

1 **CHAPTER 2 ALTERNATIVES**

2 **INTRODUCTION**

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4
5 The National Environmental Policy Act requires an EIS consider a range of reasonable Alternatives, including a No
6 Action Alternative. NEPA requires the No Action Alternative be evaluated as a baseline for comparison for other
7 Alternatives, even if a No Action Alternative may not be implemented due to legal, regulatory, or other
8 considerations, including a legislative command to act.
9

10 As required in Council on Environmental Quality regulations (40 CFR 1502.14), agencies must “rigorously explore
11 and objectively evaluate all reasonable Alternatives” in an EIS. CEQ defines reasonable Alternatives as those
12 technically and economically feasible. Alternatives must also: meet project objectives, resolve needs, and alleviate
13 potentially significant impacts on important resources. CEQ is also clear that agencies should not pare Alternatives
14 to only those that are cheap, easy, or the agency’s favorite. Rather, feasibility is an initial measure of whether the
15 Alternative makes sense and is achievable (DO 12, page 20).
16

17 Through the EIS process, eight Alternatives (A, B, C, D, E, F, G, and the NPS Preferred Alternative) were
18 considered for management of commercial air-tour and general-aviation operations over Grand Canyon in the
19 SFRA. For reasons defined in Alternatives and Actions Considered and Dismissed from Further Consideration,
20 Alternatives B, C, D, and G were dismissed from further consideration. In 2009 the NPS, in consultation with the
21 FAA and stakeholders, worked to refine the NPS Preferred Alternative. During that process much iteration of
22 Alternatives E, G, and elements of Alternative A were explored. The outcome of those efforts is the NPS Preferred
23 Alternative. As a result, four Alternatives have been retained for further evaluation
24

25 **Alternative A No Action/Current Condition Map 2.2**

- 26 • continue current management and current helicopter and fixed-wing air-tour routes
- 27 • long and short-loop air-tours operate in Zuni Point and Dragon Corridors year-round
- 28 • annual allocation of 93,971 air-tour flights
- 29 • no quiet-technology incentives or conversion requirement
- 30 • four existing General Aviation corridors
- 31 • Flight-free Zone ceilings at 14,499 feet, except Sanup at 7,999 feet
32

33 **Alternative E Alternating Seasonal Use Map 2.3**

- 34 • short-loop air-tours alternate use of Zuni Point and Dragon Corridors seasonally
- 35 • no long-loop tours over North Rim; no routes over Marble Canyon; dogleg in Dragon Corridor
- 36 • annual allocation of 93,971 air-tour and air-tour related flights
- 37 • daily cap of 364 air-tour and air-tour-related flights
- 38 • full conversion to quiet-technology aircraft by date to be determined
- 39 • only quiet-technology aircraft allowed on East End routes early and late hours of flight day
- 40 • three modified general-aviation corridors
- 41 • all Flight-free Zone ceilings raised to 17,999 feet, and three zone boundaries enlarged
42

43 **Alternative F Modified Current Condition Map 2.4**

- 44 • similar to current routes and altitudes, except seasonal shift in Dragon Corridor, and changes in West End routes
- 45 • annual allocation of 93,971 air-tour flights
- 46 • incentives for quiet-technology aircraft; conversion to quiet-technology aircraft in 10 to 12 years
- 47 • One general-aviation corridor eliminated; three general-aviation corridors as in Alternative A
- 48 • Flight-free Zone ceilings same as current; Flight-free Zone boundaries changed to accommodate seasonal shift
49 in Dragon Corridor
50

51 **NPS Preferred Alternative Map 2.5**

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

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

9 **Alternatives Components**

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

11 requirements such as

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

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

21 feet MSL.

22 Mitigation measures that apply to Action Alternatives (E, F, and the NPS Preferred Alternative) appear in Chapter 2,

23 Mitigation Provisions to Manage Aircraft Noise under Action Alternatives

24 **Formulation of Alternatives**

25 Alternatives for managing the SFRA were developed to meet EIS objectives. Alternatives also consider public

26 scoping comments, and tribal, agency, and Grand Canyon Working Group input.

27 As described in Chapter 1, the Grand Canyon Working Group was established under authority of the National Parks

28 Overflights Advisory Group, and consists of representatives from NPS and FAA, air-tour operators, environmental

29 groups, tribes, commercial and general aviation, recreational interests, and other Federal agencies. The working

30 group was tasked with assisting the agencies in meeting the statutory mandate contained in Public Law 100-91. As a

31 result, Alternatives incorporate many Working Group recommendations and ideas.

32 **Participants in Alternatives Formulation Process**

33 The Grand Canyon Working Group began assisting agencies developing preliminary EIS Alternatives in early 2006.

34 Over the course of numerous Working Group meetings, March 2006 through December 2007, several options for

35 managing aircraft overflights were proposed by Working Group members and stakeholder groups. An additional

36 Working Group meeting was held to discuss a Draft NPS Preferred Alternative in July 2009.

37 In spring 2006, as part of the EIS process, the EIS Planning Team¹⁸ reviewed more than 1,200 public scoping

38 comments to identify options (which were of varying scope and complexity) to meet the goal of substantial

39 restoration of natural quiet. Key elements suggested by the Grand Canyon Working Group, and those submitted

40 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)

1 **ELEMENTS COMMON TO ALL ALTERNATIVES**
2

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

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

20
21 Although this EIS does not propose Alternatives to manage administrative flights or aircraft operating at or above
22 18,000 feet MSL, noise impacts generated by these aircraft are considered in Cumulative Effects analyses.
23

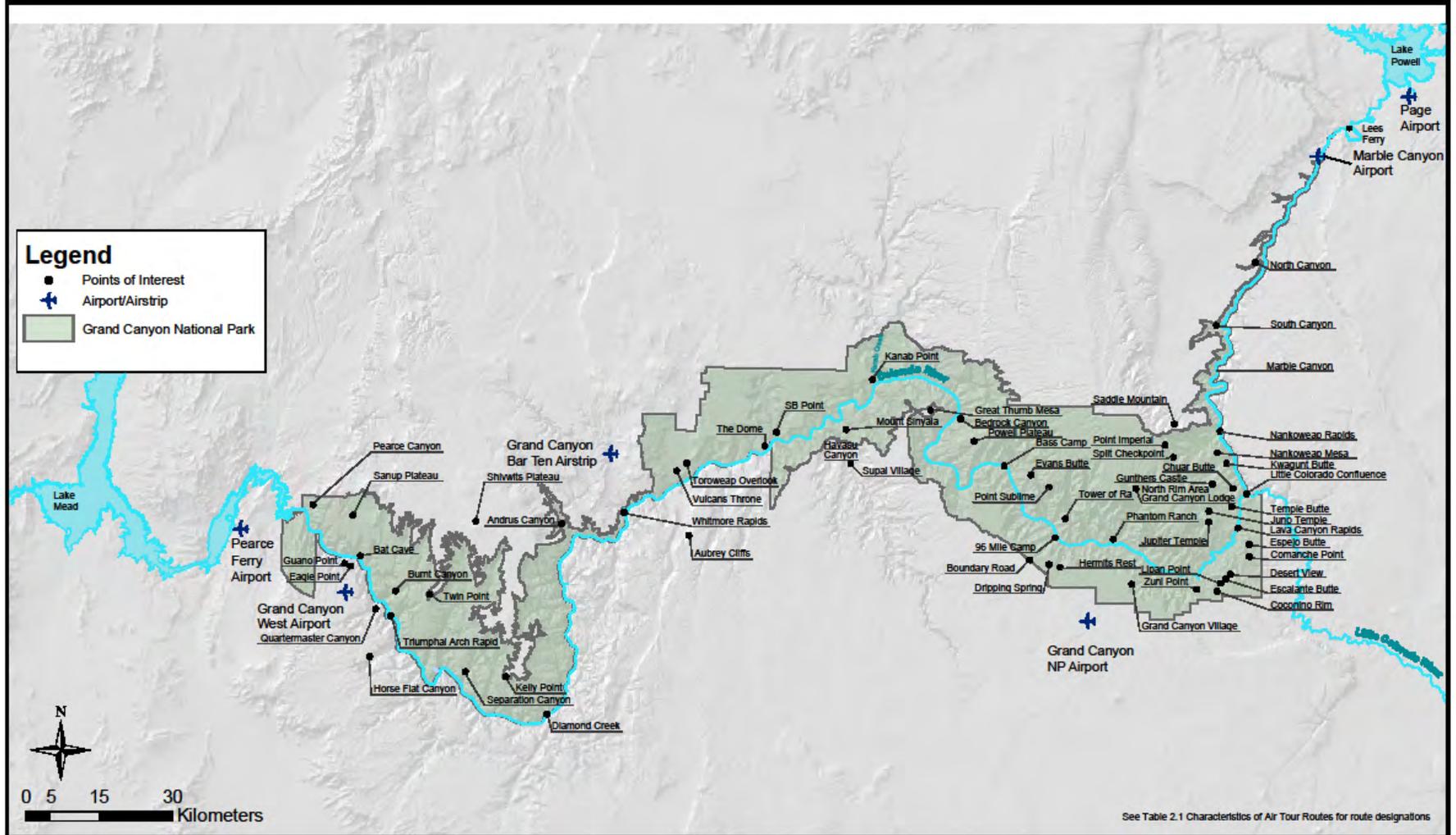
24 Unless otherwise noted in Alternatives, existing SFRA regulations, 14 Code of Federal Regulations (CFR) Part 93
25 Subpart U, would continue to apply and be enforced.
26

27 Weather and safety route segments may be created or modified by the FAA as needed to address prospective safety
28 concerns of regular SFRA routes. Deviation Reports will be filed with the FAA Las Vegas Flight Standards District
29 Office any time deviations from an existing SFRA route occur, as currently required.
30

31 Monitoring and noise modeling will be conducted as part of an Adaptive Management approach to ensure noise
32 provisions of sections 804 of Public Law 106-181 would be met.
33

34 Grand Canyon place names commonly mentioned in Alternatives are shown in Map 2.1.
35

Map 2.1 Locations



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1 **General Aviation Corridors**

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3 The four SFRA general-aviation corridors are shown in Map 2.2. In these corridors, northbound general-aviation
4 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.

5
6 From east to west, flight corridors are

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

11
12 **Dragon Corridor**, between Bright Angel and Toroweap/Shinumo Flight-free Zones, is about 15-miles long. It is
13 about 4.5-miles wide along its northern half widening to about 9.5 miles at its southern end. Park features overflow
14 by aircraft using this corridor include Hermits Rest, Hermit Trail, The Dragon, and Tower of Ra. Air-tour operations
15 also occur in this flight corridor below altitudes available for general aviation.

16
17 **Fossil Canyon Corridor** crosses the park through Toroweap/Shinumo Flight-free Zone, and is about 4.5-miles wide
18 along its entire 18-mile length. Park features overflown by aircraft using this corridor include Great Thumb Mesa,
19 Bedrock Canyon, and Powell Plateau.

20
21 **Tuckup Corridor** crosses GCNP through Toroweap/Shinumo Flight-free Zone, and is about 4.5-miles wide, but
22 due to the surrounding Flight-free Zone's irregular shape, the corridor is about ten-miles long on its east side and 15-
23 miles long along its west side. Aircraft using this corridor overfly SB Point.

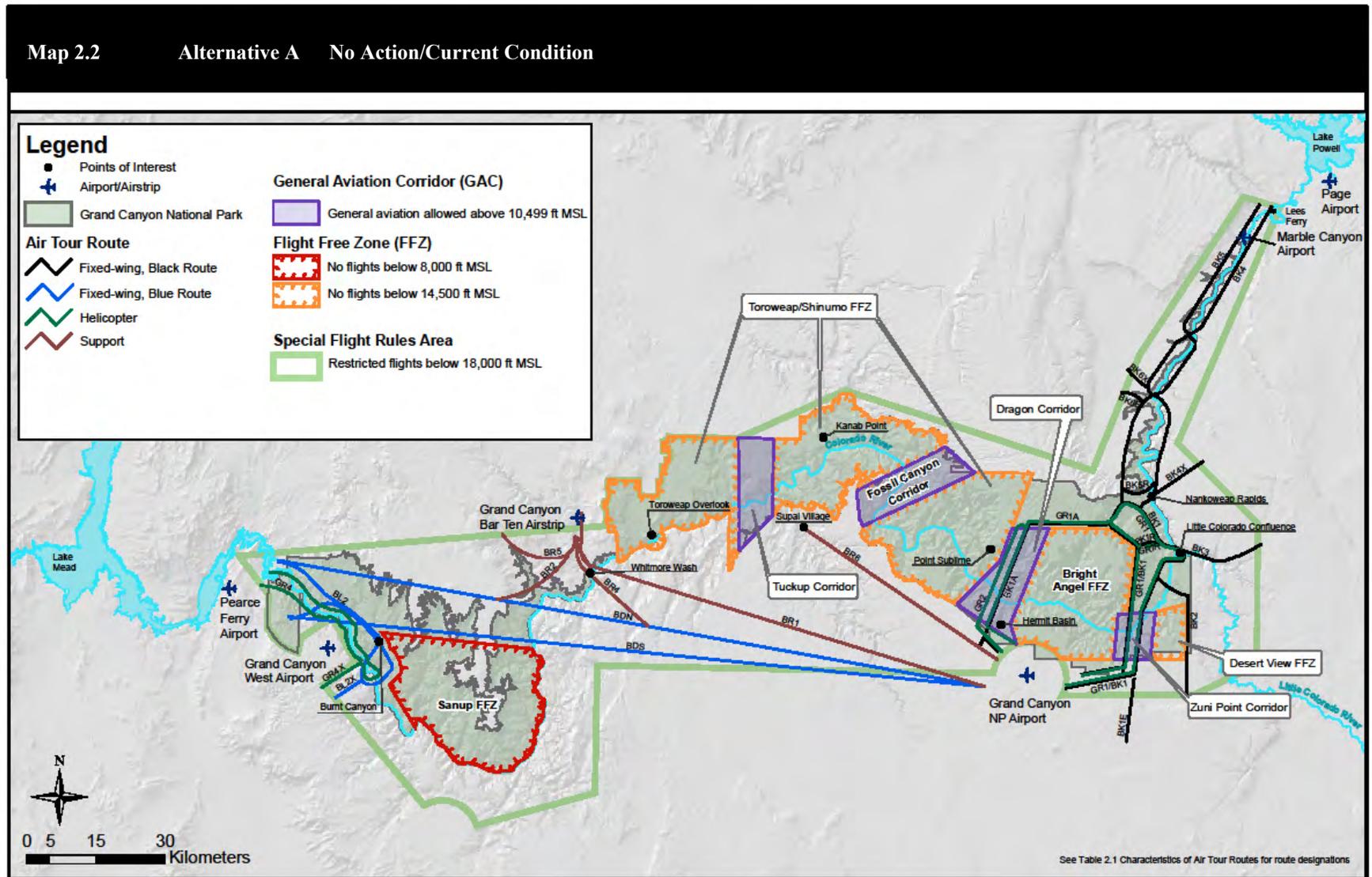
24 **Air-tour Routes**

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

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

37
38 Each includes a specified path and altitude. Pilots are not allowed to deviate from routes by more than 0.5 miles
39 laterally and 300 feet vertically. Conformance is critical as multiple aircraft can use a route simultaneously.

40
41 Table 2.1 presents route characteristics. Route designation abbreviations in parenthesis correspond to route
42 designations found on Alternative maps.



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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 as Black-1A , except ends at north end of Dragon Corridor	Same as 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

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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.

1 **ALTERNATIVE E ALTERNATING SEASONAL USE**

2 3 **Concept**

4
5 Alternative E (Map 2.3) would alternate use of Zuni Point and Dragon Corridors seasonally, and eliminate a long-
6 loop tour between Zuni Point and Dragon Corridors over North Rim, providing areas of GCNP with no air-tour
7 noise during portions of the year. Dragon Corridor air-tour routes could be used September 16 through June 30. Zuni
8 Point Corridor routes could be used July 1 through September 15. There would be an annual allocation of 93,971,
9 and a daily cap of 364 for flights classified as air tours, transportation, repositioning, and other air-tour-related
10 flights. Operations on Brown routes and those in support of the Hualapai Tribe would continue exempt from annual
11 allocations and daily caps.

12
13 Other major features include eliminating one of the four general-aviation corridors (Fossil Canyon), expanding East
14 End Flight-free Zones, changing direct-flight routes to/from Las Vegas to either avoid or fly over less of the park,
15 raising Flight-free Zone upper boundaries, expanded curfews, and conversion to best available quiet technology over
16 time.

17 18 **Special Flight Rules Area**

19
20 Alternative E would not include any changes to Special Flight Rules Area boundaries. Operations in support of the
21 Hualapai Tribe would continue exempt from annual allocations and daily caps.

22 23 **Flight-free Zones**

24
25 The upper boundary of all Flight-free Zones would be increased to 17,999 feet MSL. No flights would be allowed
26 below 18,000 feet MSL except administrative use under an appropriate written waiver approved by both the FAA
27 and the manager(s) of the over-flown land(s).

28
29 **Desert View Flight-free Zone** would be enlarged by extending its boundary north to about twice its current length.

30
31 **Bright Angel Flight-free Zone** would be substantially enlarged by extending its boundary north to include all of the
32 SFRA surrounding Marble Canyon. The Flight-free Zone's southwest corner would be expanded west to
33 accommodate the Dragon Corridor dogleg to reduce aircraft noise at popular Hermits Rest and Hermit Trail visitor-
34 use areas. The Flight-free Zone would be expanded east to include features such as Jupiter and Juno Temples and
35 Gunthers Castle.

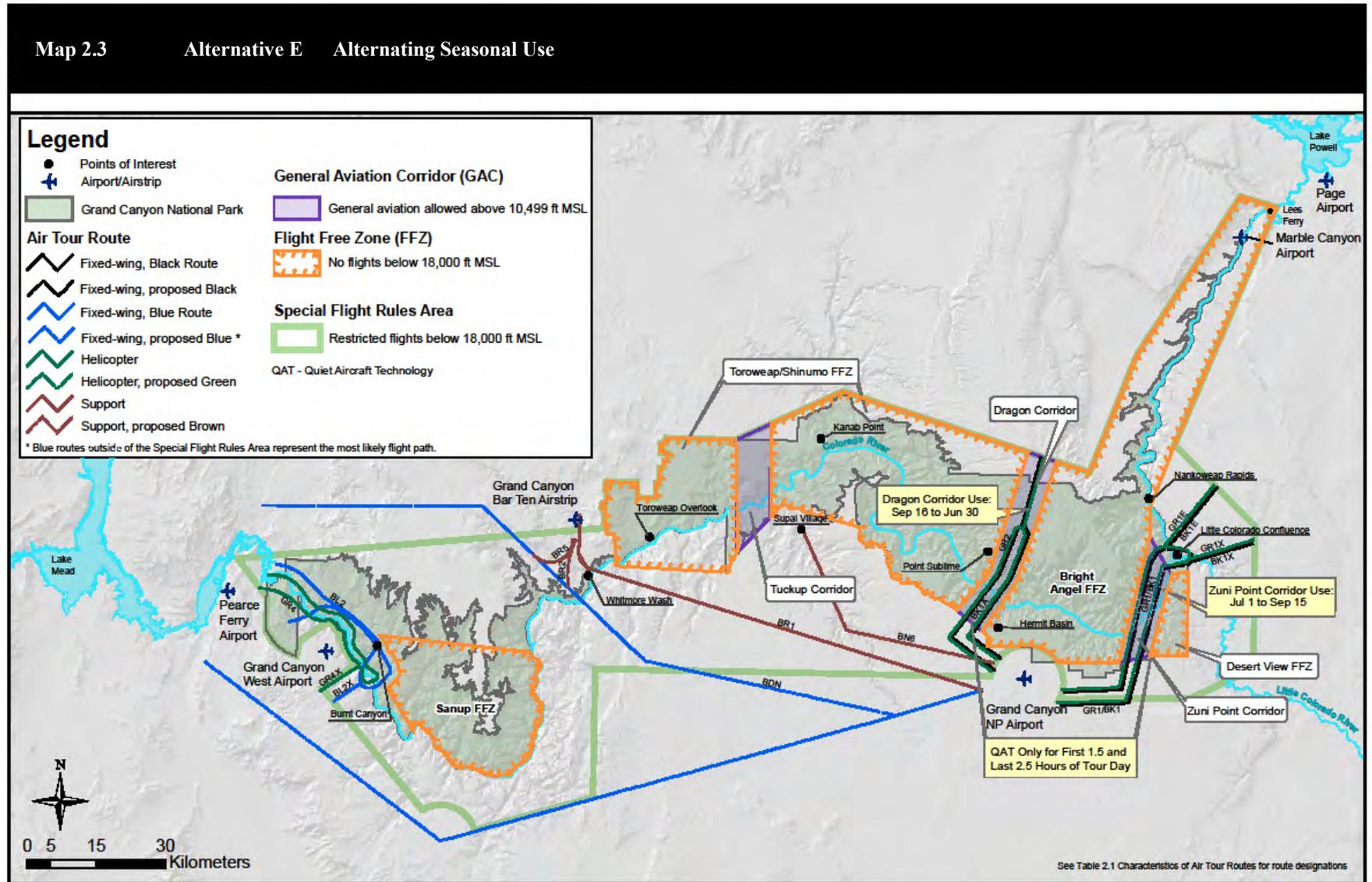
36
37 **Toroweap/Shinumo Flight-free Zone** would be increased in size by extending its northern boundary east of
38 Tuckup Corridor from the GCNP boundary to the SFRA boundary and west of Tuckup Corridor by extending its
39 southern boundary south of the park boundary to encompass some Hualapai tribal lands.

40
41 Except for the increase in its upper boundary, no changes would be made in **Sanup Flight-free Zone**.

42 43 **General-Aviation Corridors**

44
45 Three corridors would be open for year-round general-aviation use (Map 2.3). Corridor use would be the same as
46 Alternative A (Current Condition); northbound aircraft would continue to fly at 11,500 feet or 13,500 feet MSL;
47 southbound aircraft would fly at 10,500 feet or 12,500 feet MSL.

48
49 The **Zuni Point Corridor** would be extended northeast to about twice its current length, with the northernmost
50 extent near Kwagunt Butte. Its alignment would be shifted east to accommodate eastern expansion of **Bright Angel**
51 **Flight-free Zone**.



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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.

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

3

4 **Quiet-Technology Incentives and Conversion**

5

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

12

13

14

1 **ALTERNATIVE F MODIFIED CURRENT CONDITION**

2 3 **Concept**

4
5 Alternative F (Map 2.4) meets Chapter 1 objectives by minimizing changes from current practices. Changes include
6 modification of West End air-tour routes at the request of the Hualapai Tribe, as well as a seasonal shift to Dragon
7 Corridor routes. February 1 through November 30, Dragon Corridor would be open as currently configured.
8 December 1 through January 31, Dragon Corridor air-tour routes would be relocated seven miles west to reduce air-
9 tour noise during part of the year near the current Dragon Corridor. Operations in support of the Hualapai Tribe
10 would continue exempt from annual allocations and daily caps.

11 12 **Special Flight Rules Area**

13
14 The notch¹⁹ in the SFRA boundary near Grand Canyon West Airport would be modified to reduce aircraft noise at
15 Eagle and Guano Points. This boundary change would include Hualapai Over the Edge flights in the SFRA; such
16 flights are currently outside the SFRA. These flights in support of the Hualapai Tribe would continue exempt from
17 annual allocation and daily cap requirements.

18 19 **Flight-free Zones**

20
21 Alternative F would not result in any changes to **Desert View or Bright Angel Flight-free Zones**.

22
23 **Toroweap/Shinumo Flight-free Zone**'s eastern boundary would be moved west to accommodate Dragon Corridor
24 modifications, as described below.

25
26 **Sanup Flight-free Zone**'s northern boundary would be moved south to accommodate modifications of Blue Direct
27 routes, as described below.

28
29 Flight-free zone ceilings would be the same as Alternative A. No flights would be allowed below Flight-free Zone
30 ceilings except administrative use under an appropriate written waiver approved by both the FAA and the
31 manager(s) of the over-flown land(s).

32 33 **General Aviation Corridors**

34
35 Three corridors would be open for year-round general-aviation use, as shown on Map 2.4, and one would be
36 eliminated.

37
38 **Zuni Point Corridor** would remain the same as Alternative A.

39
40 **Dragon Corridor** size and boundary would change. The corridor's west side would be narrowed to the east, the
41 north boundary would be extended slightly, and the southeast corner would be eliminated. This configuration would
42 be in use year-round for general aviation.

43
44 **Fossil Canyon Corridor** would be eliminated.

45
46 **Tuckup Corridor** would remain the same as Alternative A.

47
48
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

1 **Air-tour Routes**

2
3 Except as noted in Table 2.3, air-tour routes would be the same as described in Table 2.1 for Alternative A.

4 **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

5
6
7 **Allowable Times of Operation**

8
9 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.

10
11
12
13
14 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.

15
16

1 **Numbers of Flights Allowed**

2

3 Alternative F would have the same annual allocation provision (93,971 commercial air-tour operations) as

4 Alternative A. There would be no daily cap under this Alternative.

5

6 **Quiet-Technology Incentives and Conversion**

7

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

9 • Forgiveness of fees charged for SFRA flights

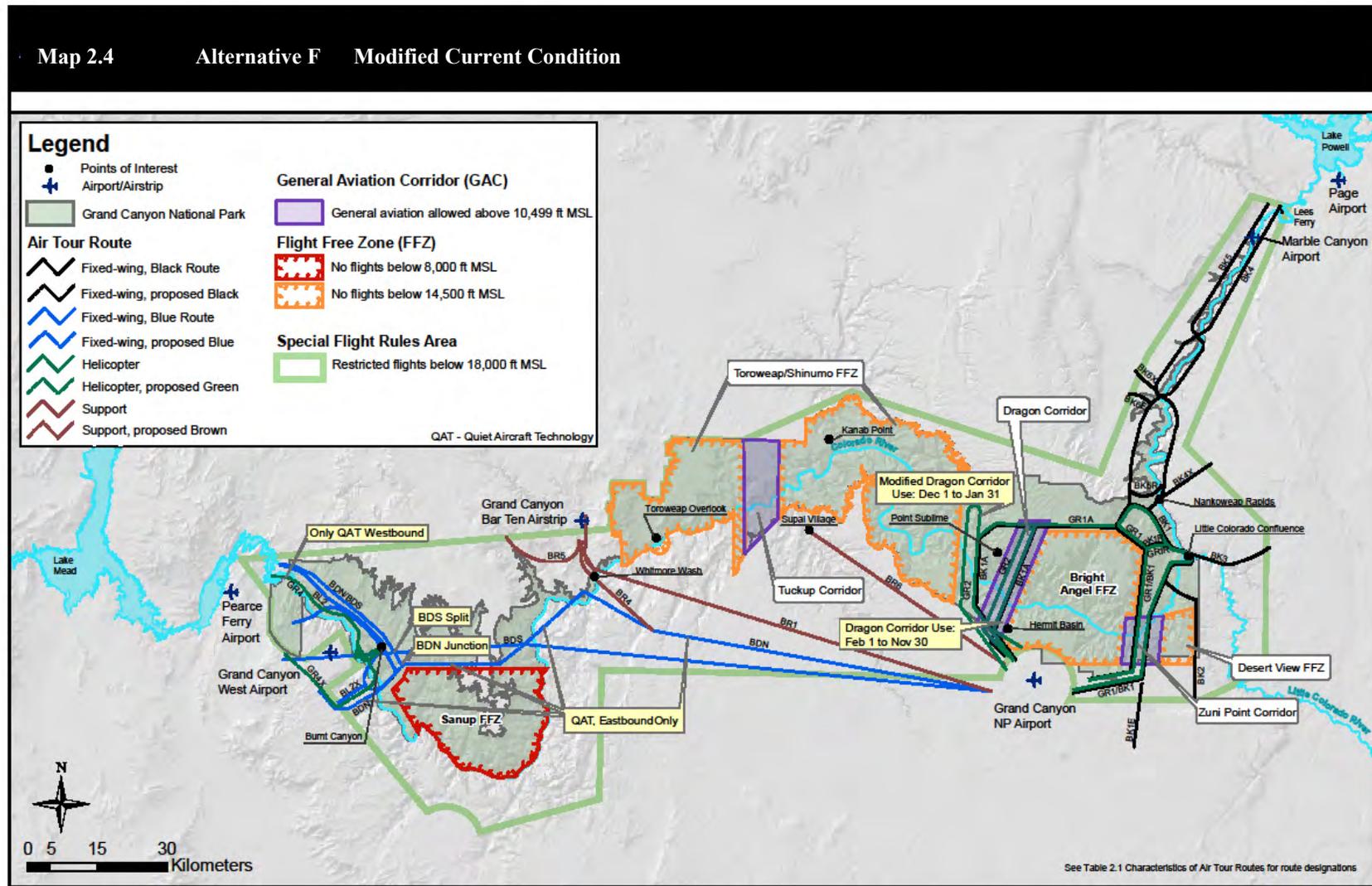
10 • Additional flights, as long as the cumulative impact of such flights does not increase noise in the park, and does
11 not adversely impact substantial restoration of natural quiet

12 • Provision of a West End quiet-technology helicopter route on westbound portion of Green-4. Blue Direct North
13 eastbound route would be used by quiet-technology aircraft only

14 • On Black-1, quiet-technology aircraft would be allowed to fly at 8,000 feet MSL while non-quiet-technology
15 aircraft would be required to fly at 9,000 feet MSL

16 • Over a 10- to 12-year period, flight operations would convert to quiet-technology aircraft

17



1
2

1 **NPS PREFERRED ALTERNATIVE**

2 3 **Concept**

4
5 The NPS Preferred Alternative (Map 2.5) would seasonally alternate use of Zuni Point and Dragon Corridors for
6 short-loop air tours, while long-loop tour routes over North Rim beginning in Zuni Point Corridor and ending in
7 Dragon Corridor would be open year-round, but only to quiet-technology aircraft after a four-year phase in. Short-
8 loop tour routes in Dragon Corridor would be open May 1 through October 31. Short-loop tour routes in Zuni Point
9 Corridor would be open November 1 through April 30. There would be an annual allocation of 65,000 commercial
10 air-tour and air-tour-related operations, and a daily cap of 364 flights classified as commercial air tours. All flights
11 on SFRA routes would be classified as commercial air tours with limited exceptions for maintenance and training
12 flights. Operations in support of the Hualapai Tribe would continue exempt from annual allocations and daily caps.
13

14 Other major features of this Alternative include raising Flight-free Zone upper boundaries, curfew changes, and,
15 after ten years, all SFRA routes would be open only to quiet-technology aircraft.
16

17 **Special Flight Rules Area**

18
19 The notch in the SFRA boundary near Grand Canyon West Airport would be modified to reduce aircraft noise at
20 Eagle and Guano Points, the same as Alternative F. This boundary change would include Hualapai Over the Edge
21 flights in the SFRA; such flights are currently outside the SFRA. These flights in support of the Hualapai Tribe
22 would continue exempt from annual allocation and daily cap requirements.
23

24 **Flight-free Zones**

25
26 The upper boundary of all Flight-free Zones would be increased to 17,999 feet MSL. No flights would be allowed
27 below 18,000 feet MSL except for 1) aircraft in transition on Victor airways V210, V257, and V293 at or above
28 14,500 feet, 2) aircraft under the positive control of an air-traffic control center or tower when necessary for safety,
29 3) administrative use under an appropriate written waiver approved by both the FAA and the manager(s) of the over-
30 flown land(s).
31

32 Except for the upper boundary increase, there would be no changes in **Desert View Flight-free Zone**.
33

34 **Bright Angel Flight-free Zone** would be modified by expanding the southwest corner west to the park boundary.
35 This action would accommodate creation of a dogleg in Dragon Corridor that would reduce aircraft noise at the
36 popular visitor-use areas Hermits Rest and Hermit Trail.
37

38 **Toroweap/Shinumo Flight-free Zone** would be decreased in size by moving the southeast corner slightly west to
39 accommodate the Dragon Corridor dogleg.
40

41 Except for the upper boundary increase, no changes would be made to **Sanup Flight-free Zone**.
42

43 **General Aviation Corridors**

44
45 There would continue to be four corridors for year-round general-aviation use, as shown in Map 2.5. Corridor use by
46 general-aviation aircraft would be the same as described for Alternative A; northbound aircraft would continue to fly
47 at 11,500 feet or 13,500 feet MSL and southbound aircraft would fly at 10,500 feet or 12,500 feet MSL.
48

49 **Zuni Point Corridor** would remain the same as Alternative A.
50

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

5
 6 **Fossil Canyon Corridor** would be rotated 28 degrees to the southeast to move the corridor away from Great Thumb
 7 Mesa and Supai Village.

8
 9 **Tuckup Corridor** would remain the same as Alternative A.

10
 11 **Air-tour Routes**

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

13
 14 **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. Nankowep 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

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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.

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

2 3 **Numbers of Flights Allowed**

4
5 The NPS Preferred Alternative would implement a daily cap of 364 commercial air-tour operations in the SFRA,
6 based on Peak Day use data for commercial air-tour operations 2004 to 2006. A new annual allocation of 65,000 air-
7 tour and air-tour-related operations in the SFRA would be implemented, based on the maximum annual number of
8 operations reported for each operator 2004 to 2008.

9
10 The daily cap would apply to total commercial air-tour operations, not to individual air-tour operators and not to
11 non-air-tour operations. It is intended that air-tour operators would cooperate with each other to avoid exceeding the
12 daily cap. Each non-exempt operation in the SFRA would require use of an annual allocation. Current exemptions
13 would remain in place for operations solely over tribal lands, operations in support of the Hualapai Tribe on SFRA
14 routes, limited training and maintenance flights, and other operations specifically exempted by law (Whitmore and
15 Bar Ten). Quiet-technology aircraft operations would not be required to annual allocations three months each year
16 (January 1 to March 31).

17 18 **Adaptive Management**

19
20 A key to successful NPS Preferred Alternative implementation would be appropriate and effective monitoring and
21 reporting. The NPS Preferred Alternative would require reporting of daily operations by air-tour operators on as
22 close to a daily basis as is reasonable. This reporting would be enforceable by the FAA as part of revised SFRA
23 regulations. Reported and validated data are essential for verifying compliance with both the daily cap and annual
24 allocation, and to provide data for ongoing GCNP noise modeling and monitoring.

25
26 The NPS Preferred Alternative would also involve a communication-based adaptive management process involving
27 the NPS, FAA, commercial air-tour operators, and other stakeholders to achieve the NPS Preferred Alternative's
28 goals and intents. This process would address any problems encountered in implementing the NPS Preferred
29 Alternative such as exceeding the daily cap, and route deviations that become more than a rare occurrence. Using
30 proactive communication among stakeholders and agencies, the intent of the process would be to search for
31 solutions within the approved plan or with only minor changes. However, if the nature and severity of a problem
32 requires changing the plan or regulations to solve the problem, a new NEPA process may be necessary. The adaptive
33 management process would also identify and address potential opportunities if monitoring indicates the plan's
34 objectives can be met in a less restrictive way (for example, increasing the daily cap for quiet-technology
35 operations).

36 37 **Quiet-Technology Incentives and Conversion**

38
39 The NPS Preferred Alternative would require all commercial aircraft flying on SFRA routes to be quiet-technology
40 aircraft within ten years of implementation. Commercial operations in support of the Hualapai Tribe would continue
41 exempt from this requirement.

42
43 Quiet-technology incentives would include allowing only quiet-technology aircraft (fixed-wing and helicopters) to
44 fly a long-loop route year-round between Zuni Point Corridor and Dragon Corridor via North Rim. Use of this long-
45 loop route by non-quiet-technology aircraft would be phased out within four years of plan implementation. Also, the
46 Marble Canyon fixed-wing route (Black-4) would be available for use only by quiet-technology aircraft as soon as
47 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

1 conducts flight-following for administrative flights, and flight-following may be encouraged, requiring it as a
2 component of an Alternative in this EIS was considered infeasible and not necessary to accomplish EIS objectives.
3 Future technological advances may make flight-following more desirable to be considered through adaptive
4 management to enhance monitoring efforts.
5

6 **Exclude General Aviation from Analysis of How Each Alternative Meets the Substantial Restoration of** 7 **Natural Quiet Mandate**

8
9 PL 100-91 requires NPS and FAA consider all aircraft. Additionally, the August 16, 2002 court decision, relative to
10 the 2000 Final Supplemental EA stated “in the absence of any reasonable justification for excluding non-tour
11 aircraft from its noise model, we must conclude that this aspect of the FAA’s methodology is arbitrary and
12 capricious and requires reconsideration by the agency.” Therefore, noise from all aircraft, including general-aviation
13 aircraft, must be included in the Alternative analyses, and is considered in cumulative effects.
14

15 **Alternative B Unimplemented 2000 Environmental Assessment**

16
17 This Alternative included actions discussed in the FAA’s Final Supplemental EA, February 2000, Special Flight
18 Rules in the Vicinity of Grand Canyon National Park. Some elements from that EA were modified to address safety
19 concerns raised in late 1999 and 2000, which resulted in not implementing most East End actions. Only West End
20 airspace changes were implemented. As much of the original proposal as possible was retained. To meet the 2000
21 National Parks Air Tour Management Act, incentives for quiet technology were incorporated as mitigation to further
22 reduce noise impacts.
23

24 Alternative B was dismissed from further evaluation primarily because other Alternatives receiving further
25 evaluation contained almost all Alternative B provisions with minor modifications that provide greater advantages in
26 meeting EIS objectives.
27

28 Alternative B, if implemented, would have restored 54% of the park to natural quiet Base Year, and 53% Ten-Year
29 Forecast. Compared to restoration achieved with Alternative A (55% and 53% in Base Year and Ten-Year Forecast,
30 respectively), Alternative B did not provide a substantial improvement over current conditions. Alternative B did not
31 meet the EIS objective to improve natural quiet in the park and provide for enhanced visitor experience. Due to
32 these factors, Alternative B was dismissed from further study.
33

34 **Alternative C Consolidated Use**

35
36 Alternative C expanded Flight-free Zones, concentrated air-tour routes closer to park developed areas, and removed
37 annual allocation limits. The Alternative also changed allowable flight times, provided an incentive route for quiet
38 technology, and required eventual full conversion to quiet technology for all commercial air-tour aircraft flying in
39 the SFRA. This Alternative eliminated Dragon Corridor and associated air-tour routes, Black-1A and Green-2. It
40 created a new Developed Area Corridor across the canyon over popular visitor use-areas that, particularly on the
41 rim, often experience substantial levels of human-caused noise from other sources. These included South Rim’s
42 Grand Canyon Village area, Phantom Ranch on the Colorado River, and North Rim’s Grand Canyon Lodge.
43 Alternative C was developed to be most consistent with park management zoning, in that motorized visitation (i.e.,
44 air tours) would be routed over Developed Zones, roads, and other areas zoned for motorized visitation. Thus, it had
45 less impact on undeveloped and Wilderness areas where motorized use is not consistent with zoning and
46 management objectives.
47

48 In Alternative C, Dragon Corridor was replaced with a Developed Area Corridor, something very different from
49 remaining Alternatives. Even though the Developed Area Corridor seemed to be more consistent with park
50 management zoning by routing mechanized use and associated noise over developed areas, it impacted most park
51 visitors and was inconsistent with park administrative flight practices. (To the extent possible, administrative flights
52 are routed away from developed areas for noise abatement and to avoid the possibility of increased risk to visitors,
53 residents, facilities, and park resources including listed National Register historic buildings and districts).
54

1 Alternative C did not meet EIS objective 6 (limited aircraft intrusions for visitors at rim developed areas and major
2 frontcountry destination points), and objective 8 (minimize conflicts with other park visitors). Alternative C
3 maximized conflicts with other park visitors by routing air tours over the highest-use areas for ground visitors.
4

5 Because Alternative C routed air tours over developed areas (hotels, visitor centers, residences) and the highest
6 concentrations of ground-based visitors, it caused air-tour noise directly over the vast majority of park visitors,
7 facilities, National Register buildings, and National Historic Landmarks. This guaranteed the majority of park
8 visitors and facilities were exposed to the highest sound levels.
9

10 Alternative C also routed air tours directly over the Cross-Canyon Corridor, which includes heavily used
11 backcountry trails and campgrounds. Even though the Corridor is not Proposed Wilderness, it sees most of the
12 park's backcountry visitation (by design, visitation to the rest of backcountry is limited much more than in the
13 Corridor).
14

15 Alternative C had the greatest number of flight hours between curfews (11) of any Alternative, thereby providing the
16 least protection for visitors during sensitive morning and evening hours. The greatest remaining number of daily
17 flight hours after dismissing Alternative C is ten hours under Alternative A.
18

19 In Alternative C, Blue Direct North followed the Colorado River for 20 miles near Twin Peaks and Whitmore,
20 something no other Alternative does. This was not entirely consistent with objectives 1, 5, and 8. Due to the above
21 factors, Alternative C was dismissed from further study in this EIS.
22

23 **Alternative D Modified 1995 Report to Congress**

24
25 Alternative D was based primarily on recommendations provided in Chapter 10 of the NPS 1995 Report to
26 Congress, with some modifications. Under this Alternative, two of the four general-aviation corridors across Grand
27 Canyon and the easternmost Flight-free Zone would have been eliminated; the other three existing Flight-free Zones
28 would have been expanded; and air-tour flights on Marble Canyons west side would have been eliminated. The
29 Alternative included operational changes, such as curfews and quiet-technology incentives.
30

31 Recommendations were based on the general concepts of simplifying the commercial tour route structure, expanding
32 Flight-free Zones, accommodating air-tour industry forecast growth, and phasing in use of quiet-aircraft technology.
33

34 The Zuni Point Corridor was eliminated, with aircraft routed east of Desert View one-way northbound, and west of
35 Desert View one way southbound. This is very different from remaining Alternatives. On East End canyon routes,
36 flight time over the canyon was found to be less than the time over forest and sagebrush, which greatly reduced
37 quality of aerial viewing experience (EIS Objective 8) compared to other Alternatives. Alternative D also closed
38 Dragon Corridor, except for quiet-technology fixed-wing aircraft, 25% or less of the day. The combination of these
39 two features, although providing substantial noise reduction, greatly reduced time over the canyon, and thus the
40 quality aerial viewing experience. These factors contributed to Alternative D's dismissal.
41

42 D was the only Alternative with a noise budget. However, the agencies were not able to describe exactly how to
43 implement a noise budget; noise budgets have been implemented in very limited fashion at a few airports. A noise
44 budget appeared to be very complex and infeasible to address park noise concerns, with other, more practical
45 mechanisms available in remaining Alternatives. This feature contributed to dismissal of this Alternative.
46

47 The Navajo Nation, during government-to-government consultation, strongly objected to having a Marble Canyon
48 route on the east (i.e., Navajo) side of the river, and also objected to routes east of Desert View over Navajo lands.
49 In response to these concerns, the agencies agreed to dismiss proposed changes to the Marble Canyon route (as
50 contained in Alternative D) from further study.
51

52 In Alternative D, Fossil and Dragon General-Aviation Corridors were eliminated, the only Alternative to do so. This
53 made it more difficult for general aviation to navigate Grand Canyon airspace, another factor contributing to
54 dismissal of this Alternative. Due to all above factors, Alternative D was dismissed from further study in this EIS.
55

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.

1 **Assure for All Americans Safe, Healthful, Productive, and Esthetically and Culturally Pleasing Surroundings**

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

10
11 **Attain the Widest Range of Beneficial Uses of the Environment without Degradation, Risk to Health or
12 Safety, or Other Undesirable and Unintended Consequences**

13 To attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or
14 other undesirable and unintended consequences, a wide range of opportunities must be provided for ground-based
15 visitor experiences with limited aircraft intrusions, as well as a wide range of opportunities for quality aerial viewing
16 experiences for air-tour visitors, while protecting and reducing impacts to park resources and minimizing conflicts
17 with other park visitors. The range of beneficial uses without degradation is reduced when the range (variety and
18 amount) of opportunities for ground-based and air-tour visitors are reduced, when conflicts between air-tour and
19 ground-based visitation increase, and/or when resource impacts increase. In terms of risk to health and safety, a
20 major reason for establishing the SFRA was to provide a safe environment for air-tours and other aviation.

21
22 **Preserve Important Historical, Cultural, and Natural Aspects of our National Heritage, and Maintain,
23 Wherever Possible, an Environment which Supports Diversity and Variety of Individual Choice**

24 To preserve important aspects of our national heritage, and maintain diversity and variety of individual choice,
25 impacts to these resources must be reduced while providing a diverse range of recreational opportunities to ground-
26 based and air-tour visitors and minimizing conflicts among visitors. To meet this criterion, reductions in aircraft
27 noise impacts must be balanced against diversity and variety of choices for air-tours, and ground-based visitor
28 experiences without aircraft noise impacts.

29
30 **Achieve a Balance between Population and Resource Use which Will Permit High Standards of Living and a
31 Wide Sharing of Life's Amenities**

32 A balance would be achieved when park resources are protected, reasonable access to a variety of quality aerial
33 viewing and ground-based experiences is provided, and conflicts among different types of visitor use are minimized.
34 In doing so, a balance would be achieved for both ground-based and air-tour visitors, while minimizing aircraft
35 noise impacts on park resources.

36
37 **Enhance the Quality of Renewable Resources and Approach the Maximum Attainable Recycling of
38 Depletable Resources**

39 Alternatives that best enhance resources or best reduce impacts or energy/fuel use would contribute to meeting this
40 criterion.

41
42 **Conclusion**

43 Based on analysis presented in Table 2.5, the NPS Preferred Alternative best achieves requirements of NEPA
44 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

1

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

1 *Table data is for the Ten-Year Forecast
 2 SRNQ=Substantial Restoration of Natural Quiet
 3
 4

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. Black-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 southwest, 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-2 shortened and modified to accommodate modification of Blue Direct North route	Brown-2 route eliminated	Brown-2 same as Alternative A
	Brown-4 continues as river support route to/from Bar Ten airstrip	Brown-4 eliminated	Brown-4 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	<p>Blue-2 current configuration flown at 5,500 feet or 7,500 feet MSL eastbound; 6,500 feet or 8,500 feet MSL westbound</p> <p>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</p>	<p>Blue-2 and Blue-2X same as Alternative A</p>	<p>Blue-2 route same as Alternative A</p>	<p>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</p> <p>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</p>
	<p>Blue Direct North current configuration flown at 7,500 or 9,500 feet MSL eastbound; 8,500 or 10,500 feet MSL westbound</p>	<p>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</p>	<p>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</p>	<p>Blue Direct North same as Alternative A</p>
	<p>Blue Direct South current configuration at 9,500 feet MSL eastbound and 10,500 feet MSL westbound</p>	<p>Blue Direct South eliminated</p> <p>Any traffic displaced outside SFRA expected to travel on existing Victor airways as shown on Map 2.3</p>	<p>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</p>	<p>Blue Direct South eliminated</p> <p>Any traffic displaced outside SFRA expected to travel on existing Victor airways as shown on Map 2.3</p>

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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				
<i>Sanup Flight-free Zone</i>	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
<i>Toroweap/Shinumo Flight-free Zone</i>	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
<i>Bright Angel Flight-free Zone</i>	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
<i>Desert View Flight-free Zone</i>	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

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1 **IMPACTS DETERMINATION COMPARISON OF ALL ALTERNATIVES TEN-YEAR FORECAST**
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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

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TABLE 2.8 SOUNDSCAPE IMPACTS (TEN-YEAR FORECAST)							
Impact Category	A	Alternative					
		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 routes	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 routes with moderate beneficial change from Alternative A	Moderate to major adverse under Blue Direct routes with moderate beneficial change from Alternative A	Moderate to major adverse under Blue Direct routes 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	In GCNP negligible with negligible to minor beneficial change from Alternative A	In GCNP negligible with negligible to minor beneficial change from Alternative A	In GCNP negligible to minor adverse with negligible change from Alternative A	In GCNP negligible with negligible to minor beneficial change from Alternative A	In GCNP negligible with negligible to minor beneficial change from Alternative A	In GCNP negligible with negligible to minor beneficial change from Alternative A
	Minor to major adverse in Saddle Mt. Wilderness Area	Negligible in Saddle Mt. and Paria-Vermilion Cliffs Wilderness Areas with moderate to major beneficial change from Alternative A	Negligible in Saddle Mt. and Paria-Vermilion Cliffs Wilderness Areas with moderate to major beneficial 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	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 Area 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	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 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 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

1 *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	<p>Moderate adverse impacts in areas near the Little Colorado confluence</p> <p>Minor adverse impacts in areas represented by Little Colorado, Nankoweap River, and Pasture Wash Location Points</p> <p>Minor to moderate adverse impacts at Tusayan Museum and Bright Angel Point Location Points</p>	<p>Negligible impacts in Bright Angel Point, Little Colorado and Nankoweap River Location Points</p> <p>Minor adverse impacts at Pasture Wash Location Point</p> <p>Moderate adverse impacts at Temple Butte and Little Colorado River Location Points</p> <p>Negligible to moderate beneficial change from Alternative A for all areas</p>	<p>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</p>	<p>Negligible impacts in areas represented by Little Colorado and Nankoweap Location Points with negligible to minor beneficial change from Alternative A</p> <p>Minor adverse impacts at Bright Angel Point and Pasture Wash Location Points with minor to moderate beneficial change from Alternative A</p> <p>Minor to moderate adverse impacts at Little Colorado River and Temple Butte Location Points with minor beneficial change from Alternative A</p>	<p>Minor adverse impacts at Pasture Wash Location Point with minor to moderate beneficial change from Alternative A</p> <p>Minor adverse impacts at Little Colorado River and Temple Butte Location Points with minor to moderate beneficial change from Alternative A</p> <p>Negligible impacts at Bright Angel Point Location Point with minor to moderate beneficial change from Alternative A</p>	<p>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</p> <p>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</p>	<p>Minor adverse impacts at Pasture Wash Location Point with moderate to major beneficial change from Alternative A</p> <p>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</p>
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	<p>Negligible impacts in areas away from air-tour routes (Meriwhitca and Granite Peak Location Points)</p> <p>Moderate adverse impacts under Green-4 and Black-2 routes</p>	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 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

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	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 Toroweap/Shinumo Flight-free Zone negligible to minor adverse impacts with up to major beneficial 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 up to major beneficial change from Alternative A	Amid Bright Angel Flight-free Zone eastern portion of and Toroweap/Shinumo Flight-free Zone negligible impacts with negligible change from Alternative A	
	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					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	

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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 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 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 routes 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	

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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)		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	beneficial 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 Cedar Ridge Location Point negligible impacts with major beneficial change from Alternative A				Middle of Bright Angel Flight-free Zone quiet with negligible impacts and negligible 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						

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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	

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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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