Wilderness in or adjacent to the SFRA. Wilderness activities and experiences include hiking, backpacking, and outstanding opportunities for solitude and primitive, unconfined recreation.

Due to the remote nature of the area and dispersed nature of most recreation activities, it is difficult for managing agencies to obtain actual numbers of visits. Estimated visitation to the three areas is presented in Table 3.9.

TABLE 3.9 RECREATION VISITS BY YEAR, NEARBY AREAS

Year	Arizona Strip BLM	Parashant BLM	Parashant NPS	Vermilion BLM
1999	114,252	13,093	---	39,704
2000	120,150	12,058	---	39,702
2001	125,472	12,949	---	41,884
2002	118,745	14,280	---	39,934
2003	112,475	25,298	8,880	45,329
2004	112,846	44,233	9,180	39,093

Source: BLM, Arizona Strip Field Office Resource Management Plan

While visitor use has typically peaked during spring and fall months, improved navigation technologies, outdoor gear, transportation modes, and attraction site promotion have contributed to visitation increases in winter and summer months (BLM 2008a).

The Kaibab National Forest is administered by the U.S. Forest Service and, overall, receives over 600,000 visits a year (USFS 2010). Recreational activities include mountain biking, camping and cabin use, hiking, horse riding, hunting, target shooting, outdoor learning, picnicking, boating, fishing, snowshoeing, and skiing.

The North Kaibab Ranger District is adjacent to, and a portion contained in, the SFRA. Recreational visitors to the district are generally of two categories: visitors whose primary destination is Grand Canyon National Park, but who stop in the district for some period of time, and those who visit the district to hunt game or gather fuel wood. Other activities, most notably mountain biking, are popular in the district, but visitors participating in these activities are not as common as those visiting Grand Canyon, hunting game, or gathering fuel wood. Visitation fluctuates widely with the seasons, as North Rim and Highway 67 close for the winter (USFS 2010).

Air-tour Visitors

Based on flight data, aircraft capacity data, and load factors specific to location and aircraft type, an estimated 423,000 passengers took air tours in the SFRA. About half flew fixed-wing and half helicopter tours. Over 58% of all air-tour passengers took East End tours, and the remaining 42% flew West End routes.

The following information was provided in interviews with Grand Canyon air-tour operators conducted as part of this EIS (Harvey 2007a). On GCNP's West End, air-tour visitors tend to be international, with many coming from Asia and the Pacific Basin. These visitors tend to travel in larger groups and generally participate in day trips over Grand Canyon and to the Hualapai Reservation as part of a longer Las Vegas area trip. These groups come to Las Vegas year-round and do not have seasonal travel patterns East End visitors do. Asian travelers make up 60 to 90% of passengers for Las Vegas-based operators.

Comparatively, on GCNP's East End, air-tour visitors tend to come from the U.S., other North American and European countries, especially England and Germany. At Tusayan-based operators, 35 to 50% of air-tour passengers are international. East End visitors are more likely to be couples or families and include a large percentage of small groups that arrive by car or camper and spend at least one night in the local area. The bulk of visitation to the East End occurs during summer months and school vacations when U.S. families have time to travel with children. Also visiting East End are Asian visitors that have taken a flight from Las Vegas through the SFRA as part of a day trip.

Several operators reported serving customers of all ages, including young families; however, the majority of operators fly tours mainly made up of adults 40 to 65 years of age. The elderly do not make up a large portion of business for any tour operator. Only a small percentage of air-tour visitors are disabled; operators reported not more than 1 to 2% of all passengers were handicapped. Air-tour customers can generally be described as having higher-end incomes, although those in middle-income ranges also take air tours.

According to tour operators, key air-tour selling points include canyon views/other scenery and amount of time spent flying over Grand Canyon. Customers appear to enjoy that they can see a large Grand Canyon area, including

special features, in a short period. Other selling points are the variety of accompanying tours packaged with flights, quality of customer service and, for some, Las Vegas proximity.

Importance of Natural Quiet

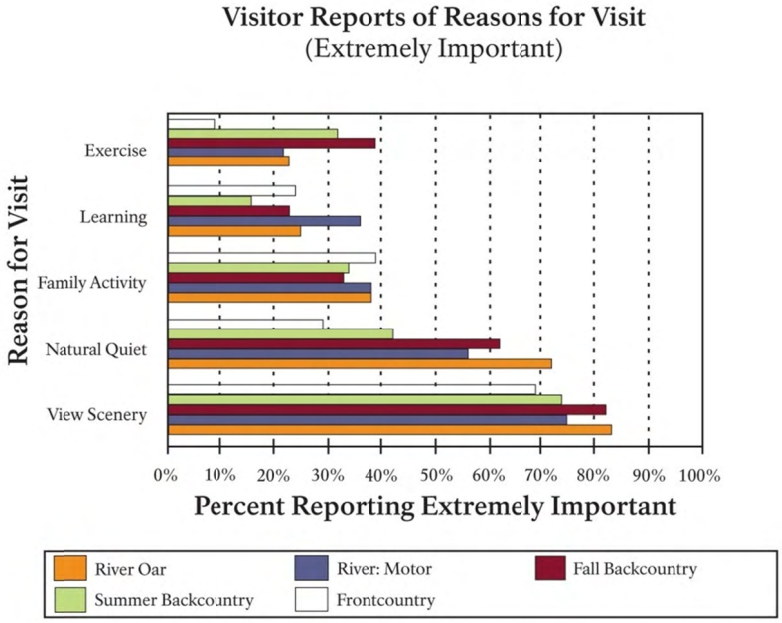
National park visitors often indicate an important reason for visiting is to enjoy the relative quiet parks can offer. Americans surveyed in 1998 (NPS 2003) were asked to identify some of the most important reasons for having national parks. Seventy-two percent said, "Providing opportunities to experience natural peace and the sounds of nature." This ranked as the fifth most common response. In studies of visitor preferences, respondents consistently rate many natural sounds, such as birds, animals, wind, and water, as very pleasing. As a result, presence of unwanted, uncharacteristic, or inappropriate sounds can interfere with or alter the Soundscape resource and degrade visitor experience.

Experiencing natural quiet and associated events such as solitude are part of the park's purpose and significance, and Grand Canyon is recognized as a place with unusual and noticeable natural quiet. Many surveys have shown natural quiet an important part of the recreational experience, and recreational users have stated in numerous research reports that escaping noise and enjoying nature's sounds are among the most important reasons for visiting natural environments (Driver et al. 1991).

A mail survey was conducted of randomly sampled Grand Canyon visitors. These visitors were categorized as frontcountry visitors, summer backcountry visitors, fall backcountry visitors, river users in motorized boats, and river users in oar-powered boats (Baumgartner et al. 1994). Figure 3.1 shows how these visitors ranked various reasons for their canyon trip. Five of these categories, representing the response range, are shown for those who rated their reasons as extremely important.

For some visitor categories, specifically river users and fall backcountry visitors, natural quiet is almost as important a reason for visiting Grand Canyon as viewing scenery. Enjoying natural quiet is extremely important to many Grand Canyon visitors.

FIGURE 3.1 VISITOR REPORTS OF EXTREMELY IMPORTANT REASONS FOR VISITING GRAND CANYON



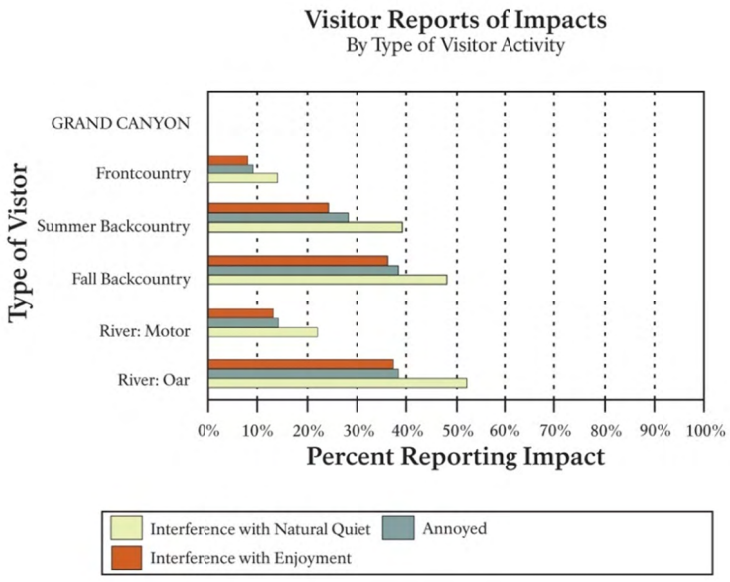
Source: NPS 1994

Visitor Responses to Air-tour Noise

NPS and FAA have conducted data collection of dose-response measurements to characterize how visitors feel about sound of aircraft overflights. Dose-response studies measured visitor noise reactions by statistically relating noise amount visitors were exposed to (dose) with visitor noise responses as expressed by degree they were annoyed or that noise interfered with park enjoyment. The research measured park aircraft sound levels and asked visitors, "Were you bothered or annoyed by aircraft noise during your visit to the site," and "How much did the sound from aircraft interfere with your enjoyment of the site?" Simultaneous measurement of aircraft sound levels and visitor surveys permitted an improved understanding of dose-response relationships that estimate what percent of people are affected by a given level of aircraft overflight sound (Anderson et al. 1993). For tour-aircraft overflights, sound measure that best predicts visitors' reactions is percent of time aircraft are audible. Even when aircraft are audible for relatively low percentages of time, some visitors notice the aircraft, and believe the sound has interfered with their appreciation of natural quiet (NPS 1994).

Results, summarized on Figures 3.2 and 3.3, show visitors have very different sensitivity to aircraft sound depending on their park location. Backcountry hikers and oar-powered river users reported greatest sensitivity. As presented in the 1995 Report to Congress, for a given aircraft-sound level, considerably fewer visitors at frontcountry overlook sites reported annoyance or interference with natural quiet than backcountry or oar-powered river visitors. For visitors to short-hike sites, 30 to 40% can be expected to report moderate to extreme interference with their appreciation of natural quiet when aircraft are audible 10% of the time (NPS 1994). Backlund et al (2008) found in 2005 that 32% of overnight backcountry visitors felt there were too many aircraft flying over the backcountry. Though many factors likely influence sensitivity, it is likely that as visitors pursue activities that take them away from their cars and other visitor activities, they are likely to be more sensitive to mechanized sounds, including the sound of overflights from tour aircraft.

FIGURE 3.2 VISITOR REPORTS OF IMPACT



Source: NPS 1994

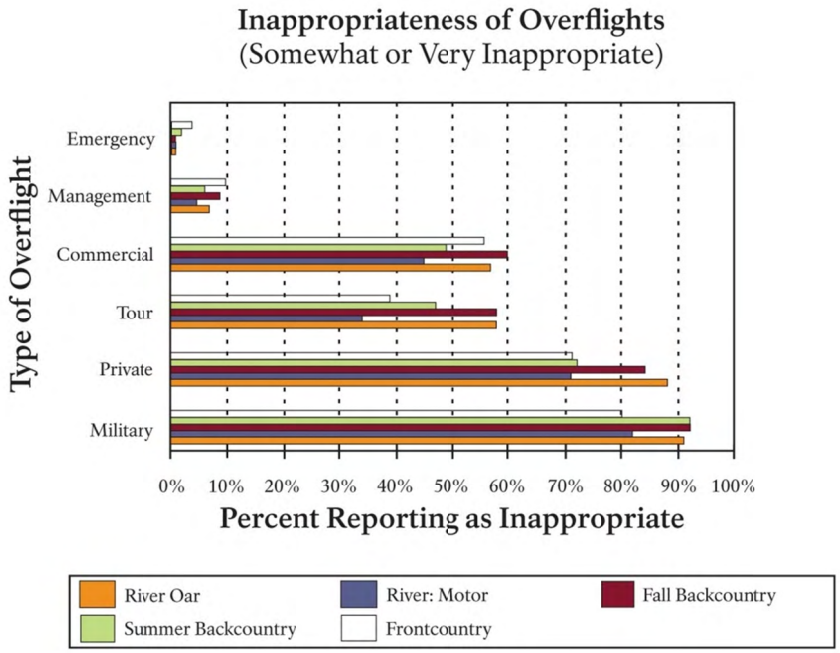
In 2005, the U.S. Department of Transportation's Volpe Center[29] conducted a noise/visitor response study and combined this with results of all known aircraft noise response data previously collected in national parks (Volpe

[29] U.S. Department of Transportation, Volpe National Transportation Systems Center online at http://www.volpe.dot.gov

2005). This effort revealed perception differences between overlook users and those on short hikes. The study found those on hikes in the four national park units studied were much more likely to hear and be annoyed by presence of aircraft noise (Table 3.10). In comparing respondents at overlooks to those on short hikes, a substantial difference existed in percentage who reported hearing aircraft when they were present, 37% and 66%, respectively, and a greater percentage of short-hike visitors expressed some level of annoyance (Volpe 2005). While the results do not indicate whether visitors on short hikes were, on average, exposed to more aircraft noise than visitors at overlooks, they do indicate a greater sensitivity by those on short hikers to noise exposure. This is consistent with findings of differing perceptions between backcountry and frontcountry park users (Baumgartner and McDonald, 1994).

Anderson, et al, (1993) reported that at the same national park units, including GCNP, at short-hike sites about 22% of visitors were annoyed when aircraft were audible 20% of the time. Similarly, about 5% were annoyed at overlooks when aircraft were audible 20% of the time.

FIGURE 3.3 VISITORS REPORTING INAPPROPRIATENESS OF OVERFLIGHTS



Source: NPS 1994

TABLE 3.10 OVERVIEW OF RESPONSES TO AIRCRAFT NOISE DOSE

Percentage of Respondents who	Overlook	Short Hike
Were exposed to aircraft noise	94%	89%
Reported hearing aircraft when exposed to aircraft noise	37%	66%
Reported moderate to extreme annoyance when exposed to aircraft noise	9%	26%
Reported very or extreme annoyance when exposed to aircraft noise	2%	12%

Source: Volpe 2005

Table 3.11 also presents visitor responses to both air-tour aircraft and high-altitude jets. Forty-five percent of overlook visitors and 77% of hikers reported hearing aircraft noise that included tour aircraft and high-altitude jets. While visitors on short hikes expressed greater annoyance to aircraft noise, both groups appear to be more sensitive to air-tour aircraft than to high-altitude jets.

Overall, research results consistently conclude that increased exposure to aircraft noise resulted in an increased diminishment of visitor enjoyment, and that visitors farther from park development (e.g. on short hikes or in the

backcountry) have an increased sensitivity to equivalent noise doses compared with visitors in developed park settings (e.g. at overlooks).

TABLE 3.11 OVERVIEW OF RESPONSES TO TOUR AIRCRAFT AND JETS BY VISITORS TO GCNP

	Overlook Visitors		Short Hike Visitors	
	Tour Aircraft plus Jet	Jet Only	Tour Aircraft plus Jet	Jet Only
Number of respondents	785	150	1,122	50
Percent who reported hearing aircraft	45	17	77	55
Percent who reported moderate to extreme annoyance from noise	11	4	30	10
Percent who reported very or extreme annoyance from noise	3	1	14	6

Source: Volpe 2005

WILDLIFE

Introduction

Grand Canyon is a valuable wildlife resource due to the park's size, elevation range, and associated habitat variety. The park wildlife database lists 90 mammals, 355 birds, and 56 amphibian and reptile species. GCNP's diverse vegetation associations provide suitable conditions for both habitat generalists and specialists. Wildlife occurrence can generally be grouped in habitats defined by vegetation: mixed-conifer (spruce-fir and mixed-conifer types), ponderosa pine, piñon-juniper, shrub-grass, and riparian. Many wildlife species are habitat generalists, using ecosystems from desert scrub through coniferous forest to meet basic requirements. Some species are habitat specialists, requiring specific vegetation composition and structural components to supply their needs. Appendix E provides a habitat list with common species found in the park. The following focuses on information regarding park wildlife; however, the information also pertains to areas outside the park in the SFRA that support the same habitats. Information presented below is predominantly based on park documents and references cited therein (NPS 2010b, NPS 2005a).

Analysis focuses on those wildlife groups most likely to be affected by commercial air-tour operations. As discussed in Chapter 2, it is unlikely invertebrates would be detectably affected by air-tour operations, thus, they are not considered for further analysis in this EIS. In addition, bats are not considered for further analysis as they are not active during air-tour flight times, and thus would not be affected. Special-status species are considered separately as the next impact topic.

Reptiles and Amphibians

Approximately 56 reptile and amphibian species reside in GCNP, the majority along the river corridor or in upland desert and riparian sites. Highest densities and diversity occur in riparian areas due to abundant vegetation and invertebrate food sources. Sixteen reptiles species have been identified along the Colorado River (Carpenter 2003). Reptiles commonly associated with the river corridor include Western whiptail lizards (*Cnemidophorus spp.)*, tree lizards (*Urosaurus ornatus)*, desert spiny lizards (*Sceloporus magister*), and Grand Canyon pink rattlesnakes (*Crotalus atrox*). Little is known about herpetofauna that inhabit the park's forested communities. A variety of lizards and snakes inhabit plateau coniferous forests especially in piñon-juniper woodlands and ponderosa pine forests. Common lizard species found on the plateau area include the greater short-horned lizard (*Phrynosoma hernandesi*), northern plateau lizard (*Sceloporus undulatus elongatus*), and northern sagebrush lizard (*Sceloporus graciosus graciosus*). Great Basin gopher snake (*Pituophis catenifer deserticola*) is common in ponderosa pine forests, piñon-juniper woodlands, and desert scrub. Primarily found on South Rim, the Sonoran gopher snake (*Pituophis catenifer affinis*) occurs in predominantly scrub to piñon-juniper woodlands.

Amphibians are not well-represented in the park generally due to arid conditions; few amphibians inhabit plateaus. Tiger salamanders (*Ambystoma tigrinum*) inhabit areas around pools, marshes, and water tanks in meadows in North Rim ponderosa pine to spruce-fir forests. Great Plains toad (*Bufo cognatus*) and Great Basin spadefoot toad (*Spea*

intermontana) can be found in riparian areas or in ponderosa pine forests. Rocky Mountain (*Bufo woodhousii*) and red-spotted toads (*Bufo punctatus)* are found in inner canyon riparian areas along the river and perennial tributaries.

Birds

Grand Canyon's striking elevational and topographic diversity creates complex mosaics of vegetation types, providing diverse habitat for bird species. Riparian habitats along the river in the park provide breeding habitat, migratory stopover sites, and wintering areas for birds throughout the year. Over 370 bird species have been recorded in the Grand Canyon region, approximately 250 of which are from the river corridor (NPS 2010a). Some species are year-round residents such as canyon wren (*Catherpes mexicanus),* wild turkey *(Meleagrif gallapavo),* and American dipper (*Cinclus mexicanus)*, but most are migrants that use the river seasonally for breeding or as a travel corridor, or are from other canyon habitats and use the river corridor during nonbreeding or migratory seasons. Other species that breed in the canyon and are present through most of the summer include song sparrow (*Melospiza melodia)*, house finch *(Carpodacus Mexicanus)*, and Bell's vireo (*Vireo bellii*). Waterfowl have been found to be more abundant in winter than in other seasons and are particularly abundant in the canyon's upper reaches between Lees Ferry and the Colorado/Little Colorado River confluence.

In plateau areas, a number of bird species are generalists and occupy a variety of habitats (ponderosa pine, ponderosa-mixed-conifer transition, mixed-conifer, and meadow). Generalist forest species such as broad-tailed hummingbird (*Selasphorus platycerus)*, plumbeous vireo (*Vireo plumbeus*), brown creeper (*Certhia americana*), and evening grosbeak (*Coccothraustes vespertinus*) have been found in all forest types from ponderosa pine to spruce-fir forests. Breeding warbler diversity in ponderosa pine is second only to the Colorado River corridor, which has four breeding species. Secondary cavity nesters (e.g., violet-green swallow (*Tachycineta thalassina*), pygmy nuthatch (*Sitta pygmaea*), western bluebird (*Sialia mexicana*), brown creeper, and white-breasted nuthatch (*Sitta carolinensis*) are also an important component of the ponderosa pine forest bird community.

Several raptors are closely associated with ponderosa pine, including the rare northern goshawk (*Accipiter gentilis*), red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), great horned owl (*Bubo virginianus*), and northern pygmy owl (*Glaucidium californicum*). The northern goshawk breeds in high, forested mountains and plateaus across Arizona (usually above 6,000 feet); primary potential goshawk habitat in the park is in North Rim mixed-conifer and ponderosa pine habitats. As of 2007, 18 northern goshawk territories are identified in North Rim forests, and four in South Rim forests. The northern pygmy owl also occurs in ponderosa pine, but hunts during the day or at dusk (Brown, et al. 1987). Flammulated owls (*Otus flammeolus*) are migratory and occur in dry, montane coniferous forests in central and western North America.

Golden eagles (*Aquila chrysaetos*) are usually found in open country, prairies, arctic and alpine tundra, open wooded country and barren areas, especially in hilly or mountainous regions. They nest on rock ledges, cliffs, or in large trees; however, nesting golden eagles are very rare in Grand Canyon (Ward 2009). They commonly hunt in early morning and early evening.

Small Mammals

A number of small mammals are habitat generalists using ecosystems including desert scrub, coniferous forests, and riparian areas. Deer mice (*Peromyscus maniculatus*) and western harvest mice (*Reithrodontomys megalotis*) are common throughout the park, and serve as important prey species for many predators. The deer mouse is the only rodent that depends directly on the riparian zone for its existence. Botta's pocket gopher (*Thomomys bottae*) inhabits South Rim and North Rim's warmer West End. They use desert scrub, piñon-juniper and ponderosa pine forests wherever suitable soil exists for digging. The brush mouse (*Peromyscus boylii*) uses a variety of park habitats, preferring piñon-juniper forests, riparian areas, rocky slopes, and shrublands, and sometimes spruce-fir forests. Mexican woodrat (*Neotoma mexicana*), bushy-tailed woodrat (*Neotoma cinerea*), and Mexican vole (*Microtus mexicanus*) occur only on South Rim. The bushy-tailed woodrat occurs in piñon-juniper woodlands or ponderosa pine forests, but is restricted to suitable rocky areas. The Mexican woodrat inhabits rocky areas in ponderosa pine, frequently along rim edges and sometimes into the piñon-juniper belt. They often use the same habitat as rock squirrels (*Spermophilus variegates*). Mexican voles prefer areas that tend to be drier with sparse grass. The Uinta chipmunk (*Tamias umbrinus)*, least chipmunk (*Tamias minimus*), golden-mantled ground squirrel (*Spermophilus*

lateralis), and Nuttall's cottontail (*Sylvilagus nuttallii*) are found only on North Rim. Shrews and voles occur in most habitats on the plateau ranging from rocky slopes to grassy meadows.

Carnivores

Most predators are highly mobile, hunting in habitats throughout GCNP. Eleven terrestrial mammalian carnivore species occur in the park. These include mountain lion (*Puma concolor*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), badger (*Taxidae taxus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale gracilis*), ringtail (*Bassariscus astutus*), and long-tailed weasel (*Mustela frenata).* Mountain lions occur throughout Arizona and can be found in any habitat, including riparian areas. Black bears are thought to exist in very low densities on North and South Rims, and are reported sporadically on South Rim. Raccoons are likely restricted to lower elevations along the river and in more developed South Rim areas. Ringtails are primarily found along canyon rims and in developed areas. Skunks are found in South Rim piñon-juniper and ponderosa pine forests and are probably present on North Rim; striped skunks occur in the canyon below 4,400 feet.

Coyotes are common throughout the park and appear particularly common on South Rim. Bobcats are commonly found throughout the park in desert and wooded areas, especially along the piñon-juniper belt. Badgers uncommonly occur in grasslands, piñon-juniper, and ponderosa pine forests on both rims. In Arizona, long-tailed weasels occur from the Kaibab Plateau south along the Mogollon Rim and in scattered mountain ranges in eastern Arizona. Long-tailed weasels are active year-round and are primarily nocturnal.

Ungulates

Ungulates such as mule deer and elk occupy zones seasonally. Both elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) are found on South Rim and use piñon-juniper and ponderosa pine forests for food and shelter. Mule deer occupy a variety of habitats from ponderosa pine forests to chaparral scrub, but tend to avoid large openings and mature forest with closed canopy. Mule deer occur on both North and South Rims and along the river corridor. On North Rim, mule deer depend on the piñon-juniper zone for essential winter forage, and move into ponderosa pine, mixed-conifer, and spruce-fir during spring, summer, and fall. Deer begin migrating into mixed-conifer forest in early May and remain there and in spruce-fir until late September. Desert bighorn (*Ovis Canadensis*) prefer rough, rocky, sparsely vegetated habitat characterized by steep slopes, canyons, and washes. They descend to the river for forage. Bighorn are commonly seen on rocky cliffs along the Colorado River, and occasionally seen on plateaus near rims.

Ambient Soundscape, Aircraft Overflights, and Wildlife

Wildlife both create and are affected by sound in their environment. Soundscape is an integral part of an animal's habitat. Wind, weather and storm activity, water, mammals, birds, insects, and occasional geologic events all contribute to the natural ambient Soundscape. Natural ambient sound levels are substantially affected by vegetation and topography, which greatly vary throughout Grand Canyon. Non-natural sounds, such as those created by low-level air-tour overflights, high-elevation aircraft noise, miscellaneous motor sounds, and other human-caused sounds, have become a regular part of the park's Soundscape.

All habitats that support park wildlife are subject to aircraft noise. Higher elevations generally experience more aircraft noise because they are closer to the source (i.e., aircraft). Where West End helicopter tours travel below the canyon rim or into side canyons, lower elevations could experience more aircraft noise. Low frequency wind sounds have potential to mask aircraft sounds in some situations, especially in ponderosa pine forests (Ambrose 2006).

Altitudes and areas where air tours most often occur are such that potential for noise or visibility effects on wildlife are increased, and thus, indicate areas where existing conditions may present noise and visual impacts to wildlife. In the 1995 Report to Congress, the complexity of determining effects on wildlife due to various factors that influence an individual's response was presented. The report discusses differences in stimuli perception based on physical environment and psychological attributes of the animal at the time of its exposure. The report states: "Some habitats enhance stimuli associated with aircraft overflights. The sound and visual stimuli associated with aircraft have different effects in an open desert than in a forest where trees can obscure the sight and may reduce the sound of

aircraft." In addition, the report surmised that "…the relationship between aircraft and animals is clear in that the closer an aircraft is, the greater the probability that an animal will respond...."

The 1995 Report to Congress discussed physiological and behavioral responses to overflights including accidental injury, reproductive and energy losses, and habitat avoidance and abandonment. Physiological responses to aircraft overflights would vary depending on noise characteristic and species, with reactions ranging from mild annoyance to panic. Behavioral responses similarly vary between and within a species due to age, sex, prior exposure, etc.

Some research has been conducted in the park focusing on effects of aircraft on wildlife. Bighorn were shown to be sensitive to helicopter noise during winter resulting in reduced foraging efficiency. The effect from helicopter noise decreased in spring when sheep migrated to lower elevations, creating greater distance between them and the helicopters (Stockwell and Bateman 1987, Stockwell et al. 1991).

Air tours are not conducted to specifically afford viewing opportunities of any particular wildlife species or habitat. Aircraft striking wildlife is a relatively uncommon event. Direct conflict between wildlife and aircraft overflights is most often associated with bird strikes. FAA's Airports Division has wildlife hazard records dating to 1990. Since that time there have been four wildlife incidents recorded for Grand Canyon Airport: in 1990, 1998, and 2000 aircraft struck sparrows, crows, and a common raven, respectively. In 1992 an aircraft struck an elk (NPS 2008a).

SPECIAL-STATUS SPECIES

Introduction

Special-status species and their critical habitats include the following categories

- Federally listed, proposed, or candidate
- State-listed, proposed, or candidate
- Tribally listed, proposed, or candidate

The U.S. Fish and Wildlife Service only formally considers Federally listed species in Biological Assessments and subsequent Biological Opinions. However, the NPS uses a broader approach that considers all species with listing status at Federal, state, and tribal levels. As a result, some species not addressed in previous Biological Assessments and Opinions, such as American peregrine falcon, are included in this analysis.

Several threatened and endangered species in the SFRA would not be affected by the Alternatives, and are not analyzed; see Chapter 1, Impact Topics Considered and Dismissed from Detailed Analysis. Table 3.12 provides a list of three special-status bird species evaluated in this EIS.

TABLE 3.12 SPECIAL STATUS SPECIES WITH POTENTIAL TO BE AFFECTED BY AIRCRAFT OVERFLIGHTS

		Listing Status					
Common Name	**Scientific Name**	**Federal[a]**	**State[b]**	**Navajo[c]**	**GCNP**	**Other[e]**	**Designated Critical Habitat in GRCA**
American peregrine falcon	*Falco peregrinus anatum*		WSC	--	--	SSC	No
California condor[d]	*Gymnogyps californianus*	E, XN	WSC	--	--		No
Mexican spotted owl	*Strix occidentalis lucida*	T	WSC	G3	--		Yes

[a]Federal status: E = Endangered; T = Threatened; C = Candidate; XN = Experimental, non-essential
[b]State status: WSC = Wildlife of special concern in Arizona
[c]Navajo endangered species list: G1 = No longer occurs on Navajo Nation lands; G2 = Prospect of survival or recruitment is in jeopardy; G3 = Prospect of survival or recruitment is likely to be in jeopardy in the foreseeable future. Navajo status determination is not used by any other affiliated Grand Canyon tribes
[d]Condors are managed as Federally endangered in the park
[e]Peregrine falcons are managed as a Species of Special Concern (SSC) as they were formerly listed as Threatened; see Appendix E

Species Profiles

American Peregrine Falcon

After 29 years on the U.S. Fish and Wildlife Service List of Endangered and Threatened Wildlife Species, peregrine falcon (*Falco peregrinus anatum*) was removed from the list August 25, 1999. This, however, does not end NPS concern for the species. Arizona lists peregrine falcon as Wildlife of Special Concern. Peregrine falcons are known to tolerate noise and disturbance more than other avian species (Palmer et al. 2003, Ellis 1991 in NPS 1999). However, as a conservative approach, the peregrine was retained for full evaluation to analyze potential for aircraft overflights to affect this species in Grand Canyon.

Peregrine falcons often nest high on cliff faces that afford them access to an open sky to pursue their primary prey: birds and bats (White et al. 2002).

Importance of the Grand Canyon peregrine population was first documented in 1991 with submission of a final report to the NPS covering an extensive survey conducted during the 1988 and 1989 field season by Bryan T. Brown (Brown 1990). This survey documented 58 peregrine pairs in the park, and speculated there may be upwards of 100 pairs. This study was duplicated in 1998 and 1999 with similar results (Ward 2000).

A USFWS monitoring plan must consider the Arizona peregrine population, and the population portion in the SFRA has received particular attention, as the Arizona population contributes more to recovery goals than any other state in the Recovery Plan (USFWS 1984).

California Condor

Condors are members of the New World vulture family, feeding exclusively on carrion such as deer, cattle, rabbits, and large rodents. Using thermal updrafts, condors can soar and glide at up to 50 miles per hour and travel 100 miles or more per day seeking food while expending little energy. When not foraging, condors spend most of their time perched at a roost. Cliffs, tall conifers, and snags serve as roost sites (NPS 2007b). An experimental, nonessential[30] California condor population was introduced into northern Arizona December 1996, and the Arizona Game and Fish Department (AZGFD) now lists the California condor as a Species of Special Concern. In GCNP, the experimental population is managed as threatened.

As of June 30, 2010 there are 74 California condors in the southern Utah/northern Arizona area, including six breeding pairs in the northern Arizona area that includes Grand Canyon. The first wild-reared chick in the program's history, and likely the first chick in Arizona in 100 years, fledged November 2003. Since then, five chicks have fledged in the park.

Condors create nesting sites in rock formations such as caves, crevices, and potholes (USFWS 2002a in NPS 2005a). Courtship begins in December, and breeding pairs lay a single egg between late January and early April. Eggs hatch after approximately 56 days, and young condors take their first flight at approximately six months. Young condors may be dependent on parents through the following breeding season (USFWS 1996). Their preferred roosting habitat consists of rock cliffs, snags, and live conifer stands where they can rest, preen, and socialize. Condors prefer the river corridor in winter.

[30] Under the Endangered Species Act section10(j), California condors released into northern Arizona are designated a nonessential experimental population, meaning condors will be treated as a threatened population for section 9 purposes (protection from take). For the purposes of section 7 (interagency consultation), the birds will be treated as a species *proposed* for listing--except on NPS and National Wildlife Refuge System lands, where the birds will be treated as if threatened. Nonessential experimental designation enables the USFWS to develop special management regulations more flexible than rules applying to endangered species, which helps ensure such land uses as forest management, agriculture, mining, livestock grazing, sport hunting, and non-consumptive outdoor recreation will not be restricted. The proposal to reintroduce condors in the Vermilion Cliffs area as an experimental population appeared in the January 2, 1996, Federal Register. After notices were published in local newspapers, the USFWS held 59 meetings (including 2 public hearings) in the vicinity to further explain the proposal and gather public comments. The comment period was extended several times until April 1, 1996. http://www.fws.gov/endangered/bulletin/96/condors.html

All northern Arizona condors are fitted with radio transmitters allowing field biologists to monitor their movements. Monitoring data indicate condors are using habitat throughout the park, concentrating in Marble Canyon, Desert View to Grand Canyon Village, the Village to Hermits Rest, and North Rim's Bright Angel Point. A growing number of condors typically begin visiting the Marble Canyon portion of the Colorado River corridor in February, March, and April (Peregrine Fund 2003 in NPS 2005a). Condors have been observed at Phantom Ranch.

Mexican Spotted Owl (MSO)

The Mexican spotted owl was listed as threatened in 1993 (58 FR 14248), and a recovery plan was issued in 1995 (USFWS 1995). It also is listed as a Species of Concern by Arizona and the Navajo Nation. Critical habitat for the owl, designated February 2001 (66 FR 8530–8553), includes over 75,000 acres of mixed-conifer habitat on North Rim and over 31,000 additional acres of designated Protected Activity Centers (PAC) in the park's canyon habitat.

Presence of MSO in the park was confirmed in 1992 field surveys. Additional survey results in subsequent years suggest owls occupy rugged canyonland terrain. Owl detections indicate they use side canyons and small Douglas fir stringers below the rim. Currently, 41 Draft PAC have been designated in the park, for a total of 31,000 acres. No nests are known to occur on Grand Canyon plateaus, but owls have infrequently been found to forage on North and South Rim plateaus in close proximity to the rim (Bowden et al. 2008).

MSO breed sporadically and do not nest every year. Eggs are laid in late March or, more typically, early April. Incubation begins shortly after the first egg is laid and is performed entirely by the female. MSO incubation is assumed to be 30 days. Eggs usually hatch in early May, with nestlings fledging four to five weeks later, and then dispersing late August to mid-September (Ganey 1988).

MSO monitoring as a condition of the USFWS permit since 2001 reported 18 PACs adjacent to or directly under current air-tour routes (NPS 2008d). Currently, East End flight routes traverse seven PACs. In addition, the majority of air-tour flights occur during the MSO breeding period March 15 to August 30 (NPS 2008d).

Bird Strikes

Since 2000, there have been no reported bird strikes of California condor or Mexican spotted owl species in the vicinity of Grand Canyon National Park Airport. The FAA's Air Traffic Control and Airports Divisions have both confirmed this data. Since 1990, when the FAA began recording wildlife hazard incidents at Grand Canyon Airport, there have been no recorded strikes of special-status species birds (NPS 2008d). Bird strikes associated with SFRA air-tours are known to occur; one recent example having occurred in August 2009 (http://www.nationalparkstraveler.com/2009/08/tour-helicopter-en-route-grand-canyon-makes-emergency-landing-after-bird-strike).

Existing Noise Conditions and Special-Status Species

Concerns regarding effects of commercial air-tour operations on special-status species relate to noise, in-flight collisions, and visual disturbance from aircraft. Based on previous Biological Opinions; consultation with Federal, state, and tribal agencies; scoping comments; and a preliminary assessment of potential for species to be affected by air-tour overflights, special-status species fully evaluated in this EIS include the American peregrine falcon, California condor, and Mexican spotted owl.

SOCIOECONOMIC ENVIRONMENT

Introduction

Four major socioeconomic issues are addressed in this affected environment section and subsequently analyzed in the environmental consequences section of this EIS. Selection and identification of these issues was based on agency and public scoping results, along with NPS guidelines for addressing socioeconomic issues as part of NEPA compliance. Each of the four major socioeconomic issues are defined and described below.

1. **Air-tour Industry** This EIS addresses existing conditions and economic impacts to changes in the air-tour industry that operates over GCNP. This industry would be affected by flight rules and regulations changes such as Alternative routes, operation hours, or quiet-technology equipment. Effects to industry were raised during

scoping. Most air-tour flights occur in the East End, although there are also trans-canyon flights and air tours operating on West End. Tribal-related air tours are discussed separately below

2. **Affected Tribes and Tribal-related Air Operations** Two tribes are currently directly affected by air-tour activity. The Hualapai Reservation facilitates air tours on the park's West End as part of its tourism industry, and experiences aircraft noise in certain areas. The Havasupai receive visitors via helicopter, and also experience other aircraft noise according to scoping comments. A third tribe, the Navajo Nation, is considering entering the air-tour business on the park's East End. Federally recognized tribes are afforded special consideration under government-to-government requirements, government trust responsibilities, and environmental justice considerations based on ethnic and income qualifications described in the subsequent affected environment section

3. **General-aviation Operations** General-aviation aircraft currently fly over the park according to existing rules and regulations governing non-tour flight operations. Effects of EIS Alternatives on general-aviation operations were raised during agency scoping and by the Grand Canyon Working Group. General-aviation operators could be affected by closures or other changes to existing general-aviation corridors or minimum-flight altitudes over Flight-free Zones

4. **Regional Economics and Park Values** This topic responds to dollar-denominated economic and fiscal effects stemming from changes in air-tour and ground-based park visitor patterns and visitor experience. The affected environment describes economic and fiscal conditions in gateway communities surrounding the park, and current effects of the park and air-tour activities on the region using the most up-to-date data available at time of analysis. Intrinsic, non-dollar effects related to park values expressed by visitors and non-visitors are also addressed under this topic. Regional impacts and intrinsic park values were evident among scoping comments. Also, regional business, local tax base, and economic effects must be addressed according to NPS guidelines for NEPA compliance

Air-tour Industry

Data and information on air-tour operators and operations provided in the following sections were obtained from a variety of sources and reflect several different time periods. FAA provided a full year of data on operations May 1, 1997 to April 30, 1998 and also provided data on peak-period operations from July and August 2005. In addition to FAA data, each operator provided substantial information on its existing conditions and operations during interviews with Harvey Economics in spring 2007 and fall 2008. The most current information available at the time of analysis was used for this discussion whenever possible; however, 2005 baseline information is included for several components for consistency with other impact topics.

Profile of the Grand Canyon Air-tour Industry

Air-tour Operators As of June 2010, 13 commercial air-tour operators provided scenic air tours over Grand Canyon, with most air-tour operators based in Tusayan, Arizona; Las Vegas, Nevada and the surrounding area (North Las Vegas and Henderson, Nevada). Other operators base in Santa Fe, New Mexico, and Deer Valley, Arizona. In addition to flying tours from those places, some air-tour operators also offer flights from Page and Sedona, Arizona, and Boulder City, Nevada. Table 3.13 shows air-tour operators that made up the Grand Canyon air-tour industry in 2006, and their locations. These air-tour companies run the gamut from small operators offering a few basic flight options to large operators offering varieties of helicopter and fixed-wing tours.

Air Tours Offered by Operators Tour operators offer a variety of tours over the park on both fixed-wing aircraft and helicopters. Tours range from short, air-only excursions to longer trips that include flights and ground-based activities such as river trips, meals, horseback riding, and other tours. Air tours provide views of the Colorado River and a variety of other natural features.

In addition to Grand Canyon air tours, many operators conduct tours over other national parks, monuments, recreation areas, and/or other attractions. Therefore, in many cases, an operator's resources (planes, employees) are devoted to providing tours over several locations, not only Grand Canyon. For operators conducting air tours over several locations, business and revenues are generated from a larger number of operations than just Grand Canyon

tours. The socioeconomic discussion of commercial operations (excluding tribal operations) included in this EIS pertains only to air-tour operations conducted over Grand Canyon and in the SFRA.

TABLE 3.13 GRAND CANYON AIR-TOUR OPERATORS 2006

Operator*	Location
Air Grand Canyon, Inc.	Tusayan, AZ
Aviation Ventures, Inc. / Vision Air	North Las Vegas, NV
Southwest Safaris	Santa Fe, NM
Grand Canyon Airlines	Tusayan, AZ
Heli USA	Las Vegas, NV
King Airlines, Inc.	Henderson, NV
Las Vegas Helicopters	Las Vegas, NV
Maverick Airstar, LLC	Tusayan, AZ
Maverick Helicopters	Las Vegas, NV
Papillion Airways, Inc.	Tusayan, AZ
Serenity Helicopters	Las Vegas, NV
Sundance Helicopters	Las Vegas, NV
Westwind Aviation	Deer Valley, AZ

Source: Norman Elrod, Federal Aviation Administration, 2010
*Air-tour operators with allocations to fly in the SFRA as of March 8, 2006

According to tour operators, key air-tour selling points include canyon views/other scenery and amount of time flying over the canyon. Customers appear to enjoy seeing a large canyon area, including special features, in a short period. Other selling points are variety of accompanying tours packaged with flights, quality of customer service and, for some, proximity to Las Vegas. As with some of the passenger demographic information, these passenger-use insights were obtained from air-tour operators. Operators are assumed to be generally familiar with their passengers through conversations that occur throughout the tour experience.

Air-tour Routes Current air-tour routes over GCNP include designated fixed-wing and helicopter routes over East and West Ends, and two trans-canyon routes that allow operations between the Las Vegas area and Grand Canyon National Park Airport. Map 2.2 and Table 2.1 show current designated air-tour routes over the park. Current routes are described in detail in Chapter 2, Alternative A.

Many fixed-wing aircraft and helicopter routes on the park's East End are routed around Bright Angel and Desert View Flight-free Zones through Zuni Point and Dragon Corridors. Fixed-wing air tours also operate in the Marble Canyon area on the SFRA's East End. West End air-tour routes include fixed-wing and helicopter routes generally located west-northwest of Sanup Flight-free Zone, but within the SFRA. Trans-canyon routes are north of the Sanup Flight-free Zone. Current route locations are shown on Map 2.2.

No air-tours routes exist through Fossil Canyon or Tuckup General Aviation Corridors.

As of 2007, most Las Vegas-based operators used West End air-tour routes, and several fixed-wing operators used Blue Direct trans-canyon routes. Operators based in Tusayan or other Arizona locations generally used air-tour routes in Zuni Point and Dragon Corridors.

Air-tour Prices A wide variety of air-tours are offered by operators ranging from short flights lasting less than an hour to all day trips that include one or more flights, meals, and other activities. Several operators also offer multi-day trips in which scenic flights make up only a small portion of the overall trip.

Air-tours prices cover a wide range. Factors affecting tour price include departure point (generally the Las Vegas area or Grand Canyon National Park Airport), flight length, and addition of other activities to the tour package. Tours leaving Las Vegas are more expensive and generally include round-trip transportation to and from local hotels. Flight-only tours range about $100 to about $400, depending on where the flight originates. More common

are tour packages including land-based activities in addition to a flight or flights. These tours cover a wide price range depending on included activities and can cost up to several hundred dollars. Following is a sample of air-tour prices based on the most current information available at the time of analysis

Operator Location	Tour	Flight time	Price
Tusayan	air-only fixed-wing tours	40 to 60 minutes	$109 to $120 per person
Tusayan	air-only helicopter tours	25 to 50 minutes	$130 to $235 per person
Las Vegas	air-only fixed-wing tours	several hours (door to door)	$150 to $200 range per person
Las Vegas	air-only helicopter tours	several hours (door to door)	$200 and $400 per person
Other Locales (example Sedona)		2-½ to 3 hours	$500 to $600 per person

Seasonality and Curfews Air tours take place year-round, although spring and summer experience more air visitors than fall or winter. About 60% of all air tours occur May to September (FAA 2000c). On the park's East End, between 65% and 75% of air tours take place during summer months (FAA 2007).
East End air-tour overflights are subject to seasonal curfews (designated times of day when air-tour aircraft are legally restricted from flying). As of 2007, the East End curfew was 6 p.m. to 8 a.m. May through September, and 5 p.m. to 9 a.m. October to April. Trans-canyon flights may leave the Las Vegas area as early as 7 a.m. to get to the park airport when the East End curfew lifts at 8 a.m. in summer. There are no curfew restrictions for flights on the park's West End.

On the East End, outside of curfew, air tours operate throughout the day in summer unless grounded due to inclement weather. In winter, operators may choose not to conduct tours during all allowed hours due to limited demand or poor weather. On the West End, winter weather is not as much a concern as on the East End, and there is greater year-round demand. West End flights fly throughout summer, and according to demand through winter.

Aircraft Used for Overflights Air-tour operations use a wide range of aircraft. Fixed-wing aircraft used by air-tour operators include single-engine Cessna's that hold three passengers, and larger deHavilland Twin Otters that hold 19 passengers. Helicopters used by air-tour operators include models that hold four to six passengers. Table 3.14 shows types and numbers of different aircraft used for air tours over Grand Canyon in 2005, and their maximum passenger capacity.

Air-tour operators used 133 different aircraft for commercial flights in 2005. Fixed-wing aircraft accounted for about 40% of the total air-tour fleet, and helicopters accounted for the remaining 60%. Although some changes occur in aircraft types and number used for tours and other operations over time, information provided in Table 3.14 generally represents 2007 aircraft conditions (Harvey Economics 2007).

TABLE 3.14 AIRCRAFT USED FOR AIR TOURS 2005

Type of Aircraft		Number of Aircraft	Maximum Capacity
Beechcraft 1900	Fixed Wing	2	19 passengers
Cessna 182	Fixed Wing	2	3 passengers
Cessna 206	Fixed Wing	2	5 passengers
Cessna 207	Fixed Wing	10	6 passengers
Cessna 208	Fixed Wing	5	9 passengers
Cessna 402	Fixed Wing	8	9 passengers
De Havilland Twin Otter (DHC-6) or Vistaliner (DHC-6-300)[a]	Fixed Wing	18	19 passengers
Dornier 228	Fixed Wing	5	19 passengers
Piper 31-350	Fixed Wing	1	9 passengers
Aerospatiale 350	Helicopter	36	6 passengers
Bell 206-B	Helicopter	3	4 passengers
Bell 206-L	Helicopter	18	6 passengers
Bell 407	Helicopter	4	6 passengers
Eco-Star 130 (EC-130)[b]	Helicopter	19	6 passengers
Total		**133**	

Source: Federal Aviation Administration, Peak Day JulAug-Dat05.xls; Norman Elrod, March 14, 2007; Harvey Economics 2007
[a]Vistaliner is a Twin Otter aircraft modified to meet quiet-technology standards.
[b]Eco-Star 130 helicopter is a quiet-technology aircraft

Quiet-technology Aircraft Some aircraft used for commercial air tours have incorporated technology to reduce noise emitted during flight calculated on a per passenger basis. Procedures for determining Grand Canyon National Park quiet-technology aircraft designation status for different aircraft are defined in Part 93, Chapter I, Title 14, Code of Federal Regulations and a Final Rule published by FAA in the Federal Register on March 29, 2008. Designation of GCNP quiet-technology aircraft is generally based on measured flyover sound level of an aircraft and seating configuration. Table 3.15 shows aircraft types designated GCNP quiet-technology aircraft.

TABLE 3.15 DESIGNATED GCNP QUIET-TECHNOLOGY AIRCRAFT MODELS

		Aircraft Type
Piper PA-18-150	Cessna 208	Fixed Wing
Vistaliner (DHC - 6QP)	Cessna 425	
Dornier 228	Cessna TR 182	
McDonnell-Douglas 900	Bell 407 (with Quiet Cruise Kit)	Helicopter
Whisper Jet S-55QT	ECO-Star 130	

Source: FAA Advisory Circular AC-93-2, June 2006, with appendices updated December 2008

As shown in Table 3.15, Vistaliner and EC-130 models are used for Grand Canyon air tours. Although used extensively by the NPS for administrative flights such as search and rescue, the MD 900 model is not used for air tours due mainly to issues associated with lift capability. Examples of quiet-aircraft technology include addition of a fourth blade to propellers and turbine-driven engines (compared to piston-driven) for the Vistaliner. ECO-Star helicopters are quieter than other models since tail rotors are enclosed in a shell. Of the six helicopter operators offering tours over the park, two operate a full fleet of EC-130s, three have fleets partially made of EC-130s, and one operator does not use any quiet-technology aircraft. Of the seven fixed-wing operators, one operator flies only quiet-technology aircraft, three do not use any quiet-technology aircraft, and remaining operators have mixed fleets including quiet technology and non-quiet-technology.

Flight Allocations Total number of non-tribal air tours allowed in the SFRA has an annual allocation of 93,971 flights per year. This annual allocation applies to air tours only, not to transportation or repositioning flights by tour operators. Each air-tour operator is allocated a set number of flights through Zuni Point and Dragon Corridors, and a set number of flights in the SFRA outside Zuni Point and Dragon Corridors. Each operator's annual flight allocations in these areas are based on total number of air tours they reported to the FAA May 1, 1997 to April 30, 1998. Currently, air-tour operators can use their flight allocation throughout the year, without any cap on maximum number of tours flown per day. Table 3.16 shows annual allocation held by each air-tour operator as of March 2006.

TABLE 3.16 TOTAL ALLOCATIONS HELD BY GRAND CANYON AIR-TOUR OPERATORS, 2006

Operator	Total Allocation	Operator	Total Allocation
Air Grand Canyon, Inc.	3,135	Maverick Helicopters	7,680
Aviation Ventures, Inc./Vision Air	3,471	Papillion Airways, Inc.	34,690
Southwest Safaris	13	Sundance Helicopters	2,587
Eagle Canyon Airlines/Scenic Airlines	21,355	Vista Helicopters/Silver State Helicopters	1,220
Grand Canyon Airlines	3,168	Westwind Aviation	2,985
Heli USA	2,556	Subtotal	91,250
King Airlines, Inc.	1,924	FAA Held Allocations	2,721
Las Vegas Helicopters	1,026	**Total**	**93,971**
Maverick Airstar, LLC	5,440		

Source: Gene Kirkendall, Federal Aviation Administration, 2006

Number of Air Tours Flown By Location Table 3.17 shows total number of non-tribal air tours flown over the park 2000 through 2005 by aircraft type and location.

TABLE 3.17 NUMBER OF AIR TOURS FLOWN BY LOCATION 2000 THROUGH 2005

	East End			West End			Total
Year	Fixed Wing	Helicopter	Total	Fixed Wing	Helicopter	Total	Flights
2000	8,021	34,366	42,387	24,975	4,506	29,481	71,868
2001	10,037	21,512	31,549	16,198	3,221	19,419	50,968
2002	6,463	19,909	26,372	12,681	3,392	16,073	42,445
2003	6,795	22,827	29,622	12,229	3,735	15,964	45,586
2004	6,800	28,626	35,426	13,089	4,562	17,651	53,077
2005	7,803	31,234	39,037	10,504	7,379	17,883	56,920

Source: Federal Aviation Administration, Quarterly Tables-PP.xls, obtained February 2007
Blue Direct trans-canyon flights are included in West End fixed-wing flights

Helicopter tours account for the majority of flights on the park's East End, and comprised about 68% of all air tours in 2005. Fixed-wing tours account for the majority of flights on the West End and comprised about 32% of all flights in 2005.

The total number of air tours flown decreased from about 72,000 in 2000 to about 42,500 in 2002, which may partly result from the decline in travel after the 2001 September 11th attacks. Number of air tours rose after 2002 until reaching about 57,000 in 2005. Overall, helicopter flights followed this same pattern, totaling about 39,000 in 2000, decreasing to about 22,000 in 2002, and increasing to 39,000 in 2005. Fixed-wing flights decreased from about 33,000 in 2000 to about 19,000 in 2002 and 2003. In 2004, number of fixed-wing flights increased to almost 20,000, but in 2005 decreased to about 18,300. The overall decrease in fixed-wing flights during this period was mainly due to a decrease in West End fixed-wing flights.

Number of Air Tours and Passengers Flown by Route Table 3.18 presents total number of air tours flown by route type May 1, 1997 to April 30, 1998, in 2005, and number of passengers flown for each route type for the same time periods.

TABLE 3.18 NUMBER OF AIR TOURS AND PASSENGERS BY ROUTE TYPE 1997-1998 AND 2005

Route	Type of Aircraft	Number of Air Tours		Passengers	
		1997/1998	2005	1997/1998	2005
Blue Routes	Fixed Wing	38,114	10,500	363,434	136,300
Black Routes	Fixed Wing	11,426	7,800	94,286	71,810
East End Green Routes	Helicopter	32,797	31,240	145,797	174,280
West End Green Route	Helicopter	7,922	7,380	38,340	41,030
Total		90,260	56,920	641,860	423,420

Source: Regulatory Evaluation, Regulatory Flexibility Analysis, International Trade Impact Assessment, and Unfunded Mandates Assessment; Final Rule; Commercial Air Tour Limitation in the Grand Canyon National Park Special Flight Rules Area, Office of Aviation Policy and Plans, Federal Aviation Administration, January 2000, FAA Docket No. FAA-1999-5927-280; Federal Aviation Administration, Peak Day JulAug-Dat05.xls; Norman Elrod, personal communications, March 2007; Harvey Economics, 2007

Air-tour passenger estimate is based on number of air tours flown by type of aircraft, aircraft capacity, and estimates of aircraft load factors by route.

Table 3.19 shows estimated number of air tours by route for 2005. On the park's west side, each air-tour operation flew only one of the air-tour routes (Blue-2 or Blue Direct routes) during each tour. However, on the east side many air-tour flights flew more than one route during the same tour. For example, all east side fixed-wing flights used Black-1, but a large portion of those flights also used Black-1A during the same air tour. Therefore, number of air tours by route shown in Table 3.19 does not reflect number of complete air tours flown in 2005.

TABLE 3.19 ESTIMATED NUMBER OF AIR TOURS BY ROUTE 2005[a]

Route	Number of Air Tours	Type of Aircraft	Location
Blue-2	4,078	Fixed Wing	West side
Blue-2X[b]	0	Fixed Wing	West side
Blue Direct North	6,411	Fixed Wing	Trans-canyon
Blue Direct South	16	Fixed Wing	Trans-canyon
Black-1	7,800	Fixed Wing	East side
Black-1A	6,127	Fixed Wing	East side
Black-2	336	Fixed Wing	East side
Black-3	280	Fixed Wing	East side
Black-4	747	Fixed Wing	East side
Black-4X	303	Fixed Wing	East side
Black-5	104	Fixed Wing	East side
Black-6E	0	Fixed Wing	East side
Black-6W	0	Fixed Wing	East side
Green-1	9,232	Helicopter	East side
Green-1A	8,559	Helicopter	East side
Green-1R	673	Helicopter	East side
Green-2	30,558	Helicopter	East side
Green-4	7,379	Helicopter	West side
Green-4X[b]	0	Helicopter	West side

Source: Federal Aviation Administration, Peak Day JulAug-Dat05.xls; Federal Aviation Administration, Quarterly Tables-PP.xls; Harvey Economics, 2007

[a]Actual number of tours flown by route was not available for the full 2005 year. Estimates in this table were created using flight data from July and August 2005, and total flight numbers by quarter for 2005 exit routes to Grand Canyon West Airport and the Hualapai Reservation

[b]Flights using these routes are Hualapai supported tours and not a designated commercial tour

Hualapai Exempt Flights Several operators also offer helicopter and fixed-wing tours that land on the Hualapai Reservation, and include options for additional land or river-based activities. These flights typically depart from the Las Vegas area and land at Grand Canyon West Airport using Green-4X and Blue-2X routes to exit the SFRA. A small number of fixed-wing flights also depart from Grand Canyon National Park Airport and land at Grand Canyon West. Air tours conducted in support of the Hualapai Tribe are exempt from annual allocations and daily caps to which other tours are subject. This exemption is the result of concerns regarding potential impacts flight limitations would have on the Tribe's economic development (Federal Register, Vol. 65, No. 65). These flights are accounted for separately from commercial tours described. Table 3.20 presents number of Hualapai exempt flights 2000 through 2005.

TABLE 3.20 HUALAPAI EXEMPT FLIGHTS 2000 TO 2005

Year	Fixed Wing Flights	Helicopter Flights	Total
2000	846	16,172	17,018
2001	2,244	14,886	17,130
2002	2,767	14,594	17,361
2003	3,364	20,579	23,943
2004	4,893	23,534	28,427
2005	3,443	28,559	32,002

Source: Federal Aviation Administration, Quarterly Tables-PP.xls, obtained February 2007

Total number of Hualapai exempt flights has increased annually since 2000. The majority of these flights are helicopter tours which, in 2005, made up over 89% of all Hualapai exempt flights. About 198,000 passengers flew

on Hualapai exempt flights in 2005. This estimate is based on number of flights flown by aircraft type, aircraft capacity, and an estimate of occupied seats on each flight.

Non-Tour Flights Aircraft operations in the SFRA are also conducted for purposes other than air tours. Air-tour-related operations include transportation of people and/or equipment, aircraft repositioning, maintenance, and training flights with the majority being transportation or repositioning flights as shown in Table 3.21 for 2005. Transportation flights typically include the return leg of a round-trip flight between the Las Vegas area and Grand Canyon National Park Airport. Repositioning flights are movement of empty aircraft from one airport or airstrip to another to meet operational needs. Maintenance and training flights generally account for less than 1% of total non-air-tour flights. Additionally, administrative flights are conducted in support of the NPS and other agencies, and support flights are conducted for Havasupai Tribal operations.

Non-tour transportation and repositioning flights may occur on any designated Black, Blue, or Green flight route over Grand Canyon. They may also occur on Brown routes (support routes used for transporting people, equipment, or other supplies to various points in or near the park). Brown routes are used for flights between Grand Canyon National Park Airport and Supai Village, and flights between Bar Ten airstrip and the Las Vegas area, Grand Canyon National Park Airport, or other places outside the park. Non-air-tour operations are not restricted by annual allocations regulating air tours; however, noise from these operations is considered in this EIS as part of analyses.

TABLE 3.21 TRANSPORTATION AND REPOSITIONING FLIGHTS 2005

Flight Type	Number of Flights
Transportation	12,525
Repositioning	2,216
Total	14,741

Source: Federal Aviation Administration, Peak Day Jul Aug- Dat05.xls; Federal Aviation Administration, Quarterly Tables-PP.xls; Harvey Economics 2007
Table estimates were created using flight data from July/August 2005 and total flight numbers by quarter for 2005

Historical Operator Trends Both number of air-tour operators and number of air tours flown over Grand Canyon have decreased since detailed data collection began in 1997-1998. Number of operators flying over Grand Canyon decreased from 40 in 1987 to 24 in 1997-1998 to 13 operators in 2007. Consolidation of the Grand Canyon air-tour industry may be the result of several factors (FAA 2007)

- Regulations to the Grand Canyon air-tour industry over recent years and uncertainty created by the prospect of additional regulation may have caused some operators to leave the industry. Marginal operators, whose main business focus may not have been Grand Canyon flights or who flew a very limited number of air tours over Grand Canyon, may have been deterred from continuing operations in the face of regulations. For example, SFRA creation required air-tour businesses to operate under Part 135 of Federal Aviation Regulations, rather than Part 91 as several small operators had previously
- The Grand Canyon air-tour industry might have become a mature industry. Operators may have seen demand for services reach its peak, and are seeing a more stable demand. As shown by Tables 3.16 and 3.17, total number of air tours flown each year has been less than the annual allocation allowed by the FAA in every year since 2000. If additional air tours were in demand, it is expected operators would accommodate additional customers. Therefore, it appears the market for non-tribal-related air tours over the park is in balance with operations. Although total number of commercial air tours flown has increased since 2002, operators have not reached the level flown 1997 to 1998 based on the most current data available at the time of analysis
- Additionally, there are several barriers to entry to this industry, making it difficult for any new operators to begin air-tour operations over Grand Canyon
  - Start-up costs of air-tour operations are high since aircraft and other equipment required to provide tours are expensive
  - The annual flight allocation system does not allow additional air tours over Grand Canyon above a set limit. Almost all annual allocations have been assigned to existing operators, although the FAA does hold some additional allocations

Employment and Income Generated from the Grand Canyon Air-tour Industry The air-tour industry employs pilots, mechanics, office administrators, and other types of jobs to conduct business. In addition to people directly employed by air-tour operators, others are indirectly involved with the industry including hotels tour-booking agents, and advertising and marketing professionals. Table 3.22 shows total number of people directly employed by air-tour operators, by location, in 2007.

Wages for those directly employed by air-tour operators generally range about $30,000 to $50,000 annually, including full-time and part-time employees. Employment supported by the air-tour industry provides income to workers and indirectly provides revenue to local businesses as a result of employee and operator spending.

TABLE 3.22 EMPLOYEES OF THE GRAND CANYON AIR-TOUR INDUSTRY BY LOCATION 2007

Location	Number of Operators at Location	Employees
Las Vegas/ North Las Vegas, NV	8	880
Grand Canyon National Park Airport/ Tusayan, AZ	3	293
Henderson, NV	1	10
Phoenix/ Deer Valley, AZ	1	20
Grand Canyon West, Hualapai Reservation, AZ	1	24
Boulder City, NV	1	10
Page, AZ	1	5
Sedona, AZ	1	5
Santa Fe, NM	1	2
San Diego, CA	1	2
Total		**1,251**

Source: Harvey Economics 2007
Employee information was not provided for one operator
Several operators have employees at more than one location

Financial Characteristics of Air-tour Operators Revenues

FAA reports between May 1, 1997 and April 30, 1998, air tours over Grand Canyon generated almost $100 million in gross revenue ($99.3 million). Tours in fixed-wing aircraft accounted for over 70% of all revenue generated by air tours, with helicopter tours accounting for just under 30% (FAA 2000c).

Revenues varied widely for air-tour operators flying over the park in 2006. (Revenue data was collected from most operators during individual interviews conducted by Harvey Economics in April 2007. For operators that did not provide financial data, Harvey Economics estimated gross revenues based on passenger data, operations by aircraft type, and available price information. As discussed previously, tour operators differ from one another with respect to fleet size and type, operations number, tours types, customer types flown, and other factors. These differences resulted in a wide range of reported and estimated revenues for 2006. Gross revenues resulting from tours over the park, including those that landed at Grand Canyon West, ranged about $45,000 to about $64.5 million for individual operators in 2006. According to operator interviews with Harvey Economics (April 2007), total gross revenue of air-tour operators from tours flown over the park in 2006 was $203,123,000.

Substantial air-tour price increases explain total revenue increases in light of reduced flight operations compared with 1997-1998.

Total net revenue, defined as gross revenues less gross operating costs, for 2006 was not provided for several operators and could not be estimated from available data. Net revenue for other operators, resulting only from Grand Canyon-related operations, ranged about $1.3 million in profit to about $700,000 loss in 2006. The differences in net revenues are due to specific operating characteristics of individual operators.

Marketing of Grand Canyon air tours is an industry of its own and operator revenues are affected by the amount of money dedicated to marketing of tours. For example, a portion of each tour price for some operators goes to other

companies or groups involved in selling tours. Commissions to booking agents or other tour sellers generally run 10 to 20% of gross revenues.

Operating Costs FAA developed estimates of variable operating costs including crew, fuel, oil, and maintenance costs for air-tour operators May 1, 1997 to April 30, 1998. Operating costs were estimated for each aircraft type along each air-tour route separately, with estimates of total operating costs for the industry of $29.2 million (FAA 2000c). Estimates of operating costs May 1997 through April 1998 are presented in 1998 dollars and have not been adjusted to reflect current dollars.

Only about half the 2007 air-tour operators provided information on various operating costs. Of operators that provided these financial data, total operating costs resulting from Grand Canyon-related operations ranged about $1 million to about $24 million per operator in 2006. These reported costs include wages, aircraft rental, insurance, fuel, maintenance, commissions to booking agents, advertising, landing fees, and other miscellaneous expenses. The percentage of operating costs that fall into each of these categories varies based on specific operations of individual tour providers.

Debt Service Total debt and annual debt service also varies for these tour operators. For reporting operators, total debt ranged $4.5 million to over $35 million, and annual debt service ranged about $230,000 to about $2.2 million in 2006 (Harvey Economics 2007) (These figures are based on a small number of air-tour operators. The majority of operators chose not to provide this information and therefore the actual range of total debt and annual debt service may differ from what is reported here). Difference in debt among operators results from a number of factors, from purchases of new aircraft to purchases of competing air-tour companies. Most operators obtain short-term loans (seven to ten years) for purchase of new aircraft, although several operators are able to finance these purchases themselves.

Fleet Replacement and Expansion As a result of hours flown, aircraft require periodic maintenance or replacement. Operators generally reported conducting scheduled aircraft overhauls and replacement of key parts rather than purchasing new aircraft to replace older ones. However, many of these same operators also reported plans to purchase additional aircraft within the next year or two to expand their fleet (Harvey Economics 2007). These operators generally plan to acquire one or two new aircraft at a time. Several of these operators plan on purchasing quiet-technology aircraft; these are generally operators that already have some quiet-technology aircraft in their fleet. Other operators may purchase non-quiet-technology aircraft similar to their fleet. Helicopter operators reported plans to purchase a greater number of aircraft in the near future than fixed-wing operators. This is consistent with the increasing number of helicopter tours flown over the park since 2002, and the large percentage of total tours that are helicopter operations, as shown in Table 3.17.

Overall Financial Condition of Air-tour Operators Overall financial condition of air-tour operators can generally be described as adequate. Most operators have experienced positive net revenues in recent years, although one operator reported a net loss, and other operators reported losses for specific portions of their tour operations in 2006. The majority of operators do have some amount of overall debt; however, they seem able to manage that debt. As discussed above, some operators are planning to purchase additional aircraft in the future, which will be debt-financed.

Profile of Airports Serving Grand Canyon Air-tour Operators

Nine airports provide services and support to air-tour companies flying over Grand Canyon. These facilities range from small, local airports to major international airports and are owned by various public entities including cities, counties, and the state of Arizona. Table 3.23 lists airports (and ownership) from which non-tribal-related fixed-wing and helicopter tours took-off or landed in 2006.

Several operators moved their base of operations from one airport or airstrip to another over the years for a variety of reasons. Other operators plan a future move. Location changes are expensive, requiring a considerable amount of planning and preparation, and generally occur only if absolutely necessary. For example, McCarran International Airport will soon require all air-tour operations leave that location to find another base of operations. These changes do occur from time to time, affecting use of various airports and airstrips. A large portion of flights taking off or landing at Grand Canyon National Park Airport are related to the Grand Canyon air-tour industry, while at other

airports, such as McCarran International Airport and Santa Fe Municipal Airport, percentage of total flights related to the air-tour industry is quite small. Following is a description of primary airports used by air-tour operators in 2006, including air-tour industry impacts on each.

TABLE 3.23 AIRPORTS USED BY THE GRAND CANYON AIR-TOUR INDUSTRY 2006

Airport	Owner
Grand Canyon National Park Airport, AZ	State of Arizona
McCarran International Airport, NV	Clark County, NV
North Las Vegas Airport, NV	Clark County, NV
Henderson Executive Airport, NV	Clark County, NV
Boulder City Municipal Airport, NV	Boulder City, NV
Page Municipal Airport, AZ	City of Page, AZ
Deer Valley Airport, Phoenix, AZ	City of Phoenix, AZ
Sedona Airport, AZ	Yavapai County, AZ
Santa Fe Municipal Airport, NM	City of Santa Fe, NM

Source: Air-tour operators 2007

Grand Canyon National Park Airport Owned and operated by the Arizona Department of Transportation, Grand Canyon National Park Airport is located six miles south of Grand Canyon National Park, near Tusayan. This airport is the fourth[31] most active commercial-service airport in Arizona. The air-tour industry makes up a measurable part of Grand Canyon National Park Airport operations, with air-tour operators conducting tours over Grand Canyon and other nearby sites. In 2002, commercial air tours made up about 28% of Grand Canyon National Park Airport's total operations (ADOT 2005). Six operators offer tours from Grand Canyon National Park Airport

McCarran International Airport, North Las Vegas Airport, and Henderson Executive Airport Clark County Department of Aviation operates the Clark County Airport System, made up of these three airports plus two additional airports and an airfield. The Clark County Department of Aviation operates as an enterprise fund, separate from the county. Where data are available, the three airports are discussed separately; however, revenue and expenditure information is only available at the department level. Air tours make up a much smaller operations portion of these airports than Grand Canyon National Park Airport. A large portion of operations at North Las Vegas Airport and Henderson Executive Airport are non-commercial, private-operator flights. Seven operators offer tours from these three airports

Boulder City Municipal Airport Three air-tour operators (one fixed-wing and two helicopter-tour operators) fly tours out of Boulder City Municipal Airport. This airport has only been in operation since the early 1990s and has a much smaller number of total operations than Grand Canyon National Park Airport or Clark County airports. Grand Canyon air tours make up only a small portion of flights at this airport

Page Municipal Airport One Grand Canyon air-tour operator offers flights out of Page Municipal Airport. In addition to air tours, operations at the Page Airport include other commercial air service, general-aviation and military flights, and cargo transport. Grand Canyon air tours make up only a small portion of flights at this airport

Deer Valley Airport Deer Valley Airport is a reliever airport for Phoenix's Sky Harbor International Airport and the busiest general-aviation airport in the United States (City of Phoenix 2010). These airports are part of the City of Phoenix's Department of Aviation, an enterprise fund that does not receive funding from the

[31] According to the March 2010 Arizona Office of Tourism Airport Passenger Volume Report available at http://www.azot.gov/documents/Airports%20March%202010.pdf, Arizona's busiest airports include 1) Phoenix Sky Harbor, 2) Tucson International, 3) Phoenix-Mesa Gateway, 4) Grand Canyon National Park Airport and 5) Laughlin-Bullhead City International

city. The same operator that offers flights out of Page Municipal Airport also offers flights out of Deer Valley Airport. This is the only Grand Canyon operator offering flights from Deer Valley. Air tours over Grand Canyon are a small part of total operations at Deer Valley Airport

Sedona Airport One Grand Canyon helicopter-tour operator offers flights out of Sedona Airport. The majority of this operator's tours are offered from other airports; only a few are offered from Sedona Airport

Santa Fe Airport One Grand Canyon air-tour operator offers flights out of Santa Fe Airport. This operator holds only a few allocations for Zuni Point and Dragon Corridors and these operations made up less than 0.1% of the airport's total operations in 2005-2006

Takeoffs and Landings Table 3.24 shows number of air-tour take-offs and landings at each airport serving Grand Canyon air-tour operators in 2005.

TABLE 3.24 AIR-TOUR TAKE-OFFS AND LANDINGS 2005

	GCNP Air-tour Take-offs		GCNP Air-tour Landings	
	Fixed Wing	**Helicopter**	**Fixed Wing**	**Helicopter**
Grand Canyon National Park Airport, AZ	9,861	33,652	14,318	33,212
McCarran International Airport, NV	0	3,477	0	3,477
North Las Vegas Airport, NV	6,667	0	2,202	0
Henderson Executive Airport, NV	1,268	0	1,268	0
Boulder City Municipal Airport, NV	0	1,341	0	1,341
Page Municipal Airport, AZ	109	0	8	0
Phoenix Deer Valley Airport, AZ	79	0	389	0
Sedona Airport, AZ	4	0	0	0
Valle Airport, private, AZ	13	0	0	0
Kayenta Airport, Navajo Nation, AZ	13	0	0	0
Scottsdale Airport, AZ	50	0	0	0
Monument Valley Airport, AZ	239	0	8	0
Las Vegas Strip, NV	0	142	0	142
Peach Springs Airstrip (Hualapai), AZ	4	0	113	0
Whitmore Helipad (Hualapai), AZ	0	0	0	439
Total	18,307	38,613	18,307	38,613

Source: Federal Aviation Administration, Peak Day JulAug-Dat05.xls; Federal Aviation Administration, Quarterly Tables-PP.xls; Harvey Economics 2007
Data do not include Hualapai exempt flights. Air-tour operations landing at Grand Canyon West Airport or at Hualapai helicopter landing pads along the Colorado River are discussed as part of the earlier Hualapai exempt flights discussion
Take-offs and landings at Bar-10 are not included here since they are not air tours
Data for the full year 2005 was extrapolated using flight data from July and August 2005 and total flight numbers by quarter

Passenger Demographics

May 1, 1997 to April 30, 1998 about 642,000 passengers took air tours over Grand Canyon. Just over 70% of all passengers took tours in fixed-wing aircraft, with just under 30% of all passengers taking helicopter tours (FAA 2000c) (Number of air-tour passengers does not include those flying on Hualapai exempt flights). In 2005, an estimated 423,000 passengers took air tours. About half of these passengers flew on fixed-wing tours and half flew helicopter tours. Over 58% of all air-tour passengers took tours over the East End; the remaining 42% of passengers flew on West End routes.

Air-tour visitors are further characterized in Visitor Use and Experience.

Affected Tribes and Tribal-related Air Operations

Hualapai Reservation

The Hualapai Reservation is located along 108 miles of the southern banks of the Colorado River and the park, to the west of the Havasupai Reservation down to Peach Springs, Arizona, which serves as the Hualapai Tribal Capital. The unincorporated town of Peach Springs is located in Mohave County along Route 66. The reservation encompasses about one million acres in Mohave and Coconino Counties and a very small portion of Yavapai County. Map 1.1 includes the reservation.

Community facilities on the reservation include elementary, middle and high schools, general store, service station, senior citizens center, gift shops, hunting lodge, training center, gymnasium, community center, rodeo arena, ball fields, laundromat, dialysis treatment center, emergency fire station, health clinic, and juvenile detention center (Arizona Department of Commerce 2005b). The nearest bank is in Kingman, about 50 miles from Peach Springs. Law enforcement is provided by a tribal police force that employs 12 officers (Hualapai Police Department 2006).

Hualapai Demographic Profile

Hualapai Population As of 2005, there were an estimated 2,156 total enrolled members in the Hualapai Tribe, and in 2005, 1,608 persons lived on the reservation (University of Arizona 2007). In 2005, the estimated Peach Springs population was 713, or about 44% of the reservation population. Between 1990 and 2005, reservation population increased about 96%. Often, a portion of those enrolled in a particular tribe live off the reservation. Table 3.25 provides population data for the Hualapai Reservation, Mohave and Coconino Counties, and the state of Arizona. Trust lands, small parcels outside the Reservation, are included in the Census Data. In 2000, 18 of the 1,608 population lived on these lands.

TABLE 3.25 POPULATION OF HUALAPAI RESERVATION, COCONINO AND MOHAVE COUNTIES 1990, 2000, AND 2005

Population	1990	2000	Change	2005	Change
Hualapai Reservation	822	1,353	65%	1,608	19%
Coconino County	96,591	116,320	20%	130,530	12%
Mohave County	93,497	188,032	101%	188,035	0%
Arizona	3,665,228	5,130,632	40%	5,939,292	16%

Source: 1990 data from 2000 Census population finder, accessed at www.census.gov
2005 Data, Office of Health Systems Development, Arizona Department of Health Services, Hualapai Tribe Primary Care Area and Mojave County and Coconino County, Statistical Profile 2006b

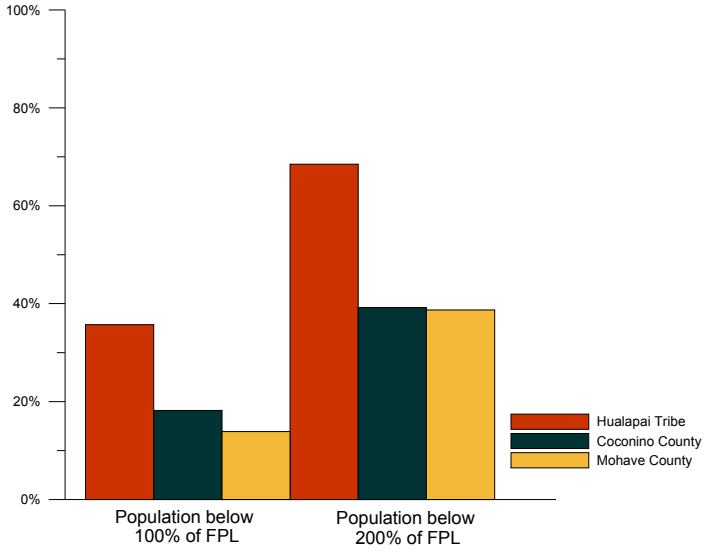
As of 2007, there were an estimated 2,000 enrolled Hualapai, of which 1,400 lived on the reservation, along with 200 non-Hualapai. Despite its recent growth, the Hualapai Reservation is sparsely populated. The population density on the reservation in 2005 was 1.0 person per square mile, as compared to 13.1 for the county and 53.2 for the state of Arizona.

Hualapai Economic Profile

Principal economic activities on the Hualapai Reservation are cattle ranching, governmental activities, tourism, and traditional and modern folk arts (Arizona Department of Commerce 2005b).

Hualapai Income According to the 2000 Census, per capita income for Hualapai Reservation residents was $8,147; median annual household income for the 358 households was $19,833. Almost 60% of households had income of less than $24,999. Public assistance income or Supplemental Security Income was received by just over 27% of households. Almost 3.5% of households had income of more than $100,000 in year 2000 (U.S. Census Bureau 2000b). Figure 3.4 provides the percent of Hualapai and Coconino and Mohave County residents below the Federal Poverty Level (FPL) and below 200% of the FPL in 2006. (In 2006, the U.S. Department of Health and Human Services calculated the poverty level as $9,800 for one person and $3,400 for each additional person in a family. For example, the FPL for a family of four is $20,000 annually.)

FIGURE 3.4 POVERTY LEVEL OF HUALAPAI RESERVATION AND COCONINO AND MOHAVE COUNTY RESIDENTS



Source: Arizona Department of Health Service, Division of Public Health Services. Hualapai Tribe Primary Care Area Statistical Profile, 2006b

Hualapai Employment Almost 99% of employed residents worked on the reservation in 2000. The population of the Hualapai Reservation 16 years or older grew from 499 to 867 between 1990 and 2000, a 74% increase. In 1990, the civilian labor force of the population was 296, or about 60% of that population, which represents the labor participation rate. In 2000, 391 of 867 residents over the age of 16 were in the labor force, representing a 15 point drop in the labor participation rate to a relatively low 45%. Among other possibilities, this may indicate unemployment data are understated as some workers may have stopped looking for employment and thus are no longer counted in the workforce.

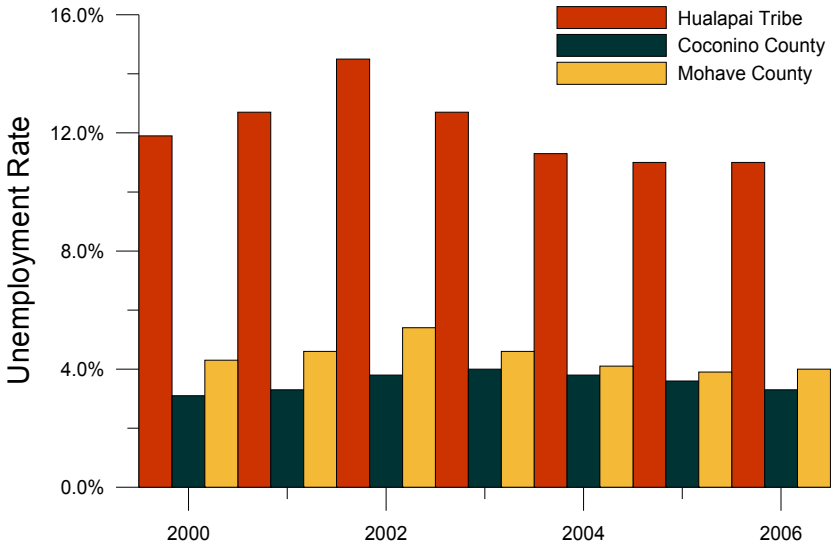
Despite the fact that unemployment may be understated on the reservation, it is still high as compared to Coconino and Mohave Counties. Figure 3.5 provides unemployment percentages for the Hualapai Tribe, and Coconino and Mohave Counties, 2000 through 2006.

Unemployment rates appear stable, and employment on the reservation is steadily growing.

Hualapai Employment by Occupation and Industry Distribution of workers by occupation on the reservation was similar to Mohave and Coconino Counties in 2000, with roughly three-quarters of employment in traditionally white-collar occupations. About 60% of Hualapai Reservation workers were employed by government as compared to 28% and 13% for Coconino and Mohave Counties, respectively (U.S. Census Bureau 2006b). Consistent with the percentage of government workers on the reservation, more than half of employees work in educational, health and social services, and public administration industries.

Tourism-related employment is extensive. Industries associated with tourism, such as retail trade, accommodation, and food services account for more than 210 employees. These activities are mostly within the Grand Canyon Resort Corporation.

FIGURE 3.5 UNEMPLOYMENT RATES FOR HUALAPAI TRIBE, COCONINO AND MOHAVE COUNTIES, 2000 THROUGH 2006



Source: Arizona Department of Economic Security, Research Administration, CES/LAUS Unit,
Arizona Unemployment Statistics Program, Special Unemployment Report
Average of monthly numbers, 2006, does not include December. County data does not include reservations

Hualapai Tourism Sector

Development of tourism on tribal land is important to the Hualapai. Their location in Grand Canyon along the banks of the Colorado River is a natural resource that provides an economic advantage that helps off-set other disadvantages, such as lack of larger population centers near the reservation.

The Hualapai Tribe owns and operates several tourist-oriented ventures, mostly under the organization of the Grand Canyon Resort Corporation. Opened in February 1988, Grand Canyon West is a large tourist-oriented facility located on the Hualapai Reservation about 120 miles east of Las Vegas and almost 250 miles from Grand Canyon National Park's Visitor Center at South Rim. Grand Canyon West encompasses about 9,000 acres and is 60 miles from Peach Springs. Grand Canyon West offers one and two-day rafting trips, Hummer vehicle tours, all inclusive trips from Las Vegas, the Hualapai Market, an Indian Village, the Hualapai Ranch, and horseback riding. Tour prices vary from about $30 per person up to $500 or more per person, depending on activity. As a part of a contractual agreement, Grand Canyon Resort Corporation is required to provide 15% of its revenues to the Tribe, or a minimum of $600,000 annually to the Tribe's general fund (FAA 2000a).

Admission to Grand Canyon West is $49.95 per person, with additional charges for various activities. In March 2007, Grand Canyon West opened the Grand Canyon Skywalk, a horseshoe-shaped glass-bottom walkway more than 4,000 feet above the canyon floor that extends 70 feet into the canyon. The cost was initially $25 per person. In addition, construction of a 6,000-square-foot visitor center, which will include a museum, movie theater, gift shop, restaurants and lounges, and event facilities, is underway. The Tribe hopes Grand Canyon West will eventually draw many visitors each year. Plans include an RV park, gas station, small grocery store, and a tram to the Canyon floor (Grand Canyon Resort Corporation 2007). The Hualapai River Runners offer one and two-day river rafting trips down the Colorado River on motorized river rafts. The GCNP Colorado River Management Plan regulates the number of people on these rafting trips to 156 passengers per day. The Hualapai also offer short (15 to 20-minute) pontoon boat tours in the Quartermaster Canyon area. The Colorado River Management Plan limits these river passengers to 600 per day.

Hualapai Lodge, which opened in 1997, is also owned by the Tribe. The lodge has 60 rooms, a restaurant and gift shop. The Tribe also sells hunting permits through Wild Life Hunting and produces and sells t-shirts, hats, and mugs through the Hualapai Arts and Crafts Enterprise (Northern Arizona University 2007b).

Tourism provides about $5 million in income and almost half the jobs on the reservation each year. Tourism contributes about 90% of the Tribe's budget each year.

Hualapai Tribal-related Air Tours

Air-tour operations are an important piece of the overall tourism economy for the Hualapai. Tribal officials estimate as much as 87% of total reservation visitors are air-tour related. Besides moving visitors onto the reservation, air tours land at Quartermaster Canyon, and other flights move visitors to the bottom of the canyon for boat tours (these are known as Elevator Flights or Over the Edge tours). Four helicopter companies operated on the reservation in 2007, providing air tours as arranged through the Hualapai Tribe.

Air tours land at both Grand Canyon West Airport and along the Colorado River. In 1997, along with conversion from a private-use to a public-use airport, a Federally funded airport renovation and runway resurfacing were completed. After that time, air tours to the reservation increased significantly. Like most air-tour operations, events of September 11, 2001 resulted in a decrease in flights, but operations gradually returned and then surpassed pre 9/11 levels. Between May 1, 1998 and April 30, 1999, five airplane and four helicopter operators conducted 10,700 air tours with 55,700 passengers to the reservation. These air-tour operations at Grand Canyon West provide income to the Tribe from landing fees, ground tours, and meals provided to passengers, trespass fees, and lease payments. More than 60% of the tribal budget can be attributed to air tours. Table 3.26 illustrates volume of air-tour flights in support of the Hualapai 2000 to 2005. These operations include flights that landed at Grand Canyon West Airport and those that landed at the multiple landing pads near Quartermaster Canyon. The majority of commercial air tours that land at Grand Canyon West Airport or at Quartermaster Canyon fly the Green-4 (helicopter) route or the Blue-2 (fixed-wing) routes in the SFRA (Aircraft can also access Grand Canyon West Airport from outside the SFRA.)

TABLE 3.26 AIR-TOUR OPERATIONS IN SUPPORT OF THE HUALAPAI TRIBE 2000-2005

Year	Fixed Wing Flights	Helicopter Flights	Total
2000	846	16,172	17,018
2001	2,244	14,886	17,130
2002	2,767	14,594	17,361
2003	3,364	20,579	23,943
2004	4,893	23,534	28,427
2005	3,443	28,559	32,002

Source: Federal Aviation Administration

The number of air tours in support of the Hualapai has further increased in recent years due to additional attractions on the reservation and increased marketing by the Hualapai. The Hualapai collect about $3 million per year in charges and fees from various operators that land on the reservation. (These charges and fees are only a portion of total Hualapai revenues.) In addition to tours shown in Table 3.26, between 25,000 and 27,000 Over the Edge flights are provided each year.

Hualapai Fixed-Base Operations

The Hualapai own four fixed-base operations: Grand Canyon West Airport, Grand Canyon West 1 Heliport, Grand Canyon West 2 Heliport, and 183 Mile Heliport. This does not include their numerous helipads near the Colorado River used for transporting river passengers in and out of the canyon and for helicopter tours based out of Grand Canyon West or the Las Vegas area.

Havasupai Reservation

The Havasupai Reservation encompasses about 188,000 acres at the western edge of Grand Canyon's South Rim in Coconino County. Most reservation residents live in Supai Village, and are governed by a seven-member tribal

council. Peach Springs, on the Hualapai Reservation, is the nearest town. The Havasupai Reservation is quite remote and can be reached only by foot, horseback, or helicopter. If not traveling by helicopter, tourists park at Hualapai Hilltop and take an eight-mile trail to the village. Map 1.1 includes the Havasupai Reservation.

The isolated nature of this reservation makes it quite different from most communities and other reservations. For example, according to the 2000 Census, no workers used a car, truck, or van to get to work. About 64% walked, and the balance used other means, possibly a horse. Seventy-seven percent of households did not have a vehicle available to them. Less than 15% of owner-occupied housing units had a mortgage (U.S. Census Bureau 2000a).

Community facilities on the reservation include a school (kindergarten through eighth grade), community building and tribal offices, library, senior center, a community playing field, basketball court, rodeo grounds, museum and cultural center, silkscreen studio, campground, lodge, café, and the Havasupai Trading Company (Arizona Department of Commerce 2005a). Law enforcement is provided by the Bureau of Indian Affairs.

Havasupai Demographic Profile

Havasupai Population Presently, there are roughly 650 enrolled members of the Havasupai Tribe. In 2005, the estimated Havasupai Reservation population was 555 persons (Havasupai Tribe 2007). Between 2000 and 2005, Havasupai Reservation population increased about 10%. Table 3.27 provides population data for the Havasupai Reservation, Coconino County, and the state of Arizona.

TABLE 3.27 POPULATION HAVASUPAI RESERVATION, COCONINO COUNTY, AND ARIZONA, 1990, 2000 AND 2005

Population	1990	2000	Change	2005	Change
Havasupai Reservation	N/A	503	N/A	555	10%
Coconino County	96,591	116,320	20%	130,530	12%
Arizona	3,665,228	5,130,632	40%	5,939,292	16%

Source: 1990 and 2000 Census population finder, accessed at www.census.gov and Office of Health Systems Development, Arizona Department of Health Services, Havasupai Tribe Primary Care Area and Coconino County, Statistical Profile, 2006a
1990 Census data for the Havasupai Reservation was not available

Reservation residents are relatively young in relation to Coconino County residents. In 2005, almost 80% of reservation residents were 44 years of age or younger as compared to 73% for Coconino County.

Havasupai Economic Profile

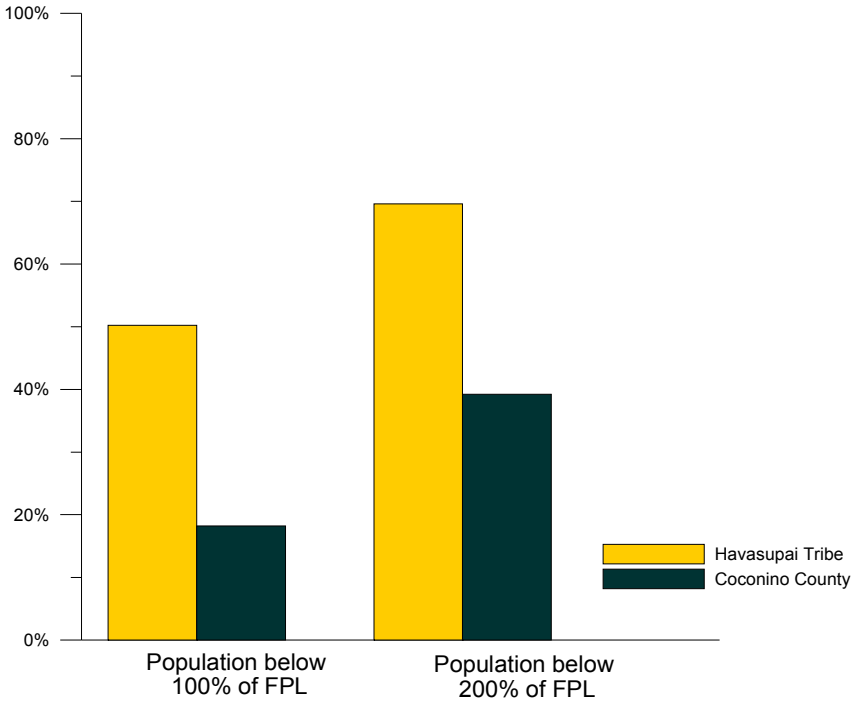
The principal economic activity on the Havasupai Reservation is tourism; more than 12,000 guests visit the reservation each year (Arizona Department of Commerce 2005a). The dramatic nature of the landscape with its deep canyons and beautiful waterfalls make it very attractive to certain tourists.

Havasupai Income According to the 2000 Census, per capita income for Havasupai Reservation residents was $7,422; median annual household income for the 117 households was $20,114. Almost 60% of households had income of less than $24,999. Public assistance income or Supplemental Security Income was received by about 18% of households. More than 5% of households had income of more than $100,000 in year 2000 (U.S. Census Bureau 2000b).

Figure 3.6 provides the percent of Havasupai and Coconino County residents below the Federal poverty level and below 200% of the Federal Poverty Level in 2006.

Havasupai Employment In 2000, the Havasupai Reservation population 16 years or older was 267. Of this group, 95 were in the labor force, for a low labor force participation rate of about 36%. The labor force participation rate for Coconino County was almost 69%. The reservation's isolation and resulting limited employment opportunities may result in an understatement of unemployment numbers.

FIGURE 3.6 POVERTY LEVEL OF HAVASUPAI RESERVATION AND COCONINO COUNTY RESIDENTS



Source: Arizona Department of Health Service, Division of Public Health Services. Havasupai Tribe Primary Care Area Statistical Profile 2006a

Although unemployment may be understated on the reservation, it is still high compared to Coconino County. Figure 3.7 provides unemployment percentages for the Havasupai Tribe and Coconino County, 2000 through 2006. Havasupai unemployment rates appear to be stabilizing, and employment is slowly increasing.

Havasupai Employment by Occupation and Industry An estimated 95% of employed residents work on the reservation since commuting in or out is quite difficult.

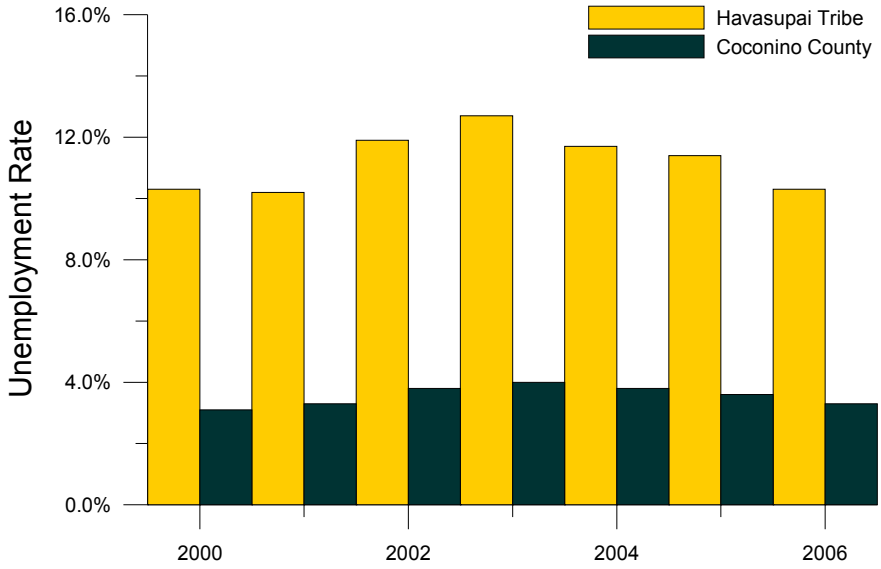
As compared with Coconino County, about 15% more employees on a reservation worked in service occupations in 2000. The majority of reservation and Coconino County employment was in traditionally white-collar occupations. About 50% of Havasupai Reservation workers were employed by government as compared to 28% in Coconino County (U.S. Census Bureau 2000b). The largest employer on the reservation is the Tribe itself (Inter Tribal Council of Arizona, Inc. 2007). Consistent with a tourism-driven economy, tourism-related industries provide another 25% of employment. Other industries, such as manufacturing and transportation, may also be indirectly related to the tourism industry.

Havasupai Tourism Sector

Tourism development on tribal land is crucial to the Havasupai Tribe as its remote location makes industries impractical. The reservation's spectacular scenery is appealing to certain tourists undeterred by the difficulty getting there. The entrance fee is $35 per adult and $17.50 for children under 12.

In addition to the natural beauty of the reservation's canyons and waterfalls, the Tribe has invested in several ventures designed to attract tourist dollars. The Tribe owns a lodge with 24 guest rooms near Havasu Falls. It also owns and operates a cafe, post office, grocery store, tourist office, museum and cultural center, silk-screening studio (Northern Arizona University 2007a), primitive campground, and horseback tours.

FIGURE 3.7 UNEMPLOYMENT RATES FOR HAVASUPAI TRIBE AND COCONINO COUNTY 2000-2006



Source: Arizona Department of Economic Security, Research Administration, CES/LAUS Unit, Arizona Unemployment Statistics Program, Special Unemployment Report
Average of monthly numbers, 2006 does not include December. County data does not include reservations

By arrangement with the Tribe, air-tour operators offer two helicopter trips per day to the reservation. Besides transportation, visitors use these flights in conjunction with hiking and other activities.

Havasupai Tribal-related Air Tours

The Havasupai do not currently conduct air-tour operations.

Navajo Reservation

The Navajo Nation (see Map 1.1) covers roughly 27,000 square miles in Arizona, Utah, and New Mexico. There are 110 Chapters within the Nation, which is governed by three branches of government: Executive, Legislative, and Judicial headquartered in Window Rock, Arizona. The Cameron Chapter of the Navajo Nation is elaborated in this section as the Chapter may develop air tours and air-tour-related fixed-based operations.

The Cameron Chapter was certified as an entity of the Navajo Nation in 1955 and occupies about 240,000 acres in Coconino County. This Chapter is part of the Bennett Freeze Area, a region disputed between the Navajo Nation and Hopi Tribe. The Bennett Freeze law (section 10(f) of Public Law 93-531, commonly known as the Bennett Freeze) prohibited construction, development, and repair on these lands. In early 2007, the Freeze was lifted, but the impacts of the Freeze still affect Chapter residents.

Community facilities include a pre-school and elementary school, several churches, and 11 businesses. Law enforcement is provided by the Tuba City Chapter. The nearest medical facility is Tuba City Indian Medical Center about 26 miles away (Cameron Chapter 2007).

Navajo Demographic Profile

Navajo Population In 2001, there were 255,543 total enrolled members in the Navajo Nation, making it the largest U.S. tribe (Navajo Nation 2007). Requirements for enrollment vary tribe to tribe, and enrolled members are not necessarily residents of Navajo Nation lands. **TABLE 3.28** provides population data for the entire Navajo Reservation, Cameron Chapter, Coconino County, and the state of Arizona.

TABLE 3.28 POPULATION NAVAJO RESERVATION, CAMERON CHAPTER AND ARIZONA, 1990 AND 2000

Population	1990	2000	Change
Navajo Nation	148,451	180,462	22%
Cameron Chapter	N/A	1,231	N/A
Coconino County	96,591	116,320	20%
Arizona	3,665,228	5,130,632	40%

Source: 1990 data from 2000 Census population finder, at www.census.gov
The estimated population of the Arizona portion of the Nation in 2005 was 113,056 residents (Arizona Department of Health Services 2006c)

Navajo Economic Profile

Principal economic activities on the Navajo Nation are sheep and cattle ranching, coal and uranium mining, weaving, jewelry making, and traditional arts. Tourism is also very important. Many parks, monuments, and museums attract tourists each year (Arizona Department of Commerce 2005c).

Navajo Income According to the 2000 census, per capita income for Navajo Nation residents was $7,269; median annual household income for the 47,761 households was $20,005. Almost 60% of households had income less than $24,999. Public assistance income or Supplemental Security Income was received by almost 31% of households. Almost 2% of households had income of more than $100,000 (U.S. Census Bureau 2000b).

Per capita income for Cameron Chapter residents was $6,055; median annual household income for the 314 households was $18,864. About 27% of households received public assistance or Supplemental Security Income. None of the households had income over $100,000.

Figure 3.8 provides the percent of Navajo Nation, Cameron Chapter and Coconino County residents who were below the Federal Poverty Level in 2000.

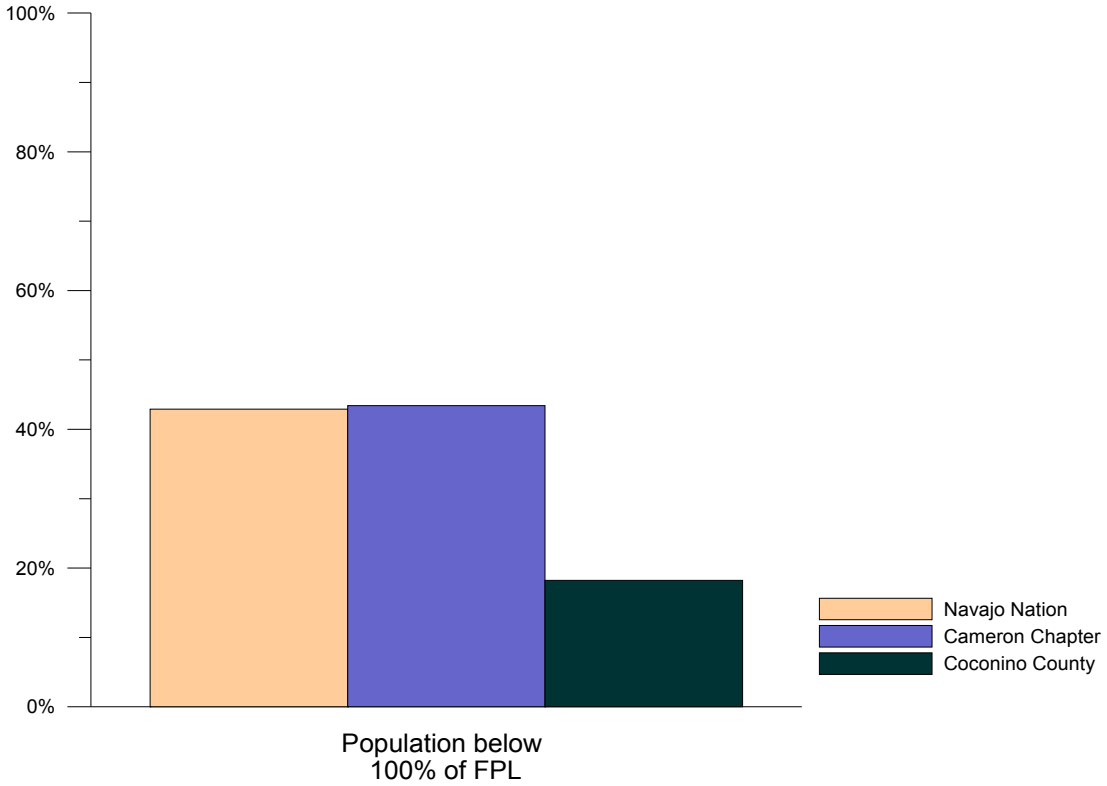
Navajo Employment In 2000 the civilian labor force on the Navajo Nation was 51,330 persons. The population over age 16 was 114,966; 33 residents were in the Armed Forces. Thus, about 45% of residents age 16 and over were in the labor force. In the Cameron Chapter, about 42% of the 841 residents over 16 were in the labor force, a relatively low figure. In Coconino County, almost 70% of residents over age 16 were in the labor force.

Although reservation unemployment may be understated, it is still high compared to Coconino County. Figure 3.9 provides unemployment percentages for the Navajo Nation, and Coconino and Mohave Counties 2000 through 2006

Navajo Employment By Occupation And Industry Service occupations provided the largest percent of employment for workers in the Cameron Chapter. In the Navajo Nation and Coconino County, management and professional occupations provided the largest employment percentage. In Coconino County, traditionally white-collar occupations provided almost 80% of all jobs as compared to about 66% for both the Navajo Nation as a whole and the Cameron Chapter. About 29% of Cameron Chapter workers were employed by government as compared to 44% on the Navajo Nation and 28% in Coconino County (U.S. Census Bureau 2000b).

Percent employment in the construction industry in the Cameron Chapter was more than double that of the entire Navajo Nation, and more than three times that of Coconino County. Retail trade and arts, entertainment, recreation, accommodation, and food services accounted for almost 40% of all employment for the Cameron Chapter, indicating a reliance on tourism. The largest employers within the Cameron Chapter are the Cameron Trading Post with approximately 50 employees and the Cameron Chapter House with approximately 11 workers.

FIGURE 3.8 POVERTY LEVEL OF NAVAJO NATION, CAMERON CHAPTER, AND COCONINO COUNTY RESIDENTS



Source: Arizona Department of Health Service, Division of Public Health Services. Navajo Tribe Primary Care Area Statistical Profile 2006c

Even so, unemployment rates on the Navajo Reservation appear to have stabilized and employment is gradually increasing.

Navajo Tourism Sector

The Little Colorado River Gorge Tribal Park is located in the Cameron Chapter. No fees are charged for park entrance; however, a visitor center is available that provides information and permits for various activities. The park includes two overlooks with picnic tables and native vendors selling handmade crafts, as well as numerous hiking and backpacking trails. The Cameron Chapter does not operate any formal tourist attractions.

Navajo Tribal-related Air Tours

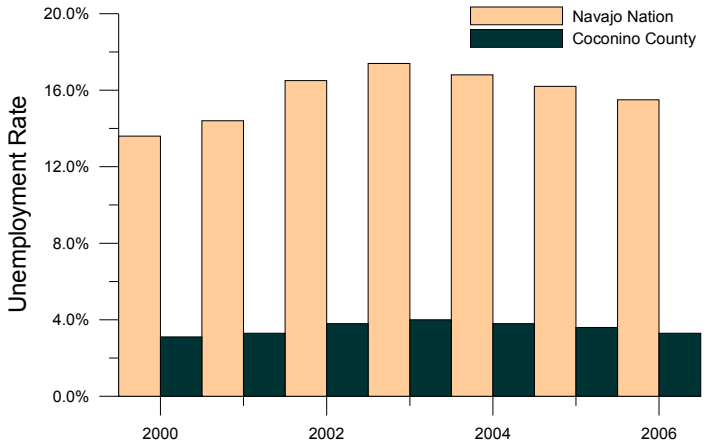
The Navajo Nation, including the Cameron Chapter, does not currently conduct air-tour operations.

General-Aviation Operations

General-Aviation Corridors

Four general-aviation corridors currently exist in the SFRA. These are: Zuni Point Corridor, Dragon Corridor, Fossil Canyon Corridor, and Tuckup Corridor. General-aviation corridors allow aircraft to fly across Grand Canyon between various Flight-free Zones. Required altitudes in corridors are lower than required to fly over Flight-free Zones. Current flight altitudes are the same for all four general-aviation corridors. Northbound flights may occur at 11,500 feet MSL or 13,500 feet MSL. Southbound flights may occur at 10,500 feet MSL or 12,500 feet MSL. Each corridor is described in Chapter 2, Alternative A, and shown on Map 2.2.

FIGURE 3.9 UNEMPLOYMENT RATES FOR NAVAJO NATION AND COCONINO COUNTY 2000-2006



Source: Arizona Department of Economic Security, Research Administration, CES/LAUS Unit, Arizona Unemployment Statistics Program, Special Unemployment Report
Navajo Nation data includes only Arizona data. Average of monthly numbers, 2006 does not include December. County data does not include reservations

Flight-free Zones

Four Flight-free Zones exist in the SFRA: Sanup, Toroweap/Shinumo, Bright Angel and Desert View. Flight-free Zones are described in Chapter 2, Alternative A, and shown on Map 2.2. Flights may currently occur over the Sanup Flight-free Zone at altitudes greater than 7,999 feet MSL and over the Toroweap/Shinumo, Bright Angel, and Desert View Flight-free Zones at altitudes greater than 14,500 feet MSL.

General-aviation Aircraft

A variety of types of general-aviation aircraft fly over GCNP at different locations and altitudes based on points of take-off and destination, as well as on mechanical aircraft capabilities. For example, single-engine piston aircraft can fly at altitudes up to 14,500 feet MSL and turbo-charged engines up to 21,000 feet MSL (Harvey Economics 2006). Examples of general-aviation single-engine piston aircraft types are shown in Table 3.29.

TABLE 3.29 EXAMPLES OF SINGLE-ENGINE PISTON AIRCRAFT

Aircraft Manufacturer	Model Types
Beech	A23; A45; B19; C24R; D35; F33A
Cessna	C120; C150L; C170A; C182E
Maule Air Inc.	MX-7-160; MXT-7-180A
Mooney	M20C; M20J; M20M Bravo; M20R
Piper	PA-12; PA22-135; PA-24-260B

Source: www.planequest.com
Only a small portion of all single engine piston aircraft types that could be used for general aviation purposes are shown

General-Aviation Operations

On the Peak Day of the Base Year (August 8, 2005), there were a total of four general-aviation flights flying within the SFRA. These flights occurred on a Beech Baron, a Cessna Conquest, and on other unidentified general-aviation single-engine aircraft. The Peak Day for total SFRA flights may or may not represent Peak Day operations for general-aviation flights. No information is available on annual number of general-aviation flights in the SFRA.

REGIONAL ECONOMICS AND PARK VALUES

This section discusses local and regional communities affected by park operations and park-related tourist activities. Current economic and demographic conditions of local communities and the relevant region are presented and the role of tourism in these economies is discussed. The value of the park to visitors and non-visitors is also discussed.

Regional Economics

Local Communities and Region Influenced by Grand Canyon National Park Visitation

Visitors to Grand Canyon, including those participating in air tours over Grand Canyon, also spend time and money in local communities outside the park, dining in restaurants, purchasing souvenirs in local shops, and staying overnight in hotels, motels, and other accommodations. These local communities, also known as gateway communities, are made up of businesses that rely on tourism as a source of income and employment for residents and local governments. Economies of many of these small communities are based on tourism and may be affected by any visitation changes resulting from changes to local overflight activity. Gateway communities to the national park include

- **City of Williams** Known as the Gateway to the Grand Canyon (Arizona Department of Commerce 2007b), Williams is located south of Grand Canyon on Highway 64, which leads to park's South Rim entrance. Williams is west of Flagstaff on Highway 40. The Grand Canyon Railway operates scenic train rides between Williams and Grand Canyon
- **City of Flagstaff** Located on Interstate 40, Flagstaff is centrally located between Grand Canyon and other tourist attractions. Highway 64, the major road leading to South Rim is west of Flagstaff. Flagstaff offers many tourist amenities to visitors including hotels, restaurants and shopping
- **Tusayan** A small town located on Highway 64 a few miles south of the park's South Rim entrance, Tusayan comprises hotels, restaurants, and other tourist amenities. Grand Canyon National Park Airport is located south of Tusayan. Many of the commercial air-tour flights depart from this airport
- **Grand Canyon Village** Although not technically a gateway community since it is located in the park, Grand Canyon Village is home to many accommodations and food service establishments. The Village also provides housing for NPS and concessionaire employees and their families (FAA 2000b)
- **City of Page** Originally a temporary camp for construction workers building Glen Canyon Dam, Page now offers a resort area located on GCNP's northeast end, on U.S. Highway 89 (Arizona Department of Commerce 2007a). Page offers amenities to tourists visiting Grand Canyon, Lake Powell, and other nearby attractions
- **Town of Fredonia** Located along the Arizona Strip, north of the Colorado River and south of the Arizona-Utah border, Fredonia is often referred to as the gateway to Grand Canyon's North Rim. Due to its location, Fredonia is a "warehousing point for expedition outfitters and guides," mainly related to river trips (Arizona Department of Commerce 2007c)

All gateway communities described above are in Coconino County and are shown on Map 1.1.

In addition to Grand Canyon, Coconino County is home to many other scenic and tourist attractions, including Oak Creek Canyon, and Sunset Crater, Wupatki, and Navajo National Monuments. Coconino County offers many visitor amenities, and a large portion of its economy is based on tourism. The county also includes several reservations including the Hualapai, Havasupai, and Navajo, discussed separately.

Demographic and Economic Characteristics of Gateway Communities

Gateway Communities Population **P**opulation of gateway communities and Coconino County are presented in Table 3.30 with growth rates since 1990. Data for the state of Arizona are provided for comparison.

Gateway communities have grown less than the state in terms of annual growth since 1990. This slower growth may be because the tourism base of these communities is largely stable but not expanding. Tusayan is surrounded by Federal land and has limited private land for expansion. Additionally, Page and Fredonia are more remotely located to the north. Flagstaff has grown more than any of the gateway communities, likely due to a more diversified economic base.

All gateway communities experienced slower growth 1990 to 2000. During recent years, growth rate increased for all gateway communities except Grand Canyon Village and Fredonia, which lost population 2000 to 2005.

TABLE 3.30 POPULATION OF GATEWAY COMMUNITIES, COCONINO COUNTY, AND ARIZONA 1990–2005

Year	Williams	Flagstaff	Tusayan	GCV[a]	Page	Fredonia	Coconino County	Arizona
1990	2,532	45,857	555	1,499	6,598	1,207	96,591	3,665,228
2000	2,842	52,894	562	1,460	6,809	1,036	116,320	5,130,632
2001	2,885	57,700	n.a.	n.a.	6,970	1,070	122,770	5,295,929
2002	2,910	59,160	n.a.	n.a.	7,050	1,090	125,455	5,438,159
2003	2,895	60,750	n.a.	n.a.	7,100	1,095	128,275	5,577,784
2004	2,950	61,505	n.a.	n.a.	7,095	1,110	130,070	5,739,879
2005	3,145	61,185	620	1,610	7,110	1,110	130,530	5,939,292
1990-2000								
Total Growth	12.2%	15.3%	1.3%	-2.6%	3.2%	-14.2%	20.4%	40.0%
Avg. Annual Growth	1.2%	1.4%	0.1%	-0.3%	0.3%	-1.5%	1.9%	3.4%
2000-2005								
Total Growth	10.7%	15.7%	10.3%	10.3%	4.4%	7.1%	12.2%	15.8%
Avg. Annual Growth	2.0%	3.0%	2.0%	2.0%	0.9%	1.4%	2.3%	3.0%

Source: U.S. Census Bureau, American Factfinder, Census 2000, www.census.gov and Arizona Department of Economic Security, Population Statistics Unit, www.workforce.az.gov. 1990 Tusayan population comes from Special Flight Rules in the Vicinity of Grand Canyon National Park Final Supplemental EA Feb 2000

[a]Grand Canyon Village

Gateway Communities Households and Home Value Number of households in gateway communities and Coconino County are presented in Table 3.31. Also shown are median homes values in these areas. Information for the state of Arizona is provided for comparison.

Number of households in all gateway communities grew slower than the rest of Coconino County and statewide. As with the slower population growth, the slower growth in households is likely due to the tourism-based economy and remoteness of many communities. After accounting for inflation, gateway community housing values have exhibited substantial increases.

Gateway Communities Household and Per Capita Income Median household income and per capita income in gateway communities and Coconino County are presented in Table 3.32. Income growth 1990 to 2000 is shown. Information for the state of Arizona is provided for comparison.

After adjustment for inflation, statewide median household income increased by about 9% 1990 to 2000. Median household income in Williams increased by a smaller percentage, and in Grand Canyon Village median household income increased by about 22%. After adjustment for inflation, per capita income for all gateway communities except Grand Canyon Village increased by a larger percentage than the state of Arizona.

TABLE 3.31 NUMBER OF HOUSEHOLDS AND MEDIAN HOME VALUE FOR GATEWAY COMMUNITIES, COCONINO COUNTY, AND ARIZONA 1990 AND 2000

	Williams	Flagstaff	Tusayan	GCV[a]	Page	Fredonia	Coconino County	Arizona
1990	946	14,417	NA	527	2,041	375	29,918	1,368,843
2000	1,057	19,306	222	651	2,342	359	40,448	1,901,327
Total Growth	11.7%	33.9%	NA	23.5%	14.7%	-4.3%	35.2%	38.9%
Average Annual Growth	1.1%	3.0%	NA	2.1%	1.4%	-0.4%	3.1%	3.3%
1990 Median Value	$98,935	$137,867	NA	NA	$140,005	$82,904	$126,111	$121,684
2000 Median Value	$116,247	$186,598	NA	NA	$160,637	$90,286	$165,157	$140,586
Growth	17.5%	35.3%	NA	NA	14.7%	8.9%	31.0%	15.5%

Source: U.S. Census Bureau, American Factfinder, Census 1990, Tables P003 and HO61A, Census 2000, Tables P15 and H76, www.census.gov; Harvey Economics 2007. 1990 Tusayan population from Special Flight Rules in the Vicinity of Grand Canyon National Park Final Supplemental EA, Feb 2000. Median home values adjusted for inflation and expressed in 2006 constant dollars

[a]Grand Canyon Village

TABLE 3.32 MEDIAN HOUSEHOLD INCOME AND PER CAPITA INCOME FOR GATEWAY COMMUNITIES, COCONINO COUNTY, AND ARIZONA, 1990 AND 2000

Year	Williams	Flagstaff	Tusayan	GCV[a]	Page	Fredonia	Coconino County	Arizona
1990 Median HH Income	$37,606	$45,822	NA	$41,090	$65,201	$40,805	$42,158	$44,463
2000 Median HH Income	$38,750	$44,351	$41,690	$50,246	$56,039	$36,163	$45,676	$48,425
Change	3.0%	-3.2%	NA	22.3%	-14.1%	-11.4%	8.3%	8.9%
1990 Per Capita Income	$16,340	$18,594	NA	$21,859	$19,942	$13,215	$17,081	$21,733
2000 Per Capita Income	$19,370	$22,252	$19,864	$23,787	$22,316	$15,890	$20,463	$24,208
Growth	18.5%	19.7%	NA	8.8%	11.9%	20.2%	19.8%	11.4%

Source: U.S. Census Bureau, American Factfinder, Census 1990, Tables P080A and P114A, Census 2000, Tables 53 and 82, www.census.gov; HE, 2007

Median household income and per capita income values adjusted for inflation and expressed in 2006 constant dollars

[a]Grand Canyon Village

Gateway Communities Employment Average 2006 employment and unemployment information for gateway communities, Coconino County, and Arizona is presented in Table 3.33. These average data account for the seasonal nature of employment in many of these communities.

TABLE 3.33 EMPLOYMENT FOR GATEWAY COMMUNITIES, COCONINO COUNTY, AND ARIZONA, 2006

	Williams	Flagstaff	Tusayan	GCV[a]	Page	Fredonia	Coconino County	Arizona
Labor Force	1,700	34,869	447	1,274	4,337	522	69,054	2,948,618
Employed	1,624	33,716	439	1,257	4,150	488	65,747	2,823,795
Unemployed	76	1,153	8	17	187	34	3,307	124,823
Unemployment Rate	4.5%	3.3%	1.8%	1.3%	4.3%	6.5%	4.8%	4.2%

Source: Arizona Department of Economic Security, Special Unemployment Report, 2006, www.workforce.az.gov

[a]Grand Canyon Village

Unemployment rates for gateway communities range 1.3% to 6.5%. Low unemployment in Tusayan and Grand Canyon Village may be the result of seasonal residents not part of the year-round labor force or are not looking for jobs in the off-season. The lower unemployment rate in Flagstaff is likely the result of employment opportunities other than those related to tourism. Fredonia had a relatively high unemployment rate, which might be due to its remoteness.

The Coconino County unemployment rate in Table 3.33 includes reservations. Excluding reservations, average 2006 unemployment rate for Coconino County was 3.3% (Arizona Department of Economic Security).

Table 3.34 shows employment by industry for gateway communities, Coconino County, and Arizona for 2000. A large percent of regional residents are employed in tourism-related industries. About 69% of Tusayan residents and 60% of Grand Canyon Village residents are employed in the arts, entertainment, recreation, accommodation, and food service industries. In Williams, about 30% of residents are employed in those industries. Comparatively, only about 10% of Arizona residents are employed in entertainment, recreation, accommodation, and related industries. Retail trade accounts for another large portion of regional employment.

Table 3.35 shows establishments and total sales for industries in several gateway communities and Coconino County. Limited data was available for Tusayan, Grand Canyon Village, and Fredonia at the zip-code level.

Many establishments in these gateway communities are related to travel and tourism, including retail trade; arts, entertainment, and recreation; and accommodation and food service. A large amount of sales in these places can also be attributed to tourism-related industries.

Role of Tourism in the Regional Economy

Tourism plays a major role in the regional economy. The Grand Canyon and the many other northern Arizona tourist attractions attract millions of visitors each year. These visitors often spend several days or more in the area, injecting money into local economies. Visitor spending from park visitors and visitors to other attractions in the area have a noticeable impact on the regional economy.

Grand Canyon National Park Visitor Spending In 2005, ground-based visitors who entered GCNP spent a total $359 million in Coconino County[32] (spending for river running, overflights and other special uses were not fully covered in visitor survey spending reports. Air-tour visitors who did not enter the park as ground-based visitors were not included in total park visitation.) About $146 million was spent inside the park and $213 million in gateway and other county communities. About $101 million was spent by park visitors on lodging including hotels and camping, and about $67 million was spent on food services including restaurants and bars. Another $70 million was spent by visitors on admissions and recreational activities. In addition to lodging, restaurants, admissions, and recreational activity, $121 million was spent by park visitors on a variety of other items, including gas/oil, other transportation expenses, groceries, souvenirs or other trip-related expenses. Eighty-four percent of total spending by park visitors was done on South Rim.

The average amount of money spent per party varied by type of visitor, ranging from $43 per party per night for backcountry campers to $412 per party per night for river runners. Table 3.36 shows average per party per night spending for seven different types of visitors as well as total spending for all visitors.

Although river runners spent the most money per night, visitors staying overnight in accommodations outside the park accounted for the largest portion of total visitor spending. Table 3.36 also shows visitors staying outside the park in hotels spent the most party-nights in the area.

[32] Harvey Economics applied methodologies and information in Economic Impacts of Grand Canyon National Park Visitor Spending on the Local Economy 2003 to 2005 visitor data to calculate 2005impacts of visitor spending. The original research was conducted by Daniel Stynes and Ya-Yen Sun of Michigan State University as part of the National Park Service Social Science Program

TABLE 3.34 EMPLOYMENT BY INDUSTRY FOR GATEWAY COMMUNITIES AND COCONINO COUNTY 2000

	Williams		Flagstaff		Tusayan		GCV[a]		Page		Fredonia		Coconino County	
Industry	**Emp.**	**%**	**Emp.**	**%**	**Emp.**	**%**	**Emp.**	**%**	**Emp.**	**%**	**Emp.**	**%**	**Emp.**	**%**
Agriculture, forestry, fishing, hunting	51	3.8%	276	0.9%	15	4.1%	7	0.7%	0	0.0%	15	3.8%	739	1.3%
Mining	4	0.3%	50	0.2%	0	0.0%	0	0.0%	29	0.9%	0	0.0%	218	0.4%
Construction	96	7.2%	1,574	5.4%	0	0.0%	44	4.1%	187	5.5%	57	14.4%	4,265	7.7%
Manufacturing	75	5.6%	1,567	5.4%	0	0.0%	7	0.7%	83	2.4%	34	8.6%	2,881	5.2%
Wholesale trade	28	2.1%	448	1.5%	0	0.0%	2	0.2%	43	1.3%	2	0.5%	910	1.6%
Retail trade	117	8.8%	4,219	14.4%	13	3.6%	97	9.0%	470	13.8%	64	16.2%	7,308	13.2%
Transportation, warehousing, utilities	113	8.5%	952	3.3%	37	10.2%	43	4.0%	601	17.7%	20	5.1%	2,991	5.4%
Information	35	2.6%	441	1.5%	4	1.1%	4	0.4%	41	1.2%	0	0.0%	851	1.5%
Finance and insurance	21	1.6%	590	2.0%	0	0.0%	4	0.4%	74	2.2%	0	0.0%	1,056	1.9%
Real estate, rental, and leasing	19	1.4%	620	2.1%	8	2.2%	1	0.1%	107	3.2%	0	0.0%	1,111	2.0%
Professional, scientific, and related services	66	5.0%	2,000	6.8%	5	1.4%	30	2.8%	104	3.1%	15	3.8%	3,290	5.9%
Education, health, and social services	157	11.8%	9,136	31.3%	15	4.1%	92	8.6%	713	21.0%	70	17.7%	14,918	26.9%
Arts, entertainment, and recreation	18	1.4%	751	2.6%	12	3.3%	188	17.5%	192	5.7%	7	1.8%	1,757	3.2%
Accommodation and food services	383	28.8%	3,753	12.8%	238	65.7%	454	42.2%	490	14.4%	46	11.6%	7,278	13.1%
Other services	49	3.7%	1,053	3.6%	0	0.0%	26	2.4%	115	3.4%	40	10.1%	2,183	3.9%
Public administration	96	7.2%	1,793	6.1%	15	4.1%	77	7.2%	147	4.3%	26	6.6%	3,754	6.8%
Total	1,328	100%	29,223	100%	362	100%	1,076	100%	3,396	100%	396	100%	55,510	100%

Source: U.S. Census Bureau, American Factfinder, Census 2000, Table P49, www.census.gov

[a]Grand Canyon Village

TABLE 3.35 NUMBERS OF ESTABLISHMENTS AND SALES FOR GATEWAY COMMUNITIES AND COCONINO COUNTY 2002

	Williams		Flagstaff		GCV[a]/Tusayan	Page		Fredonia	Coconino County	
Description of Industry/Sector[b]	Number	Sales (1,000's)	Number	Sales (1,000's)	Number	Number	Sales (1,000's)	Number	Number	Sales (1,000's)
Manufacturing	z	z	68	$623,237	NA	z	z	3	100	$820,219
Wholesale trade	3	D	80	$673,716	3	13	D	1	118	$739,367
Retail trade	27	$36,112	367	$1,025,847	16	48	$132,200	7	671	$1,503,194
Information	2	NA	34	NA	4	9	NA	NA	63	NA
Real estate, rental, leasing	4	$1,605	117	$80,493	1	16	$4,830	NA	181	$105,027
Professional, scientific, technical	1	D	217	$86,070	NA	12	D	1	284	$103,771
Administration and related services	1	D	88	$47,660	5	18	$4,817	1	153	$70,457
Educational services	z	z	16	$1,820	1	2	D	NA	25	$3,682
Health care and social assistance	6	D	282	$429,249	3	15	$26,838	3	339	$534,082
Arts, entertainment, recreation	4	D	37	$22,849	2	27	D	1	97	$118,277
Accommodation and food service	38	$23,164	256	$232,884	13	50	$55,078	5	455	$475,917
Other services	7	$856	149	$75,777	NA	28	$10,889	1	220	$97,283

Source: U.S. Census Bureau, 2002 Economic Census, www.census.gov and U.S. Census Bureau, Zip Code Business Patterns, 2002
Abbreviations: z= too small for publication, D=withheld to avoid disclosure, NA= not applicable
[a]GCV is Grand Canyon Village
[b]Information for several sectors is not published for all locations. Sales, receipts, or shipments data have been adjusted for inflation and are reported in constant 2006 dollars

TABLE 3.36 AVERAGE SPENDING FOR GCNP VISITORS BY TYPE 2005

Type of Visitor	Number of Party Days/ Nights (thousands)	Average Spending per Party Day/Night	Total Spending (millions)
Day Trip	380.9	$114	$43.4
In-Park Hotel	203.4	$338	$68.8
In-Park Camp	127.8	$98	$12.5
Backcountry Camper	92.8	$43	$4.0
Outside Park Hotel	683.2	$272	$185.8
Outside Park Camp	147.6	$97	$14.3
River Runners	72.4	$412	$29.8
Total	1,708.2	$201	$358.7

Source: Harvey Economics calculated party days/nights and total spending in 2005 based on information and methodologies included in Economic Impacts of GCNP Visitor Spending on the Local Economy, 2003 by Daniel Stynes and Ya-Yen Sun, Michigan State University 2005, and 2005 visitation data from the NPS Public Use Statistics Office, http://www2.nature.nps.gov/stats/
Air-tour visitors are excluded if they did not also enter the park in another way

Table 3.37 shows total economic impact of park visitors to the local region in 2005. Direct economic effects of visitor spending accrue to tourism-related businesses that sell directly to park visitors. Secondary effects relate to businesses that provide goods and services to directly impacted businesses and also include spending by households that earn income (directly or indirectly) from visitor spending. Therefore, the total economic impact of visitor spending is greater than just visitor spending itself.

TABLE 3.37 TOTAL ECONOMIC IMPACT OF GCNP VISITORS ON COCONINO COUNTY 2005

	Sales (millions)	Personal Income (millions)	Employment
Direct Effects	$317	$119	6,006
Secondary Effects	$139	$48	1,922
Total Impact	$456	$167	7,928

Source: Harvey Economics calculated direct and secondary effects of visitor spending in 2005 based on information and methodologies included in Economic Impacts of GCNP Visitor Spending on the Local Economy 2003 by Daniel Stynes and Ya-Yen Sun, Michigan State University 2005
Total impacts include direct effects and secondary effects
Direct effects are less than total visitor spending since only the retail and wholesale margins on visitor purchase accrue to the local economy

Travel Impacts on Coconino County In 2006, Coconino County taxable sales for several tourism-related sectors totaled over $1.5 billion. However, not all sales from these sectors are directly related to tourist visitation; local residents and businesses also spend money on goods and services in the county, especially in the retail sector. The majority of taxable sales for lodging are due to visitors. Table 3.38 shows taxable sales in Coconino County for the following sectors: food services, amusement, retail, and accommodations.

After adjustment for inflation, taxable sales decreased for the restaurant/bar, amusement, and lodging sectors Fiscal Year (FY) 2001 to FY2003. The decrease in sales in tourism-related industries is likely due to impacts on travel related to the September 11, 2001 attacks. These industries saw sales increases by FY04. Retail sales, which include purchases made by residents and businesses as well as tourists, were probably less affected by September 11th events.

TABLE 3.38 TAXABLE SALES TOURISM-RELATED SECTORS IN COCONINO COUNTY 2000-2006 IN MILLIONS

Year	Restaurant/Bar	Amusement	Retail	Hotel/Motel	Total	Annual Growth
FY[a] 2000	$274	$34	$924	$210	$1,441	NA
FY 2001	$276	$34	$939	$200	$1,448	0.5%
FY 2002	$271	NA	$957	$184	NA	NA
FY 2003	$268	$31	$975	$178	$1,452	NA
FY 2004	$278	$36	$972	$191	$1,478	1.8%
FY 2005	$288	$42	$973	$192	$1,496	1.2%
FY 2006	$314	$42	$1,027	$204	$1,587	6.1%

Source: Arizona Department of Revenue, Annual Reports, 2000 through 2006, Table 11
[a]FY indicates Fiscal Year; for example, the FY05 represents July 1, 2004 to June 30, 2005
Taxable sales have been adjusted for inflation and reported in constant 2006 dollars

Travel-related spending in Coconino County by visitors totaled $865 million in 2005 (Arizona Office of Tourism 2006). An addition $2.5 million travel spending was due to resident air travel and travel arrangements.

Table 3.39 shows direct travel spending, broken down by segment, by visitors in Coconino County 2000 through 2005.

TABLE 3.39 TOTAL DIRECT TRAVEL SPENDING IN COCONINO COUNTY 2000 TO 2005 IN MILLIONS

	2000	2001	2002	2003	2004	2005
Lodging	$230.2	$207.8	$202.9	$207.3	$217.8	$228.0
Food and Beverage	$216.5	$202.6	$206.7	$214.0	$220.7	$227.6
Food Stores	$46.2	$44.8	$45.0	$45.3	$45.4	$44.7
Ground Trans. and Gas	$54.8	$51.7	$48.7	$57.4	$66.0	$77.8
Arts, Entertainment and Recreation	$129.1	$123.5	$124.5	$129.3	$133.9	$133.1
Retail Sales	$169.3	$156.5	$152.6	$151.1	$148.9	$148.1
Air Transportation	$0.0	$0.0	$2.0	$3.2	$2.5	$2.6
Total Visitor Spending	$846.3	$786.9	$782.4	$807.7	$835.3	$862.1
Other Travel[a]	$4.3	$4.0	$2.1	$1.2	$2.4	$2.5
Total Direct Travel Spending	$850.6	$790.9	$784.6	$808.9	$837.5	$864.6

Source: Arizona Office of Tourism, Arizona Travel Impacts, 1998-2005, prepared by Dean Runyan Associates, April 2006
[a]Includes resident air travel and travel arrangement
At the time of study completion, 2005 data was preliminary
All data have been adjusted for inflation and reported in constant 2006 dollars

Visitors spent the most money on lodging and food services. Spending on ground transportation and gas was a small part of overall visitor spending, but increased as a percentage of total visitor spending in 2004 and 2005.

Visitors staying overnight in hotels or motels accounted for almost 70% of all visitor spending in Coconino County. Day travelers accounted for another 12%. Travelers staying in private homes (visiting county residents), campgrounds, or vacation homes accounted for smaller portions of overall visitor spending.

In 2005, travel spending in Coconino County generated over $222 million in total direct industry earnings, over half of which was in the accommodation and food services industries. Coconino County travel spending generated about 10,700 jobs, most in the accommodation and food services industries and the arts, entertainment, and recreation industries.

In addition to providing revenue to local businesses and income to employees, travel spending also provides revenue to local governments through a variety of tax sources including sales taxes, lodging taxes, and other tourism-related

taxes. In 2005, travel spending in Coconino County resulted in generation of about $24 million local taxes, and $31 million dollars in state taxes (Arizona Office of Tourism 2006). The state imposes a 5.6% sales tax on most business activities, and Coconino County has a 0.925% general sales tax. Incorporated cities in the county impose additional sales taxes and many also have lodging taxes of 2.0 to 4.5% (Arizona Department of Commerce 2007d).

Grand Canyon Air-tour Industry Impacts on the Regional Economy and Las Vegas

An FAA report includes an estimate of the larger impact of air tours (FAA 2000c). In that report, the U.S Air Tour Association estimates that "for each dollar spent on an air tour of the Grand Canyon, an additional $1.50 in air-tour-related revenue is generated, suggesting a Grand Canyon National Park air tour multiplier of 2.5." As indicated in the FAA report, the estimated $100 million revenues generated May 1997 to April 1998 would have resulted in an additional $150 million revenue generated in other air-tour-related businesses. Applied to the $192.6 million of revenues for 2006, that multiplier indicates an additional $289 million in revenue generated by other air-tour-related businesses.

Las Vegas Demographic and Economic Conditions and the Role of Grand Canyon Air Tours

Las Vegas Population and Households

Between 1990 and 2005, Las Vegas experienced rapid growth. During this time, city population more than doubled, growing at an average annual rate of 5.1%. The number of Las Vegas households grew at a similar rate 1990 to 2005. Table 3.40 shows the population and number of households in Las Vegas in 1990, 2000, and 2005.

TABLE 3.40 POPULATION AND HOUSEHOLDS IN LAS VEGAS 1990, 2000, AND 2005

Year	Population	Annual Growth	Households	Annual Growth
1990	258,295	NA	99,735	NA
2000	478,434	6.4%	176,750	5.9%
2005	545,147	2.6%	204,688	3.0%
Total Growth		111.1%		105.2%

Source: US Census Bureau, American Factfinder, 1990 Census, 2000 Census, and 2005 American Community Survey, www.census.gov

Las Vegas experienced faster annual growth 1990 to 2000 and slower growth 2000 to 2005. In 2005, median Las Vegas home value was $285,200, more than double the 1990 median home value, after adjustment for inflation.

Las Vegas Income In 2005, the median household income for Las Vegas residents was $47,900, and per capita income was $24,900 (U.S. Census Bureau 2005). Household and per capita incomes for Las Vegas residents are similar to statewide income levels.

Las Vegas Employment January to November 2006, the Las Vegas unemployment rate ranged 3.7% to 4.7%, similar to statewide levels. In November 2006, 296,344 Las Vegas residents were a part of the labor force, and 284,023 people were employed. The unemployment rate was 4.2% (U.S. Department of Labor 2007). Table 3.41 shows employment of Las Vegas residents by industry.

Over a quarter of employed residents worked in the arts, recreation, accommodation, and food service industries. Las Vegas is a well-known tourist destination; therefore, a large portion of the activity in these industries is likely tourist-related visitation to the city and surrounding area.

TABLE 3.41 EMPLOYMENT BY INDUSTRY FOR LAS VEGAS RESIDENTS 2005

Industry	Number Employed	Percent
Agriculture, forestry, fishing and hunting, and mining	344	0.1%
Construction	34,773	13.5%
Manufacturing	6,589	2.6%
Wholesale trade	7,741	3.0%
Retail trade	28,371	11.1%
Transportation and warehousing, and utilities	8,998	3.5%
Information	5,436	2.1%
Finance and insurance, and real estate and rental and leasing	20,167	7.9%
Professional, scientific, management, and administrative services	26,210	10.2%
Educational services, health care, and social assistance	31,502	12.3%
Arts, entertainment, recreation, accommodation, and food services	67,181	26.2%
Other services, except public administration	12,157	4.7%
Public administration	7,237	2.8%
Total	256,706	100%

Source: U.S. Census Bureau, 2005 American Community Survey, www.census.gov

Role of Tourism to the Las Vegas Economy A large part of the Las Vegas economy is based on tourism (University of Nevada Las Vegas 2010)

- Over 38 million people visited Las Vegas in 2005, spending over $36 billion. In 2006, visitation increased to almost 39 million people
- Occupancy rate of hotel rooms in Las Vegas was about 90% in 2006, and the city had over 43 million occupied room nights
- Las Vegas gross gaming revenue exceeded $10.6 billion in 2006

Over 60% of visitors reported going to Las Vegas for vacation or pleasure, and about 17% for conventions, corporate meetings, or other business events. Other reasons for visiting Las Vegas included friends/relatives, gambling, special events, or other (Las Vegas Convention and Visitors Authority 2005).

Las Vegas is located in Clark County, which collects a 7.75% sales and use tax. As of November 2006, 2006 year-to-date taxable sales in Clark County amounted to $14.7 billion (Nevada Department of Taxation 2006). Several Las Vegas revenue sources, such as room taxes and gaming taxes, are dependent on visitors. Las Vegas collected about $4.1 million in room taxes in 2006, out of almost $402 million of total taxes collected (City of Las Vegas 2006).

Las Vegas Air-tour Operations Seven of the 14 air-tour operators that offer air tours over Grand Canyon base in Las Vegas. Operations of these businesses (flights offered, employment opportunities, financial conditions) have been discussed as part of the profile of the air-tour industry. Operators based in Las Vegas rely on tourists visiting Las Vegas for a large portion of their business.

Grand Canyon is one attraction that lures visitors to the Las Vegas area; however, air tours over Grand Canyon are only a small part of the overall Las Vegas tourist draw and are a small portion of the overall tourist economy.

PARK VALUES

As a unique feature, Grand Canyon has both non-monetary and monetary values to people who visit and to those who appreciate its existence, but may never see it in person. Grand Canyon's intrinsic and existence (non-use) values are discussed below. Intrinsic value includes values park visitors ascribe to their park visit beyond actual expenditures. This is also referred to as consumer surplus, use benefits, or visitor day values. In general, intrinsic values are easier to estimate as they are at least partially based on existing visitor data and survey information collected as part of various studies. Non-use values are more difficult to estimate, although certain survey techniques have been applied in other locations.

Intrinsic Value of Grand Canyon National Park

GCNP visitors place a value on the park based on direct use of its resources. Park use may include viewing from overlooks, hiking on trails, camping, or participating in a river trip. No studies have been done specifically on Grand Canyon use value; however, an FAA report related to commercial air-tour limitations provides some Grand Canyon use estimates based on studies done in other locations (FAA 2000c).

FAA used the benefit transfer method to create these estimates. FAA took existing economic studies with detailed site-specific information that identified use values for visitors to other places and applied those data to Grand Canyon visitors. Table 3.42 shows the 1998 visitation data and intrinsic use values used by FAA to derive an estimated intrinsic value for the park to visitors in 1998.

TABLE 3.42 ESTIMATED INTRINSIC USE VALUE OF GRAND CANYON NATIONAL PARK 1998

Visitor Type	Total Visitor Days	Use Value per Visitor Day	Total Use Value
Backcountry	92,097	$37.13	$3,419,562
River	66,938	$92.44	$6,187,749
Other	5,314,491	$48.72	$258,922,002
Total	5,473,526		$268,529,312

Source: Federal Aviation Administration, Docket No. FAA-1999-5927-280

Intrinsic use value for backcountry visitors was taken from a national study of outdoor recreation; intrinsic use value for river runners from the Final EIS for Glen Canyon Dam Operations; and use value for other visitors was obtained from an analysis of recreation at Bryce Canyon National Park. As a weighted average, data suggest an intrinsic value of about $49 per day above and beyond actual expenditures per day, previously estimated to be $80 to $90 per day.

Although the FAA report provides some estimate of GCNP's use value, the benefit transfer method, as applied, has certain shortcomings. Estimates provided in Table 3.42 likely do not fully reflect Grand Canyon's actual intrinsic use value mainly because values visitors place on visiting and recreating in other places will not be the same as the values visitors place on Grand Canyon. Economic values estimated for intrinsic use of other places cannot necessarily be transferred to Grand Canyon visitors, although there is some relevance since data used were derived from regional amenities with some similarity or other national park units.

Another factor affecting total estimation of intrinsic use value for GCNP includes the estimate of total visitor days. NPS park visitation reports in 1998 show a lower visitors number than used by FAA. Park visitation numbers, based the most current information available at the time of analysis, were about 15% less than 1998 visitation figures. Using the smaller visitor number lowers total intrinsic use value. Conversely, any adjustments done to account for inflation would reflect higher use values than shown in Table 3.42.

Non-use Values of Grand Canyon National Park

Estimation of non-use values rely mostly on the contingent valuation method, which asks survey respondents who are not visitors to a particular place to answer questions about the values they ascribe to that place. This method is relatively controversial due to the survey questions' hypothetical nature, and arguments have been made that values estimated from these surveys are inflated. Regardless, non-use values such as World Heritage designation and importance to native people, Americans, and global visitors clearly exist for Grand Canyon and are relevant in this EIS.

At least one non-use study relates to the Glen Canyon and Grand Canyon area. The survey's focus was the value respondents placed on improving environmental and cultural resources in this area. The sample group included people in the local area as well as a national sample group. Average non-use values for the Glen Canyon/Grand Canyon area were found to range about $17 to $26 per household and estimates of total non-use value of the area

were estimated in the range of about $3 billion to $4.3 billion when calculated at the national level (2004 dollars) (Welsh, et al. 1995).

This information demonstrates there is a value the public ascribes to the presence or existence of Grand Canyon National Park in its current condition, regardless of whether they have visited or will ever visit the park. However, contingent valuation information applied in this instance presents several limitations when attempting to place a quantifiable dollar value on those perceptions. These figures are based on hypothetical questions of willingness to pay for an improvement to a resource that may have limited relevance to this particular case. Also, this particular study estimated the value of both Glen Canyon and Grand Canyon together and the estimated total non-use value may not reflect Grand Canyon by itself.

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