

ACR Slate Recommendations Analyses and Request:

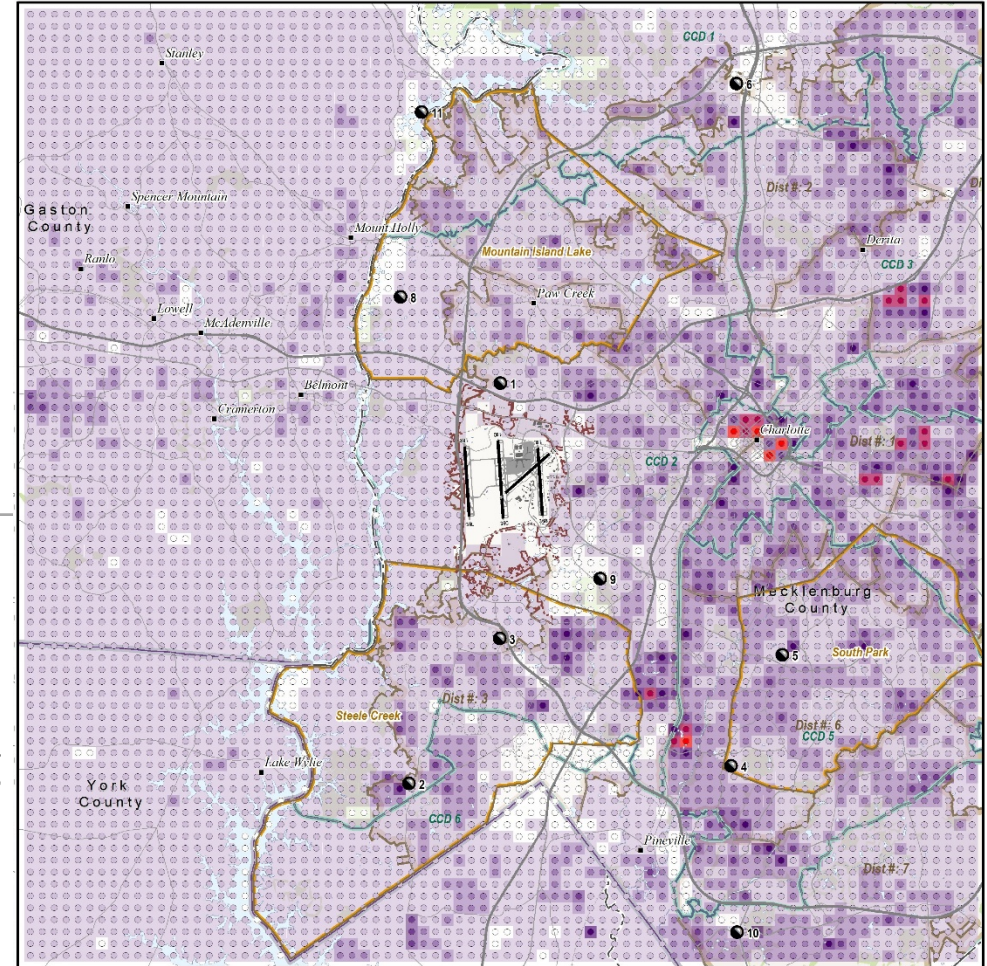
- Population Data Sources*
- Elimination of 2-Mile Departure Restriction*
- Delay Initial Turn on South Flow Departures*
- Alternating Downwind Distances*

For ACR Review, Understanding, and Discussion

September 18, 2019

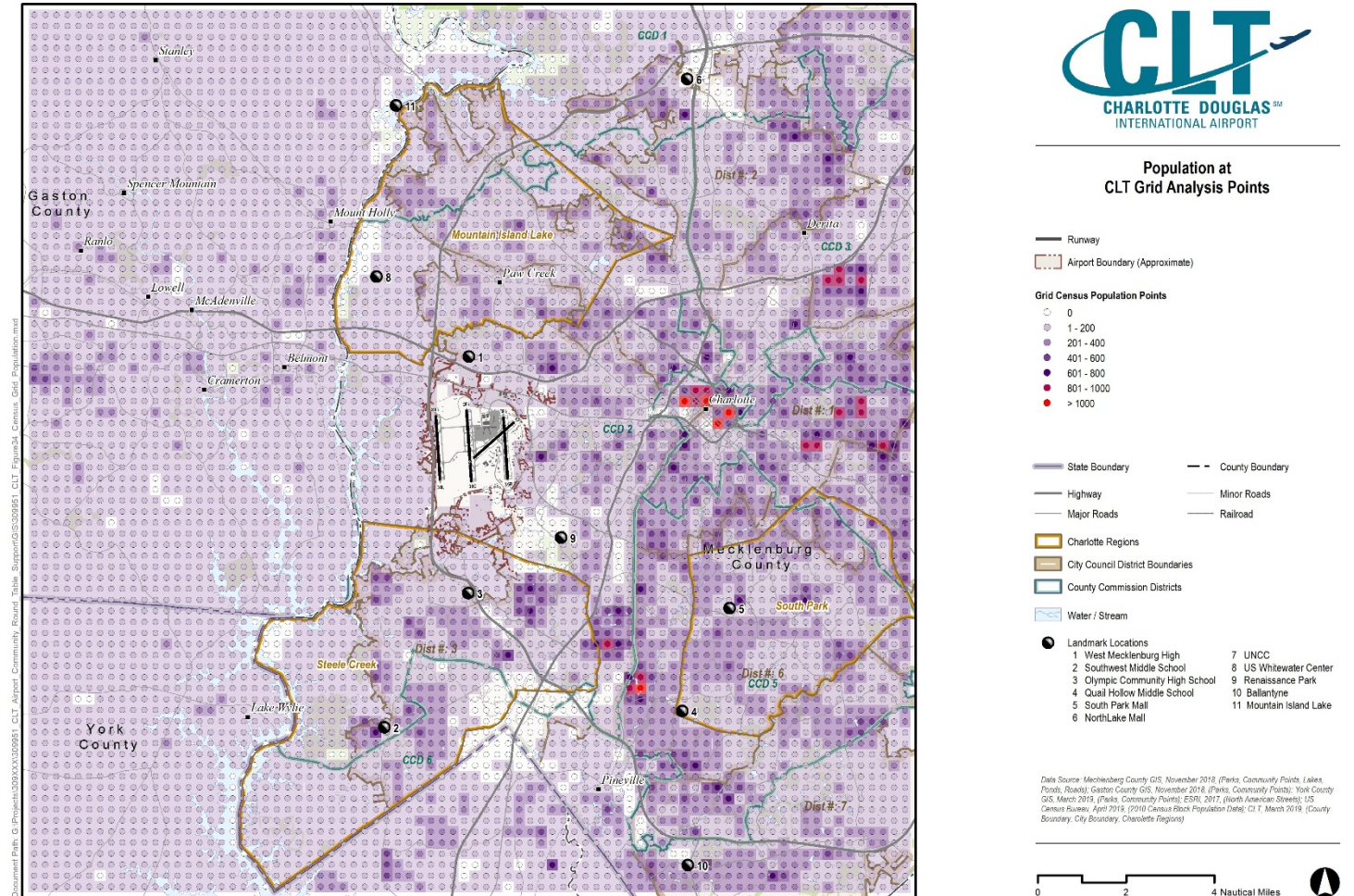
ACR Request: Population Data Sources

Request of the ACR at the August 2019 ACR meeting



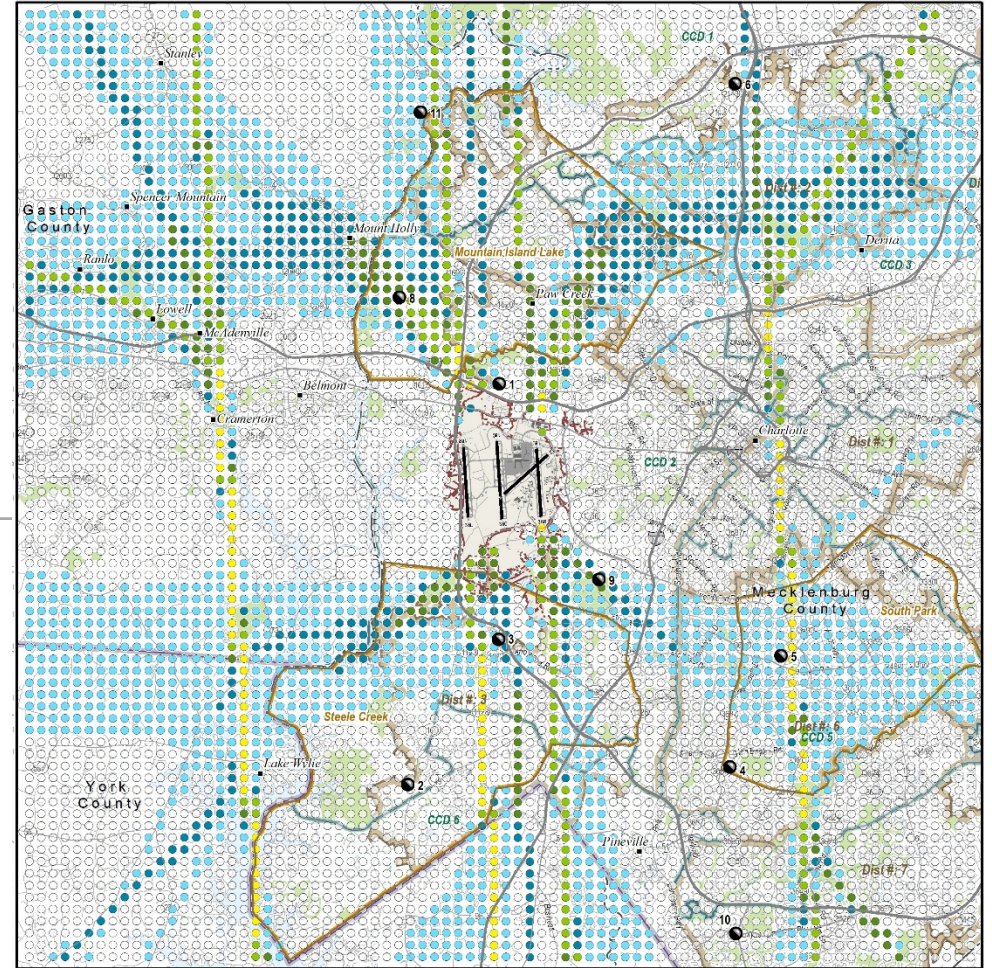
2010 US Census Population Levels at Grid Analysis Points

Population Interval	Count of Grid Points
0	323
1-200	4,578
201-400	1,154
401-600	186
601-800	39
801-1000	16
Greater than 1,000	5
Total	6,301
Total Grid Population	736,785



ACR Slate Recommendation Analysis: Elimination of 2-Mile Departure Restriction

Slate recommendation adopted by ACR at
March 2019 meeting



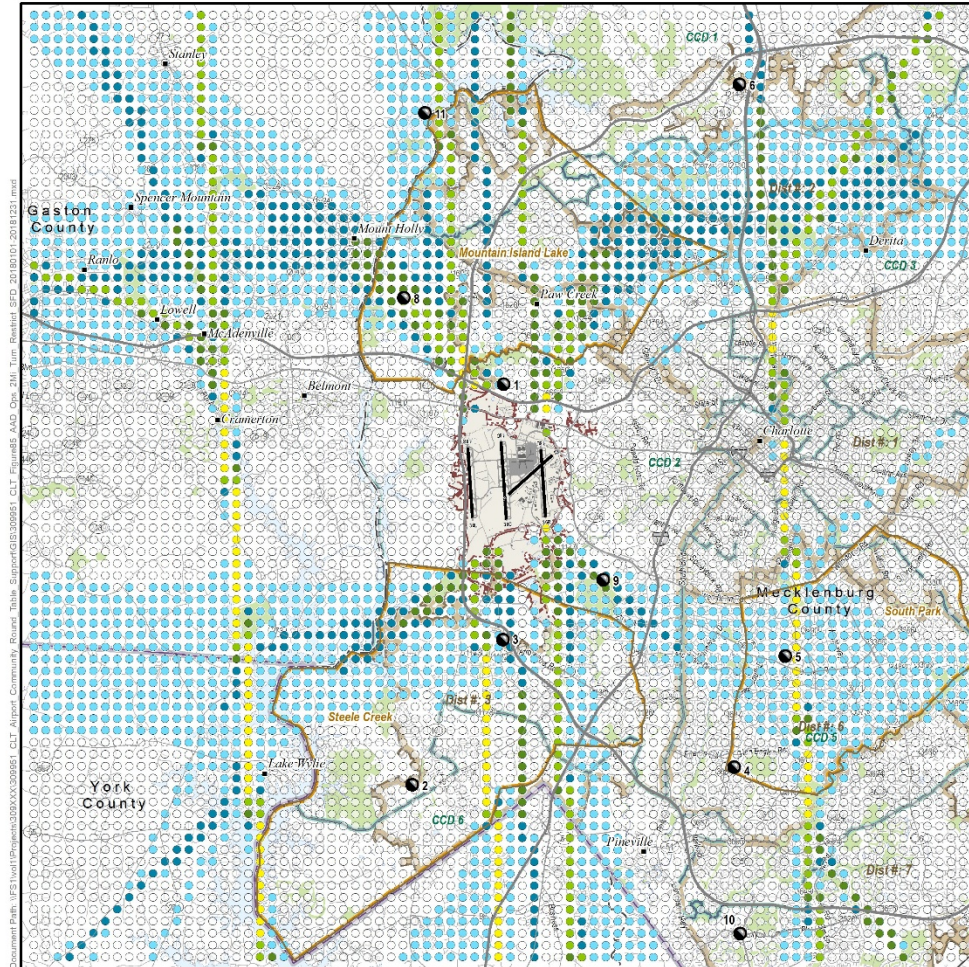
ACR Slate Recommendation – Elimination of 2-Mile Departure Restriction

- Modified calendar year 2018 aircraft South Flow departures so that aircraft would turn upon reaching the departure end of the Runway on current South Flow departure headings
- Aircraft would be expected to turn at or near the Runway departure end if the 2-mile departure restriction was removed for South Flow departures absent other changes
- Modeled the full year of aircraft operations with the modified departure flight paths
- Compared the modeled results with the 2018 baseline results at each of the grid points (including population estimates at each grid point) in terms of:
 - Number of annual-average overflights
 - Number of average daily noise events above 70 dB (N70)

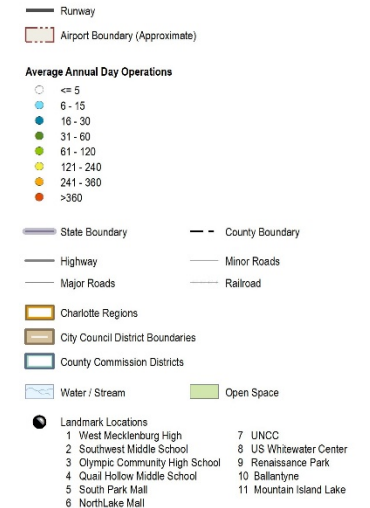


Annual Average Day Aircraft Overflights Analysis: Elimination of 2-Mile Departure Restriction

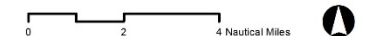
Overflight Interval (Operations)	Count of Grid Points	Count of Population
Less than 5	3,553	456,649
6-15	1,797	182,377
16-30	453	47,716
31-60	180	14,181
61-120	211	24,040
121-240	107	11,822
241-360	0	0
Greater than 360	0	0
Total	6,301	736,785



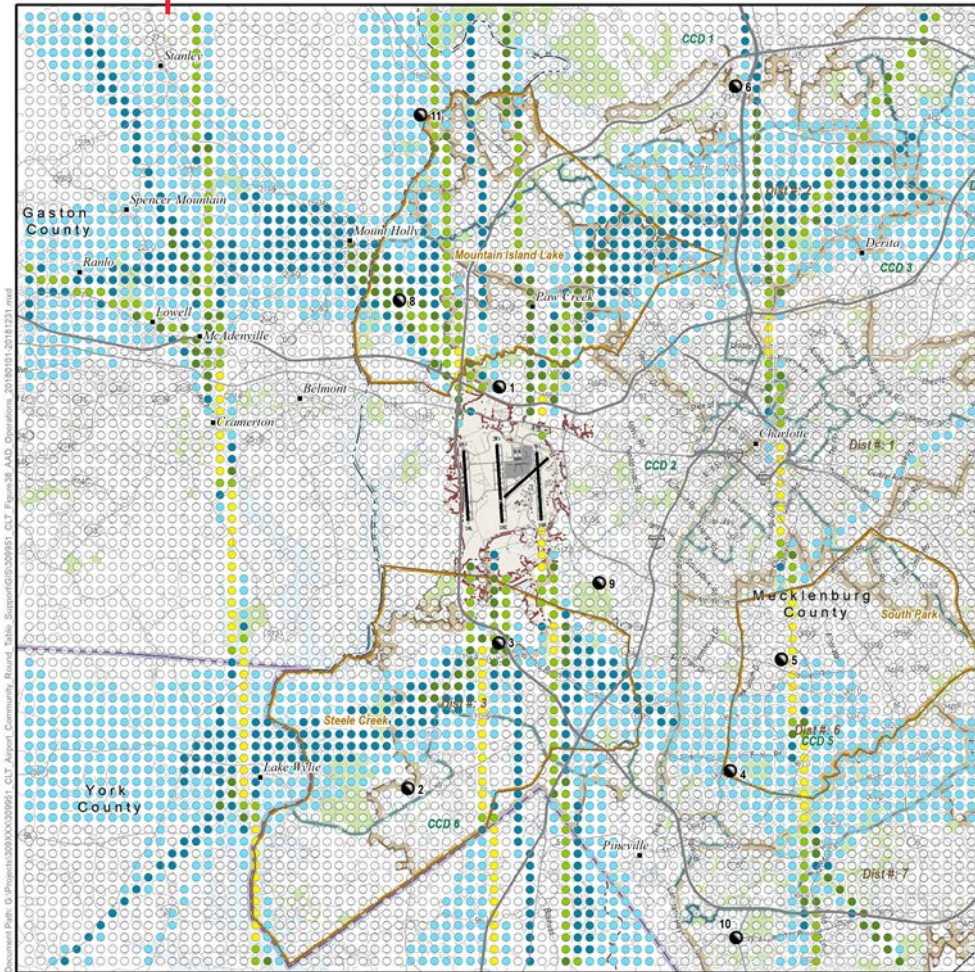
Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Elimination of
2-Mile Turn Restriction for
South Flow Departures



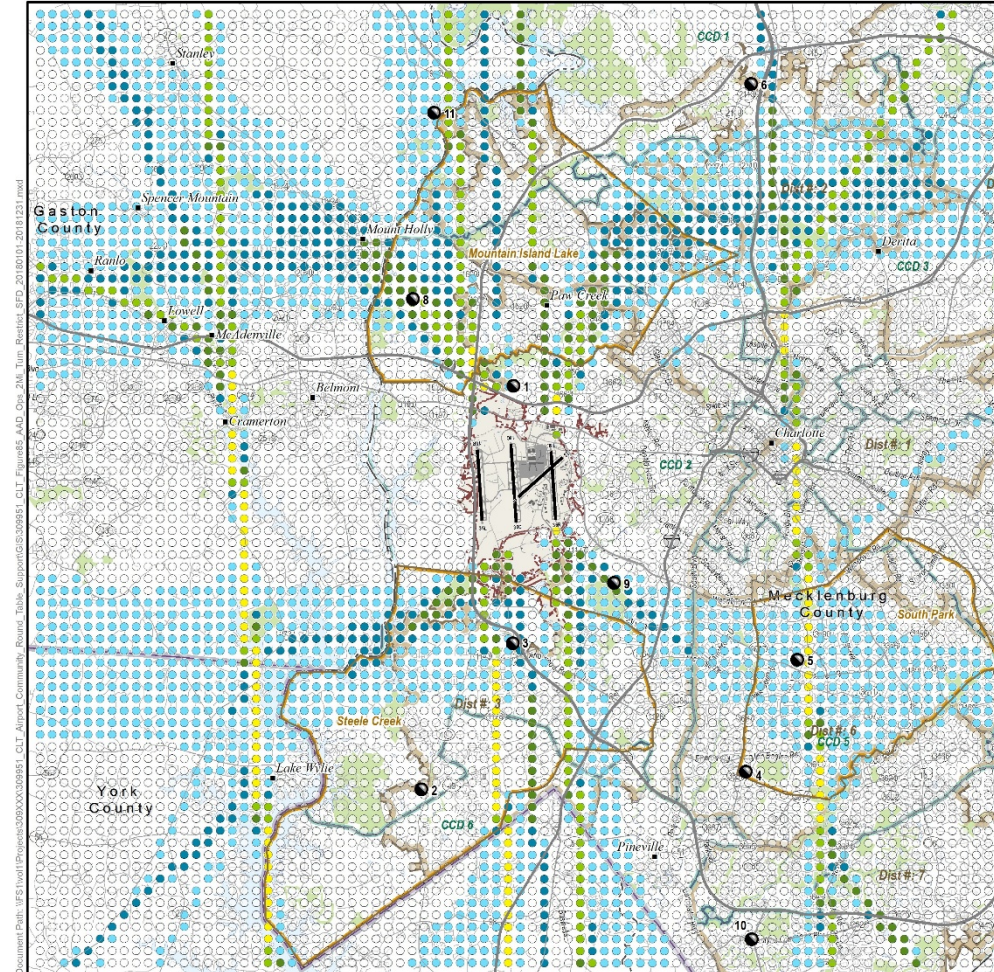
Data Source: Mecklenburg County GIS, November 2013; (Parks, County Points, Lakes, Roads, Railroads) Gaston County GIS, November 2013; (Parks, County Points, York County GIS, March 2013; (Parks, County Points); CLT, March 2019; (County Boundary, City Boundary, Charlotte Regions)



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with Elimination of 2-Mile Departure Restriction Compared to Baseline

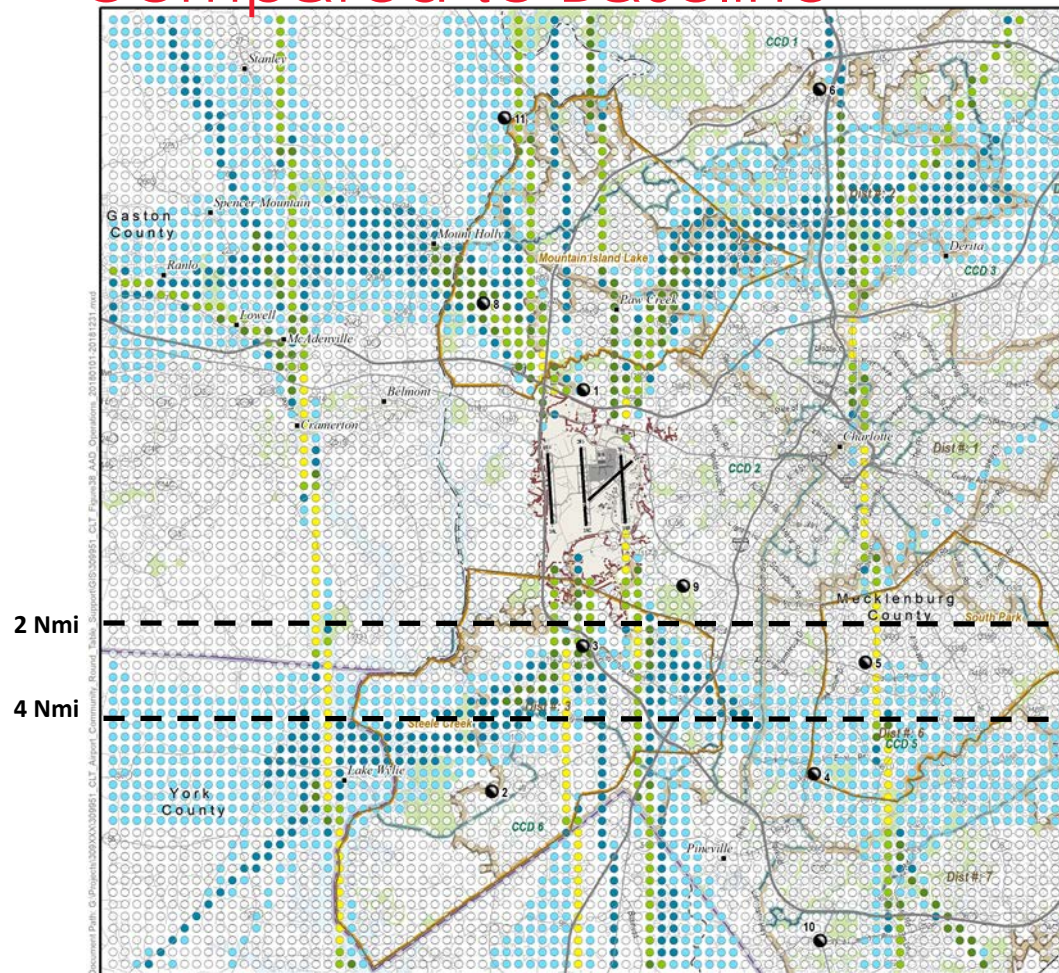


Baseline

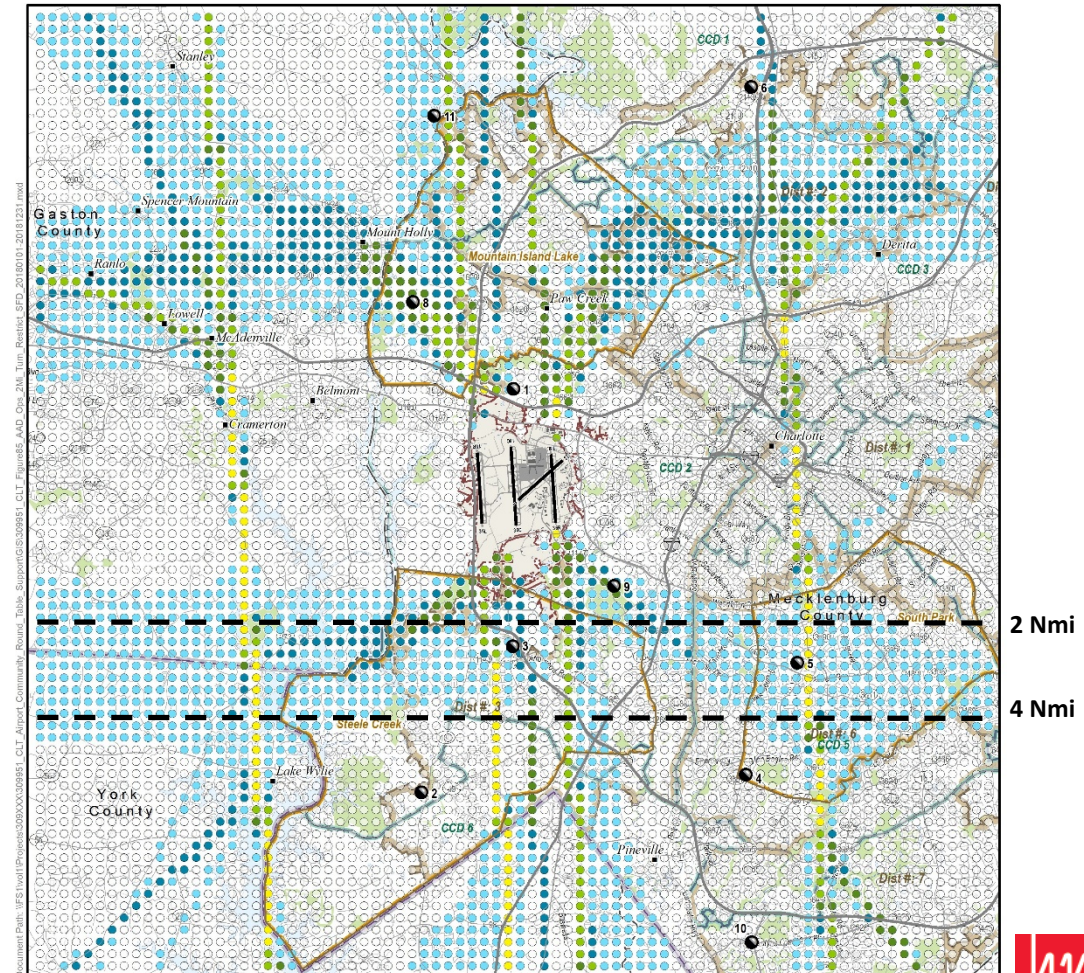


Modified

Annual Average Day Aircraft Overflights Analysis: 2018 Operations with Elimination of 2-Mile Departure Restriction Compared to Baseline



Baseline

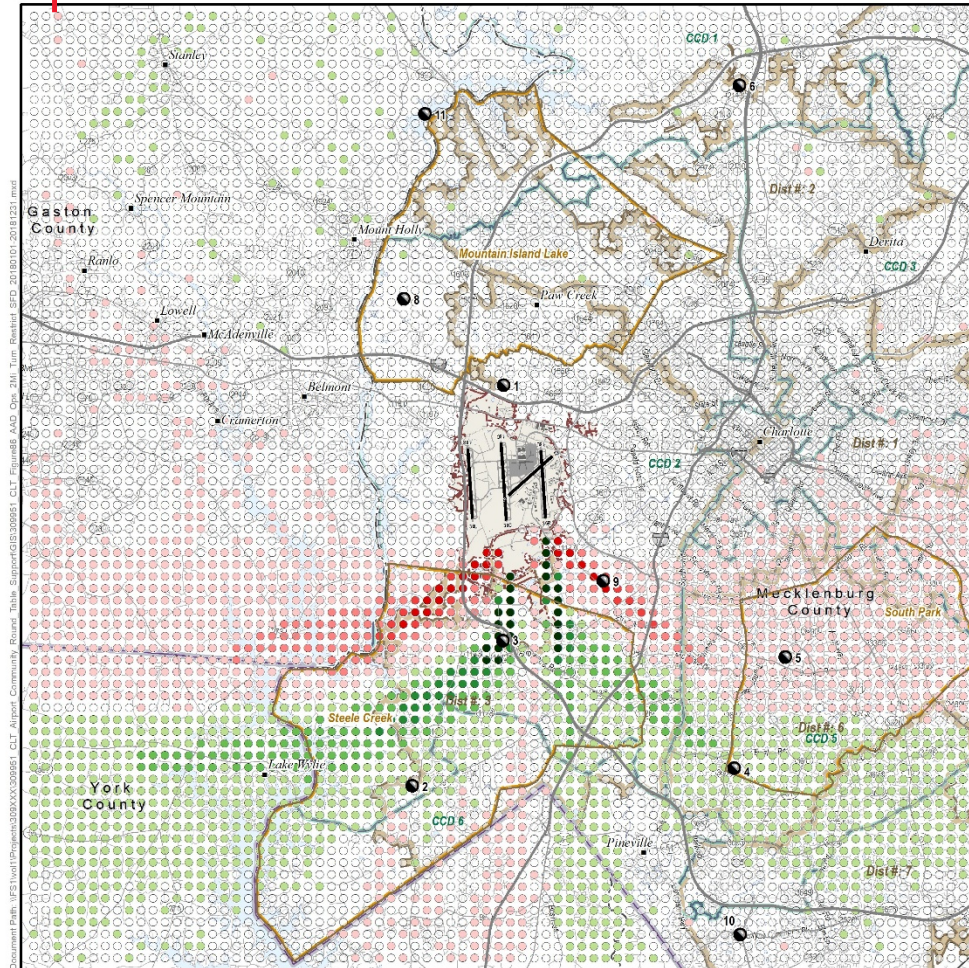


Modified

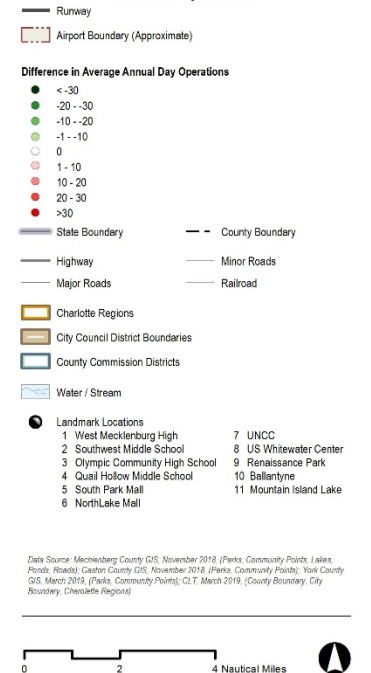


Annual Average Day Aircraft Overflights Analysis: Difference – 2018 Operations with Elimination of 2-Mile Departure Restriction Compared to Baseline

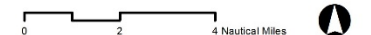
Overflight Interval (Operations)	Count of Grid Points / % Change	Count of Population / % Change
Less than -30	24 / 0.4%	2,037 / 0.3%
-30 to -20	29 / 0.5%	5,654 / 0.8%
-20 to -10	118 / 1.9%	18,630 / 2.5%
-10 to -1	698 / 11.1%	80,445 / 10.9%
-1 to 1	4,147 / 65.8%	468,575 / 63.6%
1 to 10	1,138 / 18.1%	154,222 / 20.9%
10 to 20	106 / 1.7%	4,027 / 0.5%
20 to 30	21 / 0.3%	2,291 / 0.3%
Greater Than 30	20 / 0.3%	904 / 0.1%
Total	6,301 / 100.0%	736,785 / 100.0%



Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Elimination of
2-Mile Turn Restriction for
South Flow Departures Compared to
Baseline Operations



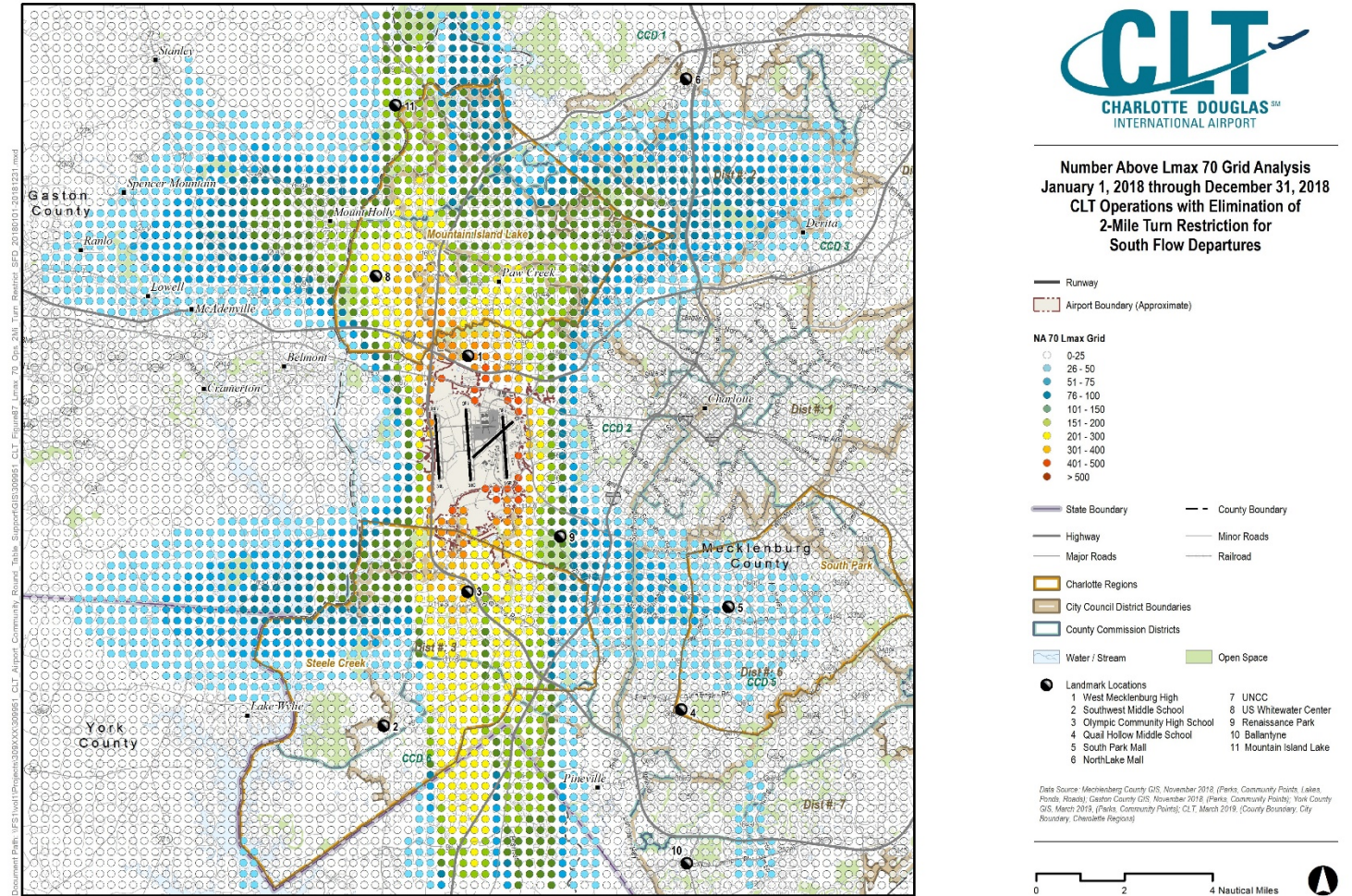
Data Source: Mecklenburg County GIS, November 2018; (Parks, Community Points, Lakes, Ponds, Roads) Gaston County GIS, November 2018; (Parks, Community Points, York County GIS, March 2019; (Parks, Community Points); CLT, March 2019; (County Boundary, City Boundary, Charlotte Regions)



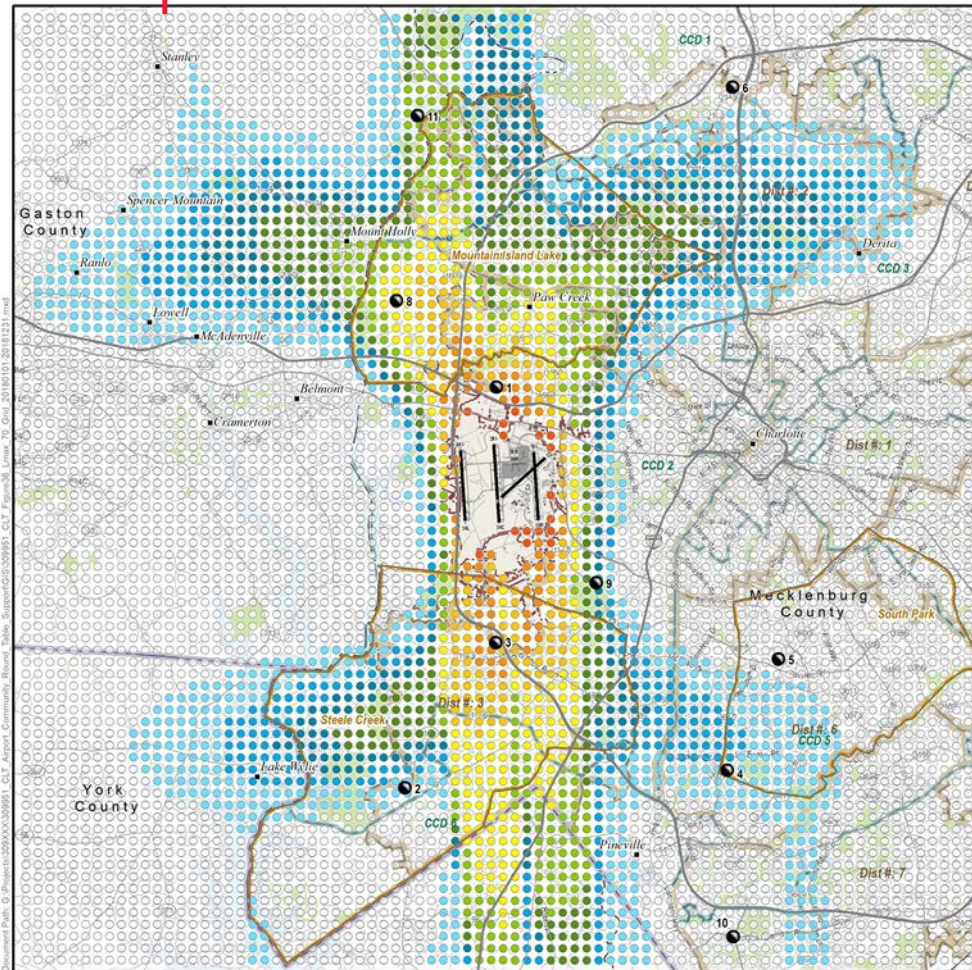
- 869 Grid points (13.9%) / 106,776 people (14.5%) would experience reduced numbers of overflights with elimination of 2-mile restriction
- 1,285 Grid points (20.4%) / 161,444 people (21.8%) would experience increased numbers of overflights with elimination of 2-mile restriction

Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with Elimination of 2-Mile Departure Restriction

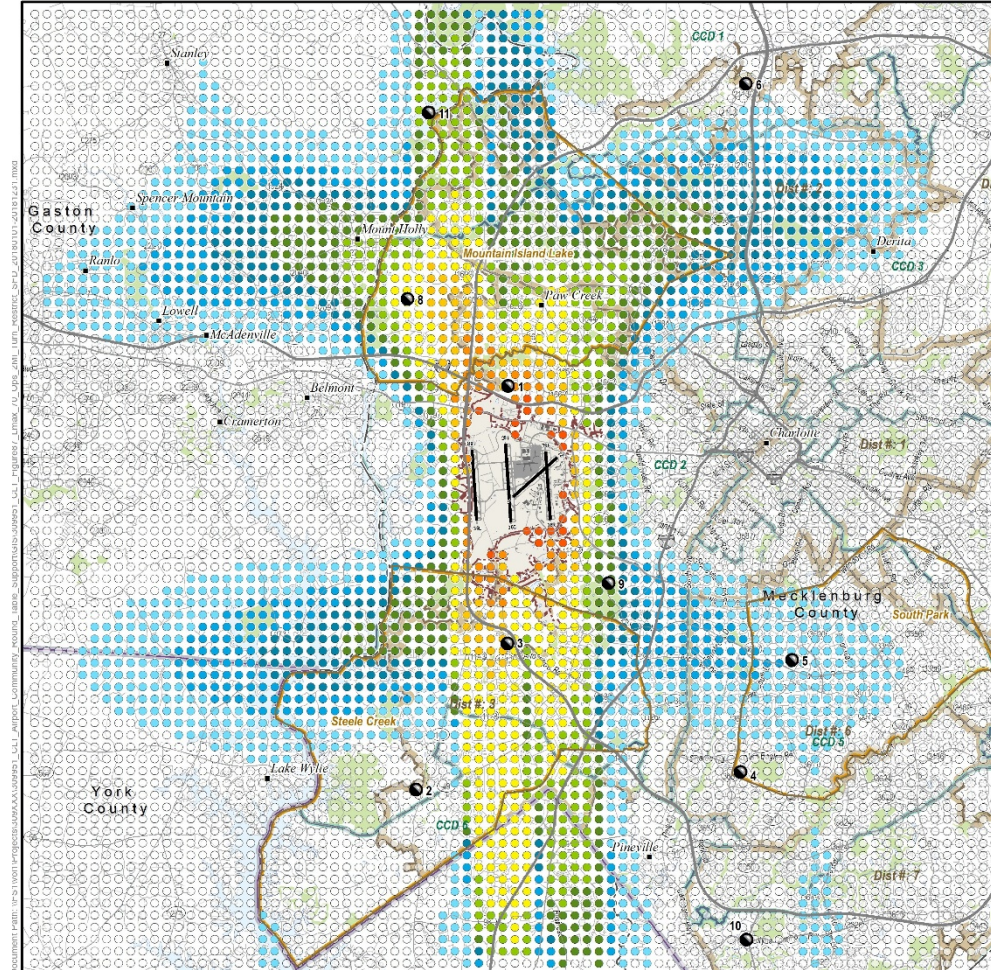
N70 Interval (Events)	Count of Grid Points	Count of Population
25 or Less	3,433	439,493
26-50	1,007	120,409
51-75	471	48,317
76-100	335	28,696
101-150	346	37,438
151-200	285	25,140
201-300	258	27,901
301-400	103	6,823
401-500	46	2,266
Greater than 500	17	302
Total	6,301	736,785



Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with Elimination of 2-Mile Departure Restriction Compared to Baseline



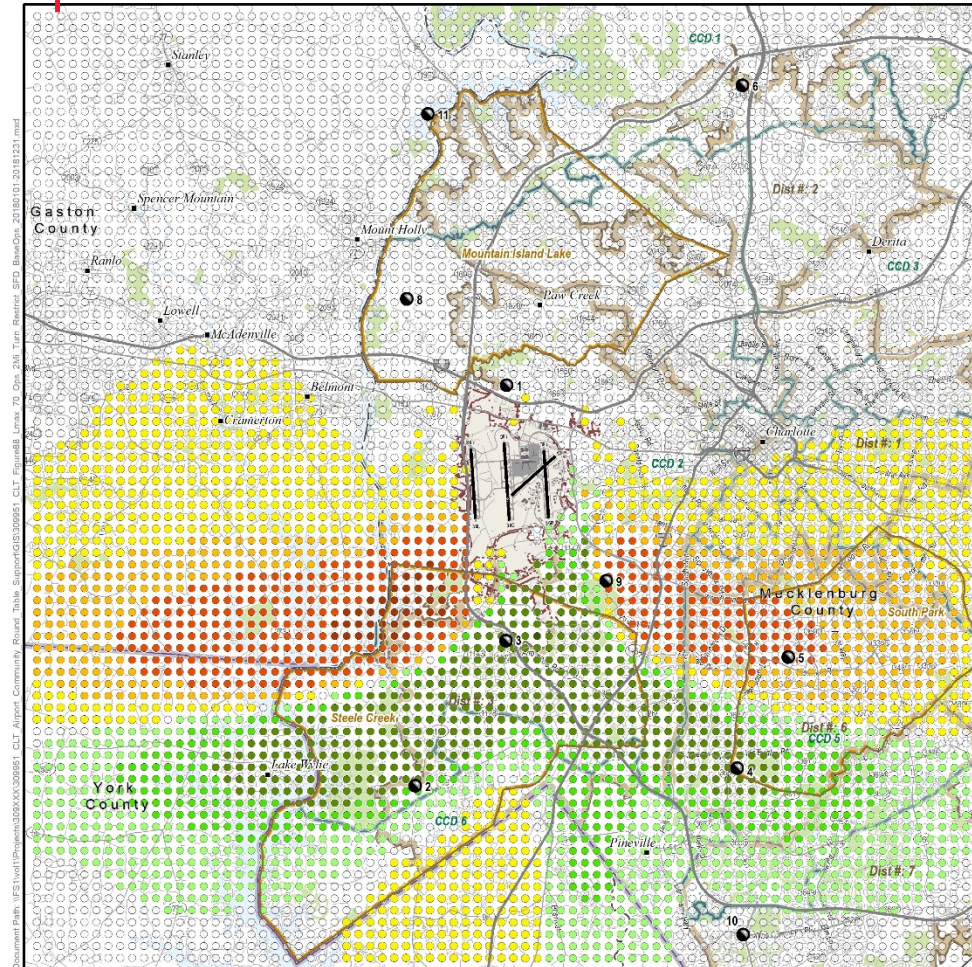
Baseline



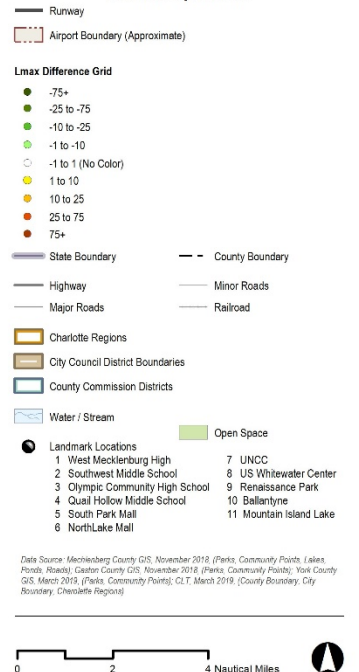
Modified

Number of Noise Events Above 70 dB (N70) Analysis: Difference – 2018 Operations with Elimination of 2-Mile Departure Restriction Compared to Baseline

N70 Difference Interval (Events)	Count of Grid Points / % Change	Count of Population / % Change
Less than -75	95 / 1.5%	13,394 / 1.8%
-75 to -25	306 / 4.9%	43,168 / 5.9%
-25 to -10	335 / 5.3%	34,886 / 4.7%
-10 to -1	636 / 10.1%	70,167 / 9.5%
-1 to 1	3,122 / 49.5%	340,161 / 46.2%
1 to 10	988 / 15.7%	147,803 / 20.1%
10 to 25	431 / 6.8%	56,251 / 7.6%
25 to 75	347 / 5.5%	28,538 / 3.9%
Greater than 75	41 / 0.7%	2,417 / 0.3%
Total	6301 / 100.0%	736,785 / 100.0%



Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Elimination of
2-Mile Turn Restriction for
South Flow Departures Compared to
Baseline Operations



- 1,372 Grid points (21.8%) / 161,615 people (21.9%) would experience fewer events above 70 dB Lmax with elimination of 2-mile restriction
- 1,807 Grid points (28.7%) / 235,009 people (31.9%) would experience more events above 70 dB Lmax with elimination of 2-mile restriction

ACR Slate Recommendation Analysis: 2018 Operations with Elimination of 2-Mile Departure Restriction Observations

- Number of average daily overflight:
 - A greater number of grid points and more people experienced an increase than decrease
- Number of noise events greater than 70 dB (N70)
 - A greater number of grid points and more people experienced an increase than decrease
- Elimination of the 2-mile departure restriction provides the greatest benefits for areas further from the airport, and least benefit for areas close to the airport east and west of the South Flow Runways
- Potential noise reductions in the southern portions of the grid and noise increases in the central and northern portion of the grid for the community of South Park
- Potential noise reductions in the central portions of the grid and noise increases in the southern and northern portion of the grid for the community of Steele Creek
- Dispersion would remain roughly the same compared to baseline operations
- This may be seen as a shifting of noise from one area of a community to another and that communities protected for years by this restriction may likely notice this change and react negatively



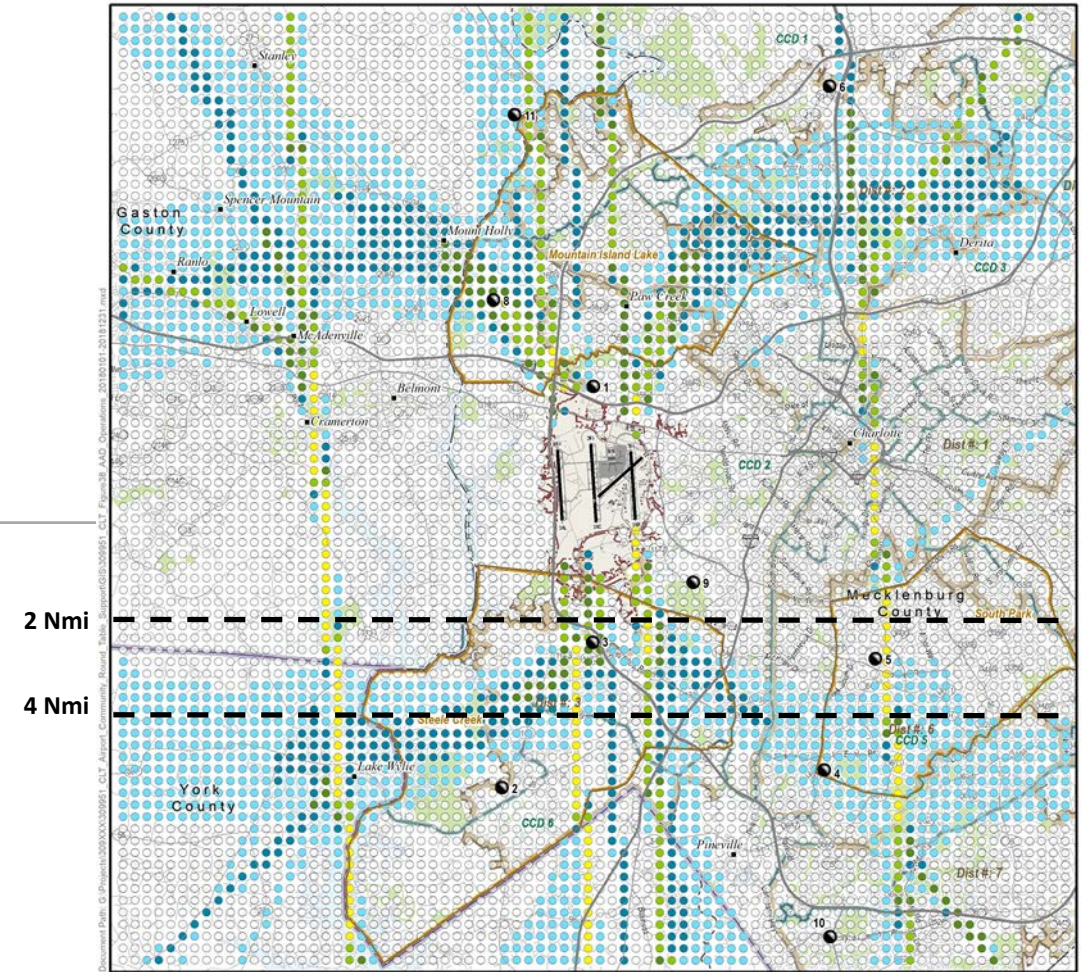
ACR Slate Recommendation Analysis: Elimination of 2-Mile Departure Restriction Overall Analysis Considerations for the ACR

- Do the reported changes from the 2018 baseline to elimination of the 2-mile departure restriction for South Flow departures meet the goals of the ACR?
- Does the ACR want to reserve a final decision to see if you want to recommend removal of the 2-mile restriction along with another measure, instead of by itself?
- Does the ACR want to recommend elimination of the 2-mile departure restriction for South Flow departures for consideration of the final slate?



ACR Slate Recommendation Analysis: Delay Initial Turn on South Flow Departures

Slate recommendation adopted by ACR at
March 2019 meeting



ACR Request– Delay Initial Turn on South Flow Departures

- Purpose of recommendation to delay the initial turn on south flow departures was to allow aircraft to climb to higher altitudes before turning, which would result in lower noise levels to communities to the east and west of south extension of the CLT runways centerlines
- HMMH suggests the altitude-based turn analyses shown last month shows similar results to what could be achieved with a delay in the initial turns
- FAA waiver currently exists at approximately 4 nautical miles that allows the delay in getting required aircraft separation through divergent headings from the parallel runways
 - This waiver exists because the FAA was unable to meet the existing requirement (less than 4 nautical miles) for separation of aircraft departing parallel runways



ACR Request– Delay Initial Turn on South Flow Departures

- HMMH recommends no further analysis *at this time* on delaying the initial turn for southbound departures
 - Altitude-based turns resulted in delaying the initial turn
 - The current separation requirements and FAA waiver to extend the separation requirements further suggests delaying the turns will be difficult to get the FAA to consider and implement such a measure
 - Depending on final recommended slate to submit to the FAA, delaying the initial turn may come back into play

ACR Slate Recommendation Analysis: Alternating Downwind Distances

Slate recommendation adopted by ACR at
March 2019 meeting



ACR Slate Recommendation – Alternating Downwind Distances

- Determined reasonable distances from the airport based on consultation with FAA for annually alternating/rotating the downwind arrival legs
 - Annual downwind alternation/rotation schedule represented the best balance of meeting community requests to vary downwind flight path locations over time while also meeting FAA training and publication requirements
 - It would take 3 years to rotate through each of the downwind distances
 - Current downwinds are at a distance of 5 nautical miles
 - Reasonable distances for alternating the downwinds would be 4 or 6 nautical miles

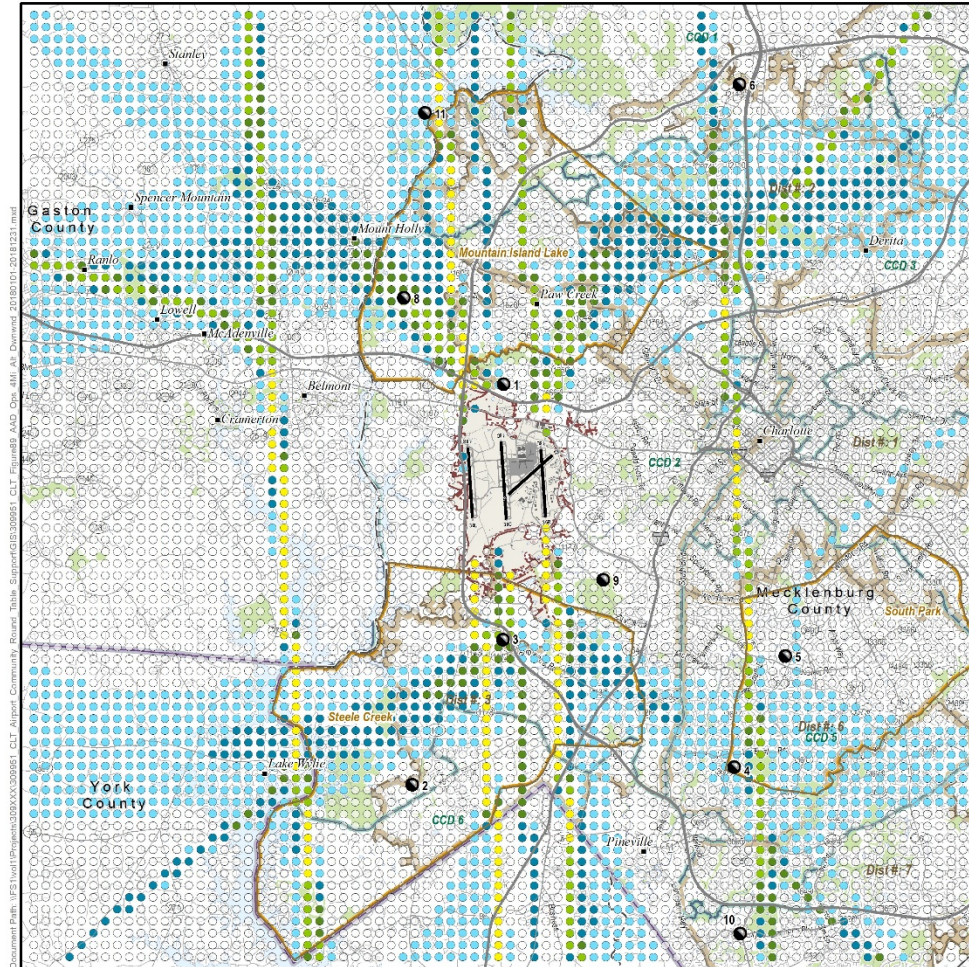


ACR Slate Recommendation – Alternating Downwind Distances

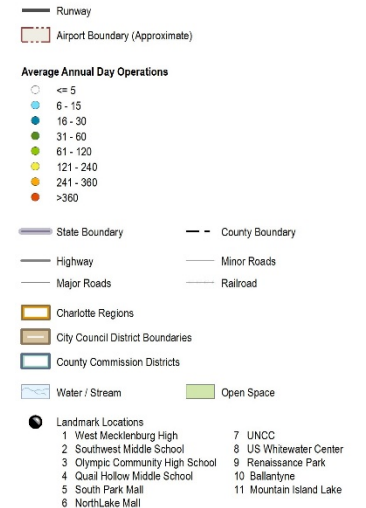
- Modified arrival flight tracks to shift downwinds to distance of 4 or 6 nautical miles from the airport
- Modeled the full year of aircraft operations with each of the modified downwind distances
- Compared the modeled results for each downwind distance with the 2018 baseline results at each of the grid points (including population estimates at each grid point) in terms of:
 - Number of annual-average overflights
 - Number of average daily noise events above 70 dB (N70)

Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 4-Mile Alternating Downwind

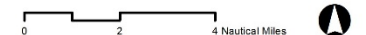
Overflight Interval (Operations)	Count of Grid Points	Count of Population
Less than 5	3,698	446,483
6-15	1,571	169,205
16-30	505	61,488
31-60	177	20,704
61-120	210	24,543
121-240	140	14,362
241-360	0	0
Greater than 360	0	0
Total	6,301	736,785



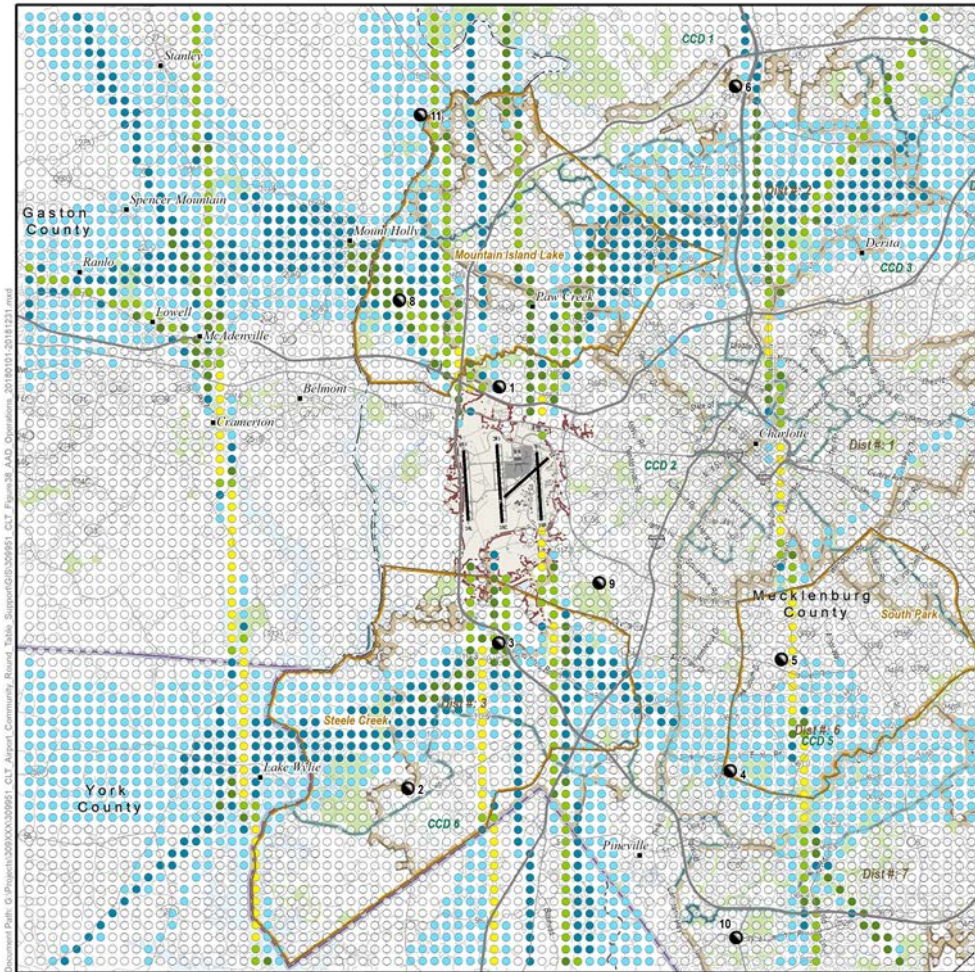
Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with
4-Mile Alternating Downwind



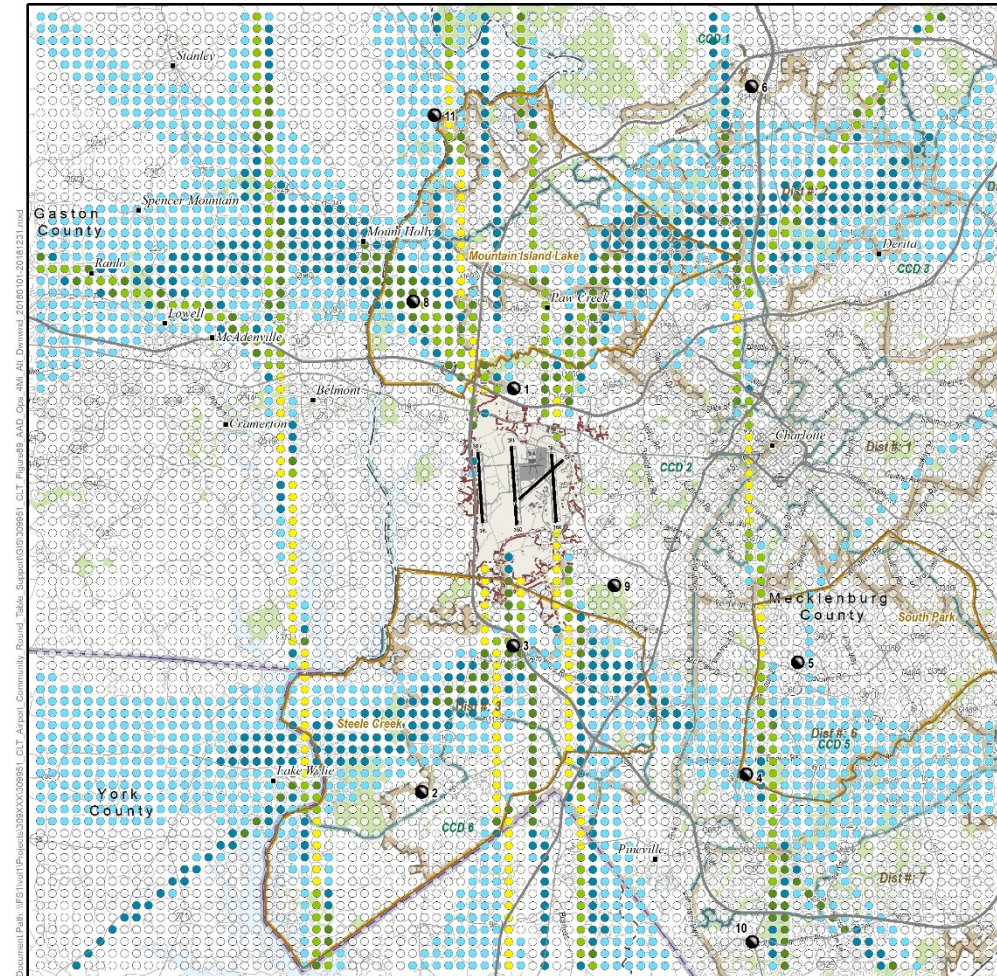
Data Source: Mecklenburg County GIS, November 2013; (Parks, County Points, Lakes, Roads, Railroads) Gaston County GIS, November 2013; (Parks, County Points, Lakes, Roads, Railroads) York County GIS, March 2013; (Parks, County Points, Lakes, Roads, Railroads) Charlotte Region, Charlotte Region



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 4-Mile Alternating Downwind Compared to Baseline



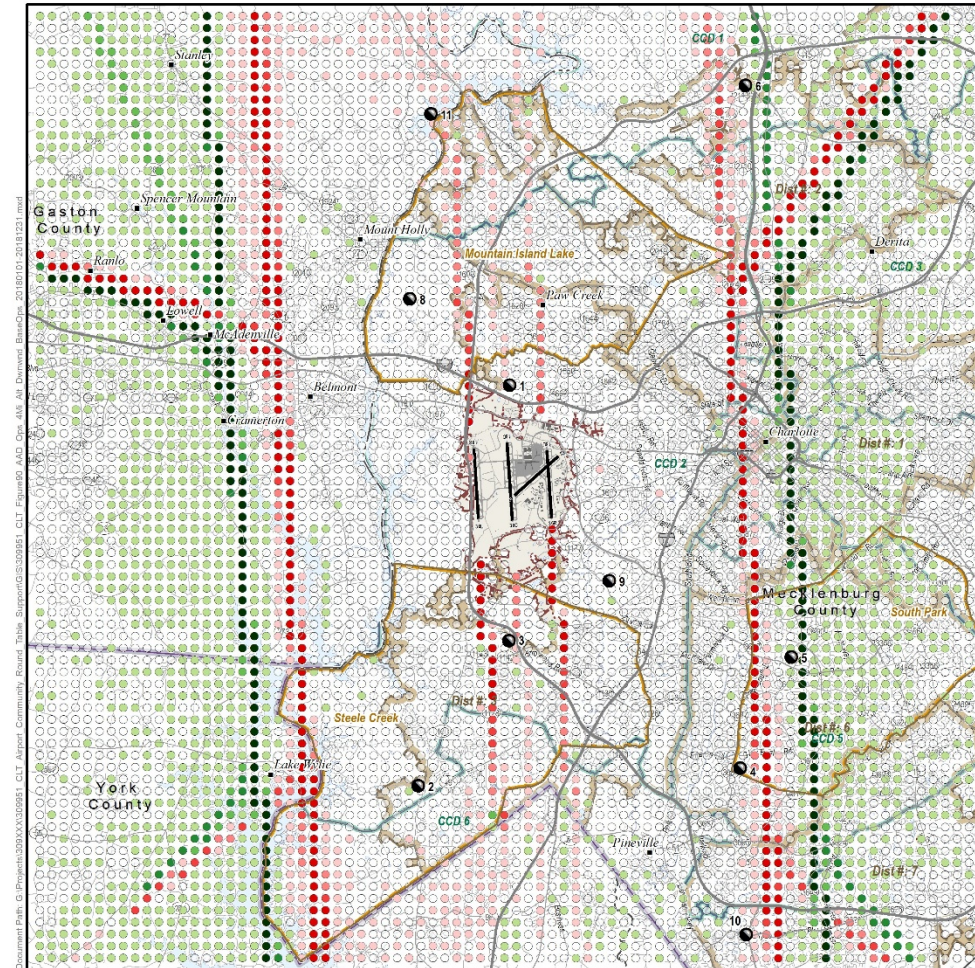
Baseline



4-mile downwind

Annual Average Day Aircraft Overflights Analysis: Difference – 2018 Operations with 4-Mile Alternating Downwind Compared to Baseline

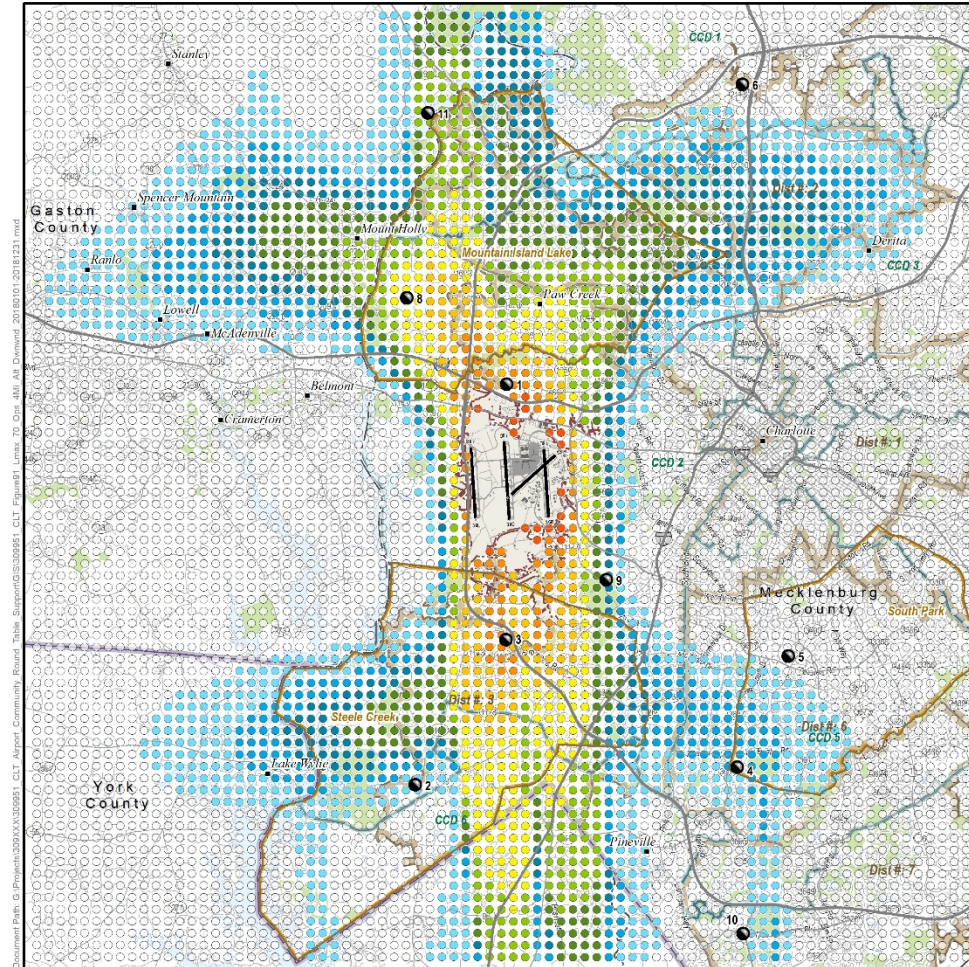
Overflight Interval (Operations)	Count of Grid Points / % Change	Count of Population / % Change
Less than -30	196 / 3.1%	25,756 / 3.5%
-30 to -20	61 / 1.0%	5,306 / 0.7%
-20 to -10	59 / 0.9%	4,926 / 0.7%
-10 to -1	361 / 5.7%	29,749 / 4.0%
-1 to 1	4,672 / 74.1%	561,816 / 76.3%
1 to 10	520 / 8.3%	54,956 / 7.5%
10 to 20	107 / 1.7%	10,613 / 1.4%
20 to 30	80 / 1.3%	10,431 / 1.4%
Greater Than 30	245 / 3.9%	33,232 / 4.5%
Total	6,301 / 100.0%	736,785 / 100.0%



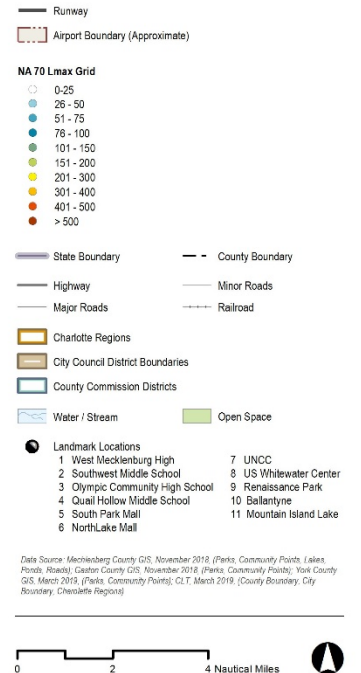
- 677 Grid points (10.7%) / 65,737 people (8.9%) would experience reduced numbers of overflights with a 4-mile alternating downwind
- 952 Grid points (15.2%) / 109,232 people (14.8%) would experience increased numbers of overflights with a 4-mile alternating downwind

Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with 4-Mile Alternating Downwind

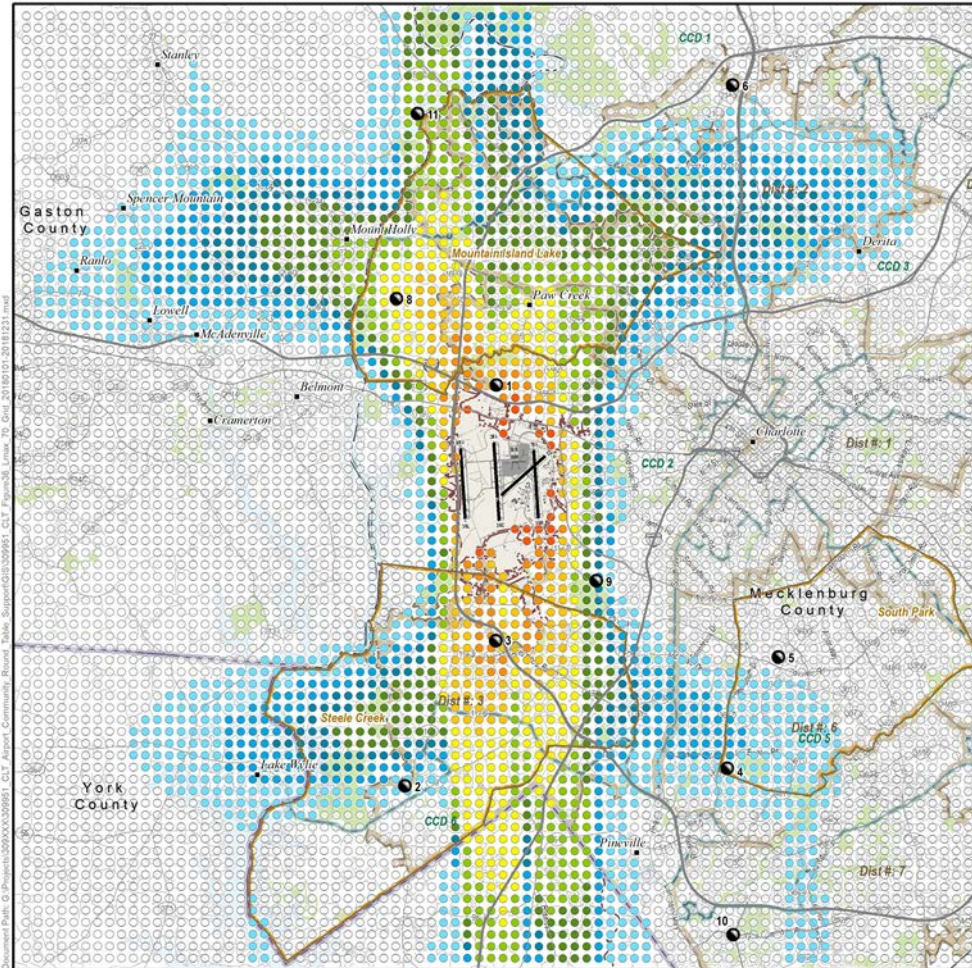
N70 Interval (Events)	Count of Grid Points	Count of Population
25 or Less	3,536	437,022
26-50	901	104,982
51-75	456	59,632
76-100	329	31,704
101-150	348	38,780
151-200	272	23,817
201-300	223	22,466
301-400	147	13,770
401-500	72	4,310
Greater than 500	17	302
Total	6,301	736,785



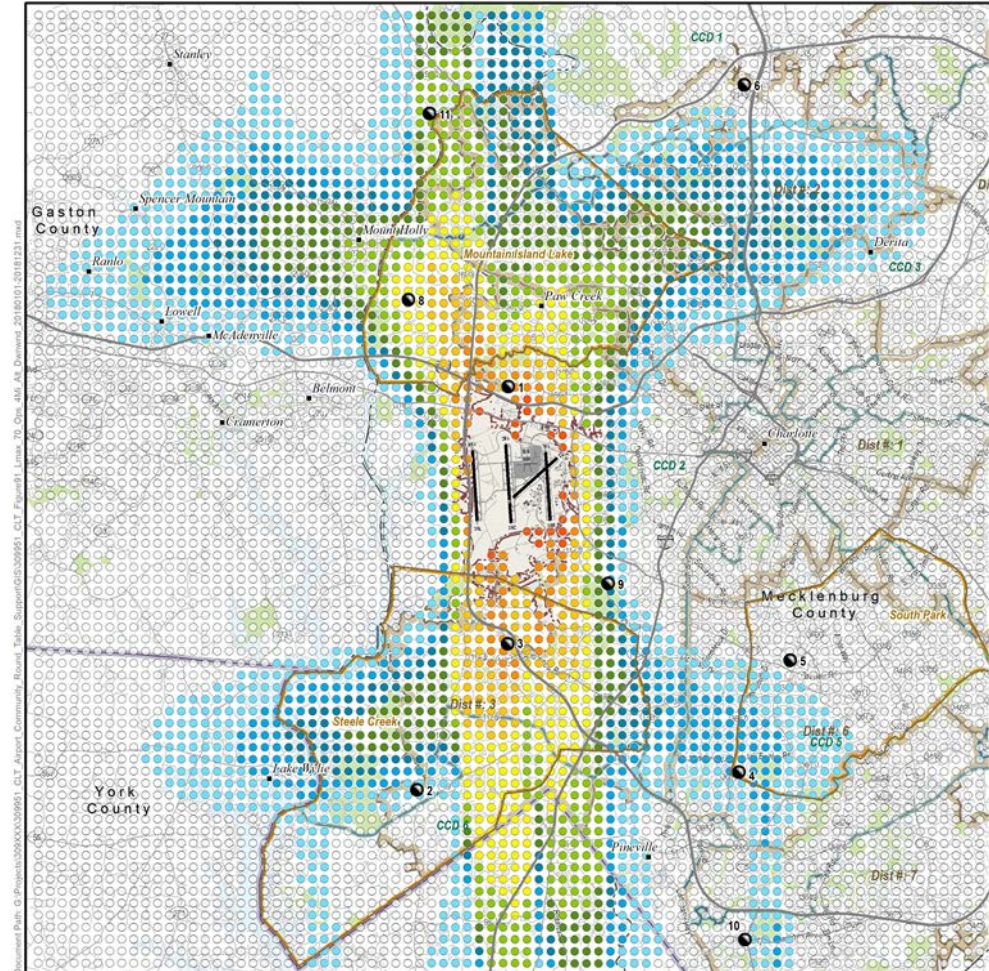
Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with
4-Mile Alternating Downwind



Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with 4-Mile Alternating Downwind Compared to Baseline



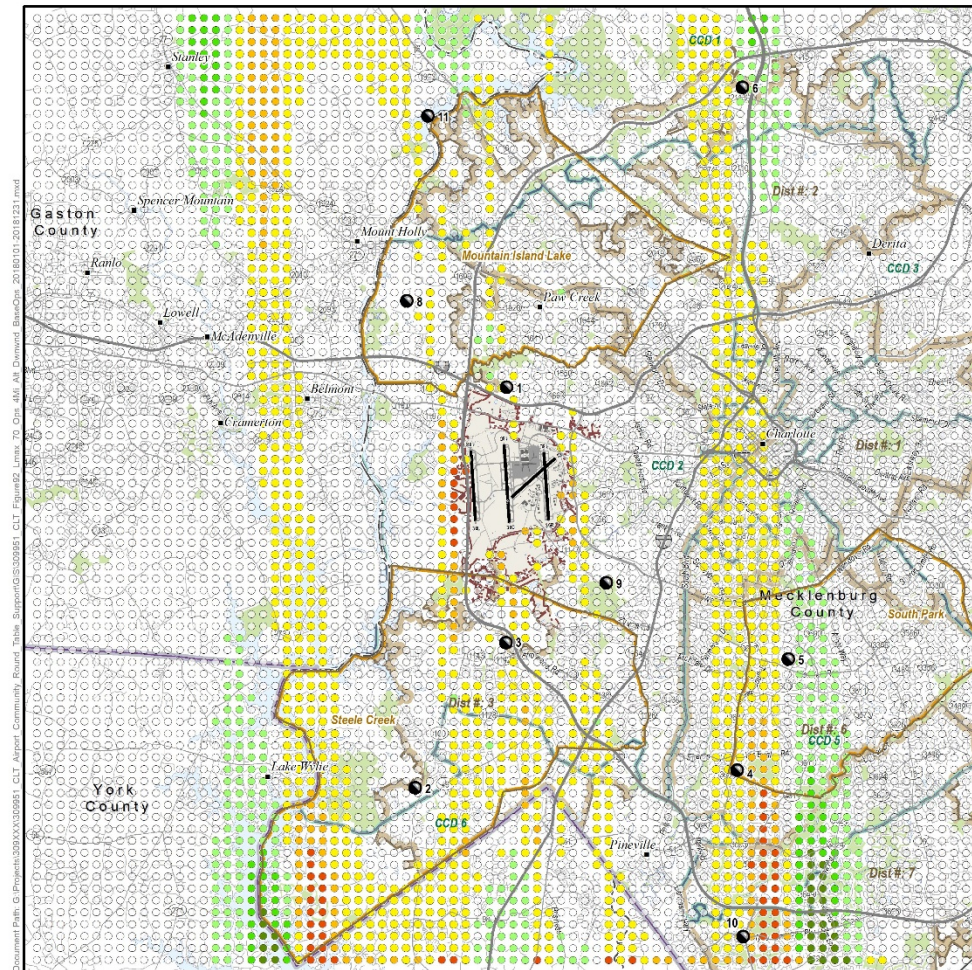
Baseline



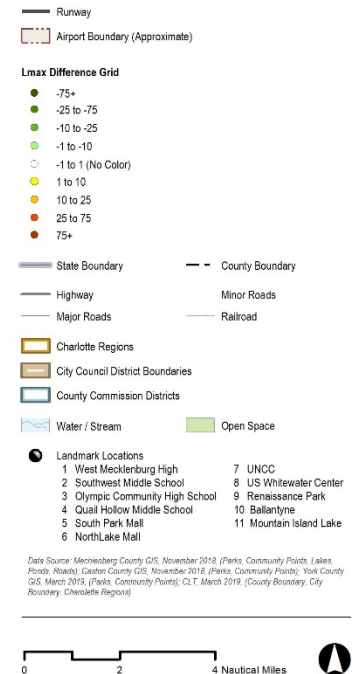
4-mile downwind

Number of Noise Events Above 70 dB (N70) Analysis: Difference – 2018 Operations with 4-Mile Alternating Downwind Compared to Baseline

N70 Difference Interval (Events)	Count of Grid Points / % Change	Count of Population / % Change
Less than -75	0 / 0.0%	0 / 0.0%
-75 to -25	32 / 0.5%	5,740 / 0.8%
-25 to -10	78 / 1.2%	5,467 / 0.7%
-10 to -1	400 / 6.3%	35,959 / 4.9%
-1 to 1	4,464 / 70.8%	533,667 / 72.4%
1 to 10	1,106 / 17.6%	134,039 / 18.2%
10 to 25	161 / 2.6%	13,701 / 1.9%
25 to 75	60 / 1.0%	8,212 / 1.1%
Greater than 75	0 / 0.0%	0 / 0.0%
Total	6,301 / 100.0%	736,785 / 100.0%



Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Altitude Based Turns with
4-Mile Alternating Downwind Compared to
Baseline Operations



- 510 Grid points (8.0%) / 47,166 people (6.4%) would experience fewer events above 70 dB Lmax with 4-mile alternating downwind
- 1,327 Grid points (21.2%) / 155,952 people (21.2%) would experience more events above 70 dB Lmax with 4-mile alternating downwind

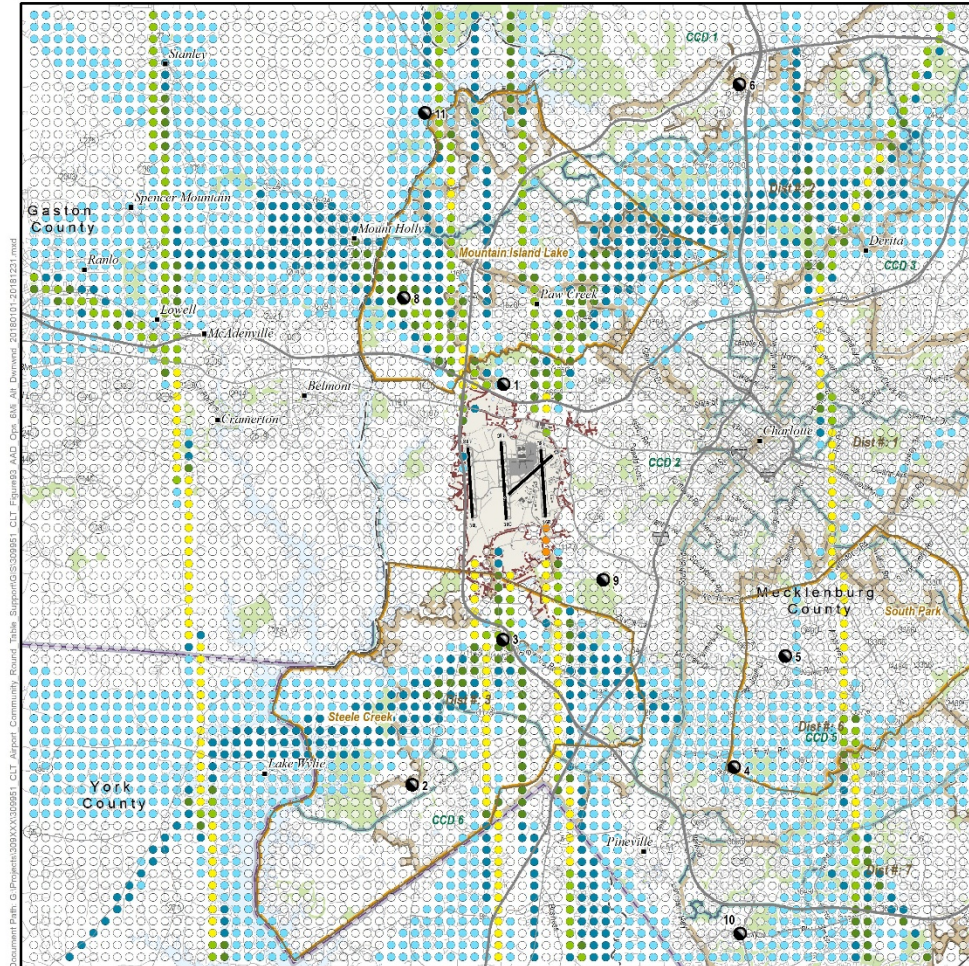
ACR Slate Recommendation Analysis: 2018 Operations with 4-Mile Alternating Downwind Observations

- Number of average daily overflight:
 - A greater number of grid points and more people experienced an increase than decrease
- Number of noise events greater than 70 dB (N70)
 - A greater number of grid points and more people experienced an increase than decrease
- Use of a 4 nautical mile alternating downwind provides the greatest benefits for areas under the current downwind at 5 nautical miles, and least benefit for areas inside (closer to the airport) of the current 5 nautical mile downwind
- Potential noise reductions in the central portions of the grid and noise increases in the western portion of the grid for the community of South Park
- Potential noise reductions in the western portions of the grid and noise increases in the central and eastern portions of the grid for the community of Steele Creek
- Potential noise reductions and increases occur at varying grid areas of the community of Mountain Island Lake
- Dispersion would remain roughly the same compared to baseline operations

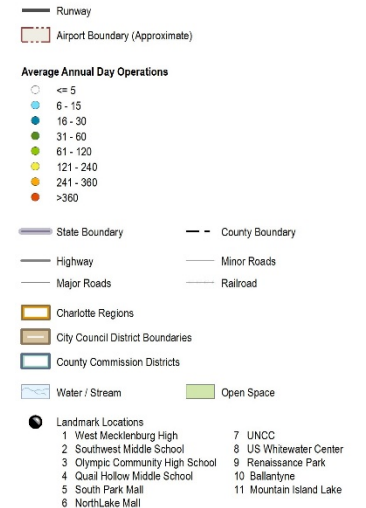


Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 6-Mile Alternating Downwind

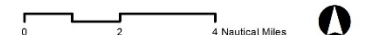
Overflight Interval (Operations)	Count of Grid Points	Count of Population
Less than 5	3,589	437,835
6-15	1,715	183,321
16-30	498	59,377
31-60	160	20,033
61-120	177	18,229
121-240	159	17,984
241-360	3	6
Greater than 360	0	0
Total	6,301	736,785



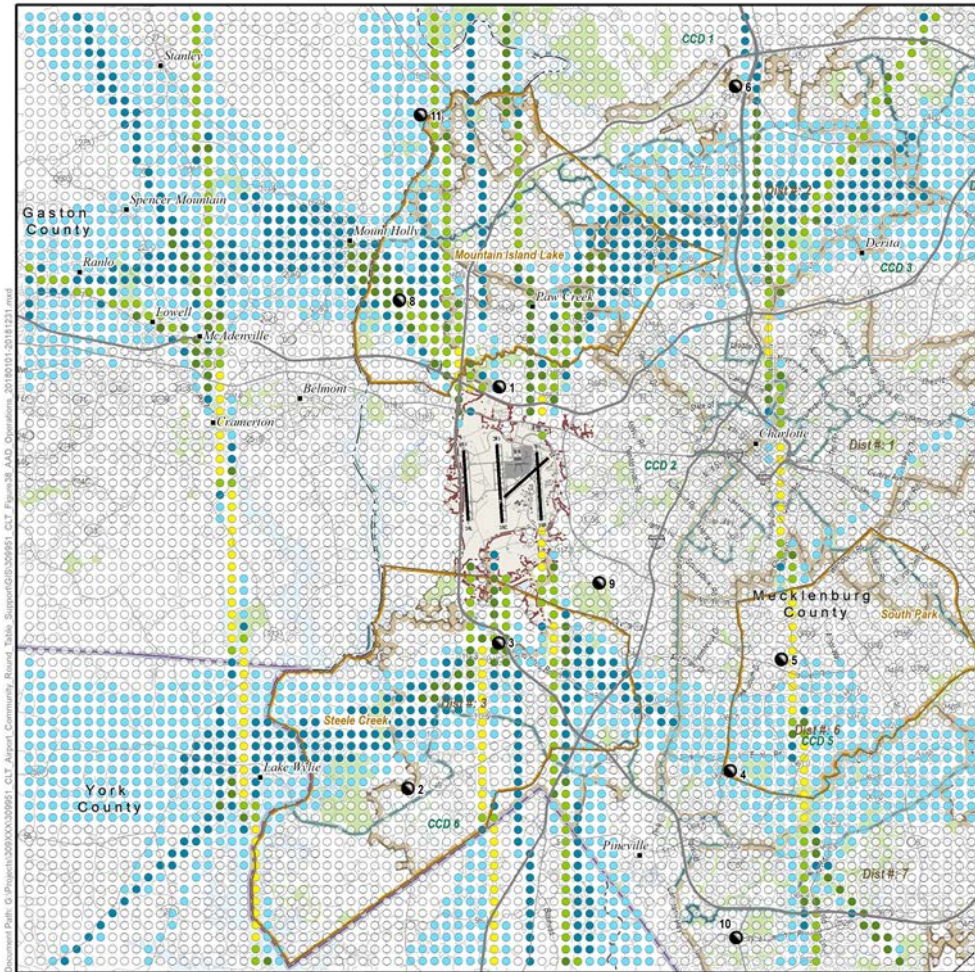
Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with
6-Mile Alternating Downwind



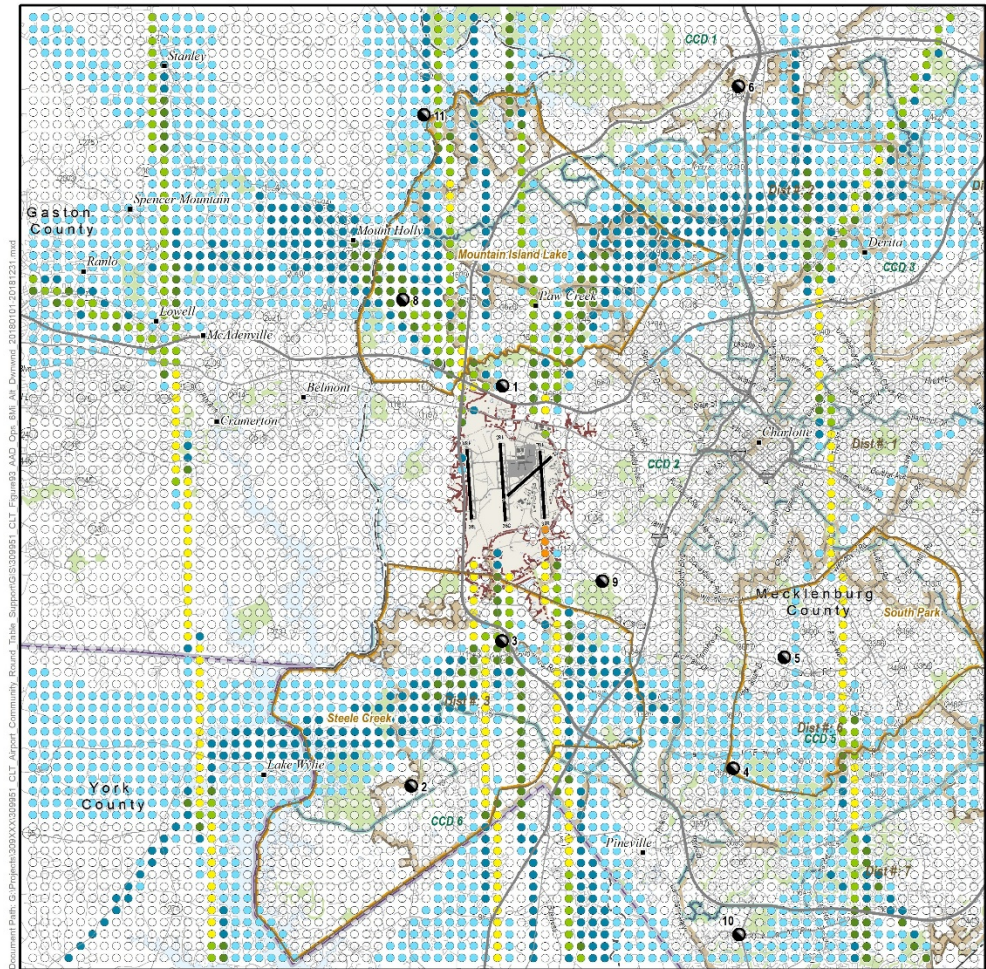
Data Source: Mecklenburg County GIS, November 2013; (Parks, Community Points, Lakes, Roads, Railroads) Gaston County GIS, November 2013; (Parks, Community Points, York County GIS, March 2013; (Parks, Community Points); CLT, March 2019; (County Boundary, City Boundary, Charlotte Regions)



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 6-Mile Alternating Downwind Compared to Baseline



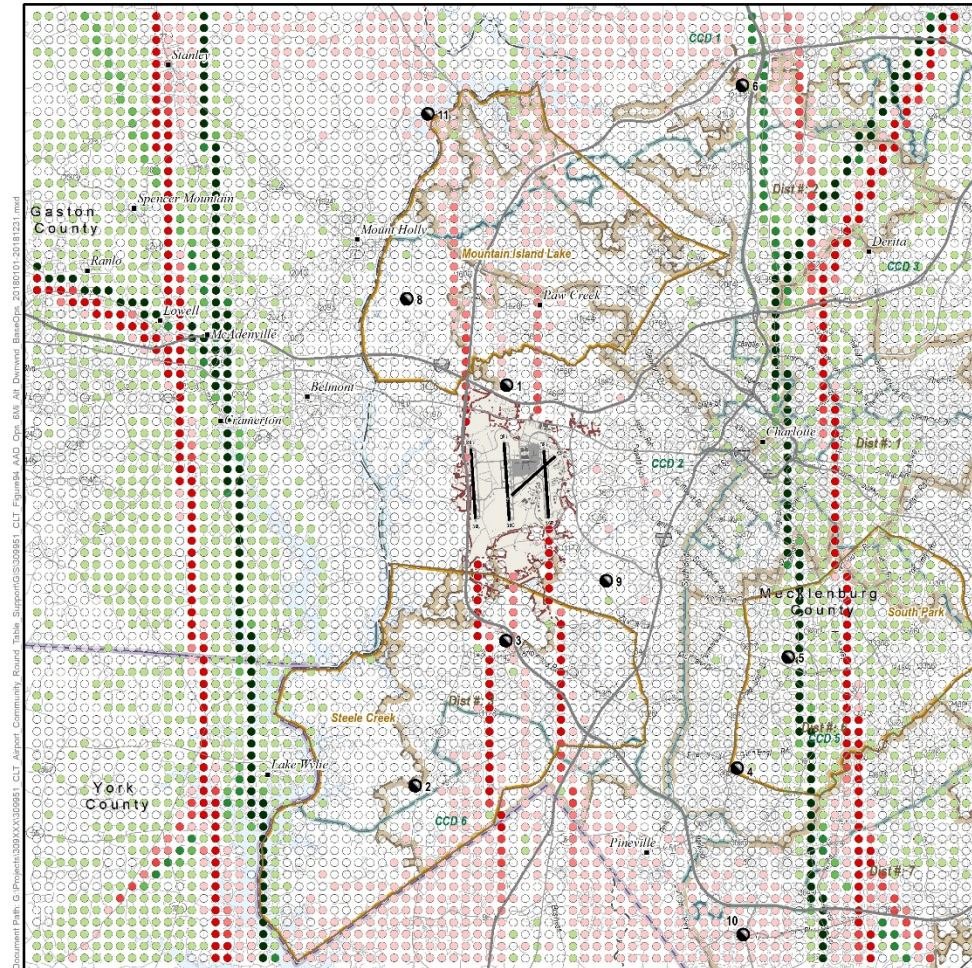
Baseline



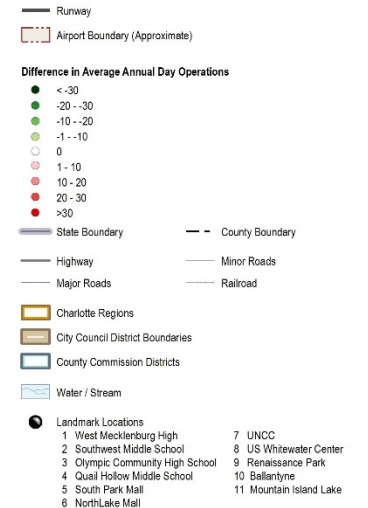
6-mile downwind

Annual Average Day Aircraft Overflights Analysis: Difference – 2018 Operations with 6-Mile Alternating Downwind Compared to Baseline

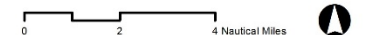
Overflight Interval (Operations)	Count of Grid Points / % Change	Count of Population / % Change
Less than -30	201 / 3.2%	26,222 / 3.6%
-30 to -20	51 / 0.8%	4,167 / 0.6%
-20 to -10	50 / 0.8%	3,780 / 0.5%
-10 to -1	252 / 4.0%	19,548 / 2.7%
-1 to 1	4,529 / 71.9%	557,193 / 75.6%
1 to 10	824 / 13.1%	77,360 / 10.5%
10 to 20	83 / 1.3%	9,393 / 1.3%
20 to 30	66 / 1.0%	7,924 / 1.1%
Greater Than 30	245 / 3.9%	31,198 / 4.2%
Total	6,301 / 100.0%	736,785 / 100.0%



Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with
6-Mile Alternating Downwind Compared to
Baseline Operations



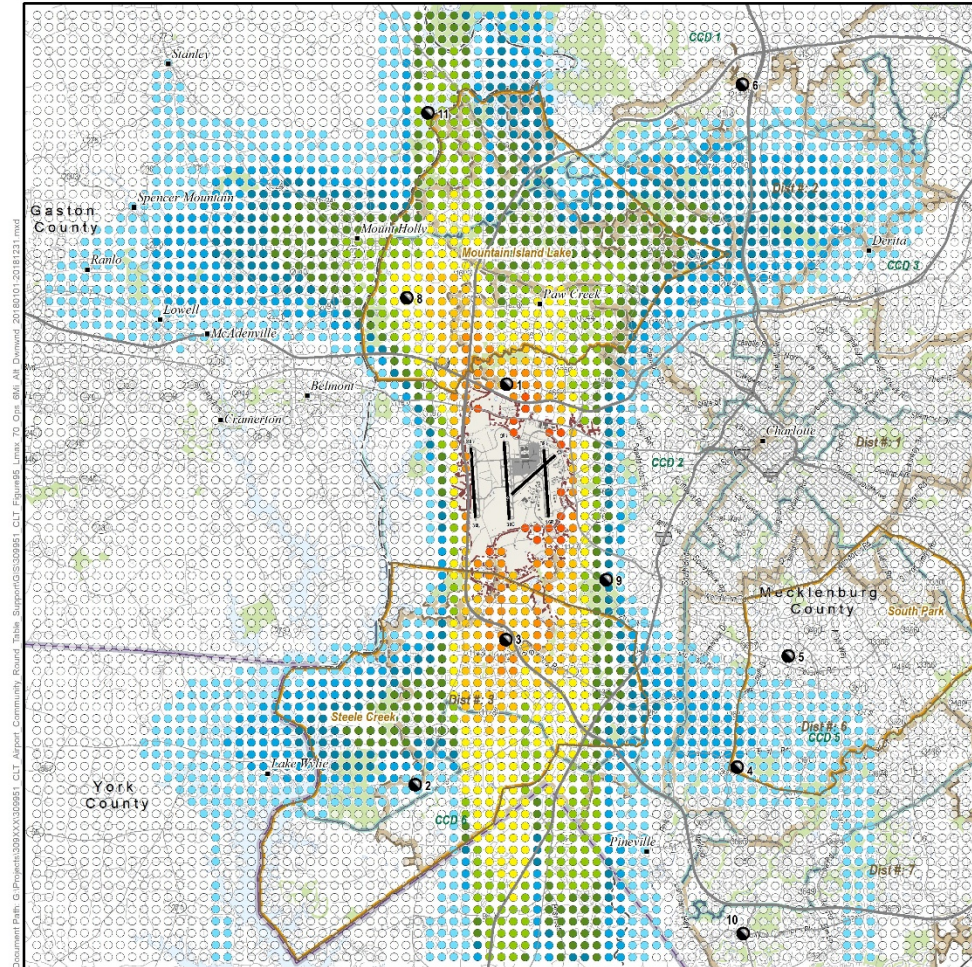
Data Source: Mecklenburg County GIS, November 2013; (Parks, Community Points, Lakes, Roads, Railroads) Gaston County GIS, November 2018; (Parks, Community Points, York County GIS, March 2013; (Parks, Community Points); CLT, March 2019; (County Boundary, City Boundary, Charlotte Regions)



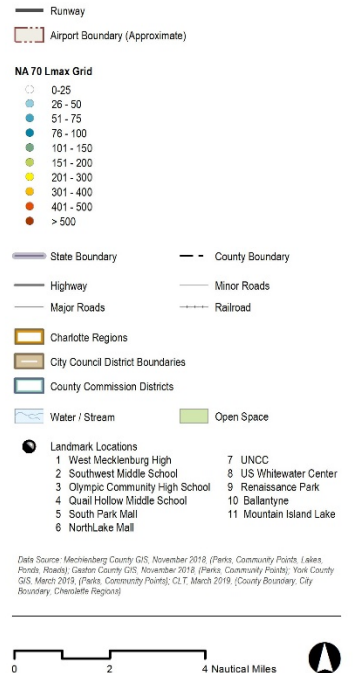
- 554 Grid points (8.8%) / 53,717 people (7.4%) would experience reduced numbers of overflights with 6-mile alternating downwind
- 1,218 Grid points (19.3%) / 125,875 people (17.1%) would experience increased numbers of overflights with 6-mile alternating downwind

Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with 6-Mile Alternating Downwind

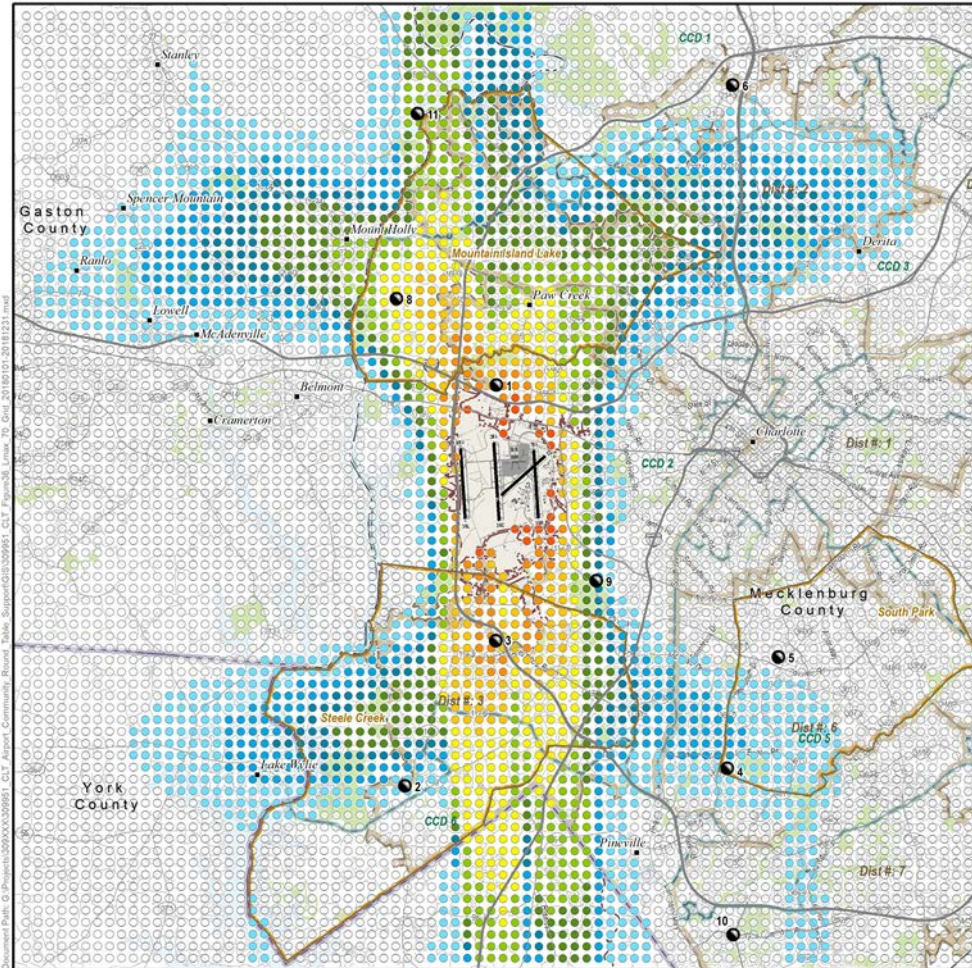
N70 Interval (Events)	Count of Grid Points	Count of Population
25 or Less	3,500	434,463
26-50	956	112,071
51-75	467	56,955
76-100	314	30,847
101-150	341	38,672
151-200	271	23,240
201-300	216	22,155
301-400	146	13,709
401-500	73	4,371
Greater than 500	17	302
Total	6,301	736,785



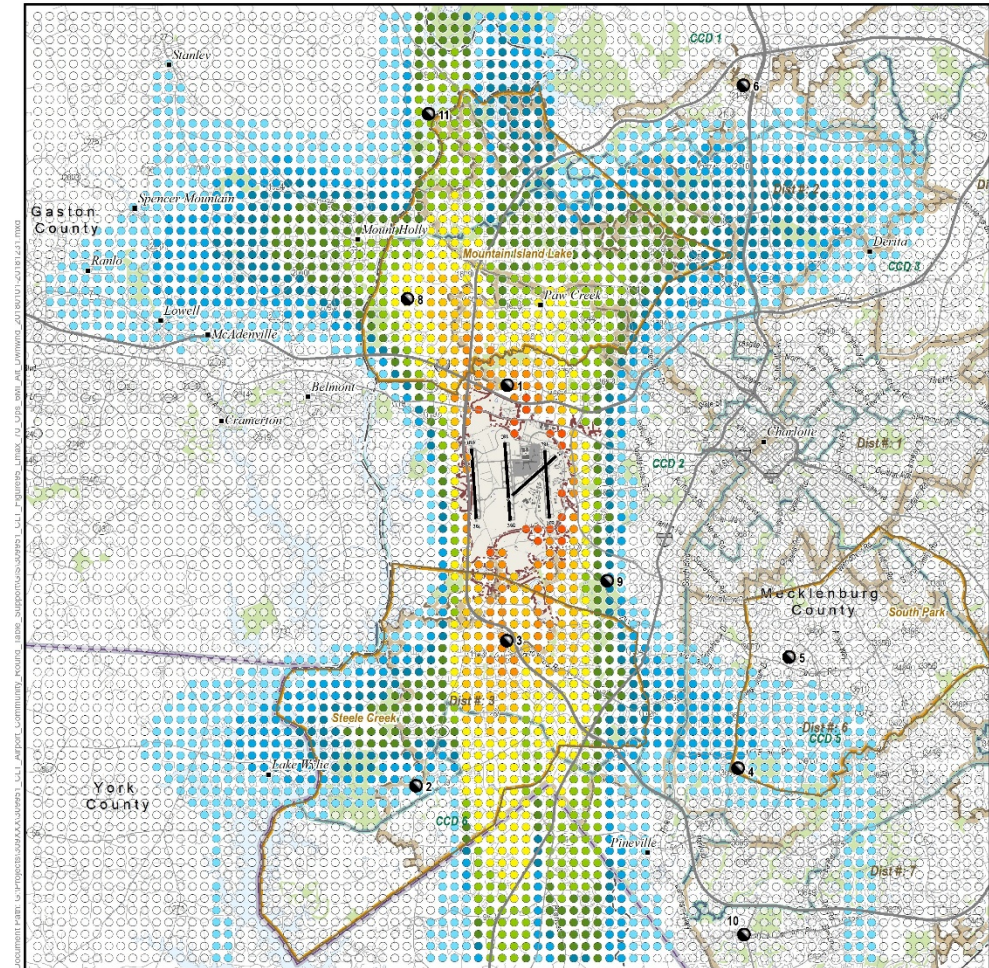
Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with
6-Mile Alternating Downwind



Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with 6-Mile Alternating Downwind Compared to Baseline



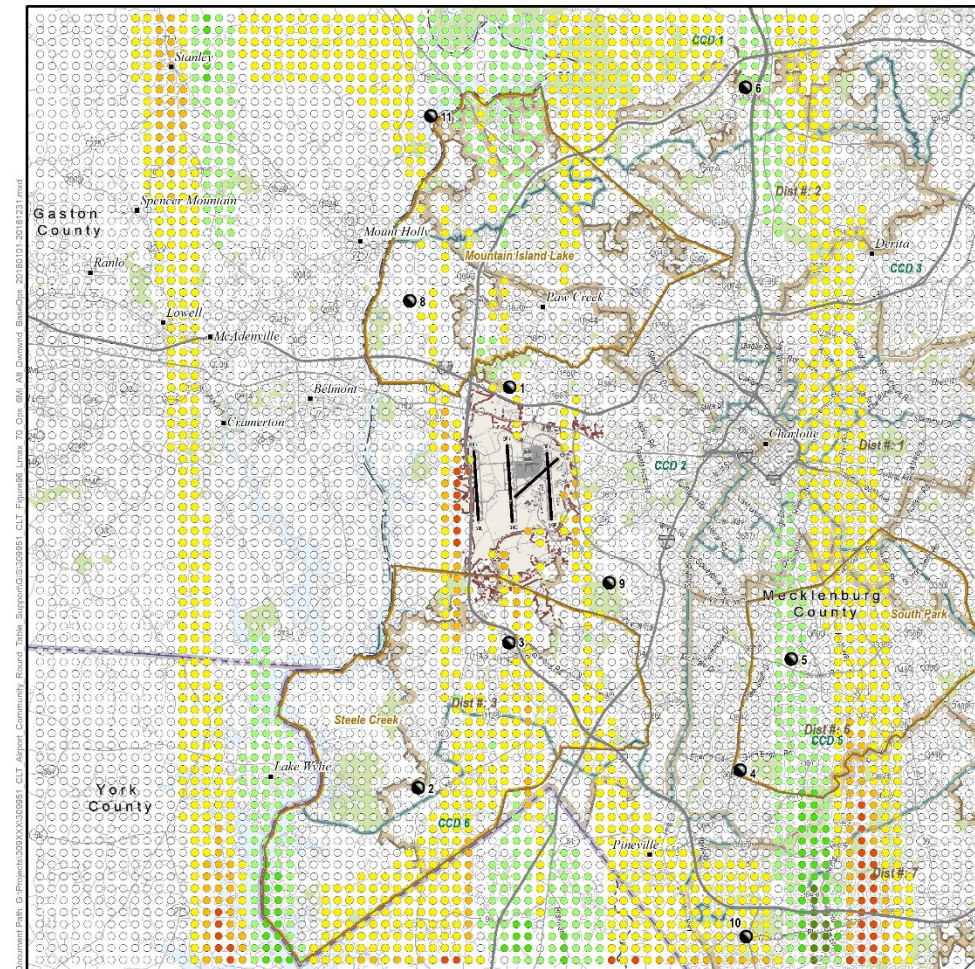
Baseline



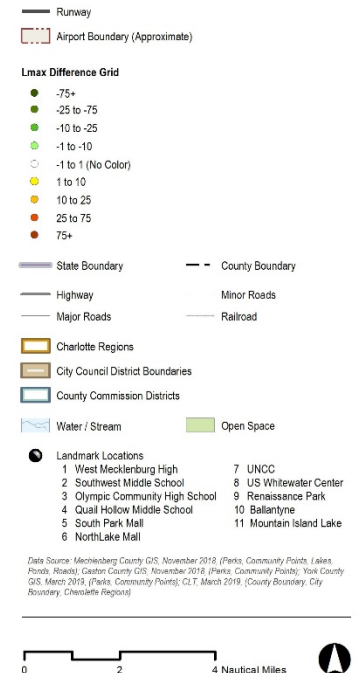
6-mile downwind

Number of Noise Events Above 70 dB (N70) Analysis: Difference – 2018 Operations with 6-Mile Alternating Downwind Compared to Baseline

N70 Difference Interval (Events)	Count of Grid Points / % Change	Count of Population / % Change
Less than -75	0 / 0.0%	0 / 0.0%
-75 to -25	11 / 0.2%	2,485 / 0.3%
-25 to -10	66 / 1.0%	6,452 / 0.9%
-10 to -1	507 / 8.0%	47,934 / 6.5%
-1 to 1	4,157 / 66.0%	515,044 / 69.9%
1 to 10	1,364 / 21.6%	142,419 / 19.3%
10 to 25	153 / 2.4%	16,573 / 2.2%
25 to 75	43 / 0.7%	5,878 / 0.8%
Greater than 75	0 / 0.0%	0 / 0.0%
Total	6,301 / 100.0%	736,785 / 100.0%



Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Altitude Based Turns with
6-Mile Alternating Downwind Compared to
Baseline Operations



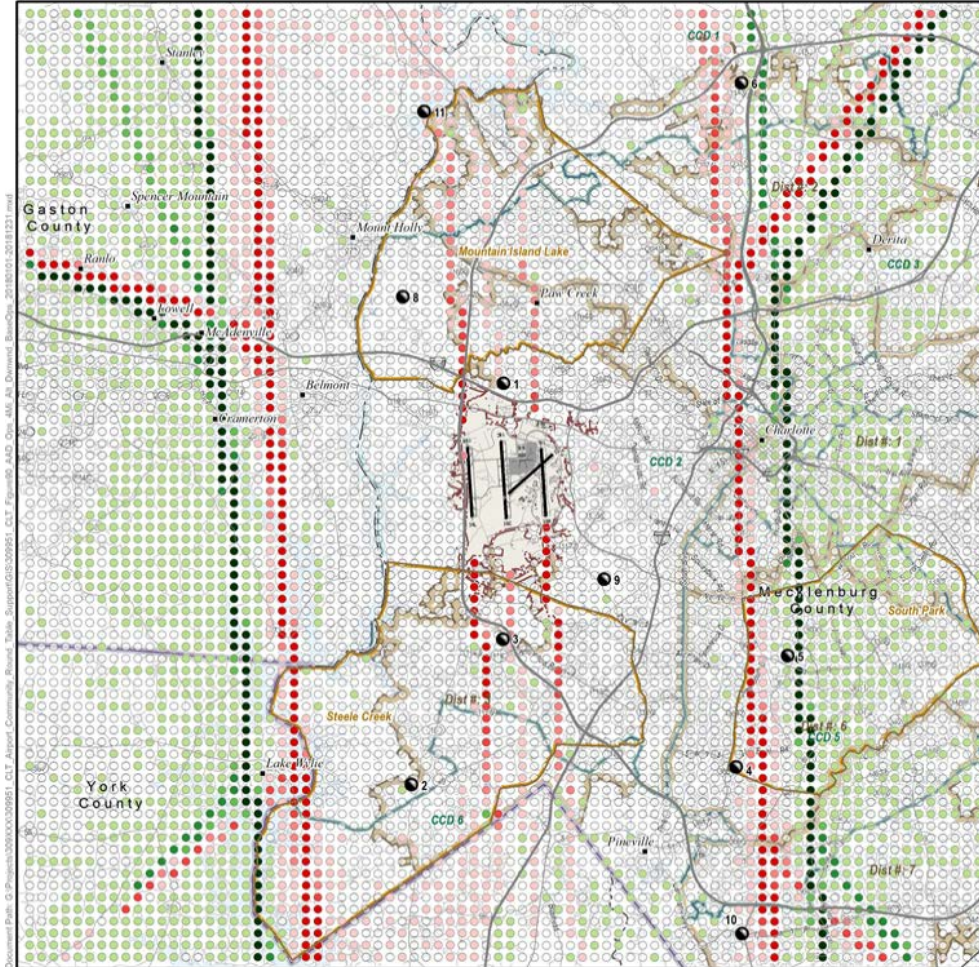
- 584 Grid points (9.2%) / 56,871 people (7.7%) would experience fewer events above 70 dB Lmax with 6-mile alternating downwind
- 1,560 Grid points (24.7%) / 164,870 people (22.3%) would experience more events above 70 dB Lmax with 6-mile alternating downwind

ACR Slate Recommendation Analysis: 2018 Operations with 4-Mile Alternating Downwind Observations

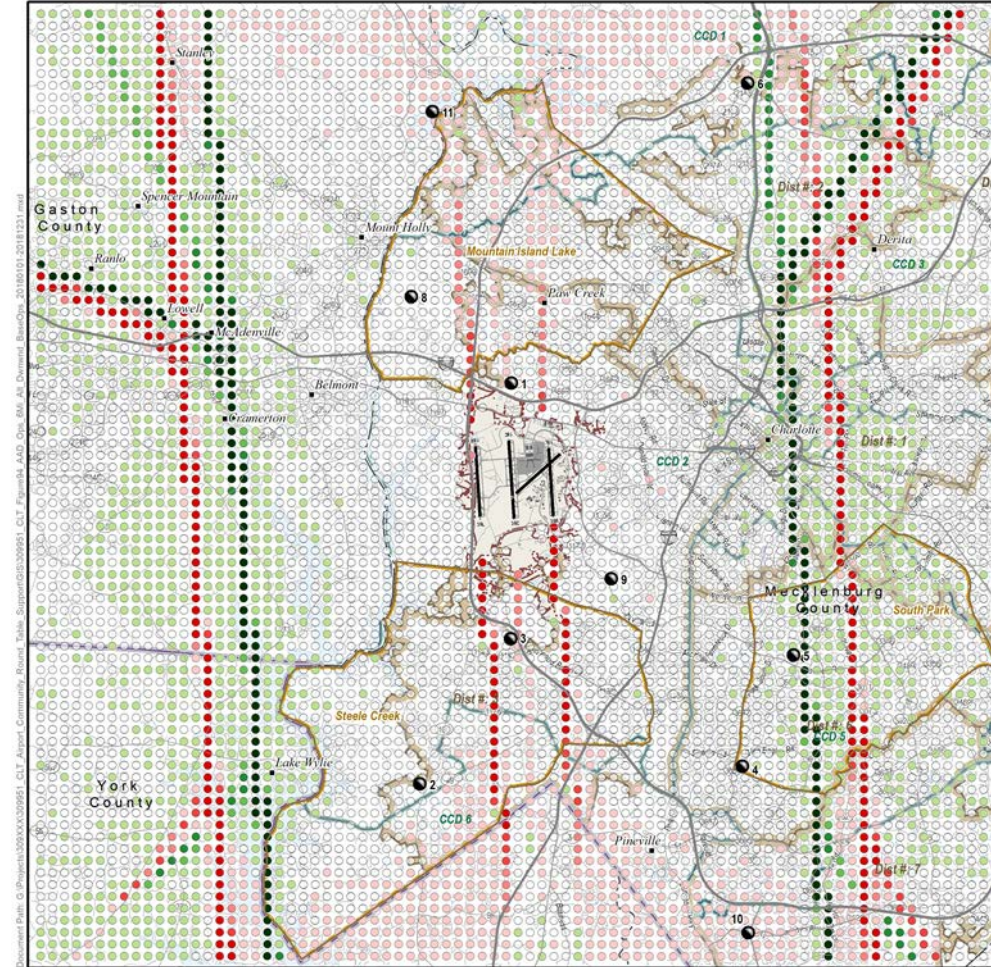
- Number of average daily overflight:
 - A greater number of grid points and more people experienced increases in overflights than decreases
- Number of noise events greater than 70 dB (N70)
 - A greater number of grid points and more people experienced an increase than decrease
- Use of a 6 nautical mile alternating downwind provides the greatest benefits for areas under the current downwind at 5 nautical miles, and least benefit for areas inside and outside (closer and further from the airport) of the current 5 nautical mile downwind
- Potential noise reductions and increases in the central portions of the grid for the community of South Park
- Potential noise reductions in the western portions of the grid and noise increases in the central and eastern portions of the grid for the community of Steele Creek
- Potential noise reductions and increases occur at varying grid areas of the community of Mountain Island Lake
- Dispersion would remain roughly the same compared to baseline operations



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with Alternating Downwind Distances Compared to Baseline



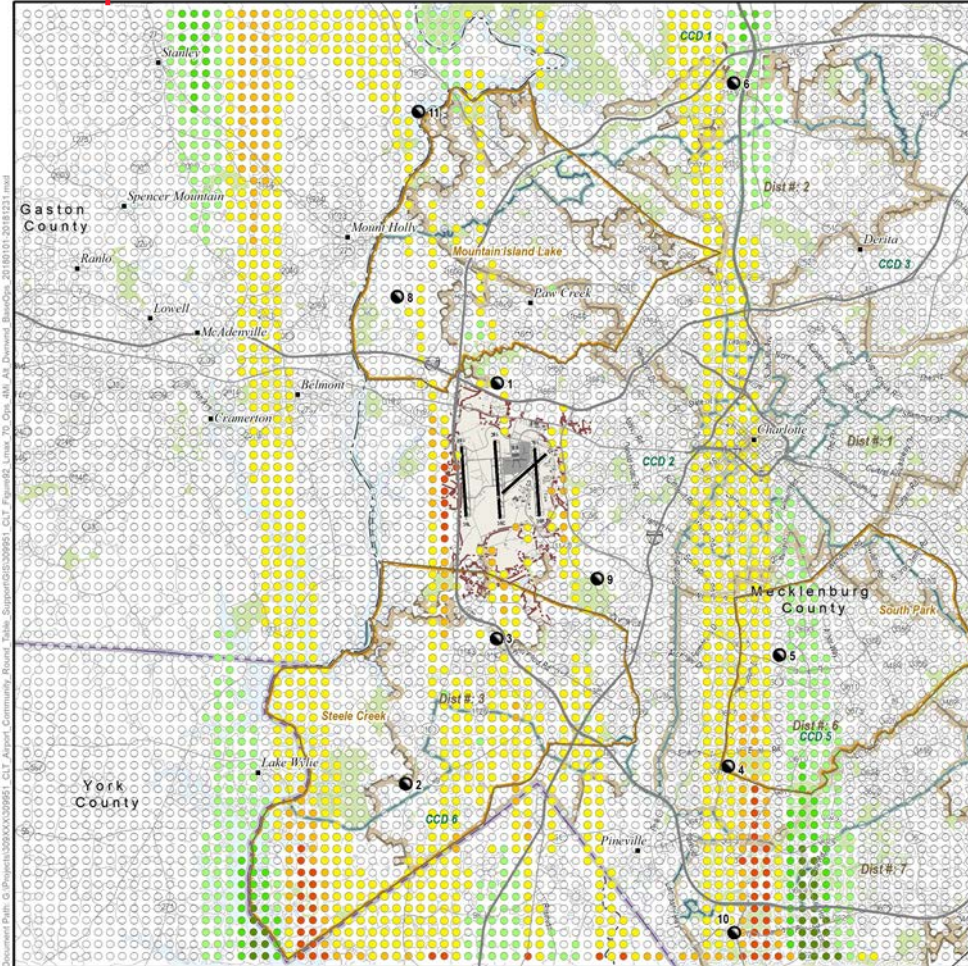
4-mile downwind



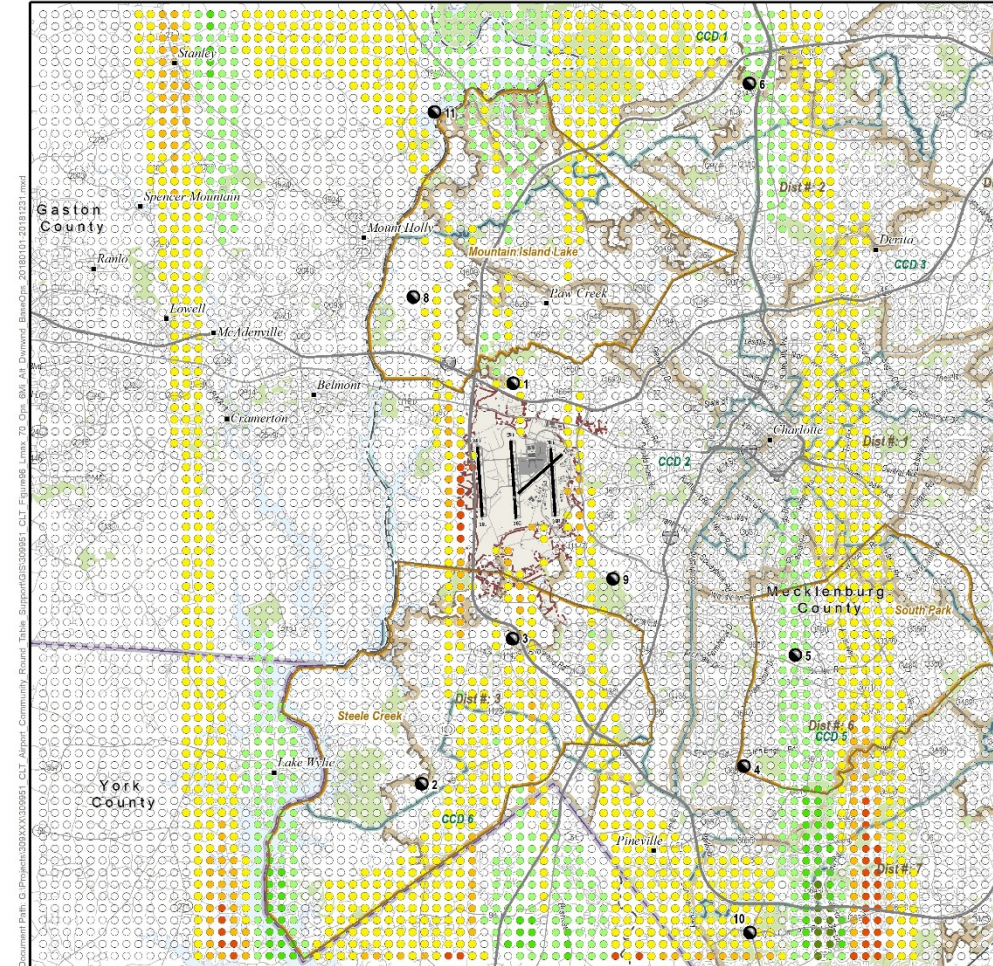
6-mile downwind



Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with Alternating Downwind Distances Compared to Baseline



4-mile downwind



6-mile downwind

ACR Slate Recommendation Analysis: 2018 Operations with Altitude Alternating Downwind Distances Overall Observations

- Alternating downwind distances may result in increases in noise levels to a greater number of grid points and population than would experience decreases compared to baseline operations based on the current grid point analysis size and a 3-year rotation period
- As the distance of the downwind changes the potential number of grid points and population increases that would potentially be exposed to increased noise levels
 - During the year where a 4 nautical mile downwind was used, areas closer to the airport would experience the least benefit
 - During the year where a 6 nautical mile downwind was used, areas further to the airport would experience the least benefit
- Areas under the current location of the downwind would experience the greatest benefit as they would experience reduced noise levels during the years where the 4 and 6 nautical mile downwind are used
- Rotating the location of the downwind legs for CLT arrivals would result in exposing new areas to aircraft noise and would likely result in community reaction to these changes



ACR Slate Recommendation Analysis: Alternating Downwind Distances Overall Analysis Considerations for the ACR

- Do the reported changes from the 2018 baseline to the implementation of alternating the downwind distance meet the goals of the ACR?
- How does the potential negative effect of alternating the downwind distance on air traffic controller training, FAA publication cycles, environmental concerns, and associated impacts on Industry factor in to the ACR recommendations for alternating the downwinds?
- Does the ACR want to recommend implementation of alternating downwind distances for consideration of the final slate?

Discussion