

reduced 14% Base Year and 17% Ten-Year Forecast, which represent minor to moderate beneficial changes in impacts compared to Alternative A.

For areas near Blue-2 and Green-4 routes (**West End's northern portion**), localized long- and short-term impacts would be moderate to major adverse (from Figures 4.5 to 4.12, Average Sound Level would be 40 to 50 dBA, Percent Time Audible would be greater than 65%), with negligible change in impacts compared to Alternative A. In **West End's southern portion**, localized long-term impacts would be negligible to minor adverse (from Figures 4.10 to 4.17, Average Sound Level would be 10 to 20 dBA, Percent Time Audible would be less than 20%), with negligible change in impacts compared to Alternative A.

<i>West End</i>	<i>Alternative E</i>	<i>Soundscape</i>
<i>Base Year and Ten-Year Forecast Off-Peak Season</i>		

For West End Location Points, results for Base Year and Ten-Year Forecast Off-Peak Season are very similar, and also similar to Peak Season. Because operation growth is anticipated Ten-Year Forecast, and Alternative E quiet-technology incentives and conversion requirements would provide some mitigation with a decrease in affected area size, those areas still affected would see an increase in localized impacts. Overall impacts would see reduction in Percent Time Audible of 5 to 10% and one dBA Average Sound Level reduction compared to Base Year, and a reduction in Percent Time Audible of 12 to 17% and 2 to 4 dBA Average Sound Level compared to Alternative A. There would be moderate to major adverse impacts in **West End's northern portion** near air-tour routes (a minor beneficial change in impacts from Alternative A), and negligible to minor adverse impacts in **West End's southern portion** away from routes (a negligible to moderate beneficial change from Alternative A).

NPS Units in SFRA	Alternative E	Soundscape
Outside Grand Canyon National Park		

For **NPS lands directly under and within five miles of Blue Direct Blue-2 and Green-4 routes** (Lake Mead National Recreation Area and Grand Canyon-Parashant National Monument), impacts would be major adverse (Average Sound Level 40 to 50 dBA). Impacts to these lands as a result of modified Blue Direct routes would shift from more remote and sensitive Wilderness areas in Grand Canyon-Parashant National Monument's southern portion to somewhat less sensitive areas in the Monument's more northern areas. Also, due to elimination of Blue Direct South, some aircraft would likely fly outside the SFRA south along existing airways. Because growth in operations is anticipated Ten-Year Forecast, and although Alternative E quiet-technology incentives and conversion requirements would provide some mitigation with decreased affected area size, those areas still affected would see an increase in localized impacts. The **remainder of the SFRA outside GCNP** would experience Average Sound Level less than 25 dBA. Localized long- and short-term impacts would be minor adverse. As with GCNP, **the SFRA as a whole** would benefit from Alternative E quiet-technology incentives and conversion requirements.

Cumulative Impacts	Alternative E	Soundscape
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Noise from aircraft flying over 18,000 feet and/or outside the SFRA, when combined with 1) noise from other sources on the ground as discussed in Alternative A, and 2) noise generated from aircraft under Alternative E as discussed above, would continue to have long-term moderate to major adverse cumulative impacts on Soundscape throughout all four areas (Marble Canyon, East End, Central, and West End), similar to cumulative impacts described for Alternative A. Quiet-technology incentives and conversion requirements under Alternative E would mitigate a small amount of those impacts over the Ten-Year Forecast period.

Conclusion	Alternative E	Soundscape
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As further explained in Chapter 4's Socioeconomic Environment, fewer flight operations are expected in Alternative E than in other Alternatives, so Soundscape would also benefit from less noise from fewer operations. Because Alternative E includes quiet-technology incentives and conversion requirements, noise impacts would decrease resulting in negligible to moderate beneficial changes in impacts Base Year to Ten-Year Forecast in the park as a whole.

Base Year would achieve Substantial Restoration of Natural Quiet in 75% of the park Peak Season, and 78% Off-Peak Season. These represent moderate beneficial changes in impacts compared to Alternative A with a 20% increase in park area restored Peak Season, and a 23% increase Off-Peak Season.

Ten-Year Forecast, Substantial Restoration of Natural Quiet would be achieved in 84% of the park Peak Season, and 86% of the park Off-Peak Season. These represent major beneficial changes in impacts compared to Alternative A with a 31% increase in park area restored Peak Season, and a 33% increase Off-Peak Season.

Conclusion by Zone

Alternative E

Soundscape

Ten-Year Forecast Peak Season

Wilderness Zone (about 94% of GCNP); area of moderate to major adverse impacts would be 11 to 24% of the Zone, a major beneficial change in impacts (32 to 37% reduction in area of moderate to major adverse impacts) compared to Alternative A.

Non-Wilderness Zone (about 4% of GCNP); area of moderate to major adverse impacts would be 15 to 39% of the Zone, a major beneficial change in impacts (47 to 74% reduction in area of moderate to major adverse impacts) compared to Alternative A.

Developed Zone (about 2% of GCNP); area of moderate to major adverse impacts would be 12 to 58% of the Zone, a major beneficial change in impacts (37 to 86% reduction in area of moderate to major adverse impacts) compared to Alternative A.

Conclusion by Area

Alternative E

Soundscape

Base Year and Ten-Year Forecast

In Marble Canyon, Central, and West End (southern portions), localized long- and short-term adverse impacts would generally be negligible to minor adverse with negligible to moderate beneficial changes in impacts compared to Alternative A. Greatest noise exposure would occur in East End where long- and short-term impacts would generally be moderate to major adverse in areas under and near air-tour routes in the seasonally active Corridor, with negligible change in impacts compared to Alternative A. However, in East End areas near seasonally inactive air-tour routes and amid Flight-free Zones, there would be negligible to minor adverse impacts with moderate to major beneficial change in impacts compared to Alternative A. In West End's northern portion with air-tour routes, there would be moderate to major adverse impacts with minor beneficial changes in impacts compared to Alternative A.

Cumulative Impacts Summary

Alternative E

Soundscape

Cumulative impacts from all actions would be long-term moderate to major adverse, due primarily to high levels of aircraft audibility.

ALTERNATIVE F

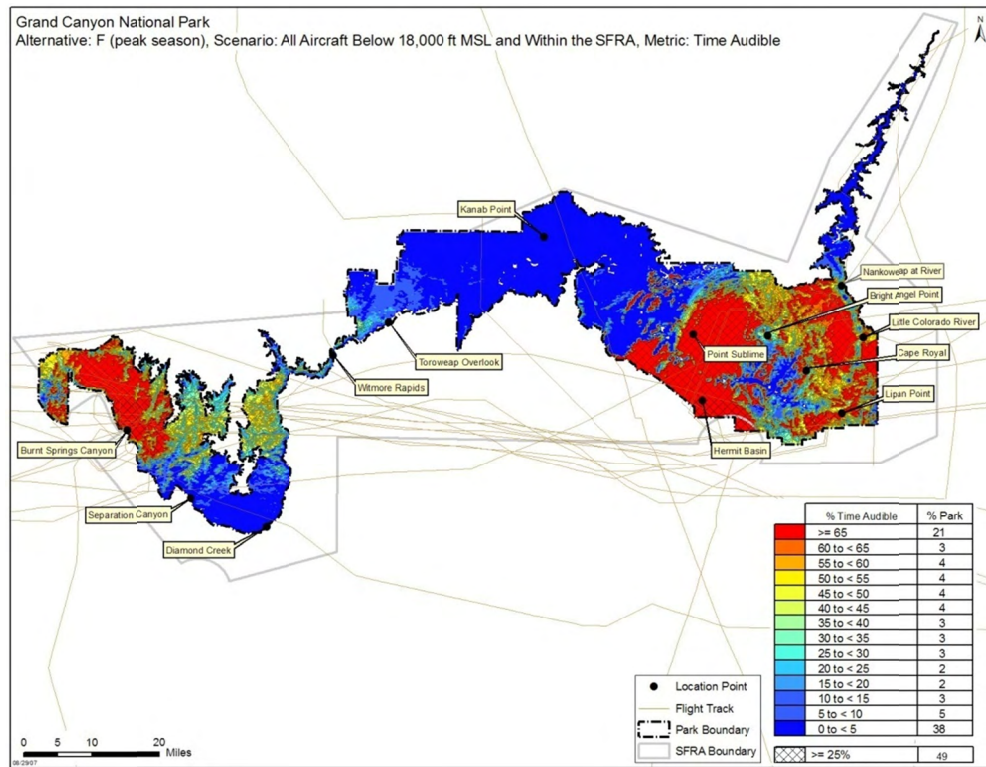
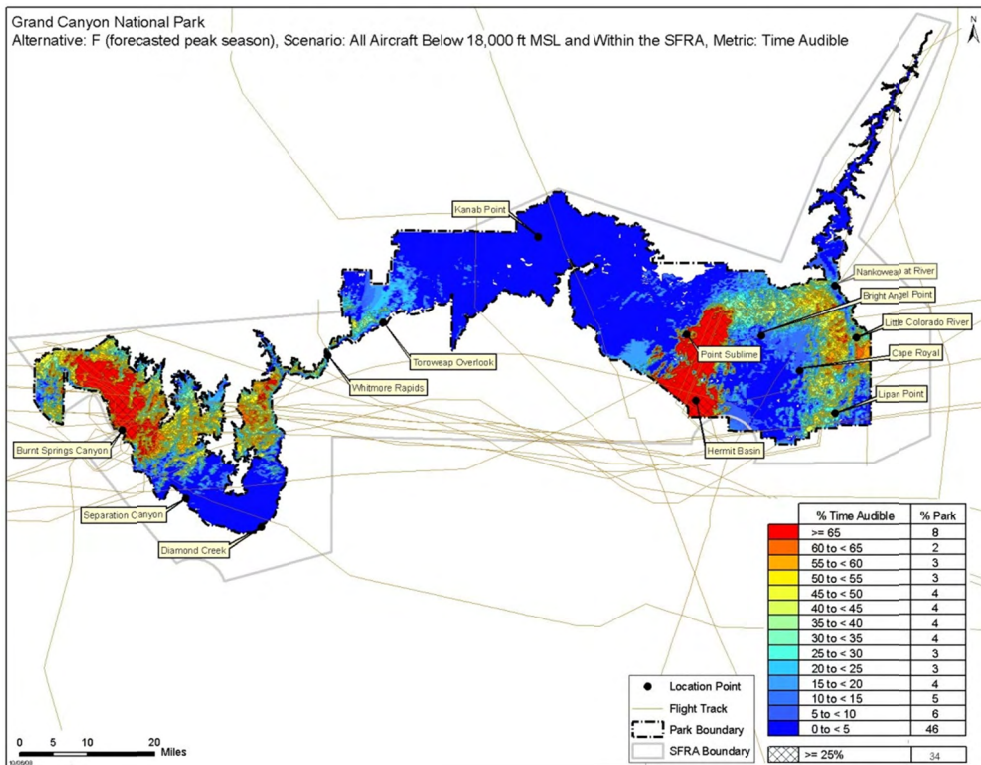
MODIFIED CURRENT CONDITIONS

SOUNDSCAPE

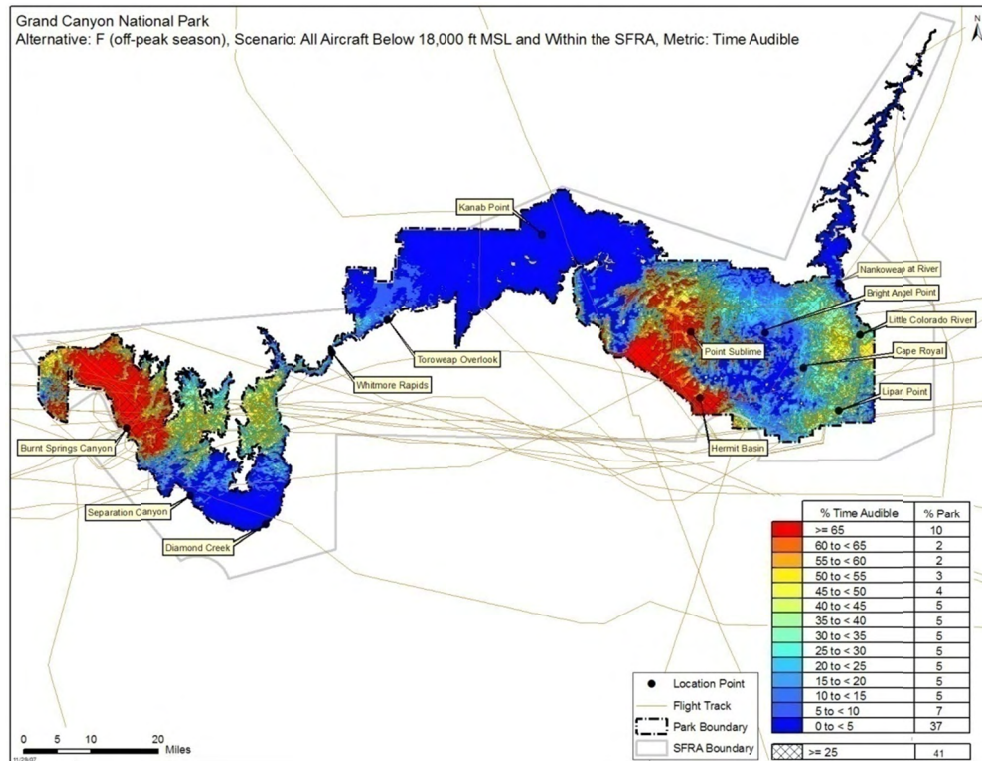
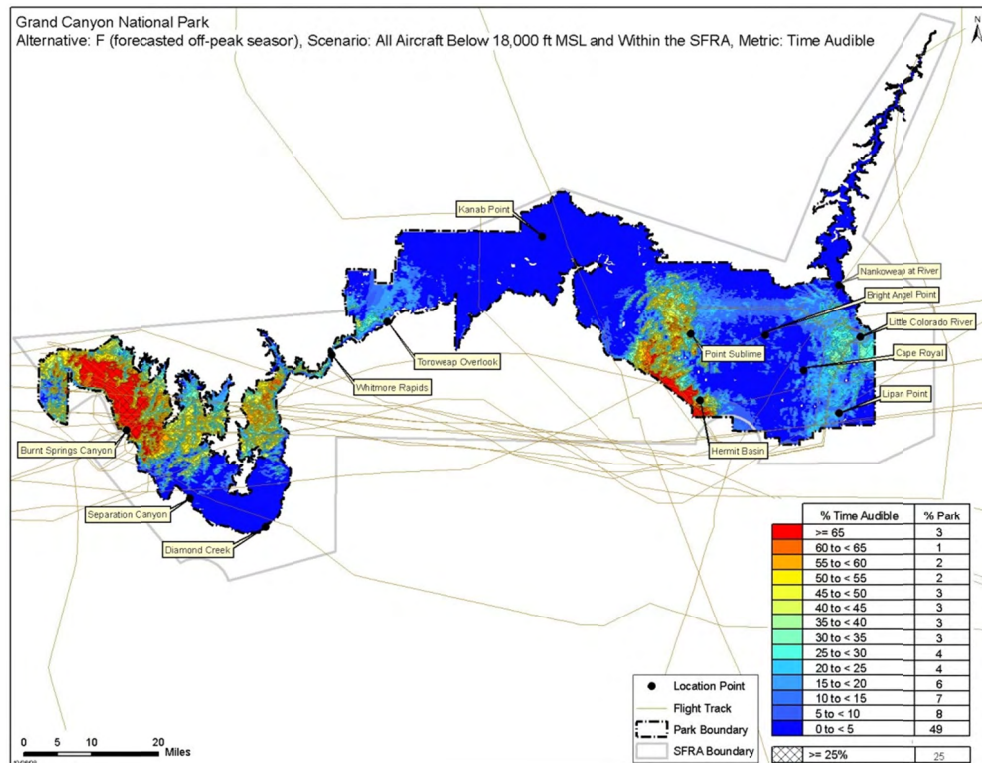
Base Year Peak and Off-Peak Season, Alternative F modifies West End tour routes to alleviate noise at Eagle and Guano Point Location Points, and seasonally shifts Dragon Corridor routes. Alternative F would achieve Substantial Restoration of Natural Quiet in 51% of the park Peak Season, and 59% of the park Off-Peak Season, as shown in Table 4.23. These represent negligible changes in impacts from Alternative A with a 4% decrease in park area restored Peak Season, and a 4% increase Off-Peak Season.

Ten-Year Forecast Peak and Off-Peak Season Substantial Restoration of Natural Quiet would be achieved in 66% of the park Peak Season, and 75% of the park Off-Peak Season as shown in Table 4.24. These represent moderate beneficial changes in impacts from Alternative A with a 13% increase in park area restored Peak Season, and a 22% increase Off-Peak Season.

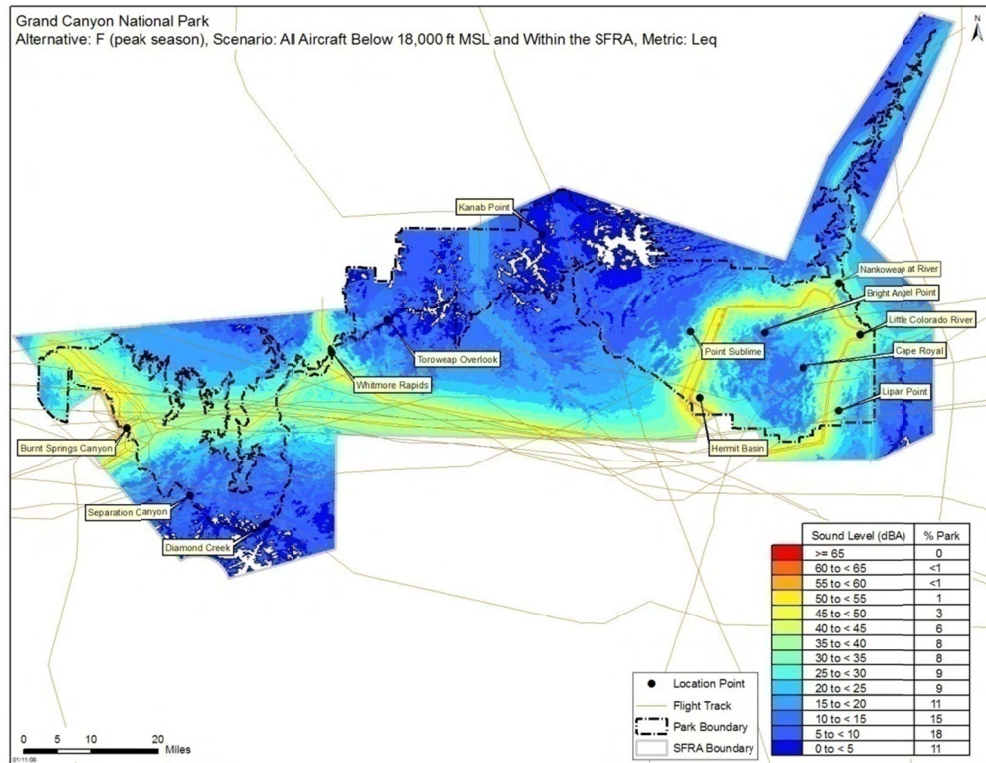
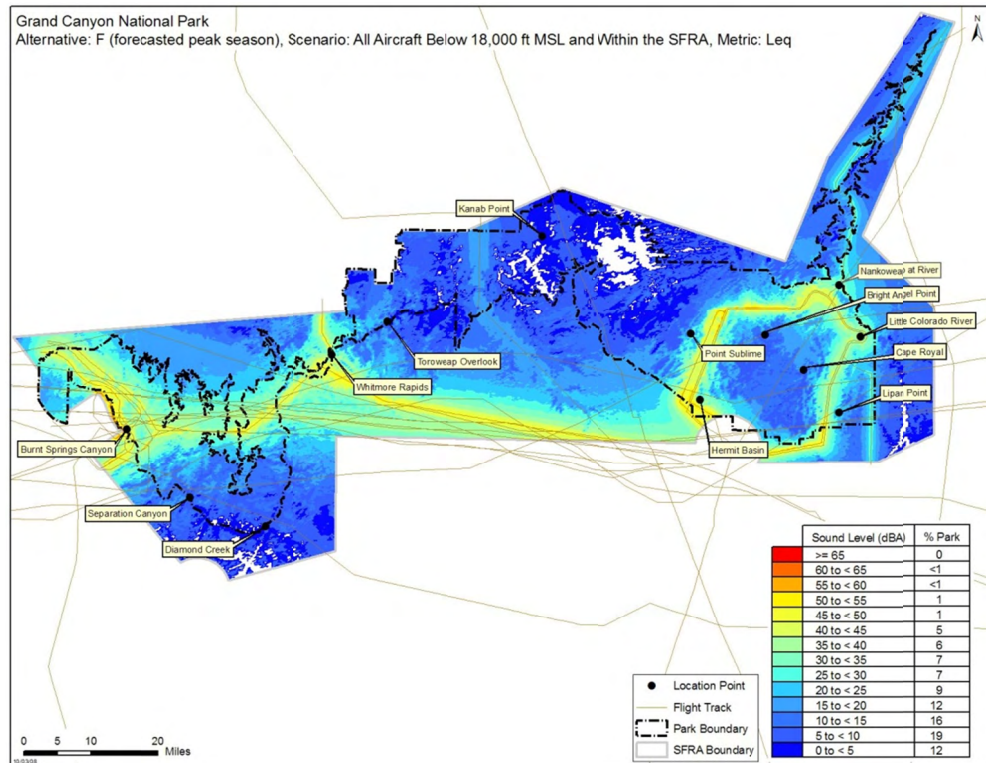
Mapped results of Alternative F noise modeling for Percent Time Audible and Average Sound Level are shown in Figures 4.18 to 4.25. Tables 4.11 to 4.16 present Contour Analysis and Location Point results computed for Alternative F Peak and Off-Peak Seasons, respectively, and include comparisons with Alternative A.

FIGURE 4.18 ALTERNATIVE F PERCENT TIME AUDIBLE BASE YEAR PEAK SEASON1
2**FIGURE 4.19 ALTERNATIVE F PERCENT TIME AUDIBLE TEN-YEAR FORECAST PEAK SEASON**

1

FIGURE 4.20 ALTERNATIVE F PERCENT TIME AUDIBLE BASE YEAR OFF-PEAK SEASON**FIGURE 4.21 ALTERNATIVE F PERCENT TIME AUDIBLE TEN-YEAR FORECAST OFF-PEAK SEASON**2
3

1

FIGURE 4.22 ALTERNATIVE F AVERAGE SOUND LEVEL BASE YEAR PEAK SEASON**FIGURE 4.23 ALTERNATIVE F AVERAGE SOUND LEVEL TEN-YEAR FORECAST PEAK SEASON**

2

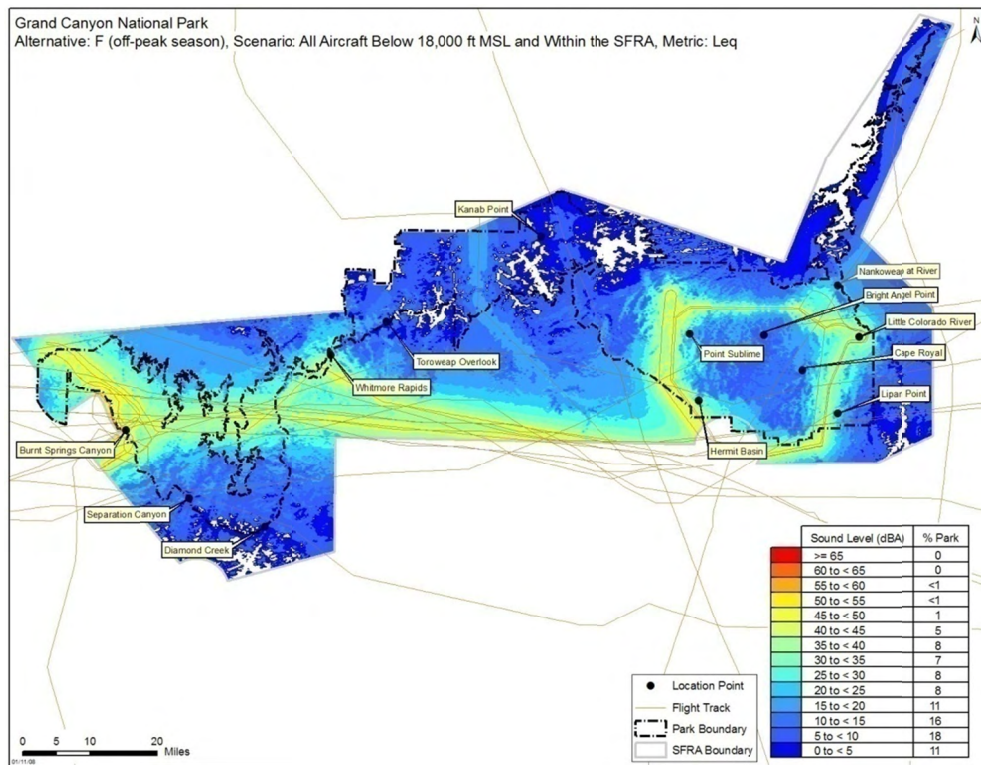
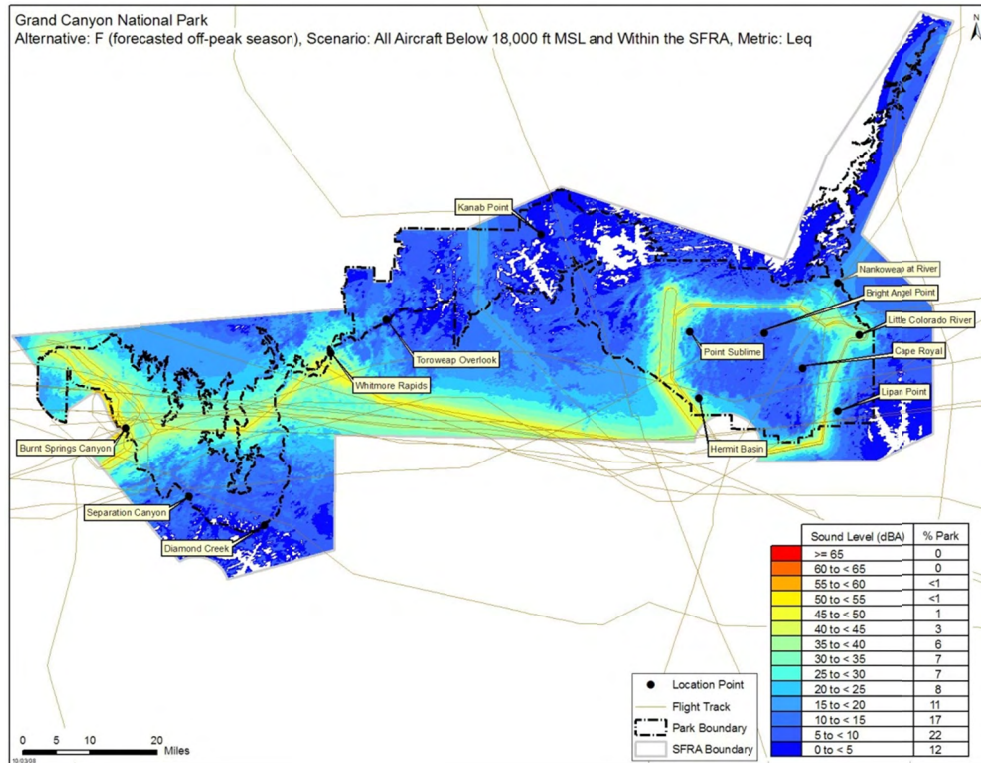
FIGURE 4.24 ALTERNATIVE F AVERAGE SOUND LEVEL BASE YEAR OFF-PEAK SEASON**FIGURE 4.25 ALTERNATIVE F AVERAGE SOUND LEVEL TEN-YEAR FORECAST OFF-PEAK SEASON**

TABLE 4.11 ALTERNATIVE F PERCENT TIME AUDIBLE CONTOUR ANALYSIS RESULTS
PEAK SEASON^{abc}

Percent Percent Time Audible	Base Year (Percent of Zone)				Ten-Year Forecast (Percent of Zone)			
	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP
Percent Park Restored				51%				66%
≥ 25	89%	80%	47%	49%	29%	30%	34%	34%
10 to < 25	6%	7%	8%	8%	26%	19%	12%	13%
5 to < 10	3%	4%	5%	5%	24%	19%	5%	6%
> 0 to < 5	2%	10%	40%	38%	21%	31%	47%	46%
% of Zone Difference in TAUD Contour Results with Alternative A								
≥ 25	-1%	-1%	-4%	-3%	61%	50%	11%	13%
10 to < 25	0%	1%	3%	3%	-21%	-13%	-2%	-3%
5 to < 10	-2%	-1%	1%	1%	-23%	-17%	0%	-1%
> 0 to < 5	2%	1%	0%	0%	-17%	-20%	-8%	-9%

^aDue to rounding differences, totals in this table may differ from Appendix D by up to 2%

^bBecause limited ambient data were available outside GCNP, contours for Percent Time Audible were computed only in GCNP boundaries; Average Sound Level contours were computed in the entire SFRA

^cColumns do not always sum to 100% because contours include blank areas to indicate where aircraft noise was not audible or was below 0 dBA

TABLE 4.12 ALTERNATIVE F AVERAGE SOUND LEVEL CONTOUR ANALYSIS RESULTS
PEAK SEASON^{ab}

Average Sound Level	Base Year (Percent of Zone)					Ten-Year Forecast (Percent of Zone)				
	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	In SFRA	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	In SFRA
≥ 35	10%	21%	17%	17%	15%	5%	13%	14%	14%	13%
25 to < 35	58%	38%	15%	16%	15%	19%	23%	14%	14%	14%
15 to < 25	30%	28%	20%	20%	27%	67%	37%	20%	21%	26%
> 0 to < 15	3%	14%	45%	44%	41%	10%	27%	49%	48%	44%
Percent of Zone Difference in Average Sound Level Contour Results with Alternative A										
≥ 35	0%	0%	-2%	-2%	-1%	19%	19%	8%	9%	1%
25 to < 35	-4%	-1%	-3%	-2%	1%	56%	35%	12%	14%	7%
15 to < 25	4%	1%	2%	2%	0%	-65%	-27%	19%	16%	14%
> 0 to < 15	0%	0%	2%	2%	-1%	-10%	-27%	-36%	-35%	-20%

^aDue to rounding differences, totals shown in this table may differ from Appendix D by up to 2%.

^bColumns do not always sum to 100% because contours include blank areas to indicate where aircraft noise was not audible or was below 0 dBA

TABLE 4.13 ALTERNATIVE F LOCATION POINT RESULTS PEAK SEASON

Location Point Grouping		Base Year					Ten-Year Forecast				
		TAUD ^b	L _{Aeq12} ^c	TALA35 dBA ^d	TALA45 dBA ^d	TALA55 dBA ^d	TAUD	L _{Aeq12}	TALA35 dBA	TALA45 dBA	TALA55 dBA
Marble Canyon	Max	3%	24 dBA	1%	0%	0%	3%	24 dBA	1%	0%	0%
	Median	2%	14 dBA	0%	0%	0%	2%	15 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
East End	Max	100%	49 dBA	100%	51%	5%	98%	46 dBA	100%	38%	3%
	Median	64%	28 dBA	5%	0%	0%	25%	24 dBA	0%	0%	0%
	Min	0%	7 dBA	0%	0%	0%	0%	2 dBA	0%	0%	0%
Central	Max	12%	25 dBA	2%	0%	0%	21%	26 dBA	4%	0%	0%
	Median	1%	8 dBA	0%	0%	0%	1%	9 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
West End	Max	91%	47 dBA	66%	24%	4%	85%	46 dBA	60%	23%	3%
	Median	17%	17 dBA	0%	0%	0%	14%	18 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
All Location Points	Max	100%	49 dBA	100%	51%	5%	98%	46 dBA	100%	38%	3%
	Median	4%	17 dBA	0%	0%	0%	3%	16 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
Difference in Location Points Results with Alternative A											
Marble Canyon	Max	0%	0 dBA	0%	0%	0%	0%	1 dBA	0%	0%	0%
	Median	0%	0 dBA	0%	0%	0%	0%	1 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	2 dBA	0%	0%	0%
East End	Max	0%	0 dBA	0%	0%	0%	2%	3 dBA	0%	19%	2%
	Median	0%	0 dBA	0%	0%	0%	42%	5 dBA	6%	0%	0%
	Min	0%	-1 dBA	0%	0%	0%	0%	4 dBA	0%	0%	0%
Central	Max	10%	2 dBA	2%	0%	0%	5%	1 dBA	1%	0%	0%
	Median	0%	2 dBA	0%	0%	0%	1%	1 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
West End	Max	2%	1 dBA	6%	4%	0%	10%	2 dBA	21%	10%	2%
	Median	1%	4 dBA	0%	0%	0%	7%	4 dBA	1%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
All Location Points	Max	0%	0 dBA	0%	0%	0%	2%	3 dBA	0%	19%	2%
	Median	5%	0 dBA	0%	0%	0%	7%	2 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%

^aMax refers to maximum Location Point value for a Location Point grouping for each respective specific metric; conversely, Min refers to minimum Location Point value. The median characterizes the central tendency of the results. That is, 50% of results are above the median; 50% below. The median, as opposed to the arithmetic mean, is more appropriate for data not normally distributed

^bTAUD = Percent Time Audible

^cL_{Aeq12} = Average Sound Level

^dTALA35 dBA, TALA45 dBA, and TALA55 dBA = Percent of time during the 12-hour day used in this analysis that aircraft sounds exceed 35, 45, and 55 dBA, respectively

TABLE 4.14 ALTERNATIVE F PERCENT TIME AUDIBLE CONTOUR ANALYSIS RESULTS
OFF-PEAK SEASON^{ab}

Percent Percent Time Audible	Base Year (Percent of Zone)				Ten-Year Forecast (Percent of Zone)			
	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP
% Park Restored				59%				75%
≥ 25	51%	43%	41%	41%	4%	10%	25%	25%
10 to < 25	28%	35%	13%	14%	35%	18%	17%	17%
5 to < 10	11%	10%	7%	7%	28%	23%	8%	8%
> 0 to < 5	10%	13%	39%	37%	33%	48%	50%	49%
Percent of Zone Difference in Percent Time Audible Contour Results with Alternative A								
≥ 25	37%	36%	3%	4%	86%	70%	19%	22%
10 to < 25	-22%	-27%	-3%	-4%	-30%	-12%	-6%	-7%
5 to < 10	-10%	-7%	-1%	-1%	-27%	-21%	-2%	-3%
> 0 to < 5	-5%	-2%	1%	1%	-28%	-38%	-11%	-12%

^aDue to rounding differences, totals in this table may differ from Appendix D by up to 2%

^bBecause limited ambient data were available outside GCNP, contours for Percent Time Audible were computed only in GCNP boundaries; Average Sound Level contours were computed in the entire SFRA

TABLE 4.15 ALTERNATIVE F AVERAGE SOUND LEVEL CONTOUR ANALYSIS RESULTS
OFF-PEAK SEASON^a

Average Sound Level	Base Year (Percent of Zone)					Ten-Year Forecast (Percent of Zone)				
	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	In SFRA	Developed Zone	Non- Wilderness Zone	Wilderness Zone	In GCNP	In SFRA
≥ 35	3%	7%	15%	14%	14%	2%	5%	11%	11%	11%
25 to < 35	18%	23%	15%	15%	13%	7%	13%	14%	14%	13%
15 to < 25	65%	34%	18%	19%	21%	62%	39%	18%	19%	22%
> 0 to < 15	15%	36%	47%	46%	47%	30%	42%	51%	51%	48%
Percent of Zone Difference in Average Sound Level Contour Results with Alternative A										
≥ 35	7%	14%	0%	1%	1%	22%	28%	11%	12%	3%
25 to < 35	37%	14%	-2%	-1%	2%	68%	44%	12%	14%	8%
15 to < 25	-32%	-6%	3%	3%	6%	-60%	-30%	21%	18%	19%
> 0 to < 15	-12%	-22%	1%	0%	-6%	-30%	-42%	-38%	-38%	-23%

^aDue to rounding differences, totals in this table may differ from Appendix D by up to 2%

TABLE 4.16 ALTERNATIVE F LOCATION POINT RESULTS OFF-PEAK SEASON^a

Location Point Grouping		Base Year					Ten-Year Forecast				
		TAUD (%) ^b	L _{Aeq12} (dBA) ^c	TALA35 dBA (%) ^d	TALA45 dBA (%) ^d	TALA55 dBA (%) ^d	TAUD (%)	L _{Aeq12} (dBA)	TALA35 dBA (%)	TALA45 dBA (%)	TALA55 dBA (%)
Marble Canyon	Max	1%	13 dBA	0%	0%	0%	1%	13 dBA	0%	0%	0%
	Median	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
East End	Max	95%	49 dBA	37%	14%	5%	83%	47 dBA	36%	11%	4%
	Median	28%	21 dBA	0%	0%	0%	11%	17 dBA	0%	0%	0%
	Min	0%	3 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
Central	Max	25%	24 dBA	2%	0%	0%	17%	26 dBA	3%	0%	0%
	Median	1%	7 dBA	0%	0%	0%	1%	9 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
West End	Max	90%	46 dBA	68%	23%	4%	81%	45 dBA	62%	21%	3%
	Median	15%	17 dBA	0%	0%	0%	11%	17 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
All Location Points	Max	95%	49 dBA	68%	23%	5%	83%	47 dBA	62%	21%	4%
	Median	5%	13 dBA	0%	0%	0%	2%	13 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
Difference in Location Points Results with Alternative A											
Marble Canyon	Max	2%	11 dBA	1%	0%	0%	2%	12 dBA	1%	0%	0%
	Median	1%	14 dBA	0%	0%	0%	2%	16 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	2 dBA	0%	0%	0%
East End	Max	5%	0 dBA	63%	37%	0%	17%	2 dBA	64%	46%	1%
	Median	36%	7 dBA	5%	0%	0%	56%	11 dBA	6%	0%	0%
	Min	0%	3 dBA	0%	0%	0%	0%	7 dBA	0%	0%	0%
Central	Max	-3%	3 dBA	2%	0%	0%	8%	2 dBA	1%	0%	0%
	Median	0%	2 dBA	0%	0%	0%	0%	2 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
West End	Max	3%	1 dBA	3%	6%	1%	14%	2 dBA	20%	12%	3%
	Median	4%	5 dBA	0%	0%	0%	11%	5 dBA	1%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%
All Location Points	Max	5%	0 dBA	32%	28%	0%	17%	2 dBA	38%	36%	1%
	Median	3%	3 dBA	0%	0%	0%	8%	5 dBA	0%	0%	0%
	Min	0%	0 dBA	0%	0%	0%	0%	0 dBA	0%	0%	0%

^aThe average used in this context is characterized by the media—the central tendency of the results. That is, 50% of results are above the median; 50% are below. The median, as opposed to the arithmetic mean, is more appropriate for data not normally distributed

^bTAUD = Percent Time Audible

^cL_{Aeq12} = Average Sound Level

^dTALA35 dBA, TALA45 dBA, and TALA55 dBA = Percent of time during the 12-hour day used in this analysis that aircraft sounds exceed 35, 45, and 55 dBA, respectively

Developed Zone (about 2% of GCNP) Alternative F

Soundscape

With exception of a very small Developed Zone area at Tuweep, all GCNP Developed Zone areas are in East End. Audibility calculations for the Developed Zone included 10 dBA added to natural ambient sound levels due to the Dual-Zone System acoustic approach explained in Chapter 4, Methodology. As such, analysis considers Developed Zone management objectives which accept presence of many non-natural sound sources (increased background ambient sound levels) including most of the park's visitors and their activities, presence of paved roads and motorized transportation, and developed facilities.

Developed Zone *Alternative F* *Soundscape*
Base Year Peak Season

Average Sound Level would generally be 25 dBA or more in 68% of the Developed Zone; that is, Average Sound Level would be 25 to 35 dBA in 58% of the Zone (moderate adverse impact), and greater than 35 dBA in 10% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 95% of the Zone; that is, 10 to 25% in 6% of the Zone (moderate adverse impact), and greater than 25% in 89% of the Zone (major adverse impact). This would represent a negligible change of 4% in area with Average Sound Level of 25 dBA or more and a negligible change of one percent in area of 10% or more Percent Time Audible compared to Alternative A (a negligible change in areas of moderate to major adverse impact), resulting in a negligible change in impacts compared to Alternative A.

Developed Zone *Alternative F* *Soundscape*
Base Year Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 34% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 37% of the Zone (moderate adverse impact), and greater than 35 dBA in 7% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 79% of the Zone; that is, 10 to 25% in 28% of the Zone (moderate adverse impact), and greater than 25% in 51% of the Zone (major adverse impact). This would represent a reduction of 44% in area with Average Sound Level of 25 dBA or more and a reduction of 15% in area of 10% or more Percent Time Audible compared to Alternative A (a 15 to 44% reduction in areas of moderate to major adverse impacts), resulting in a moderate to major beneficial change in impacts compared to Alternative A.

Developed Zone *Alternative F* *Soundscape*
Ten-Year Forecast Peak Season

Average Sound Level would generally be greater than 25 dBA in 24% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 19% of the Zone (moderate adverse impact), and greater than 35 dBA in 5% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 55% of the Zone; that is, 10 to 25% in 26% of the Zone (moderate adverse impact), and greater than 25% in 29% of the Zone (major adverse impact). This would represent a reduction of 75% in area with Average Sound Level of 25 dBA or more, and a reduction of 40% in area of 10% or more Percent Time Audible compared to Alternative A (a 40 to 75% reduction in areas of moderate to major adverse impact), resulting in a major beneficial change in impacts compared to Alternative A.

Developed Zone *Alternative F* *Soundscape*
Ten-Year Forecast Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 9% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 7% of the Zone (moderate adverse impact), and greater than 35 dBA in 2% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 39% of the Zone; that is, between 10 and 25% in 35% of the Zone (moderate adverse impact), and greater than 25% in 4% of the Zone (major adverse impact). This would represent a reduction of 90% in area with Average Sound Level of 25 dBA or more, and a reduction of 56% in area of 10% or more Percent Time Audible compared to Alternative A (a 56 to 90% reduction in areas of moderate to major adverse impact), resulting in a major beneficial change in impacts compared to Alternative A.

Non-Wilderness Zone (6% of GCNP) **Alternative F** **Soundscape**

Almost all Non-Wilderness Zone areas are located in East End (exceptions are a few Central area dirt road corridors). A portion of the Non-Wilderness Zone is in the Dual-Zone System area where 10 dBA is added to natural ambient sound levels for audibility calculations; this portion is generally close to Developed Zone areas with motorized noise sources, although there is a strip of Non-Wilderness Zone on Marble Canyon's east side. The majority of the Non-Wilderness Zone is in the area where natural ambient sound levels are used directly as the basis for audibility calculations, consistent with Non-Wilderness Zone management objectives that call for mostly natural conditions to prevail in the Zone.

Non-Wilderness Zone *Alternative F* *Soundscape*

Base Year Peak Season

Average Sound Level would generally be 25 dBA or more in 59% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 38% of the Zone (moderate adverse impact), and greater than 35 dBA in 21% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 87% of the Zone; that is, 10% to 25% in 7% of the Zone (moderate adverse impact), and greater than 25% in 80% of the Zone (major adverse impact). This would represent a negligible change of one percent in area with Average Sound Level of 25 dBA or more and in area of 10% or more Percent Time Audible compared to Alternative A (a negligible change in areas of moderate to major adverse impact), resulting in a negligible change in impacts compared to Alternative A.

Non-Wilderness Zone *Alternative F* *Soundscape*

Base Year Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 30% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 23% of the Zone (moderate adverse impact) and greater than 35 dBA in 7% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 78% of the Zone; that is, 10 to 25% in 35% of the Zone (moderate adverse impact) and greater than 25% in 43% of the Zone (major adverse impact). This would represent a reduction of 28% in area with Average Sound Level of 25 dBA or more and a reduction of 9% in area of 10% or more Percent Time Audible compared to Alternative A (a 9 to 28% reduction in areas of moderate to major adverse impact), resulting in a minor to moderate beneficial change in impacts compared to Alternative A.

Non-Wilderness Zone *Alternative F* *Soundscape*

Ten-Year Forecast Peak Season

Average Sound Level would generally be greater than 25 dBA in 36% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 23% of the Zone (moderate adverse impact) and greater than 35 dBA in 13% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 49% of the Zone; that is, 10 to 25% in 19% of the Zone (moderate adverse impact) and greater than 25% in 30% of the Zone (major adverse impact). This would represent a reduction of 54% in area with Average Sound Level of 25 dBA or more and a reduction of 37% in area of 10% or more Percent Time Audible compared to Alternative A (a 37 to 54% reduction in areas of moderate to major adverse impact), resulting in a major beneficial change in impacts compared to Alternative A.

Non-Wilderness Zone *Alternative F* *Soundscape*

Ten-Year Forecast Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 18% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 13% of the Zone (moderate adverse impact) and greater than 35 dBA in 5% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 28% of the Zone; that is, 10 to 25% in 18% of the Zone (moderate adverse impact) and greater than 25% in 10% of the Zone (major adverse impact). This would represent a reduction of 72% in area with Average Sound Level of 25 dBA or more and a reduction of 58% in area of 10% or more Percent Time Audible compared to Alternative A (a 58 to 72% reduction in areas of moderate to major adverse impact), resulting in a major beneficial change in impacts compared to Alternative A.

Wilderness Zone (about 94% of GCNP) Alternative F Soundscape

In the Wilderness Zone, results vary to a greater degree than in Developed and Non-Wilderness Zones due to the Wilderness Zone's increased size and geographic extent as compared to the others. Most of the Wilderness Zone is in the area where natural ambient sound levels are used directly in audibility calculations in the Dual-Zone System acoustic approach to noise modeling. Exceptions are West End and Marble Canyon.

Wilderness Zone *Alternative F* *Soundscape*

Base Year Peak Season

Average Sound Level would generally be greater than 25 dBA in 32% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 15% of the Zone (moderate adverse impact) and greater than 35 dBA in 17% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 55% of the Zone; that

is, 10 to 25% in 8% of the Zone (moderate adverse impact) and greater than 25% in 47% of the Zone (major adverse impact). This would represent an increase of 5% in area with Average Sound Level of 25 dBA or more and an increase of one percent in area of 10% or more Percent Time Audible compared to Alternative A (a one to 5% increase in areas of moderate to major adverse impact), resulting in a negligible to minor adverse change in impacts compared to Alternative A.

Wilderness Zone *Alternative F* *Soundscape*
Base Year Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 30% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 15% of the Zone (moderate adverse impact) and greater than 35 dBA in 15% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 54% of the Zone; that is, 10 to 25% in 13% of the Zone (moderate adverse impact) and greater than 25% in 41% of the Zone (major adverse impact). This would represent a negligible change (2 dBA and 3%) in area with Average Sound Level of 25 dBA or more and in area of 10% or more Percent Time Audible compared to Alternative A (a negligible change in areas of moderate to major adverse impact), resulting in a negligible change in impacts compared to Alternative A.

Wilderness Zone *Alternative F* *Soundscape*
Ten-Year Forecast Peak Season

Average Sound Level would generally be 25 dBA or more in 28% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 14% of the Zone (moderate adverse impact) and greater than 35 dBA in 14% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 46% of the Zone; that is, 10 to 25% in 12% of the Zone (moderate adverse impact) and greater than 25% in 34% of the Zone (major adverse impact). This would represent a 20% reduction in area with Average Sound Level of 25 dBA or more and a reduction of 9% in area of 10% or more Percent Time Audible compared to Alternative A (a 9 to 20% reduction in areas of moderate to major adverse impact), resulting in a minor beneficial change in impacts compared to Alternative A.

Wilderness Zone *Alternative F* *Soundscape*
Ten-Year Forecast Off-Peak Season

Average Sound Level would generally be greater than 25 dBA in 25% of the Zone; that is, Average Sound Level would be 25 to 35 dBA in 14% of the Zone (moderate adverse impact) and greater than 35 dBA in 11% of the Zone (major adverse impact). Percent Time Audible would generally be 10% or more in 42% of the Zone; that is, 10 to 25% in 17% of the Zone (moderate adverse impact) and greater than 25% in 25% of the Zone (major adverse impact). This would represent a reduction of 23% in area with Average Sound Level of 25 dBA or more and a reduction of 13% in area of 10% or more Percent Time Audible compared to Alternative A (a 13 to 23% reduction in areas of moderate to major adverse impact), resulting in a minor to moderate beneficial change in impacts compared to Alternative A.

Marble Canyon **Alternative F** **Soundscape**

Marble Canyon's west side is located in the Wilderness Zone; the east side in the Non-Wilderness Zone. It is also entirely in the Dual-Zone System noticeability area in which 10 dBA is added to natural ambient sound levels in calculating Percent Time Audible (Chapter 4, Methodology). Modifications to air-tour routes in Alternative F would have minimal effect in Marble Canyon

Marble Canyon *Alternative F* *Soundscape*
Base Year and Ten-Year Forecast Peak Season

Localized long- and short-term adverse impacts would be similar to Alternative A Base Year and Ten-Year Forecast. **Marble Canyon Location Points**, Base Year Peak Season, range zero to 3% Percent Time Audible (median 2%), and Average Sound Level zero to 24 dBA (median 14 dBA). Impacts would generally be negligible to minor adverse in these areas (from Figures 4.18 to 4.25, Average Sound Level would generally be less than 15 dBA and Percent Time Audible less than 5%). There would be negligible increases (Percent Time Audible of one percent and Average Sound Level one dBA) Base Year to Ten-Year Forecast, a negligible change from Alternative A.

Marble Canyon *Alternative F* *Soundscape*
Base Year and Ten-Year Forecast Off-Peak Season

Percent Time Audible and Average Sound Level would be less than Peak Season, with **Marble Canyon Location Points** experiencing Percent Time Audible of zero to one percent (median zero percent) and Average Sound Level zero to 13 dBA (median zero dBA), with almost no change between Base Year and Ten-Year Forecast. These values represent negligible impacts in Marble Canyon and negligible to minor beneficial changes in impacts compared to Alternative A (one percent less median Percent Time Audible and 14 to 16 dBA lower Average Sound Level).

East End **Alternative F** **Soundscape**

Under Alternative F, greatest exposure to noise and visual impacts would continue in East End. Dragon Corridor's seven-mile western shift Off-Peak Season would shift impacts seven-miles west. East End contains all three Management Zones: Developed, Non-Wilderness, and Wilderness.

East End air-tour aircraft Percent Time Audible would vary zero to 100% of the day, and Average Sound Level 3 dBA to 49 dBA, depending on how close a Location Point is to East End air-tour routes, and whether it is Peak Season when routes are the same as Alternative A, or Off-Peak Season when Dragon Corridor routes shift seven-miles west.

East End *Alternative F* *Soundscape*
Base Year Peak Season

East End Location Points Percent Time Audible would range zero to 100% (median 64%), and 7 to 49 dBA (median 28 dBA). At some locations, aircraft events would exceed 35 dBA for 100% of the day, 45 dBA for 51% of the day, and 55 dBA for 5% of the day. Localized long- and short-term major adverse impacts would continue in areas close to Zuni Point and Dragon Corridor routes, and routes over North Rim (from Figures 4.18 to 4.25, aircraft Average Sound Level would be 40 to 50 dBA, and Percent Time Audible would be greater than 65%). Although the majority of Location Points do not experience Average Sound Level greater than 35 dBA, several Location Points (**96-mile Camp, The Basin, Eremita Mesa, Ten X Meadow, Tower of Ra**) show Average Sound Level as high as 45 to 55 dBA for 5 to 51% of the day. Impacts would be long-term negligible to minor adverse amid Bright Angel Flight-free Zone. Values for Alternative F Base Year Peak Season represent negligible change in impacts compared to Alternative A.

East End *Alternative F* *Soundscape*
Base Year Off-Peak Season

East End Location Points Percent Time Audible would range zero to 95% (median 28%), and 3 to 49 dBA (median 21 dBA). At some locations, aircraft events would exceed 35 dBA for 37% of the day, 45 dBA for 14% of the day, and 55 dBA for 5% of the day. Because this represents a reduction of 36% in median Percent Time Audible, and a 5% reduction in maximum Percent Time Audible due to Dragon Corridor's western shift Off-Peak Season, this would be a minor to major beneficial change in East End impacts compared to Alternative A. Localized long- and short-term impacts would be major adverse in areas near the shifted Dragon Corridor, Zuni Point Corridor, and routes across North Rim (from Figures 4.18 to 4.25, aircraft Average Sound Level would be 40 to 50 dBA, and Percent Time Audible would be greater than 75%), and negligible to minor adverse amid Bright Angel Flight-free Zone. Bright Angel Flight-free Zone's eastern portion would experience markedly reduced air-tour sounds Off-Peak Season, while locations closer to Dragon Corridor (near **Point Sublime and Pasture Wash** Location Points) would see only modest reductions.

East End *Alternative F* *Soundscape*
Ten-Year Forecast Peak Season

East End Location Points Percent Time Audible would range zero to 98% (median 25%); Average Sound Level would range 2 dBA to 46 dBA (median 24 dBA). This represents a reduction of 39% in median Percent Time Audible from Base Year to Ten-Year Forecast, and a reduction of 42% in median Percent Time Audible compared to Alternative A, due in large part to Alternative F quiet-technology conversion requirements. There would be moderate to major adverse impacts under and near Dragon and Zuni Point Corridors and across North Rim (a moderate to major beneficial change from Alternative A), and negligible to minor adverse impacts away

from active routes and amid Bright Angel Flight-free Zone (a negligible to minor beneficial change from Alternative A).

East End *Alternative F* *Soundscape*
Ten-Year Forecast Off-Peak Season

East End Location Point Percent Time Audible would range zero to 83% (median 11%), and Average Sound Level zero to 47 dBA (median 17 dBA); compared to Base Year Off-Peak Season, an 11% reduction in median Percent Time Audible, and a 12% reduction in maximum Percent Time Audible, but only a 4 dBA reduction in median Average Sound Level. Compared to Alternative A, this represents a 56% reduction in median Percent Time Audible, a 17% reduction in maximum Percent Time Audible, and an 11% reduction in median Average Sound Level, due in large part to Alternative F quiet-technology conversion requirements. There would be moderate to major adverse impacts under and near Dragon and Zuni Point Corridors and across North Rim, moderate to major beneficial change in impacts from Alternative A in areas where Dragon Corridor is shifted from, but moderate to major adverse change in areas the Corridor is shifted to). There would also be negligible to minor adverse impacts away from active routes and amid Bright Angel Flight-free Zone (negligible to moderate beneficial change in impacts from Alternative A).

Central **Alternative F** **Soundscape**

The Central area is located in the Wilderness Zone, with exception of a few Non-Wilderness Zone dirt road corridors, and a very small Developed Zone area at Tuweep. The Central area is entirely in the Dual-Zone System audibility area in which natural ambient sound levels are used directly in audibility calculations. This area comprises most of the Toroweap/Shinumo Flight-free Zone, and is transected by two general-aviation corridors.

In Central areas, as shown in Figures 4.18 to 4.25, aircraft Average Sound Level would be less than 10 dBA, and Percent Time Audible would be less than 5%).

Central *Alternative F* *Soundscape*
Base Year Peak Season

Central area Location Points would range zero to 12% Percent Time Audible (median one percent), and zero to 25 dBA (median 8 dBA). At some locations, aircraft events would exceed 35 dBA for 2% of the day. Compared to Alternative A, Alternative F values represent a 10% reduction in maximum Percent Time Audible (no change in median Percent Time Audible, and only a 2 dBA change in maximum and median Average Sound Level). This represents negligible to minor adverse impacts with a negligible to minor beneficial change in impacts compared to Alternative A.

Central *Alternative F* *Soundscape*
Base Year Off-Peak Season

Central area Location Points would range zero to 25% Percent Time Audible (median one percent), and Average Sound Level zero to 24 dBA (median 7 dBA) representing negligible to minor adverse impacts with a negligible change in impacts compared with Alternative A (3% and 3 dBA).

Central *Alternative F* *Soundscape*
Ten-Year Forecast Peak Season

Central area Location Points would range zero to 21% Percent Time Audible (median one percent), and zero to 26 dBA (median 9 dBA). At some locations, aircraft events would exceed 35 dBA for 4% of the day. These values represent negligible to minor adverse impacts with a negligible to minor beneficial change in impacts compared to Alternative A.

Central *Alternative F* *Soundscape*
Ten-Year Forecast Off-Peak Season

Central area Location Points would range zero to 17% Percent Time Audible (median one percent), and Average Sound Level zero to 26 dBA (median 9 dBA). At some locations, aircraft events would exceed 35 dBA 3% of the day. The values represent negligible to minor adverse impacts with a negligible to minor beneficial change in impacts compared with Alternative A (8% and 2 dBA).

West End	Alternative F	Soundscape
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West End is located in the Wilderness Zone, and entirely in the Dual-Zone System noticeability area in which 10 dBA is added to natural ambient sound levels in audibility calculations. Impacts to West End areas tend to be very localized. Specifically, impacts range negligible to major depending on proximity to Blue Direct and Blue-2/Green-4 routes. Beneficial impacts to Soundscape would be provided for locations where Green-4's southern portion would be eliminated and where Blue Direct South shifts to avoid Eagle and Guano Points.

<i>West End</i>	<i>Alternative F</i>	<i>Soundscape</i>
<i>Base Year Peak and Off-Peak Season</i>		

Base Year Peak Season, **West End Location Points** Percent Time Audible would range zero to 91% (median 17%), and Average Sound Level zero to 47 dBA (median 17 dBA). At some locations, aircraft events would exceed 35 dBA 66% of the day, 45 dBA 24% of the day, and 55 dBA 4% of the day. Values for Base Year Off-Peak Season are within 2% and one dBA of Base Year Peak Season. For areas near Blue Direct and Blue-2/Green-4 routes (**West End's northern portion**), localized long- and short-term impacts would be major adverse (from Figures 4.18 to 4.25, Average Sound Level would be 40 to 50 dBA, Percent Time Audible would be greater than 65%). **In West End's southern portion**, localized long-term impacts would be negligible to minor adverse (from Figures 4.18 to 4.25, Average Sound Level would be 10 to 20 dBA, Percent Time Audible would be less than 20%). Minor beneficial changes in impacts from Alternative A would occur where Green-4's southern portion would be eliminated. There would be an average decrease in Percent Time Audible throughout this area (approximately 10%), but impacts would increase in the localized area at **Horse Flat Canyon Location Point** with non-quiet-technology operations exiting the route (also Percent Time Audible approximately 10%). There would also be localized short-term moderate adverse changes in impacts for locations such as **Granite Peak Location Point** (Percent Time Audible would increase approximately 20%), with Blue Direct South's southern shift to avoid **Eagle and Guano Point Location Points**. Conversely, there would also be localized moderate beneficial changes in impacts for locations such as **Andrus Canyon Location Point** (Percent Time Audible would decrease approximately 20%). These values represent negligible change in impacts compared to Alternative A (a one to 4% reduction in median Percent Time Audible, and a 4 to 5 dBA reduction in median Average Sound Level).

<i>West End</i>	<i>Alternative F</i>	<i>Soundscape</i>
<i>Ten-Year Forecast Peak Season</i>		

West End Location Points Percent Time Audible would range zero to 85% Percent Time Audible (median 14%), and Average Sound Level zero to 46 dBA (median 18 dBA). At some locations, aircraft events would exceed 35 dBA 60% of the day, 45 dBA 23% of the day, and 55 dBA 3% of the day. Similar levels and differences between **West End's northern and southern portions** would be as described for Base Year Peak Season. These values are generally slightly less than Base Year Peak Season. Compared to Alternative A, they represent a 7% reduction in median Percent Time Audible, and a 10% reduction in maximum Percent Time Audible, as well as a 4 dBA reduction in median Average Sound Level, due to quiet-technology conversion requirements in Alternative F. There would be moderate to major adverse impacts in the **northern area** near air-tour routes (minor beneficial change in impacts from Alternative A), and negligible to minor adverse impacts in the **southern area** away from routes (negligible to minor beneficial change from Alternative A).

<i>West End</i>	<i>Alternative F</i>	<i>Soundscape</i>
<i>Ten-Year Forecast Off-Peak Season</i>		

West End Location Points Ten-Year Forecast Off-Peak Season results are slightly lower than Ten-Year Forecast Peak Season (3 to 4% less Percent Time Audible, one dBA lower Average Sound Level). Similar levels and differences between **West End's northern and southern portions** would be as described for Base Year Peak Season. Compared to Alternative A, they represent an 11% reduction in median Percent Time Audible, and a 14% reduction in maximum Percent Time Audible, as well as a 5 dBA reduction in median Average Sound Level. There would be moderate to major adverse impacts in the **northern area** near air-tour routes (minor beneficial change in impacts from Alternative A), and negligible to minor adverse impacts in the **southern area** away from routes (negligible to moderate beneficial change from Alternative A).

NPS Units in the SFRA	Alternative F	Soundscape
Outside Grand Canyon National Park		

Blue Direct South's southern shift to avoid Eagle and Guano Point Location Points provides localized long- and short-term moderate beneficial impacts for **lands directly under and within five miles of Blue Direct routes** (Lake Mead National Recreation Area and Grand Canyon-Parashant National Monument); specifically, Percent Time Audible would decrease approximately 20%. Alternative F quiet-technology incentives and conversion requirements would provide some mitigation by decreasing affected area size; however, those areas still affected would see an increase in localized impacts due to growth in operations. The **remainder of the SFRA outside GCNP boundaries** would experience Average Sound Level less than 25 dBA. Localized long- and short-term impacts would generally be considered minor adverse overall to these lands. As with GCNP, **the SFRA as a whole** would benefit from quiet-technology incentives and conversion requirements Ten-Year Forecast.

Cumulative Impacts	Alternative F	Soundscape
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Noise from aircraft flying over 18,000 feet and/or outside the SFRA from aircraft under Alternative F as discussed above, would continue to have long-term moderate to major adverse cumulative impacts on Soundscape throughout all four park areas (Marble Canyon, East End, Central, and West End), and SFRA similar to cumulative impacts described for Alternative A. Quiet-technology incentives and conversion requirements under Alternative F would mitigate a small amount of those impacts Ten-Year Forecast.

Conclusion	Alternative F	Soundscape
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Because Alternative F includes quiet-technology incentives and conversion requirements, noise impacts would decrease from Base Year to Ten-Year Forecast in the park as a whole. Beneficial impacts would occur in both Percent Time Audible and Average Sound Level.

Base Year Alternative F would achieve Substantial Restoration of Natural Quiet in 51% of the park Peak Season, and 59% of the park Off-Peak Season. These represent negligible changes in impacts from Alternative A with a 4% decrease in park area restored Peak Season, and a 4% increase Off-Peak Season.

Ten-Year Forecast Substantial Restoration of Natural Quiet would be achieved in 66% of the park Peak Season, and 75% of the park Off-Peak Season. These represent moderate beneficial changes in impacts from Alternative A with a 13% increase in park area restored Peak Season, and a 22% increase Off-Peak Season.

Conclusion	Alternative F	Soundscape
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<i>Conclusion by Zone</i>	<i>Alternative F</i>	<i>Soundscape</i>
<i>Ten-Year Forecast Peak Season</i>		

Wilderness Zone (about 94% of GCNP); area of moderate to major adverse impact would be 28 to 46% of the Zone, a minor beneficial change in impacts (9 to 20% reduction in area of moderate to major adverse impacts) compared to Alternative A.

Non-Wilderness Zone (about 4% of GCNP); area of moderate to major adverse impact would be 36 to 49% of the Zone, a major beneficial change in impacts (37 to 54% reduction in area of moderate to major adverse impacts) compared to Alternative A.

Developed Zone (about 2% of GCNP); area of moderate to major adverse impact would be 24 to 55% of the Zone, a major beneficial change in impacts (40 to 75% reduction in area of moderate to major adverse impacts) compared to Alternative A.

<i>Conclusion by Area</i>	<i>Alternative F</i>	<i>Soundscape</i>
<i>Base Year and Ten-Year Forecast</i>		

In Marble Canyon, Central areas, West End (southern portions), localized long- and short-term impacts would be negligible to minor adverse (aircraft Average Sound Level would generally be less than 15 dBA, and Percent Time Audible would be less than 5%) with negligible to moderate beneficial changes in impacts compared to

Alternative A depending on specific location. Greatest exposure to noise and visual impacts occur in East End and West End's northern portion where long- and short-term moderate to major adverse impacts would occur (aircraft Average Sound Level would be 40 to 50 dBA, and Percent Time Audible would be greater than 65%), with moderate to major beneficial changes in impacts compared to Alternative A East End, and minor beneficial changes in impacts compared to Alternative A West End. Negligible to minor adverse impacts would occur away from active routes and amid Flight-free Zones with negligible to moderate beneficial change in impacts compared to alternative A East End. Beneficial impacts to Soundscape East End due to Dragon Corridor's seven-mile western shift Off-Peak Season are clearly seen in modeled results.

Cumulative Impacts

Alternative F

Soundscape

Cumulative impacts from all actions would be long-term moderate to major adverse, due primarily to high levels of aircraft audibility.

NPS PREFERRED ALTERNATIVE

SOUNDSCAPE

The NPS Preferred Alternative includes quiet-technology incentives, a modified allocation system, modified tour routes to avoid sensitive resources, and curfews.

Base Year, the NPS Preferred Alternative would achieve Substantial Restoration of Natural Quiet in 53% of the park Peak Season, and in 63% of the park Off-Peak Season, as shown in Table 4.23. These represent a negligible change in impacts compared to Alternative A Peak Season with a 2% decrease in park area restored, and a moderate beneficial change in impacts compared to Alternative A Off-Peak Season with an 8% increase.

Ten-Year Forecast Substantial Restoration of Natural Quiet would be achieved in 67% of the park Peak Season, and 77% of the park Off-Peak Season, as shown in Table 4.24. These represent moderate beneficial changes in impacts compared to Alternative A with a 14% increase in park area restored Peak Season, and a 24% increase Off-Peak Season.

Mapped results of noise modeling for the NPS Preferred Alternative for Percent Time Audible and Average Sound Level are shown on Figure 4.26 to 4.33. Table 4.17 to 4.22 present Contour Analysis and Location Point results computed for the NPS Preferred Alternative Peak and Off-Peak Seasons, respectively, and include comparisons with Alternative A.

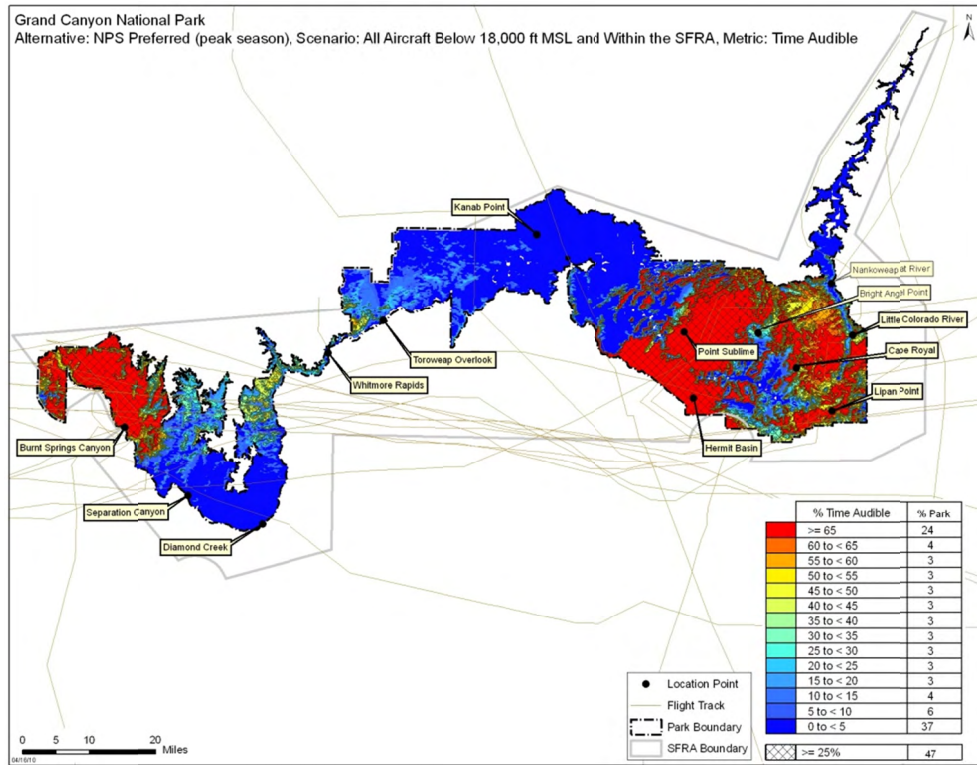
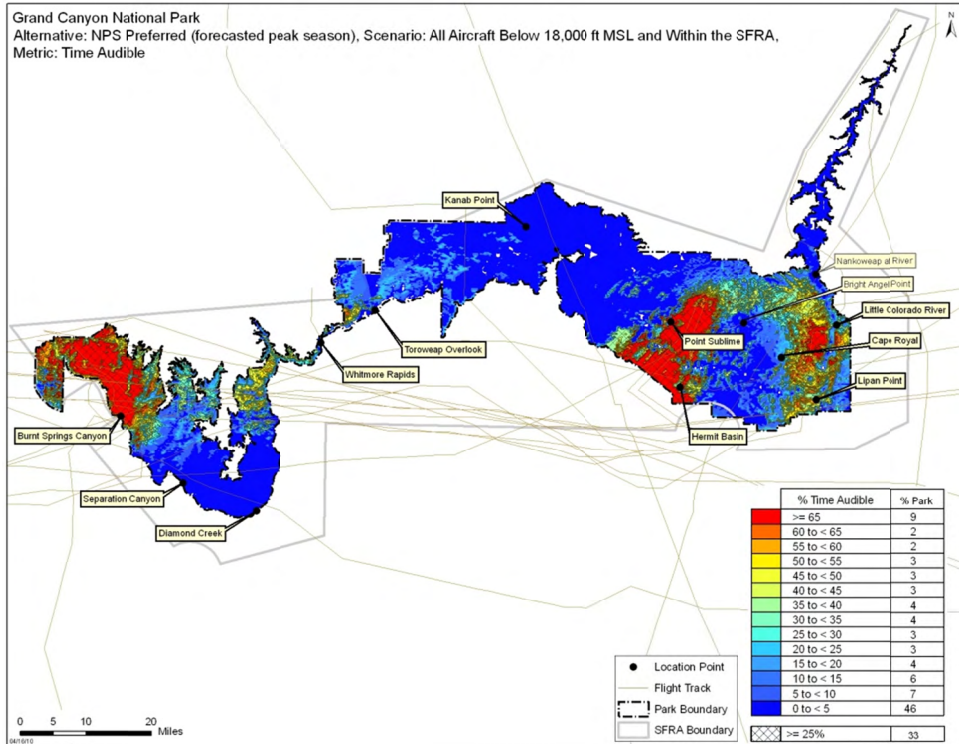
FIGURE 4.26 NPS PREFERRED PERCENT TIME AUDIBLE BASE YEAR PEAK SEASON**FIGURE 4.27 NPS PREFERRED PERCENT TIME AUDIBLE TEN-YEAR FORECAST PEAK SEASON**

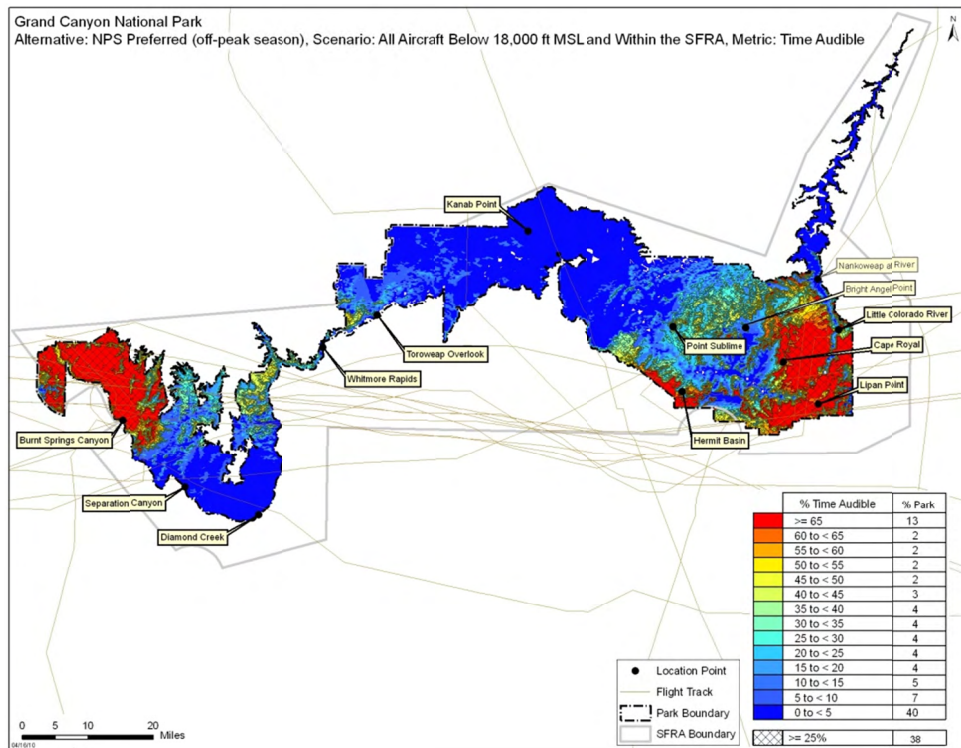
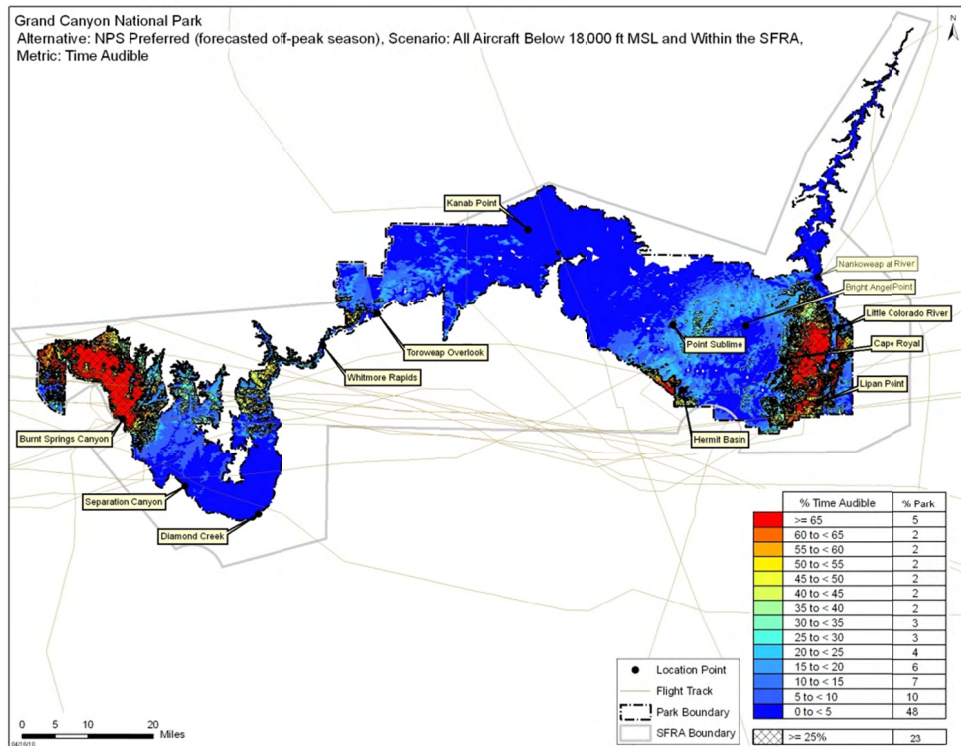
FIGURE 4.28 NPS PREFERRED PERCENT TIME AUDIBLE BASE YEAR OFF-PEAK SEASON**FIGURE 4.29 NPS PREFERRED PERCENT TIME AUDIBLE TEN-YEAR FORECAST OFF-PEAK SEASON**

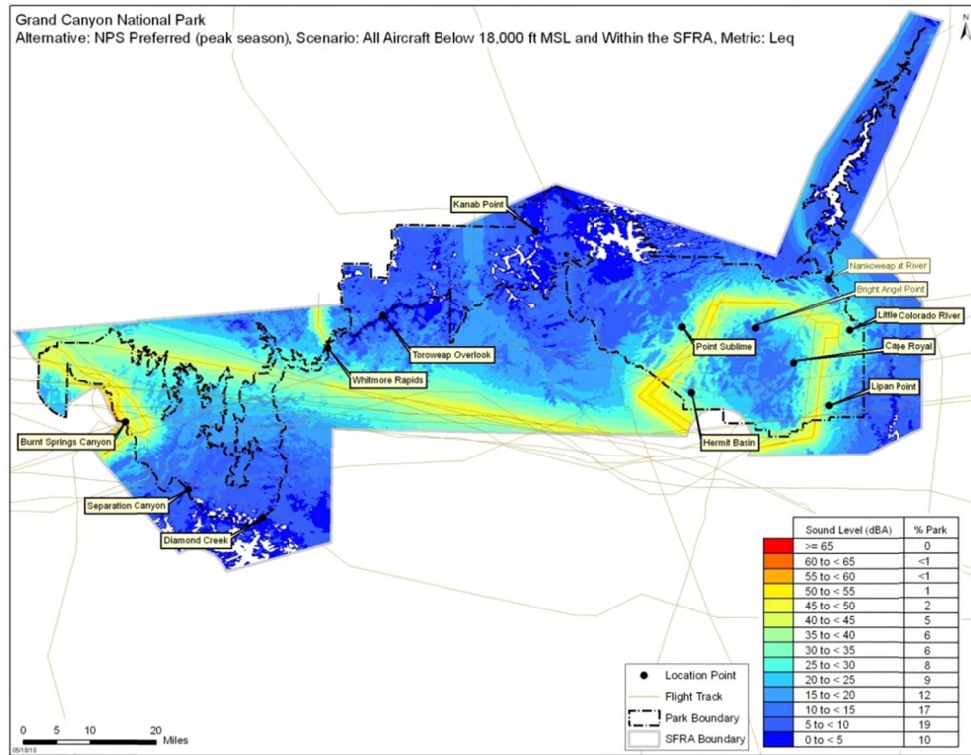
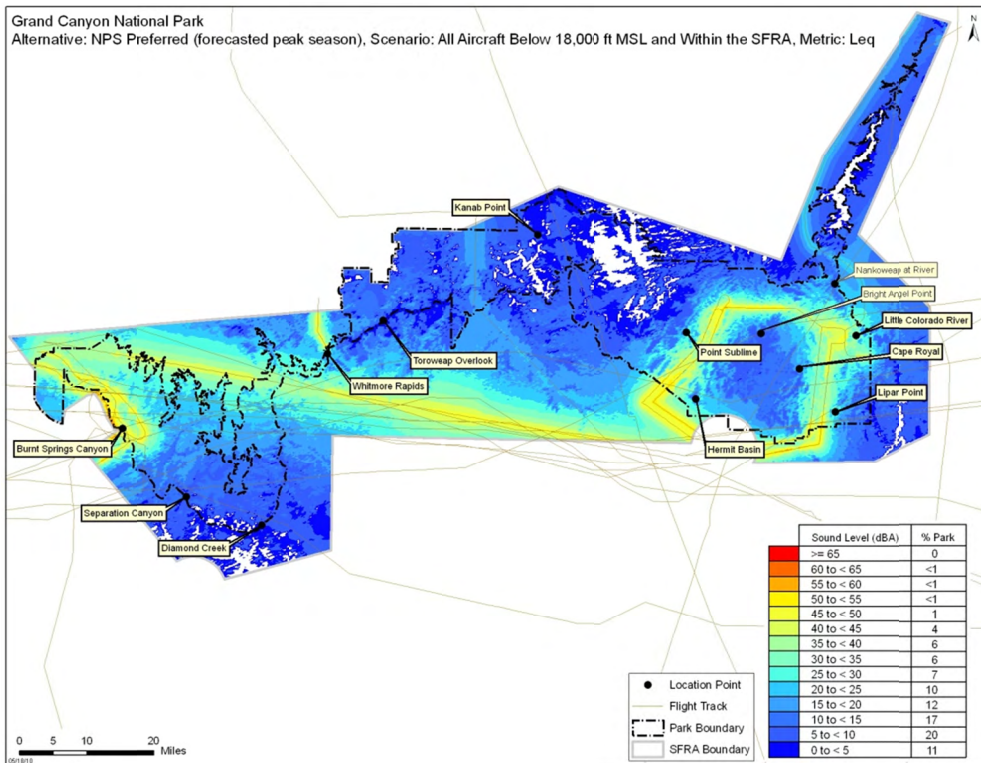
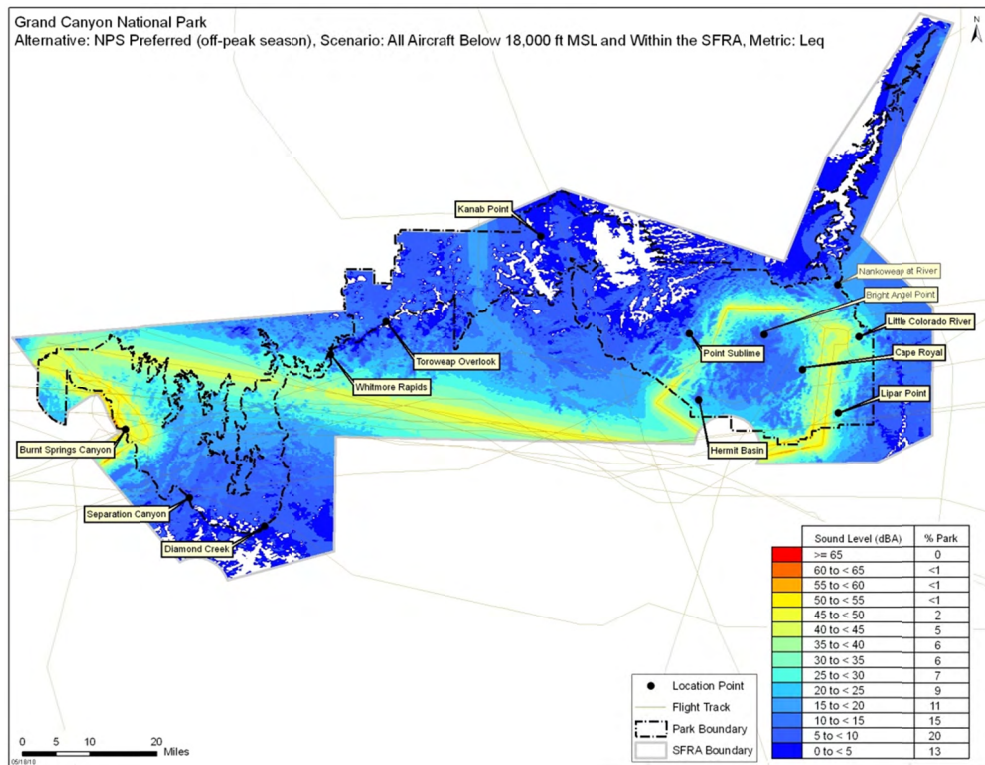
FIGURE 4.30 NPS PREFERRED AVERAGE SOUND LEVEL BASE YEAR PEAK SEASON**FIGURE 4.31 NPS PREFERRED AVERAGE SOUND LEVEL TEN-YEAR FORECAST PEAK SEASON**

FIGURE 4.32 NPS PREFERRED AVERAGE SOUND LEVEL BASE YEAR OFF-PEAK SEASON**FIGURE 4.33 NPS PREFERRED AVERAGE SOUND LEVEL TEN-YEAR FORECAST OFF-PEAK SEASON**