NOISE MITIGATION REPORT
April 6, 2007

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Table of Contents

List of Tables

List of Figures

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Background

In its effort to increase the efficiency and reliability of the airspace structure and Air Traffic Control (ATC) system while maintaining safety, the FAA has proposed to redesign the airspace in the NY/NJ/PHL Metropolitan Area. To that end, the FAA published a Draft Environmental Impact Statement (DEIS) in December of 2005 which presented an evaluation of the environmental effects of the NY/NJ/PHL Metropolitan Area Airspace Redesign (Airspace Redesign) project alternatives in accordance with the National Environmental Policy Act of 1969 (NEPA). The FAA did not identify a preferred alternative in the DEIS document, preferring to wait until the public comments could be gathered and considered as part of the preferred alternative identification process.

The publishing of the DEIS document on December 20, 2005 marked the opening of an extensive public comment period that spanned some 181 days and ended on July 1, 2006. Subsequent to the publishing of the DEIS, a series of 30 public meetings were conducted throughout the Study Area. These meetings began in February 2006 and were concluded in early May of 2006. Both written and oral comments were taken at these hearings. In addition, written comments were accepted throughout the comment period via letter or electronic submittal.

Throughout the course of the public meetings and the comment period, the FAA committed to the development of a noise mitigation package to alleviate, to the extent possible, the impacts associated with the selected preferred alternative. On March 23, 2007 the FAA announced the identification of the Integrated Airspace Alternative Variation with Integrated Control Complex (ICC) as the Preferred Alternative. Noise mitigation measures were considered and evaluated based on the Preferred Alternative per FAA's commitment.

Introduction

This report presents an overview of the evaluation of various noise abatement measures considered as potential mitigation of the noise impacts associated with FAA's Preferred Alternative: The Integrated Airspace Alternative Variation with ICC. A general overview of the methodology used to evaluate the mitigation alternatives is presented and is followed by a detailed discussion of the preferred mitigation package along with the results of the noise modeling of the mitigation package.

The Integrated Airspace Alternative Variation with ICC is anticipated to be implemented in two phases. In the near-term, some of the elements of the alternative would be implemented initially, while complete implementation of the ICC elements would take longer. This was addressed in the DEIS with the analysis of the Integrated Airspace Alternative Variation without ICC for the 2006 condition and the Integrated Airspace Alternative Variation with ICC for the 2011 condition. Although mitigation packages were developed for both variations or phases, the mitigation of the variation without ICC is a subset of the mitigation elements for the variation with ICC. Thus, with a couple of minor exceptions which are noted, the detailed discussion of the Integrated Airspace Alternative Variation with ICC mitigation elements presented later in this report serves to address the details of both variations. The results of the noise analysis are discussed by airport and individual procedure where appropriate. Finally, the overall results for the entire study area are presented and compared to the results of the Preferred Alternative without mitigation as well as the Future No Action Airspace Alternative as required by the National Environmental Policy Act (NEPA).

While reviewing this document and considering the results of the noise mitigation analysis, it should be noted that there have been some minor changes in the noise analysis methodology since the publishing of the DEIS. These changes were a direct result of comments received on the DEIS and reflect a modest refinement in the methodology.

The first refinement affects the noise modeling itself. Specifically, the issue relates to how the Noise Integrated Routing System (NIRS) model handles multiple airports with differing airfield and runway elevations in a large study area. NIRS relates all aircraft flight profiles (arrival & departure) to the NIRS Study Center elevation, which was set at 22 feet at LaGuardia (LGA) for this project. At the same time, the model uses the US Geological Survey terrain data to correctly place the noise receptors (population centroids or grid points) at the correct ground elevation throughout the study area. Some airports in the study, such as Westchester County (HPN) and Stewart (SWF), have airfield elevations that are substantially different (+400') than the 22' elevation near LGA, JFK, Newark (EWR), and Philadelphia (PHL). Thus as the NIRS model departs and lands aircraft at the Study Center elevation of 22 feet, some centroids near these airport may be exposed to aircraft passing at unusually small slant-range (line-of-sight) distances. For any centroid that is located in just the right place this could mean that the noise exposure levels at that centroid for both the Future No Action and alternative conditions would be higher than would be expected. The refined NIRS runs used in this analysis incorporate various airport elevations to more closely model these differences at the higher elevation airports. This refinement does not affect the results portrayed in the DEIS based on the comparisons between the No Action scenarios and the alternatives. In fact, this refinement generally results in a slight reduction in computed noise levels near these higher elevation airports.

The second refinement in the noise methodology affects the way noise impacts are tallied. Specifically, the DEIS used the internal NIRS software calculation methodology to identify impact based on FAA's noise impact threshold. The original computations in the DEIS are based on using the computed noise values out to 6 decimal places. Thus, a centroid whose noise value was 64.999998 DNL would not be considered in the 65 DNL range. However, noise spreadsheets provided to the public via the project website included noise values for all population centroids within the Study Area rounded to one decimal place. Consequently, the centroid that was 64.999998 DNL in NIRS became 65.0 in the spreadsheets. This led to confusion for those who used the spreadsheets to compute the number of centroids/persons exposed to change at FAA's threshold levels. Often the spreadsheet computation did not match what was in the DEIS as computed by the NIRS software. The FAA received numerous comments to this effect and has decided to present the results of the analysis in the Final EIS document based on rounding to one decimal place. Similarly, the analysis presented in this report is based on rounding to one decimal place. It should be noted that this change in methodology only results in slightly more impacts and not less. The rounding to one decimal place generally makes no difference at most points, but some that were very close to the thresholds are indeed tipped into the category of a FAA threshold based impact. A specific example is located about six miles northwest of HPN near Pleasantville, NY where a single population centroid was tipped into the +5 DNL change within a 45-60 DNL area for the Integrated Airspace Alternative Variation with ICC in 2011.

General Methodology

This section presents an overview of the process and methods by which various noise mitigation procedures were identified and evaluated. A summary of each step in the process is provided along with a discussion of the results of each step. The process begins with the development of a comprehensive list of potential mitigation measures and concludes with a final mitigation package that is both operationally feasible and likely to provide reductions in noise impacts as compared to the unmitigated Preferred Alternative.

Noise Mitigation Measures Considered

After the public comment period closed for the DEIS in July of 2006, all comments received were organized and categorized for response in the Final EIS document. As part of this process, any comment that discussed a potential noise mitigation measure was flagged and grouped for review by the FAA team. There were over 450 such comments considered. At the same time, the FAA reviewed both the threshold-based noise impacts presented in the DEIS and the raw noise changes throughout the Study Area to identify the areas where mitigation actions might provide some benefit. Potential mitigation measures were then identified that might improve the noise condition in those areas. The results of this review process were combined with the public comments related to mitigation to develop an initial list of potential mitigation measures. As would be expected, many of the mitigation comments focused on similar issues and techniques and some of these were similar to the ideas that were generated separately by the FAA. While some ideas from the public comments were immediately identified as infeasible due to operational constraints or safety concerns, others required further discussion and/or analysis to determine their operational viability. **Table 1** presents a summary of the mitigation items that passed the initial screening.

The table identifies the traffic or airport that would be affected by the mitigation measure, the measure, what design alternative it would apply to, the approximate geographical area that might be affected by the measure, and the category of the measure. As the mitigation categories indicate, the FAA considered measures in all areas, not just those areas that experienced a significant impact or a slight to moderate threshold-based noise change as reported in the DEIS. Consideration was given to measures that would affect areas of noise increase that did not receive a significant or slight to moderate noise increase, as well as long standing issues that may be improved with this airspace redesign opportunity.

Table 1
Initial Mitigation Strategies Considered

Traffic/Airport/ Runway	Mitigation Measure	Alternative	Applicable Area	Mitigation Category
Mitigation Category Key: (1) +3 DNL in 60-65 DNL or +1.5 DNL in 65+ DNL, (2) +5 DNL in 45 - 60 DNL, (3) Composite raw noise change map, (4) Other Environmental/Security Concerns, (5) Long standing problems that there's an opportunity to improve				
EWR 22 Departures	220, 240, 260 headings - Do noise analysis and attempt to draw a backbone RNAV departure procedure that utilizes less noise sensitive corridors (i.e., Turnpike, industrial corridor)	Integrated Airspace Alternative Variation with ICC	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Two headings - 190 as it is used today, and 240 to industrial corridor.	Integrated Airspace Alternative Variation with ICC	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Three headings (220, 240, and 260 RNAV) from 7 am to 10 pm, restricted to 190 RNAV from 10 pm to 7 am.	Integrated Airspace Alternative Variation with ICC	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Reduce number of headings from 3 to either 2 or 1.	Modifications, Integrated	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Changing the proposed headings from 220, 240, and 260 degrees to 190, 220, and 240 degrees.	Modifications, Integrated	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Changing the proposed headings from 220, 240, and 260 degrees to 190, 220, and 240 degrees used only when departure delays are more than 15 minutes.	Modifications, Integrated	Elizabeth/Union Co.	1, 2
EWR 22 Departures	190 heading until 15 minute delay, then 190 and 240 degrees until another 15 minute delay, then use 190, 240, and 260.	Integrated Airspace Alternative Variation with ICC	Elizabeth/Union Co.	1, 2
EWR 22 Departures	Changing the proposed headings from 220, 240, and 260 degrees to 195, 200, 215, 240, and 260 degrees with time of day restrictions.	Modifications, Integrated	Elizabeth/Union Co.	1, 2
EWR 22 Departures	RNAV noise sensitive routing (Turnpike departure, Route 28 departure).	Modifications, Integrated	Elizabeth/Union Co.	1, 2, 3
EWR 22 Departures	Changing the proposed headings to less than 190 degrees.	Modifications, Integrated	Elizabeth/Union Co.	1, 2
EWR 22 Arrivals	Increase the altitude.	Integrated Airspace Alternative Variation with ICC	Bergen County	3

Table 1 (Continued)
Initial Mitigation Strategies Considered

Traffic/Airport/ Runway	Mitigation Measure	Alternative	Applicable Area	Mitigation Category
EWR 4 and 22 Arrivals	Increase the altitude.	Integrated Airspace Alternative Variation with ICC	Bergen County & Morris County	3
EWR Departures	Modified nighttime ocean routing 10 pm to 7 am.	Integrated Airspace Alternative Variation with ICC	Elizabeth/Union Co.	1, 2, 3
EWR Departures	NJCAAN RNAV Ocean Routing	Ocean Routing	Newark/Elizabeth/Union Co	1, 2, 3
EWR Departures	Nighttime ocean routing.	Modifications, Integrated	Elizabeth/Union Co.	1, 2, 3
EWR	Expand EWR airspace to the east to allow EWR controllers to run arrivals or departures along the Hudson corridor.	All	Essex/Bergen Co	1, 2, 3
EWR 22 Arrivals	Raise the downwind and move it east, closer to the Airport	Integrated	Morris Co, Sussex Co	2, 3
EWR 22 Departures	Ocean Routing RNAV	All	Newark/Elizabeth/Union Co	1, 2, 3
EWR 4 Departures	Delay left turns off Runway 4 to stay over the Meadowlands	All	North of Newark	5
EWR Arrivals	Continuous Descent Approach	Integrated	Bergen County & Morris County	2, 3
HPN	Increase altitude for arrivals and departures.	All	Westchester County	1, 2, 3
HPN – Runway 34	Implement FMS approach	All	Westchester County	5
HPN Departures	Departures from all runways moved away from the Nuclear Power Plant.	Integrated	Westchester County	4
LGA 31 Departures	Develop RNAV procedures to miss Riker's Island.	Integrated	Riker's Island	1
LGA 31 Departures	Adjust time of day use of headings	Integrated	Riker's Island	1
LGA 22 Arrivals	Arrivals using the LDA or RNAV approach to 22	All	Sound Shore Community	5

Table 1 (continued)
Initial Mitigation Strategies Considered

Traffic/Airport/ Runway	Mitigation Measure	Alternative	Applicable Area	Mitigation Category
LGA	Nighttime Ocean, CDA	All	Brooklyn, Queens, Bronx	5
Overflights	Move V213 over I87 following the thruway.	Future No Action, Modifications, Ocean Routing	Ulster County	5
PHL 9/27	CDA and RNAV	Modifications, Integrated	Delaware Co, Philadelphia Co, Wilmington	3, 5
PHL 9R	Increase use of the visual approach to Runway 9R (the River Approach)	All	Pennsylvania and Delaware	5
PHL 9 Departures	Reduce fanned headings	Integrated Airspace Alternative variation with ICC	Pennsylvania	2
PHL 27 Departures	Reduce the number of dispersal headings indicated in the plans.	Modifications, Integrated	PA, DE, NJ	1, 2
TEB Rwy 19 Arrivals, Runway 1 Departures	Develop GPS approach and departure over commercial area north-northeast of TEB.	All	Hackensack, NJ	5
ISP Departures	Minimize the impact to the wilderness area. Narrow the corridor for ISP south departures.	Integrated Airspace Alternative	Fire Island Seashore	4, 5
TTN Rwy 6 and 24 Departures	Remove altitude restriction of 24 and 6 departures	All	Trenton Mercer Area	5
MMU 23	Change departure heading over Office Complex	All	Morristown Airport	5
JFK 13, 31	Move arrivals over water	All	Jersey Shore/Sandy Hook	5

Operational Evaluation

In order to determine the acceptability of the 38 measures on the initial list, it was necessary to evaluate each of the suggested measures operationally to identify any safety or efficiency issues that could result from the implementation of a measure. This process was performed at two levels. First, a qualitative review and evaluation of each measure was undertaken by Air Traffic Control and Operational Simulation professionals. This evaluation identified measures that were not operationally feasible or raised safety concerns. The second level of evaluation was a quantitative analysis of the remaining measures using the Total Airport & Airspace Modeller (TAAM) model to identify the degree of operational efficiency lost with a given measure. The results and a detailed discussion of this effort are documented in the MITRE report: *Operational Analysis of Mitigation of the New York/New Jersey/Philadelphia Airspace Redesign*, which is published in conjunction with this report and is available on the project Website at http://www.faa.gov/nynjphl_airspace_redesign/.

In general the operational analysis identified several key aspects of some of the viable mitigation measures that would allow them to be operationally feasible. These conclusions are summarized as follows:

- EWR - 3 departure headings are necessary to maintain operational efficiency
- EWR – The use of the 3 headings could be varied throughout the day to minimize noise impact.
- EWR – A modified ocean routing could be used for some late-night departures.
- EWR - Some of the arrival routes could be raised to reduce noise.
- EWR – Continuous Descent Approach (CDA) procedures could be used for some arrival routes during the nighttime hours.

- PHL – A minimum of 3 departure headings are necessary to maintain operational efficiency.
- PHL – The current single heading departure procedure could be used during the nighttime hours given the forecast traffic levels.
- PHL – The river approach to Runway 9L could be used more to reduce noise.
- PHL – CDA procedures could be used for some arrival routes during the nighttime hours given the forecast traffic levels.

- LGA – The use of the new departure headings could be varied throughout the day to minimize noise impact.
- LGA – The LDA approach procedure to Runway 22 could be used more as an RNAV procedure.

- HPN – Departures to the northwest could be routed more like No Action to reduce noise impacts.

These factors provided a general framework in which the specific mitigation measures could be developed for noise reduction. **Table 2** presents a list of the mitigation measures that survived the operational screening and were considered to be potentially viable measures. Some of the measures on this list are unique and as such were incorporated directly into the final mitigation package analysis without further screening. Other measures, however, had several options and required further noise screening to identify the best option in terms of noise reduction for the final mitigation package. The measures from **Table 1** that do not appear in **Table 2** were rejected based on the operational evaluation.

Table 2
Initial Mitigation Measures Retained for Noise Screening

Airport/ Runway/ Procedure	Mitigation Measure	Next Step
EWR 22 Departures	Find the 3 best headings using the same route weightings as defined in the Preferred Alternative.	Noise Screening
	Using the 3 best headings found above, move all night events to a modified ocean routing procedure	Noise Screening
	Using the 3 best headings defined above; change the proportion of use such that weightings reflect usage based on a 15 minute delay threshold.	Noise Screening
EWR 4 and 22 Arrivals	Raise all arrival altitudes as much as possible.	Include in final package
EWR Arrivals	Nighttime Continuous Descent Approach (2) for the fixes on the final approach side of the airport depending on direction of flow.	Include in final package
HPN Departures	Move departure routes to be more like No Action routes NW of the airfield	Include in final package
LGA 31 Departures	Adjust time of day use of headings	Include in final package
LGA 22 Arrivals	Increase arrivals using the LDA or approach to 22 through RNAV procedure	Include in final package
PHL 9R/27L Arrivals	Develop CDA routes from 3 primary arrival fixes.	Include in final package
PHL 9R Arrivals	Increase use of the visual approach to Runway 9R (the River Approach) through an RNAV overlay.	Include in final package
PHL 27L/R Departures	Find the 4 best headings using the same day/night split and weightings as defined in the preferred alternative.	Noise Screening
	Using the 4 best headings defined above; change the night time use so that single best heading over the river is only used at night.	Noise Screening
	Find the 3 best headings using the same day/night split and weightings as defined in the preferred alternative.	Noise Screening
	Using the 3 best headings defined above; change the night time use so that single best heading over the river is only used at night.	Noise Screening
PHL 9L/R Departures	Find the 4 best headings using the same day/night split and weightings as defined in the preferred alternative.	Noise Screening
	Using the 4 best headings defined above; change the night time use so that single best heading over the river is only used at night.	Noise Screening
	Find the 3 best headings using the same day/night split and weightings as defined in the preferred alternative.	Noise Screening
	Using the 3 best headings defined above; change the night time use so that single best heading over the river is only used at night.	Noise Screening
ISP Departures	Minimize the impact to the wilderness area south of airport. Narrow the corridor for ISP south departures.	Noise screening

Noise Screening

Once it was determined that a mitigation measure would be carried forward for noise screening, the measure was fully vetted to determine the optimal routes and the optimal number of aircraft operations assigned to those routes. Two tools were used during the noise screening process. The Route Optimization and Mitigation Analysis (ROMA) tool was used for the first level of screening to find the best departure headings/routes. The NIRS Screening Tool (NST) was then used to optimize the heading usage.

The ROMA tool provided the capability of testing large and potentially complex sets of aircraft routes to identify the best set for reducing noise. To do this ROMA used rules to generate routes and to describe how the routes could be combined into a set of routes representing a mitigation measure. ROMA then scored each set of routes in order to compare the sets of routes to one another. Ultimately ROMA presented the best set or sets of routes to meet the goal of noise reduction. During the mitigation process ROMA was primarily used to identify the best departure headings for both EWR and PHL. These results were then used within the NST or combined with land use data to assist in identifying the final proposed routes.

The NST is a screening level application designed to provide guidance in evaluating potential noise impacts as a result of changes in airport arrival and departure routes. In this instance, NST was used to compare the affects of assigning different numbers of aircraft operation levels to each heading identified by ROMA. By using NST the optimal level of aircraft operations on the ROMA headings were determined. These results were then reviewed and the most effective scenario in terms of noise impact reduction became the basis or template for adjusting the noise model inputs and ultimately calculating the noise results.

The noise screening process was primarily focused on identifying the best departure headings and routes for PHL departures and EWR departures. Below is a summary of the options screened for PHL and EWR.

- PHL Options Analyzed
  - Option 1: Find the optimal 4 departure headings for reducing noise impacts in each direction of flow.
  - Option 2: Find the optimal 3 departure headings for reducing noise impacts in each direction of flow.
  - Both options will include the nighttime use of the current single heading procedure.

- EWR Options Analyzed
  - Option 1: Find the optimal three departure headings for reducing noise impacts.
  - Option 2: Using the three headings identified in option 1, add Nighttime Ocean routing for those operations occurring between 10:30pm and 6:00am.

  - Option 3: Using the option 2 scenario, further reduce the amount of traffic on the three new headings by adding the 190 heading (current procedure) and using it when traffic delay allows. When traffic volume increases during the day, drop the use of the 190 heading in favor of two headings most closely aligned with the runway from option 1. During periods of maximum traffic demand, add a third westerly heading from option 1.
  - Options 1-3 were considered for two sets of headings
    - Set 1: consider an additional constraint that the first heading (220) should stay "close" to runway heading to help reduce air traffic control/pilot communication. In this set, we considered headings between 215 & 225 for the first heading.
    - Set 2: remove the constraint on the first heading.

The options for PHL focused on identifying the best initial departure headings and routes for PHL departures. The options for EWR, however, were more complicated in that not only were the best departure routes sought, but variations on the number of aircraft operations using the headings were considered. Consequently, two levels of screening were conducted. The first level sought to identify the best initial departure headings and routes from EWR and PHL. Since no further variations were part of the PHL measures, this level of screening served to complete the evaluation for PHL. Once the best headings/routes were identified for EWR, a second level of screening was employed to test the variations related to the usage of the best headings.

The following points below provide a summary of the route optimization set-up for the PHL departure heading scenarios.

- Starting point
  - No Action 2011 vs. Integrated Airspace Alternative with ICC Variation 2011
  - PHL East & West departure headings were considered (reviewing 3 & 4 heading alternatives)
  - Use 2011 population centroids for impact comparison

- Route Optimization
  - Route variants generated in 1 degree increments for each heading from condensed routes
  - Maintain 15 degrees divergence as required by ATC rules
  - PHL East 3 Headings - 132,000 combinations were considered of which 23,300 passed the rules defined above
  - PHL East 4 Headings - 1.6 million combinations were considered of which 82,500 passed the rules defined above
  - PHL West 3 Headings - 132,000 combinations were considered of which 22,200 passed the rules defined above
  - PHL West 4 Headings - 1.5 million combinations were considered of which 64,700 passed the rules defined above
  - The resulting combinations were ranked by various criteria (noise impact threshold-based change and/or total noise exposure at various DNL levels)

Figure 1 highlights the results of the ROMA analysis for the PHL west flow departure 3-heading scenario. The best noise routes are highlighted in red while the remaining route variations are shown in white.

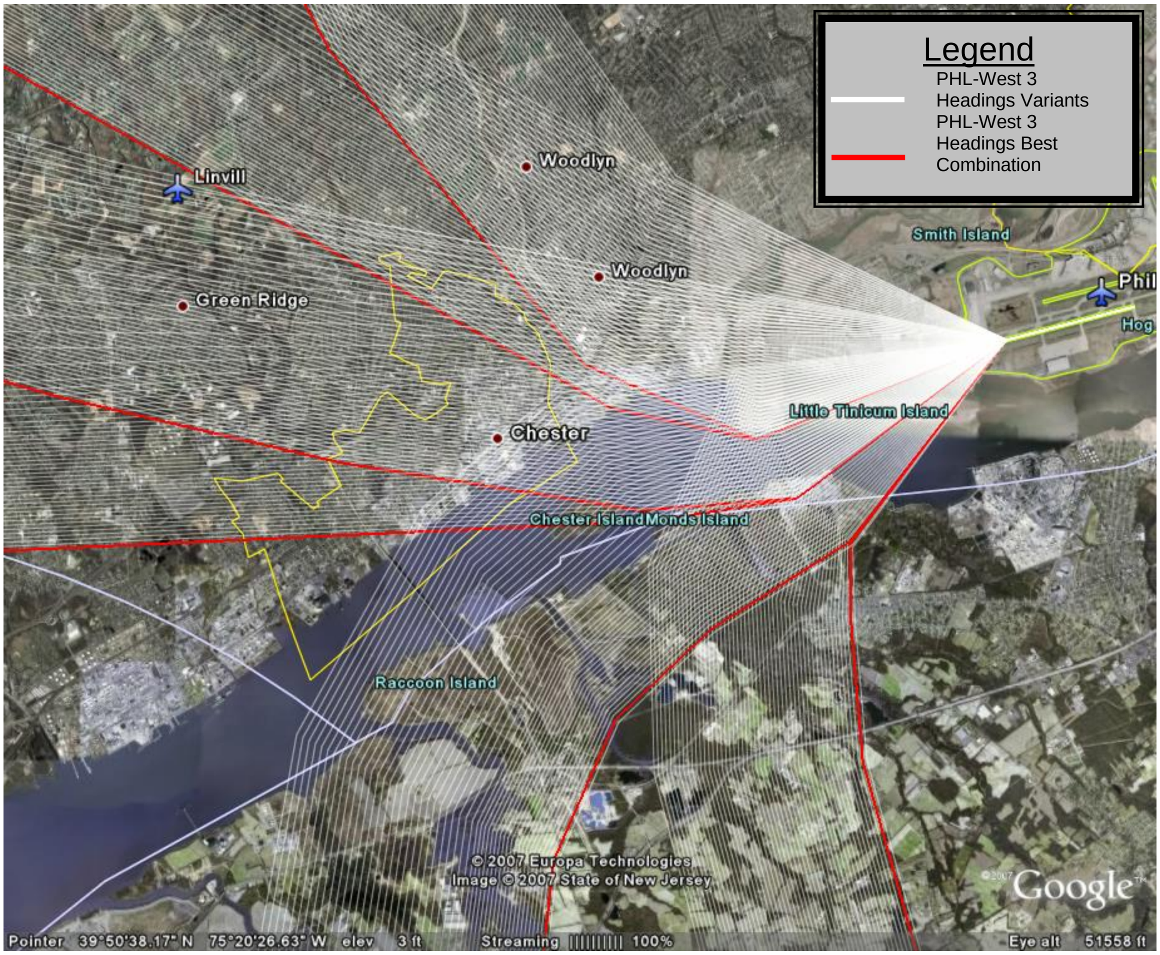

Figure 1: PHL Runway 27 departures 3 best headings with variants

A similar process was conducted for the EWR departure heading variations. The points below provide a summary of the route optimization set-up for those scenarios.

- Starting point
  - No Action 2011 vs. Integrated Airspace Alternative Variation with ICC 2011
  - Only EWR South flow departure headings were considered since the limited use of the north flow headings did not generate noise impacts
  - Use 2011 population centroids for impact comparison

- Route Optimization
  - Route variants generated in 1 degree increments for each heading from condensed routes
  - Maintain 15 degrees divergence as required by ATC rules
  - 69,000 combinations were considered of which 8,400 passed the rules defined above

- The resulting combinations were ranked by various criteria (noise impact threshold-based change and/or total noise exposure at various DNL levels)

Since the PHL scenarios were not as complex as the EWR scenarios, the ROMA analysis was sufficient to identify the best set of headings for inclusion into the final mitigation package. At EWR however, the ROMA analysis was able to identify the best initial departure headings and routes but further analysis in the NST was necessary to identify the best overall scenario that included the usage of each heading.

The results of the screening analysis provided for the identification of the best options for both EWR and PHL from the list of potentially viable measures listed in **Table 2**. These routes were then reviewed from each runway end to the departure fix to identify any opportunities to further use noise compatible corridors such as highways, waterways, or commercial areas etc. Where possible, the routes were further adjusted to take advantage of these features or adjusted to be more closely aligned with the No Action Airspace Alternative routes if possible. Once the final routes in the best scenarios were identified, the detailed routes and procedures were input into the noise model and analyzed. **Table 3** presents a summary of the final mitigation package. Note that the table includes both those mitigation measures carried forward as a result of the original operational analysis and those mitigation measures that required noise screening to fully describe and optimize the measure (i.e., departures for EWR and PHL).

Table 3
Mitigation Strategies Retained for Final Noise Modeling

Traffic/Airport/ Runway	Mitigation Measure
EWR 22 Departures	Use 3 departure headings based on demand during daytime hours. - Light Demand use single 190 heading like current conditions - Moderate Demand use 2 departure headings of 215 and 239 - Heavy Demand use 3 departure headings of 215, 246, and 263 At night (10:30pm – 6:00am)use 190 heading only and over ocean routes
PHL 9L/R Departures	Use 4 departure headings of 081, 096, 112, and 127 during daytime hours. At night use 1 departure heading of 085 like current conditions.
PHL 27L/R Departures	Use 3 departure headings of 230, 245, and 268 during daytime hours. At night use 1 departure heading of 255 like current conditions.
EWR 4 and 22 Arrivals	Raise all arrival altitudes as much as possible.
EWR Arrivals	Use CDA procedures at night for arrivals from the Northwest and Southwest
PHL 9R/27L Arrivals	Use CDA procedures for nighttime arrivals from North, Northwest, and Southwest
PHL 9R Arrivals	Increase use of the visual approach to Runway 9R (the River Approach)
LGA 31 Departures	Adjust the usage of the new headings dependant on departure demand during the day.
LGA 22 Arrivals	Increase arrivals using the LDA or approach to 22 through RNAV procedure
HPN Departures	Move departure routes to be more like No Action routes NW of the airfield

Noise Modeling

As discussed DEIS, the principal noise analysis for the mitigation evaluation was conducted using FAA's Noise Integrated Routing System (NIRS) computer model. NIRS is the model specified and required in FAA's Order 1050.1E for major airspace redesign studies. The modeled noise levels for the year 2006 and 2011 Future No Action Airspace Alternative conditions were developed through a rigorous and detailed noise modeling effort and presented in the DEIS. As previously discussed, the Future No Action model input was refined slightly as discussed in an earlier section. Similarly, the Preferred Alternative NIRS input was also refined prior to the mitigation evaluation modeling.

In order to develop the input to NIRS for the mitigation package, the project team started with the refined Preferred Alternative input. For each mitigation measure, the project team then incorporated the changes to the preferred alternative routing, profiles, or route weightings that constitute the mitigation procedure. Although the NIRS modeling was conducted for all airports with all of the mitigation elements incorporated in a single noise computation, the effects of individual mitigation procedures are largely localized and related to specific airports. Consequently, the detailed analysis presented in this section focuses on the specific airports where mitigation procedures were incorporated and the local results for each procedure. The overall results for the complete mitigation package throughout the Study Area are presented at the end of the document in the Summary section.

The detailed analysis presented here focuses on the 2011 version of the Preferred Alternative which is the Integrated Airspace Alternative Variation with ICC. The initial phase of implementation for this alternative however, would be the Integrated Airspace Alternative Variation without ICC. Mitigation procedures were also developed and analyzed for this variation; however, since these procedures were generally a subset of the procedures for the Integrated Airspace Alternative Variation with ICC, the detailed discussions are focused on the variation with ICC analysis. It should be noted that there are some slight differences between the scenarios. The following points highlight those differences by airport so that the reader can keep them in mind while reviewing the detailed discussions in this section.

- EWR Departures - Departure headings are the same in both variations. The traffic loadings on the headings are slightly different as the variation without ICC uses different departure fixes than does the variation with ICC.
- EWR Arrivals – CDA procedures are used in both variations, but the process of raising the downwind legs is only incorporated into the variation with ICC since the arrivals don't change in the variation without ICC.
- PHL Departures – Departure headings are the same in both variations. The traffic loadings on the headings are slightly different as the variation without ICC uses different departure fixes than does the variation with ICC.

- PHL Arrivals – Both variations use the same procedures.
- LGA Departures – Both variations use the same procedures.
- LGA Arrivals – Both variations use the same procedures.
- HPN Departures – Mitigation only applies to the variation with ICC since the variation without ICC does not include changes to HPN departures.

The following sub-sections provide the results of the noise analysis for the mitigation package for FAA's Preferred Alternative. The sections are organized by airport and operation type. A brief summary of the mitigation strategy is presented followed by a discussion of the specific methodology used to model the mitigation element. Illustrations are provided to assist the reader in understanding the changes in flight routes and noise model input. Finally, the noise results are presented and discussed by area of effect. The changes in population impacted resulting from exceeding the FAA's thresholds, are presented along with an illustration of the raw changes in noise in the area. Again, illustrations of the noise results are also provided to orient the reader regarding the areas of noise change and the effects of the mitigation element.

EWR Departures

- Mitigation Strategy – EWR Departures

At EWR the Preferred Alternative called for use of three initial jet departure headings in the southwest flow configuration (Runways 22L/R). These fanned headings were designed in this alternative to improve operational efficiency because EWR effectively uses only one jet departure heading under current conditions. Since noise modeling in the Draft EIS showed that use of the fanned headings would potentially cause noise impacts, a strategy for mitigation was developed to investigate better placements of the headings as well as, using the new headings only when operational demands required additional departure headings. Additionally an ocean routing plan that takes advantage of the Raritan Bay and the Atlantic Ocean was developed to further mitigate noise from operations that occur between 10:30pm and 6:00am when airport and airspace constraints were less demanding.

- Specific Methodology – EWR Departures

The starting point for determining a set of mitigation headings for the Preferred Alternative at EWR was to find the minimum number of allowable headings in the alternative that would still provide an acceptable improvement in operational efficiency from the single-heading No Action Alternative. Although a 2-heading scenario was evaluated only the 3-heading scenario was found to be able to provided the operational efficiency to keep up with the expected departure demand at EWR. The route optimization tool, ROMA, was used to perform screening analysis of all potentially valid 3-heading combinations to reduce noise impacts under a mitigated version of the alternative. The validity of specific combinations of headings was determined by setting limits on the maximum acceptable deviation from runway heading and on the Air Traffic

Control requirement that adjacent departure headings must be separated by at least 15 degrees. The results from ROMA identified the best 3-heading scenario for minimizing noise impacts in a southwest flow. This scenario was further analyzed in NST to evaluate additional concepts related to a nighttime procedure that uses the ocean and limited use of the new headings.

The first scenario tested by NST simply added the ocean routing procedure that would initially use the No Action departure heading before turning south to the Raritan Bay and then turning east over the Atlantic Ocean. Once over the ocean, flights to the west and north would then turn north over JFK before turning to their desired departure fix and routes to the southwest and south would turn over the ocean to their desired departure fix. Note that no altitude profile restrictions were enforced for these procedures due to the time period that they are available. **Figure 2** below displays the nighttime procedures as they were modeled for noise. All nighttime operations that occurred between 10:30pm and 6:00am and used EWR runways 22L/R in the original Preferred Alternative were moved to these routes.

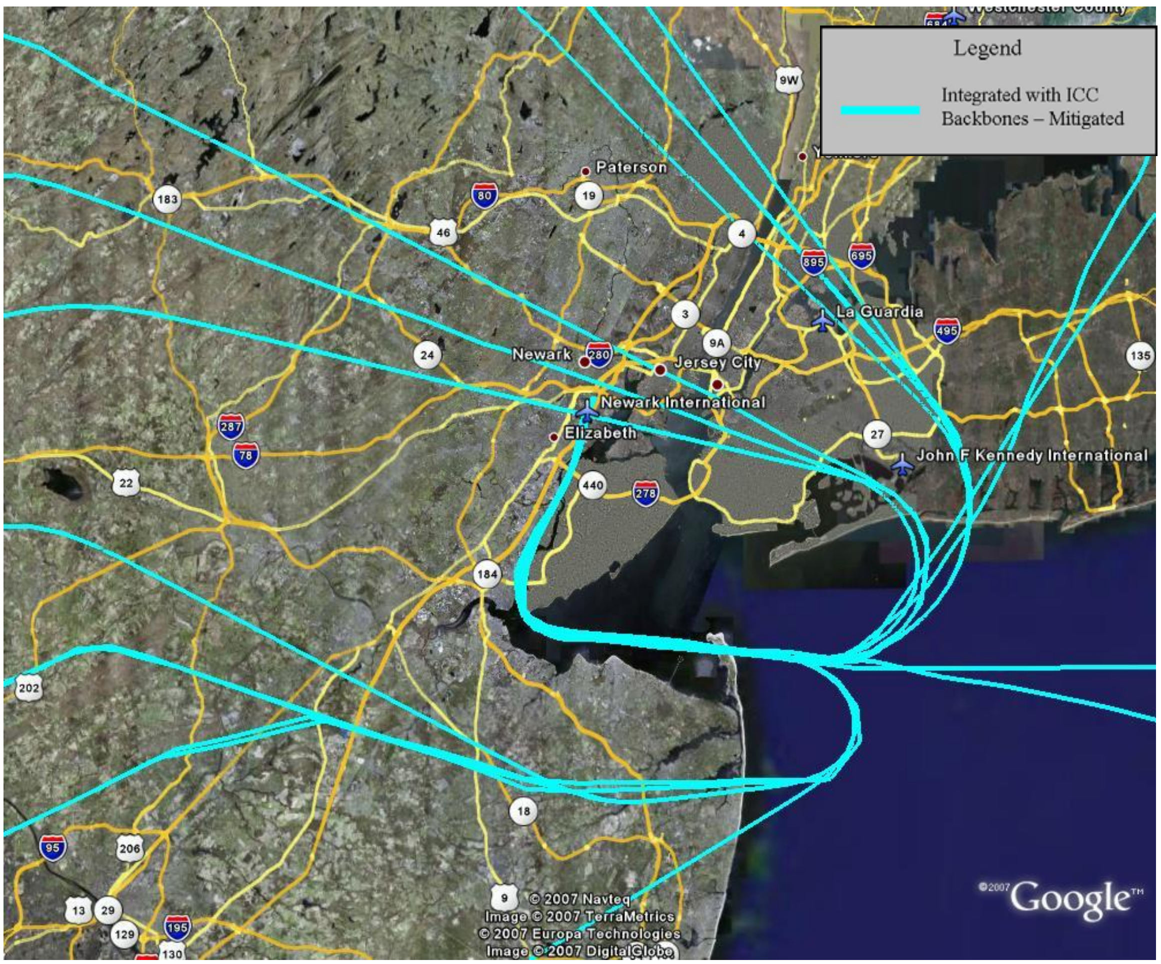

Figure 2: EWR Mitigated Preferred Alternative - Nighttime Ocean Routing Departures

The second scenario reviewed by NST began with the prior scenario and further reduced the use of the new headings by adding the original 190 heading and limiting the use of the new headings to only those periods when operational demand required them. Use of the four headings could be described as:

- Light Demand use single 190 heading like current conditions
- Moderate Demand use 2 departure headings of 215 and 239
- Heavy Demand use 3 departure headings of 215, 239, and 263
- At night (10:30pm – 5:59am) use 190 heading only and over ocean routes

Figure 3 illustrates the changes that were made to the modeled departure routes at EWR for mitigation of the Preferred Alternative. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

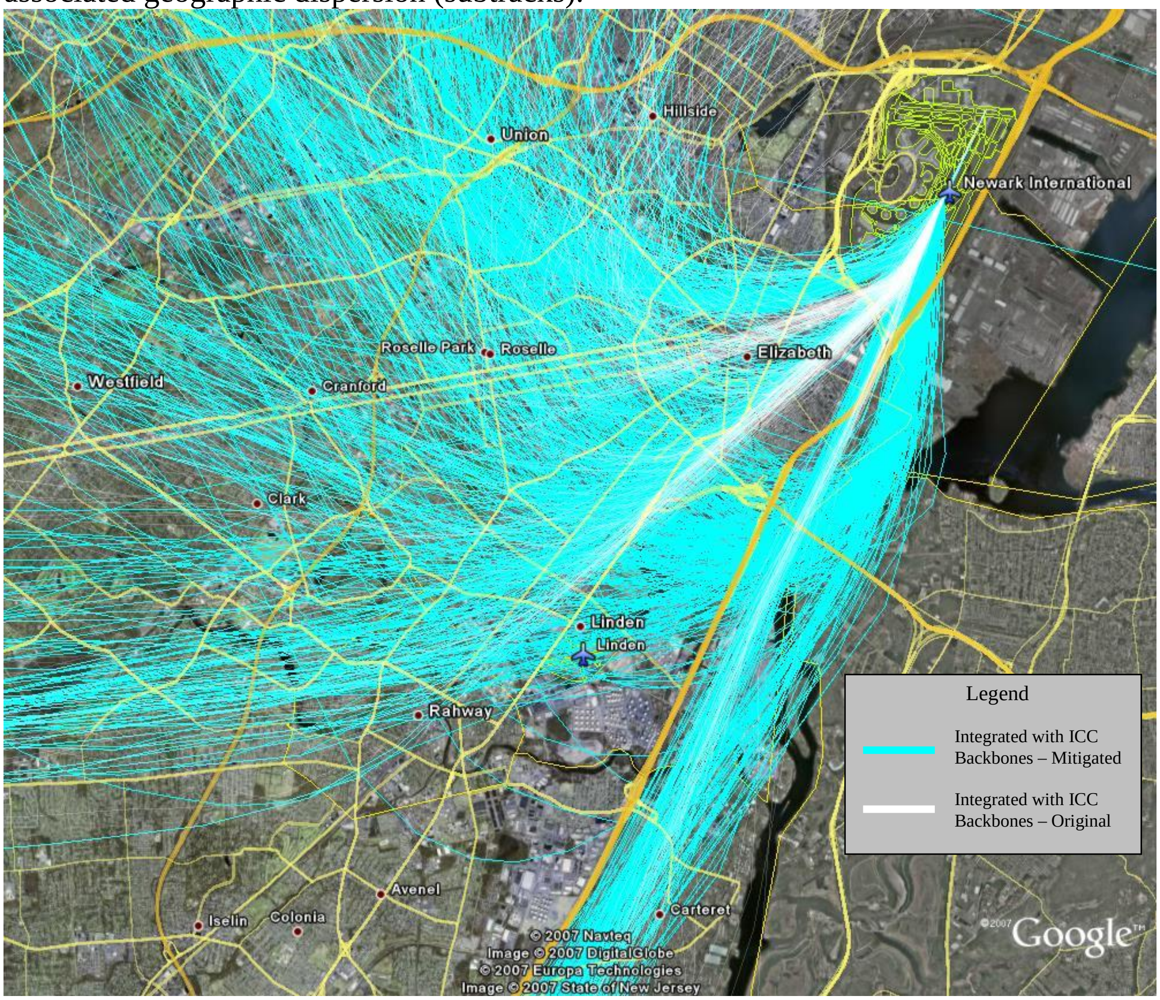

Figure 3: EWR Preferred Alternative 22L/R Departure Headings – Mitigated vs. Original

These figures convey the primary noise mitigation strategy of reducing and optimizing the initial headings used for jet departures at EWR. The general approach can be summarized by the following:

- If new headings are required, pick the optimal location given the population directly south and west of the airport.

- Further reduce the nighttime traffic over the new heading by using a nighttime ocean routing procedure that takes traffic over the ocean before turning to their desired departure route.
- Finally, only use the new headings when demand at the airport requires them.

- Results – EWR Departures

The primary result sought by mitigation of EWR Departures was a reduction in the total people potentially impacted by noise level changes caused by the Preferred Alternative. In the noise modeling, the people who are potentially impacted are represented by the impact categories defined by FAA Policy Order 1050.1E. These categories are based both on total noise exposure levels and on the expected amount of change in noise exposure caused by implementation of a new plan. **Table 4** shows the number of people who fall in these impact categories under the original Preferred Alternative, and under the mitigated Preferred Alternative. In the original version of the alternative, 2,729 people are projected to experience significant noise impacts due to departures at EWR and 64,501 people are projected to receive slight to moderate impacts. Additionally 6,984 people are projected to receive significant noise relief due to departures at EWR and 18,920 people are projected to receive slight to moderate relief.

Table 4
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative vs Mitigated Preferred Alternative for EWR Departures

	DNL Noise Exposure With Alternative		
	65 DNL or more	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated with ICC - Original	2,729	31,161	33,340
Integrated with ICC - Mitigated	0	16,803	19,357
Noise Decreases			
Integrated with ICC - Original	6,984	22	18,898
Integrated with ICC - Mitigated	3,201	1	0

In the mitigated version, there are no significant noise impacts and only 36,160 people are projected to receive slight to moderate impacts. Likewise 3,201 people are projected to receive significant noise relief due to departures at EWR and 1 person is projected to receive slight to moderate relief. Both sets of impacts are determined in the exactly the same manner, by examining the differences between the proposed plan and the No-Action scenario.

Figure 4 and **Figure 5** illustrate the geographic details of how mitigation would potentially affect the population experiencing noise impacts south and west of EWR. In both figures, a satellite image shows EWR and the south and west area. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Integrated Airspace Alternative. The colored dots are the population block centroids which are identified as areas of potential noise impact based on the FAA thresholds with respect to the Future No Action as the baseline for comparison.

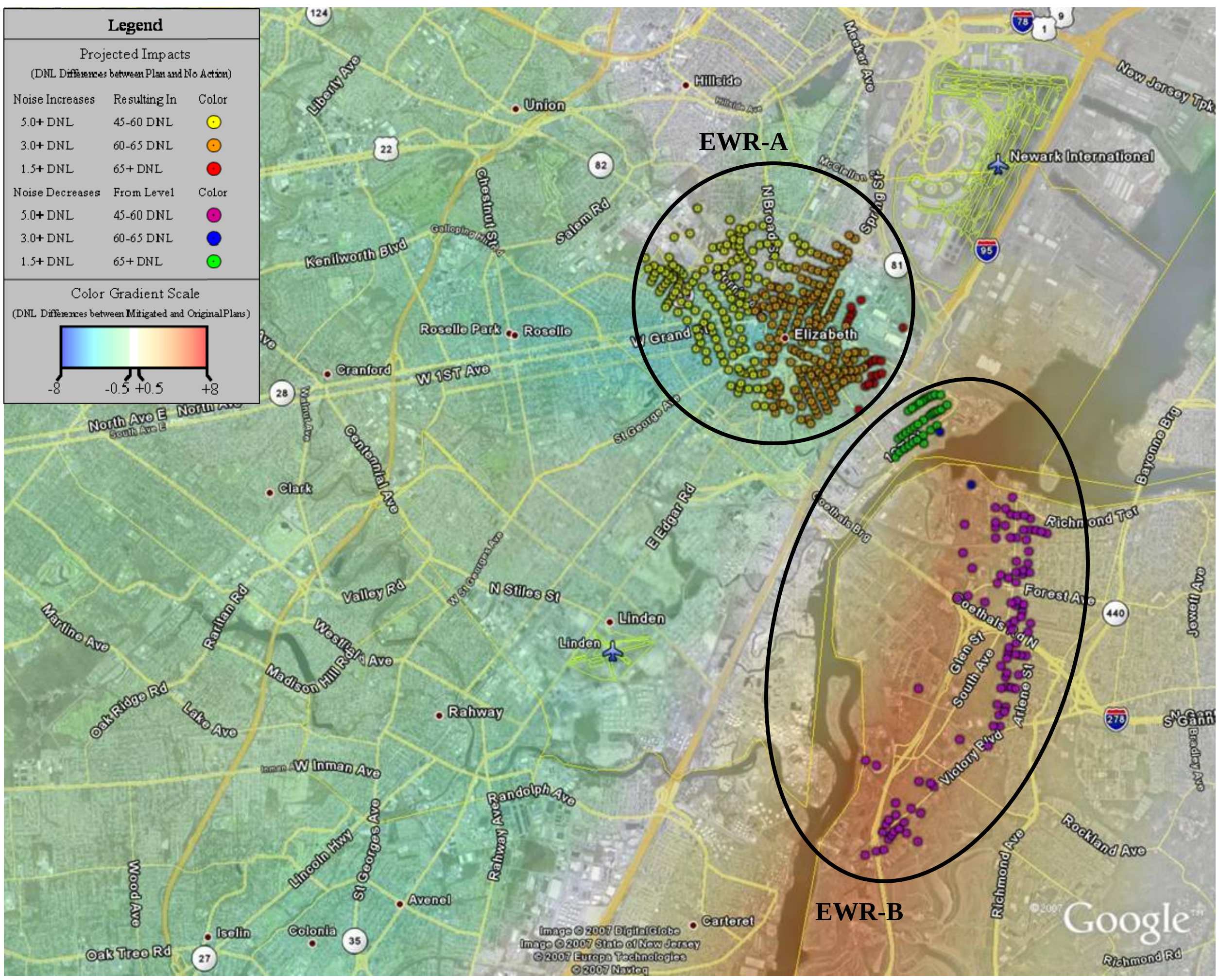

Figure 4: EWR Original Preferred Alternative – Impacts

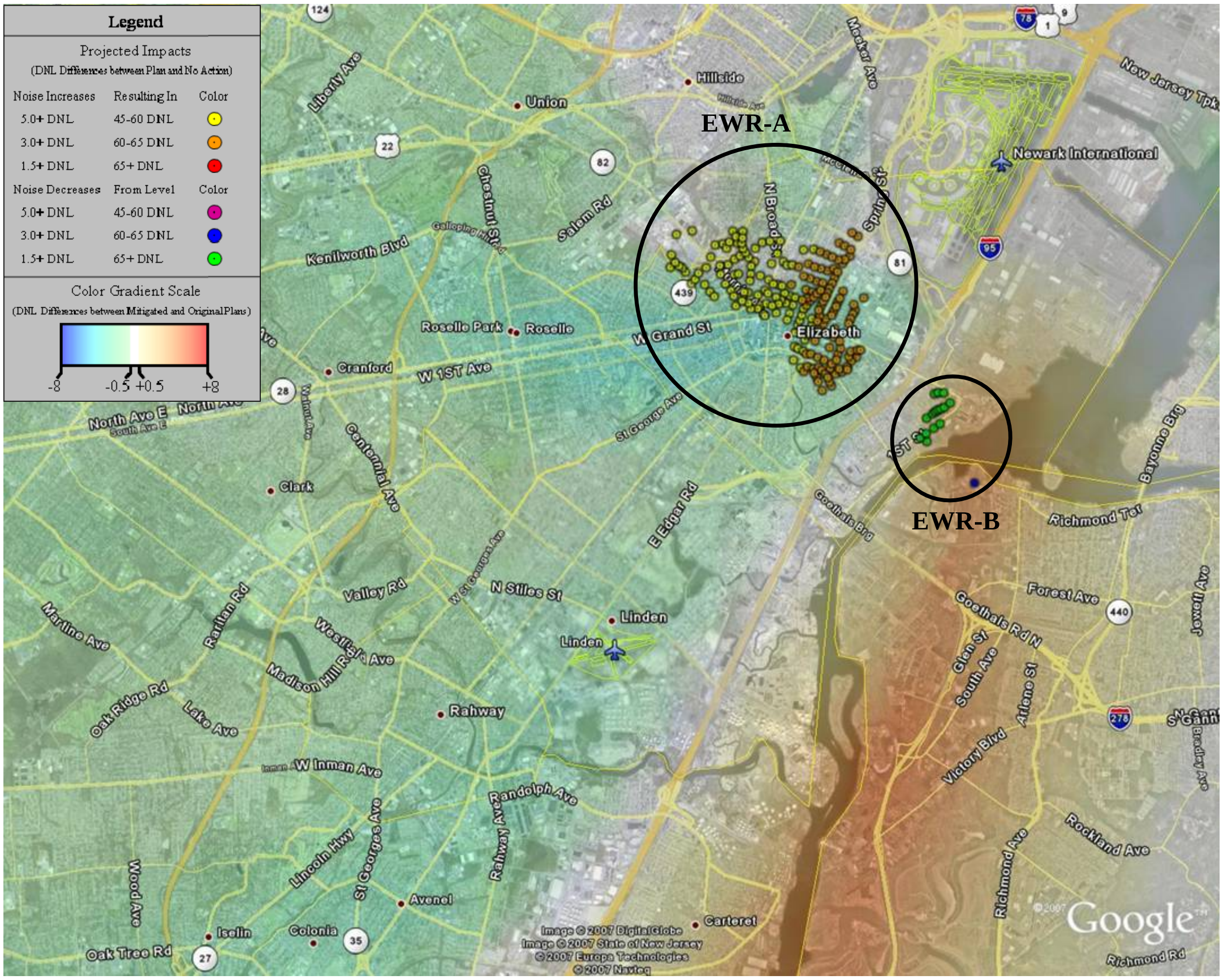

Figure 5: EWR Mitigated Preferred Alternative - Impacts

In **Figure 4** the colored dots are the potential impacts under the original Preferred Alternative, and **Figure 5** shows impacts resulting from the mitigated Preferred Alternative. The zone marked EWR-A describes the population that would potentially receive an increase in noise, while the zone marked EWR-B describes the portion of the population that potentially sees noise relief. Examining the figures, it can be seen that the mitigation strategy would be successful in reducing the levels of noise over areas of potential impact. In **Figure 4**, the color gradient map shows that the mitigation would reduce noise levels in the predominant areas of red, orange, and yellow impact dots in the original Preferred Alternative. In **Figure 5** it can be seen that most of the areas of potential population impact disappear due to these reductions. Likewise it can also been seen that the amount of noise relief is reduced as more traffic is placed back on the original EWR 22L/R departure heading.

EWR Arrivals

- Mitigation Strategy – EWR Arrivals

In the Preferred Alternative there were two significant traffic pattern changes associated with arrivals that caused increases in noise. The downwind procedures to runways 04L/R and 22L/R were moved further west to accommodate dual arrivals to EWR parallel runways and arrivals to runways 22L/R take a more direct approach when arriving from the north and east. When mitigation strategies for the Preferred Alternative were being examined two measures were considered. First the ability to keep the altitude of arriving aircraft higher until the aircraft is closer to the airport was presented and second, the use of CDA procedures or Continuous Descent Arrivals to replace traditional arrival profiles. These mitigation scenarios were not evaluated by a noise screening process since they are expected to result in a reduction of noise.

- Specific Methodology – EWR Arrivals

Arrivals to EWR in the Preferred Alternative used traditional approach profiles to each of the runways. In many cases these profiles have level segments or step downs as air traffic controller sequence aircraft on to the runway.

First, the use of higher altitudes profiles for all aircraft arriving to EWR was reviewed as a potential noise mitigation measure. In the Preferred Alternative, arrivals to runways 22L/R from the southwest maintained a 4,000 to 5,000 feet altitude while making the base turn to final. Furthermore arrivals to runways 22L/R from the north and east displayed several level segments at various altitudes between 3000 and 4000 feet. In reviewing the traffic pattern to the west for runways 22L/R it was determined that the altitudes could be raised to 6,000 feet and that traffic arriving from the north and east should follow a more constant rate of descent.. **Figure 6** illustrates the two areas where these changes were made. The areas are identified with the orange polygons and are labeled “A” and “B” respectively. **Figure 7** presents a profile graph comparison between the original Preferred Alternative 22L/R arrival tracks shown in **Figure 6** and the same tracks with the mitigation. The approximate locations of the zones from **Figure 6** have been noted on the graph so that the reader can see the general increases in altitudes for the mitigation tracks.

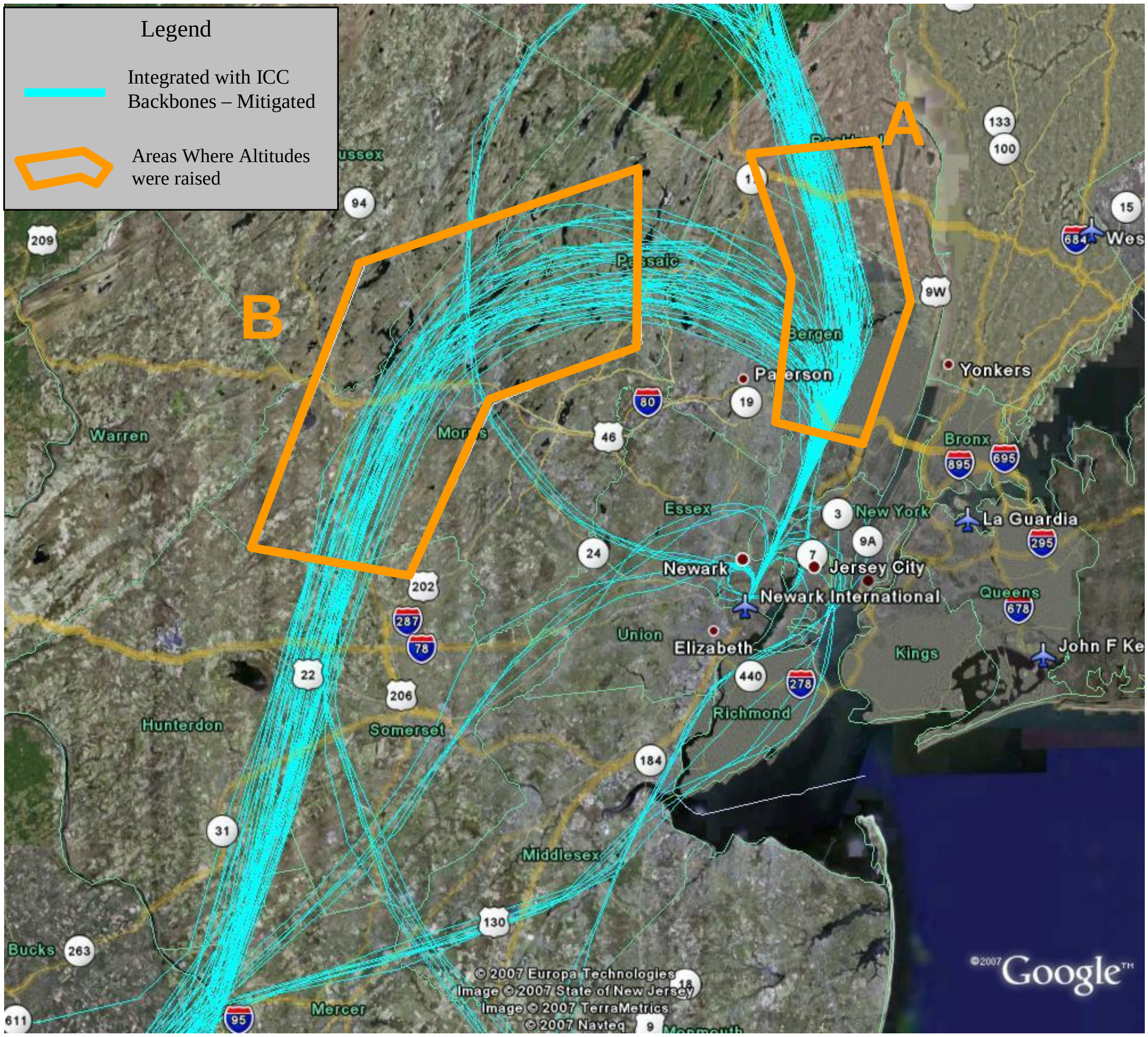

Figure 6: EWR 22L/R Arrivals – Mitigated Preferred Alternative

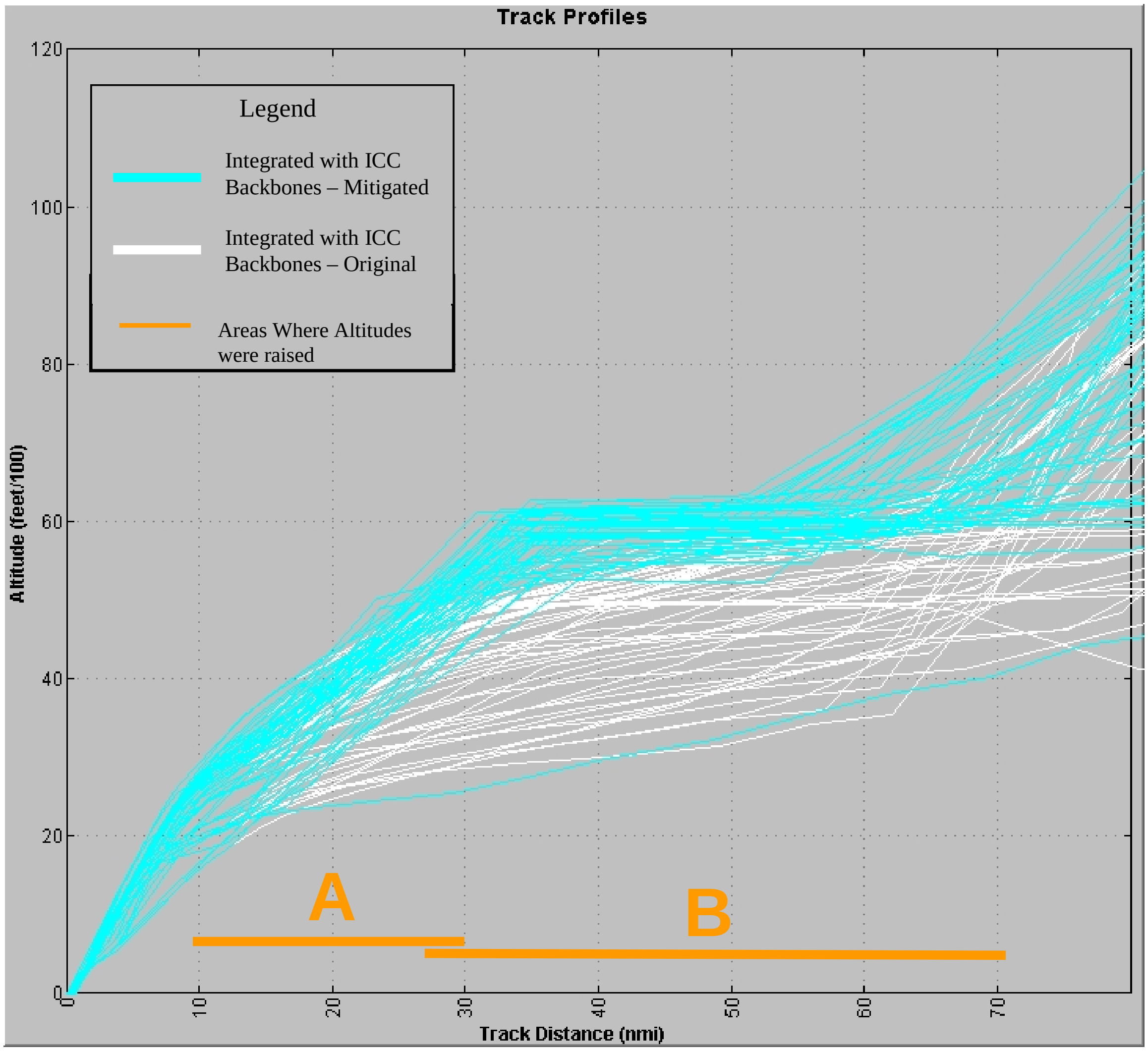

Figure 7: EWR 22L/R Arrivals – Mitigated Preferred Alternative Altitude Comparison

In addition, arrivals to runways 04L/R from the north and east had a slow gradual decent along the downwind to the base and final. The mitigation measure is to raise the arrivals from the north and east to an altitude of 8,000 feet until the base turn to final. These strategies are only available in the Preferred Alternative because the arrivals streams were moved further west to allow for parallel arrivals to EWR runways and to provide greater separation from the new departure headings to the west. By moving this traffic further west the departures have a greater opportunity to climb over the arrival streams and therefore allow the arrivals to be raised. **Figure 8** below displays the portion of the procedure where the altitudes were modified. The area where the change was made is again identified with the orange polygon. It should also be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

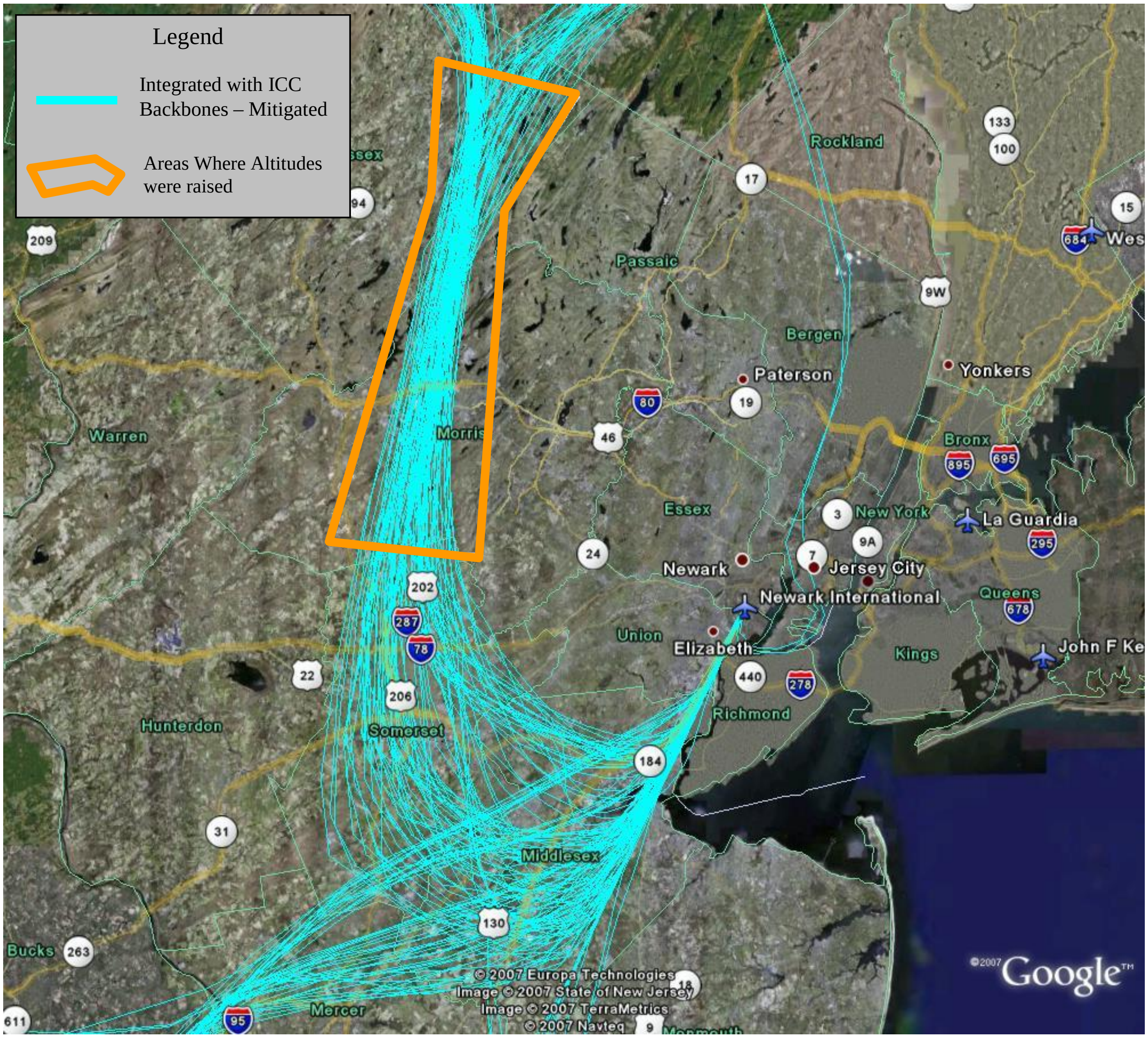

Figure 8: EWR 04L/R Arrivals – Mitigated Preferred Alternative

Figure 9 presents a profile graph comparison between the original Preferred Alternative Runways 4L/R arrival tracks shown in **Figure 8** and the same tracks with the mitigation. Again the approximate location of the zone from **Figure 8** has been noted on the graph so that the reader can see the general increases in altitudes for the mitigation tracks.

Currently, many aircraft arriving to EWR descend to about 4,000 feet and then maintain that altitude until they begin a constant 3 degree descent to the airport. In order to maintain 4,000 feet, aircraft need to alter their thrust settings which can increase noise exposure. The use of CDA procedures in mitigation alleviates the need for leveling at 4,000 feet which reduces the amount of thrust and therefore reduces the noise generated by the aircraft. In order for CDA procedures to be implemented, the sequencing of aircraft needs to take place much earlier in the arrival process. Because of the complexity of the NY/NJ/PHL Airspace this can only be done safely at lower altitudes and during the nighttime hours when fewer flights are operating.

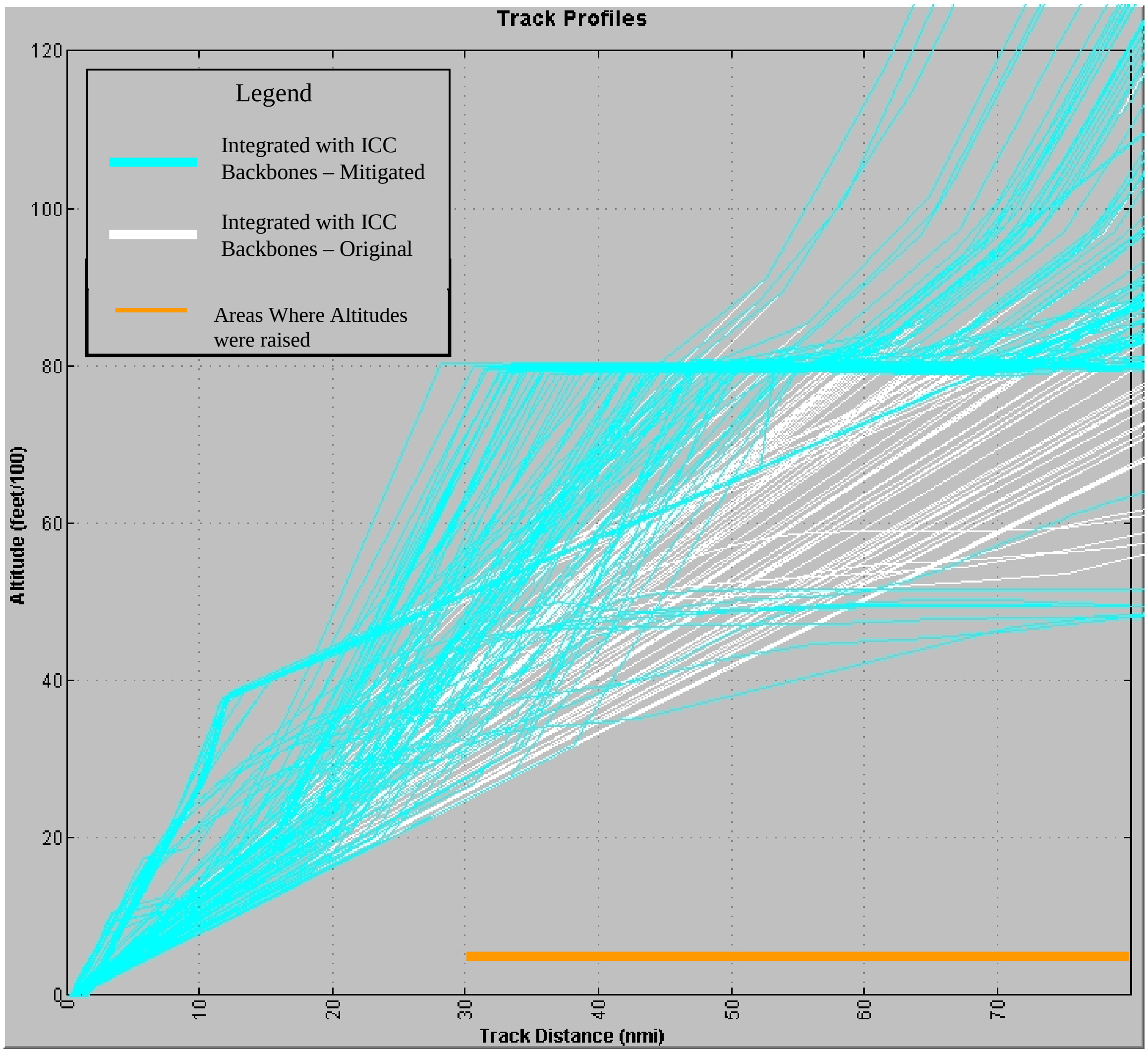

Figure 9: EWR 04L/R Arrivals – Mitigated Preferred Alternative Altitude Comparison

The use of CDA procedures was limited to an arrival fix supporting runway 04R and an arrival fix supporting runway 22L between the hours of 10:00 pm and 6:59 am. In reviewing the CDA lateral and vertical position as compared with the Preferred Alternative, the CDA approach to runway 04R uses a much longer final than originally developed for the nighttime arrivals.

Figure 10 illustrate the position of the original Preferred Alternative as compared to the mitigated or CDA version. Flight altitudes along this path were raised to match the expected flight profiles for this operation. Lateral and vertical positions for arrivals to runway 22L did not vary from the predefined noise inputs and were not altered to support CDA flight profiles in the Preferred Alternative. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

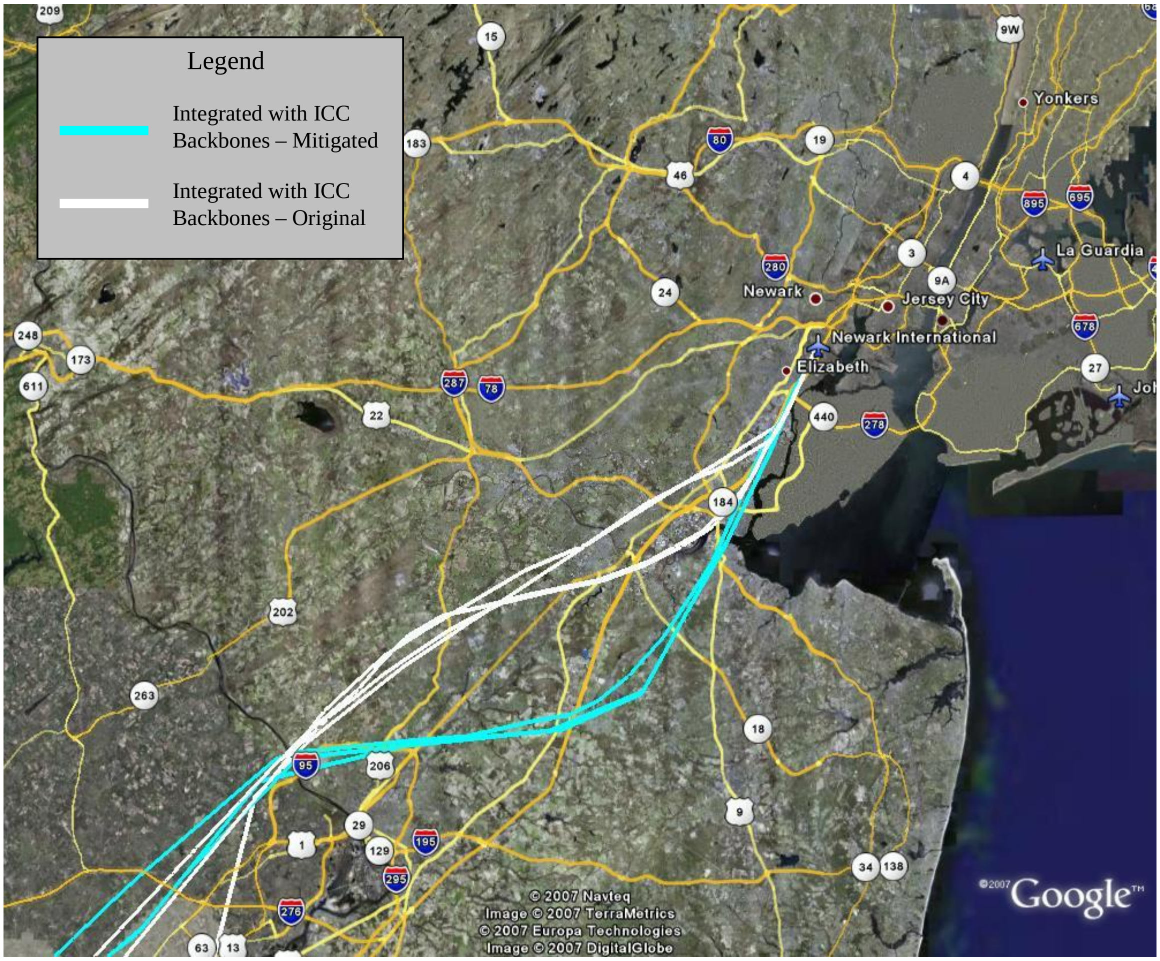

Figure 10: EWR 04R CDA Arrivals – Preferred Alternative

Figure 11 presents a profile graph comparison between the original Preferred Alternative Runway 4R arrival tracks shown in **Figure 10** and the same tracks with the CDA mitigation. As the graph indicates the CDA profile represents a smoother descent as well as a higher altitude path for much of the arrival route.

- Results – EWR Arrivals

The primary result sought by mitigation of the EWR arrival impacts is a reduction in the total number of people potentially impacted by noise level changes caused by the Preferred Alternative. In the noise modeling, the people who are potentially impacted are represented by the impact categories defined by FAA Policy Order 1050.1E. These categories are based both on total noise exposure levels and on the expected amount of change in noise exposure caused by implementation of a new plan. **Table 5** shows the number of people who fall in these impact categories under the original Preferred Alternative, and under the mitigated Preferred Alternative. In the original version of the alternative, 144,090 people are projected to experience slight to moderate noise impacts due to arrivals at EWR. In the mitigated version, 24,115 people are projected to experience slight to moderate impacts due to arrivals at EWR. Both sets of impacts are determined in the exactly the same manner, by examining the differences between the proposed plan and the Future No-Action scenario.

In addition to decreasing the number of people experiencing a slight to moderate noise impact, the mitigation to the EWR arrivals also allowed an increase in the number of people experiencing a slight to moderate noise relief. In the original version of the Preferred Alternative, 22,184 people are projected to experience a slight to moderate noise relief. With the mitigation to the EWR arrivals, the number of people receiving a slight to moderate noise relief increases to 182,843 people.

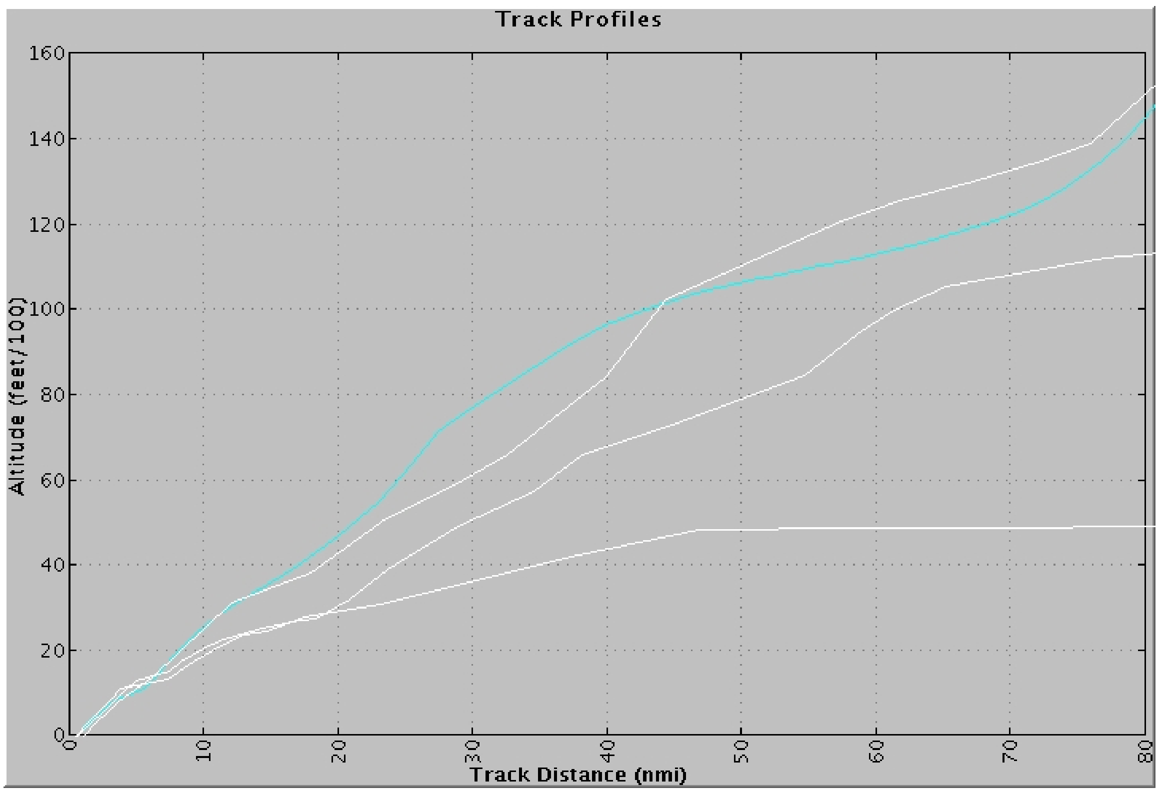

Figure 11: EWR 04R CDA Arrivals - Integrated Airspace Alternative with ICC Altitude Comparison

Table 5
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative ICC vs Mitigated Preferred Alternative for EWR Arrivals

	DNL Noise Exposure With Alternative		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated with ICC - Original	0	0	144,090
Integrated with ICC - Mitigated	0	0	24,115
Noise Decreases			
Integrated with ICC - Original	0	0	22,184
Integrated with ICC - Mitigated	0	0	182,843

Figure 12 and **Figure 13** show the geographic details of how mitigation would potentially affect the population experiencing noise impacts surrounding EWR. In both figures, a satellite image shows EWR and the surrounding area.

The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Preferred Alternative. The colored dots are the population block centroids which are deemed to be areas of potential noise impact. In **Figure 12** the colored dots are the potential impacts under the original Preferred Alternative as compared against Future No Action, and **Figure 13** shows impacts under the mitigated Preferred Alternative as compared to Future No Action.

Examining the figures, it can be seen that the mitigation strategy would be successful in reducing the levels of noise over areas of potential impact. In **Figure 12,** the color gradient map shows that the mitigation would reduce noise levels in the predominant areas of yellow impact dots in the original Preferred Alternative. In **Figure 13** it can be seen that most of the areas of potential population impact shrink or disappear due to these proposed mitigation measures.

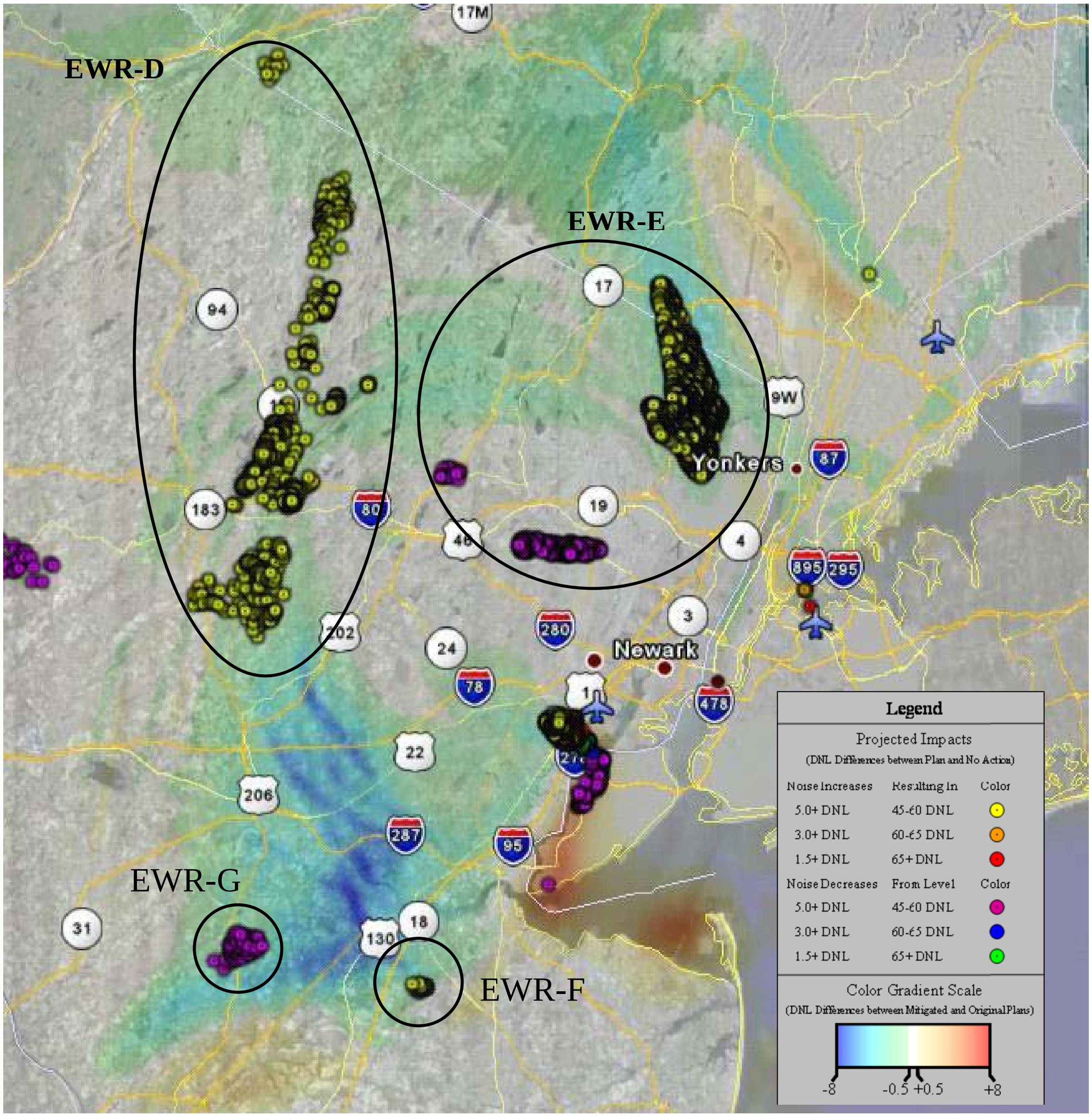

Figure 12: EWR Arrival Impacts for Preferred Alternative

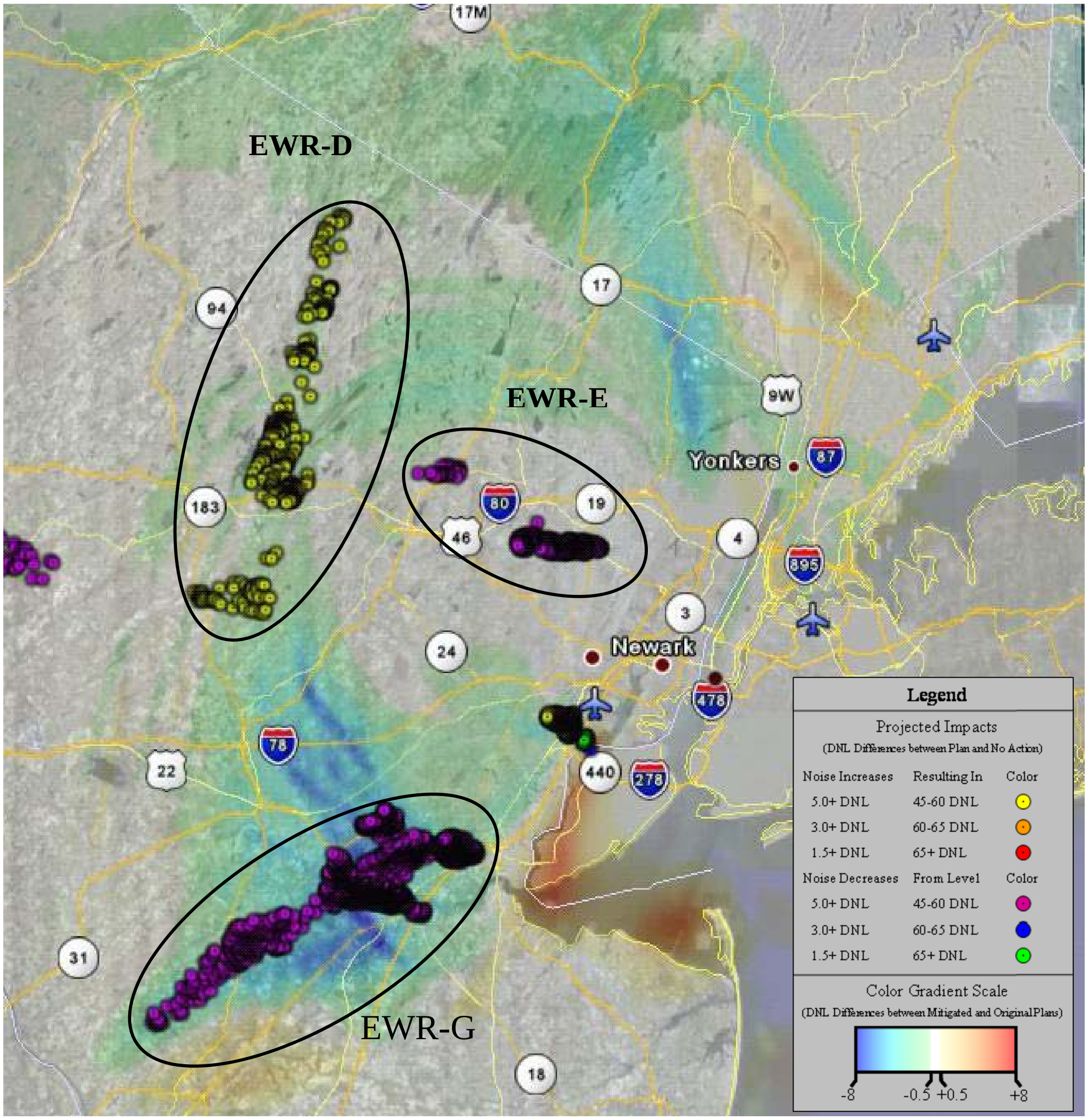

Figure 13: EWR Arrival Impacts for Mitigated Preferred Alternative

In summary, four things were changes to help mitigate noise increases caused by the Preferred Alternative. In general all four dealt with raising the altitudes of EWR arrival procedures to help mitigate noise effects. Altitudes were raised for

- Downwind procedures to Runway 22L/R arrivals from the southwest
- Approach to Runway 22L/R arrivals from the north and east
- Downwind procedures to Runway 04L/R arrivals from the north and east
- Nighttime arrivals from the southwest to Runway 04R take advantage of CDA profiles

The result of the first three had the largest affect on the change zones displayed in **Figure 13**. To some degree they all contributed to the overall benefits seen in **Table 6** below which shows how each zone was affected by the mitigation measures.

Table 6
Estimated 2011 Population Impacts - Change Analysis Summary by Zone
Original Preferred Alternative vs Mitigated Preferred Alternative for EWR Arrival Areas

	DNL Noise Exposure With Alternative					
	Noise Increases			Noise Decreases		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate	Significant	Slight to Moderate	Slight to Moderate
EWR-D - Original	0	0	41,743	0	0	0
EWR-E - Original	0	0	100,574	0	0	16,953
EWR-F - Original	0	0	1,773	0	0	0
EWR-G - Original	0	0	0	0	0	5,231
Total - Original	**0**	**0**	**144,090**	**0**	**0**	**22,184**
EWR-D - Mitigated	0	0	24,115	0	0	0
EWR-E - Mitigated	0	0	0	0	0	21,552
EWR-G - Mitigated	0	0	0	0	0	161,291
Total - Mitigated	**0**	**0**	**24,115**	**0**	**0**	**182,843**

PHL Departures

- Mitigation Strategy – PHL Departures

At PHL the Preferred Alternative called for use of six initial jet departure headings in the east flow configuration (Runways 09L/R) and seven jet departure headings in the west flow configuration (Runways 27L/R). These fanned headings were designed in the Preferred Alternative to improve operational efficiency because PHL effectively uses only one jet departure heading under current conditions in each direction of flow. Since noise modeling in the Draft EIS showed that use of the fanned headings would potentially cause noise impacts, a strategy for mitigation was developed to investigate reducing the number of allowable headings in the Preferred Alternative. Additionally a strategy was developed for nighttime departures to use an over-river departure heading solely, as in the current conditions, when traffic levels are low enough at PHL to allow for heading consolidation.

- Specific Methodology – PHL Departures

The starting point for determining a set of mitigation headings for the Preferred Alternative at PHL was to find the minimum number of allowable headings in the Preferred Alternative that would still provide an acceptable improvement in operational efficiency from the single-heading No Action Alternative. The operational analysis showed that this minimum number of headings was 3 for both east flow and west flow configurations. With a minimum number chosen, it was then decided that both 3-heading and 4-heading combinations would be screened for east and west flow to examine the noise benefits of both possibilities. A noise screening tool, ROMA, was used to perform this screening analysis of all potentially valid 3 and 4 heading combinations to reduce noise impacts under a mitigated version of the Preferred Alternative. The validity of specific combinations of headings was determined by setting limits on the maximum acceptable deviation from runway heading and on the Air Traffic Control requirement that adjacent departure headings must be separated by at least 15 degrees.

Noise screening results from ROMA showed that a 4-heading scenario worked best for minimizing noise impacts in east flow, while a 3-heading scenario minimized noise impacts in west flow. Thus, a mitigation scenario for the Preferred Alternative at PHL was fully developed with 4 jet departure headings for the east flow runways and 3 headings for the west flow runways. The initial jet departure headings modeled for the mitigated version of the Preferred Alternative, as well as for the original Preferred Alternative and No Action scenarios are shown in **Table 7.**

Table 7
Initial Jet Departure Headings - PHL

<table>
<tr><th colspan="3">West Flow (27L/R)</th><th colspan="3">East Flow (09L/R)</th></tr>
<tr><th rowspan="2">No Action</th><th colspan="2">Integrated w/ ICC</th><th rowspan="2">No Action</th><th colspan="2">Integrated w/ ICC</th></tr>
<tr><th>Original</th><th>Mitigated</th><th>Original</th><th>Mitigated</th></tr>
<tr><td rowspan="7">255</td><td>190</td><td rowspan="2">230</td><td rowspan="6">85</td><td>30</td><td rowspan="2">81</td></tr>
<tr><td>230</td><td>50</td></tr>
<tr><td>250</td><td rowspan="3">245</td><td>70</td><td>96</td></tr>
<tr><td>270</td><td>110</td><td>112</td></tr>
<tr><td>290</td><td>130</td><td rowspan="2">127</td></tr>
<tr><td>310</td><td rowspan="2">268</td><td>150</td></tr>
<tr><td>330</td><td></td><td></td><td></td></tr>
</table>

Figure 14 and **Figure 15** illustrate the changes that were made to the modeled departure routes at PHL for mitigation of the Preferred Alternative. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks). Also, model tracks for only the primary departure runways are shown. In the actual noise modeling, the mitigation headings were applied to secondary runways as well.

As the figures illustrate, the headings chosen for noise mitigation have a more tightly consolidated splay and tend to be grouped closer to the river corridors than their original Preferred Alternative counterparts. These groupings minimize the number of people exposed to potential noise impacts caused by PHL departures in the Preferred Alternative.

In addition to displaying the initial headings, the figures show that mitigation routes will be in different locations beyond just their initial segments. In essence, choosing new headings requires moderately revised routing between the initial flight segments and the assigned airspace fixes. The new track positions between the initial heading segment and the assigned airspace fix are mainly determined by the location where the aircraft are allowed to turn off of their initial segment. In choosing where these turns should take place, an attempt was made to select the turn locations in the areas most likely to minimize overall noise impacts.

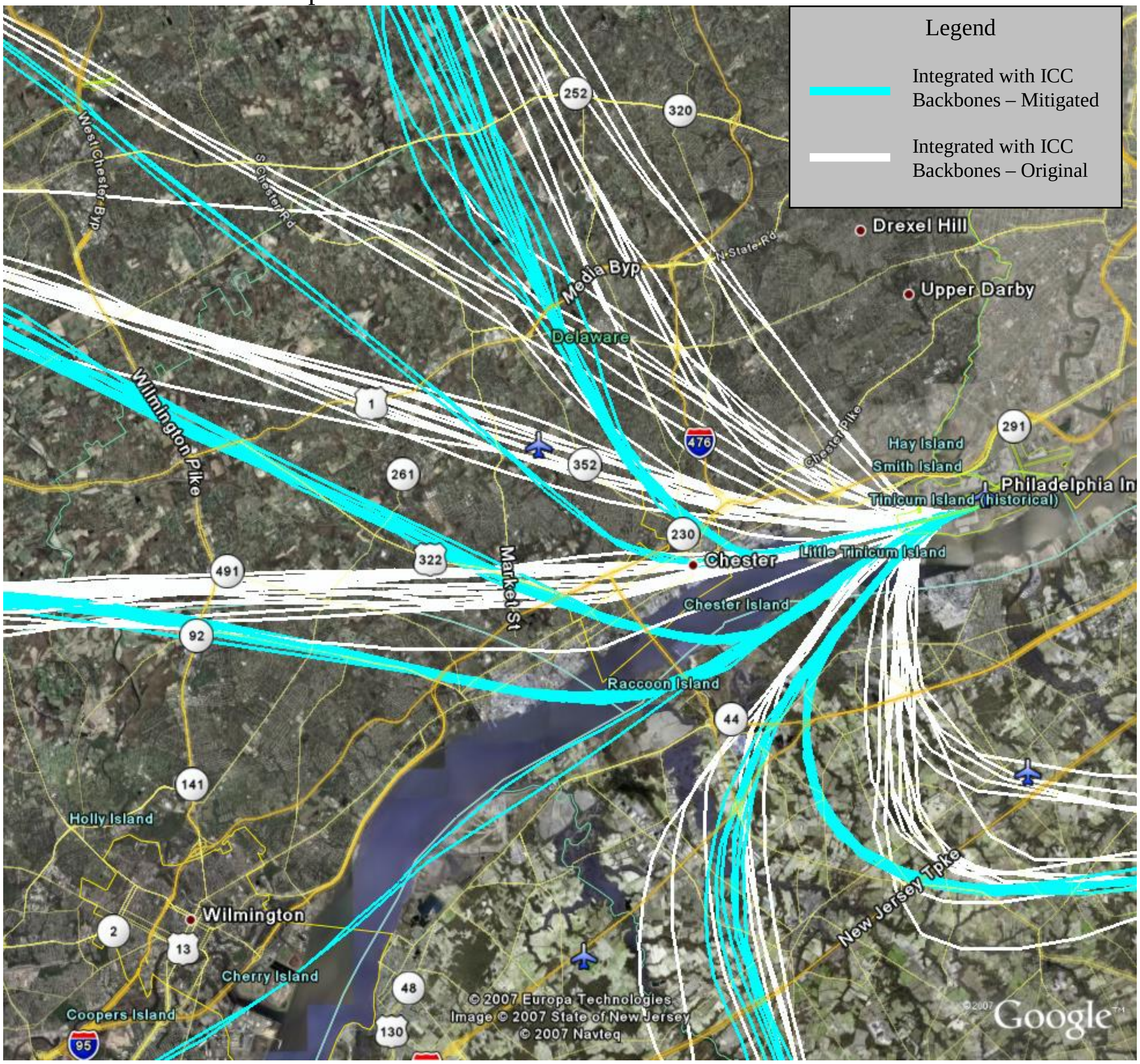

Figure 14: PHL Preferred Alternative West Flow Departures – Mitigated vs Original

Beyond reducing the number of headings used under typical to heavy operational demand conditions at PHL, a strategy was investigated whereby only one heading would be available during nighttime hours when low traffic volume allows for heading consolidation. Operational simulation showed that the use of a single heading could be expected to be possible between 10 pm and 6 am. On average this time period accommodates 20 % of all nighttime departures at PHL (between hours 10 pm and 7 am). Thus, in the noise modeling for mitigation of the Preferred Alternative, 20 % of the nighttime operations were modeled to fly their original No Action headings (085 – East Flow, 255 – West Flow).

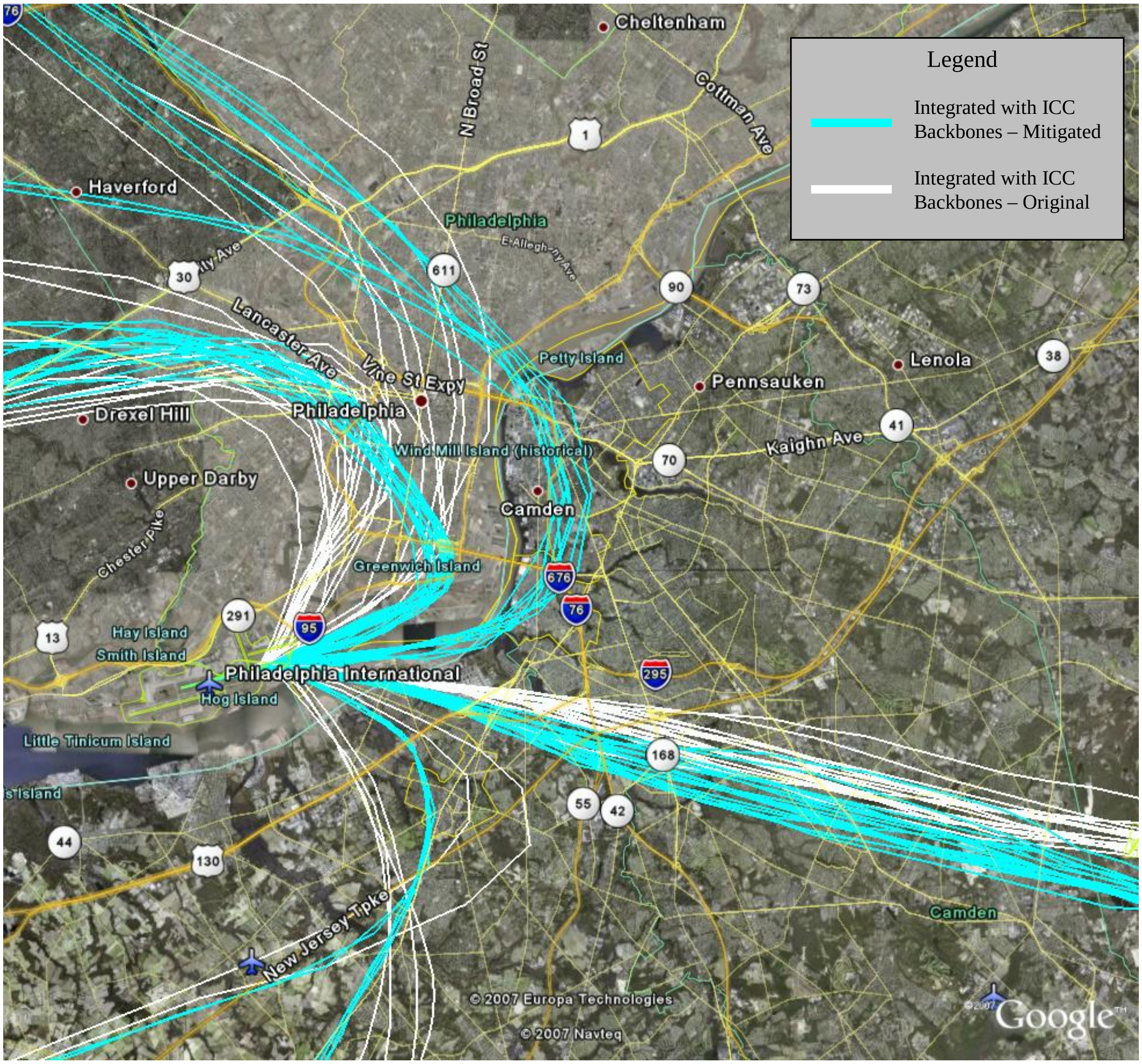

Figure 15: PHL Preferred Alternative East Flow Departures – Mitigated vs Original

In terms of noise impact, these headings represent the best possible choice for a single heading scenario as they initially put aircraft over the Delaware River. The remaining 80% of nighttime operations were modeled to fly the daytime 3-heading and 4-headings scenarios determined for the primary mitigation strategy.

Figure 16 and **Figure 17** show the changes that were made for 20% of nighttime departure operations at PHL. The figures show the consolidation of departures to one heading over the river that would take place at nighttime when traffic conditions allow.

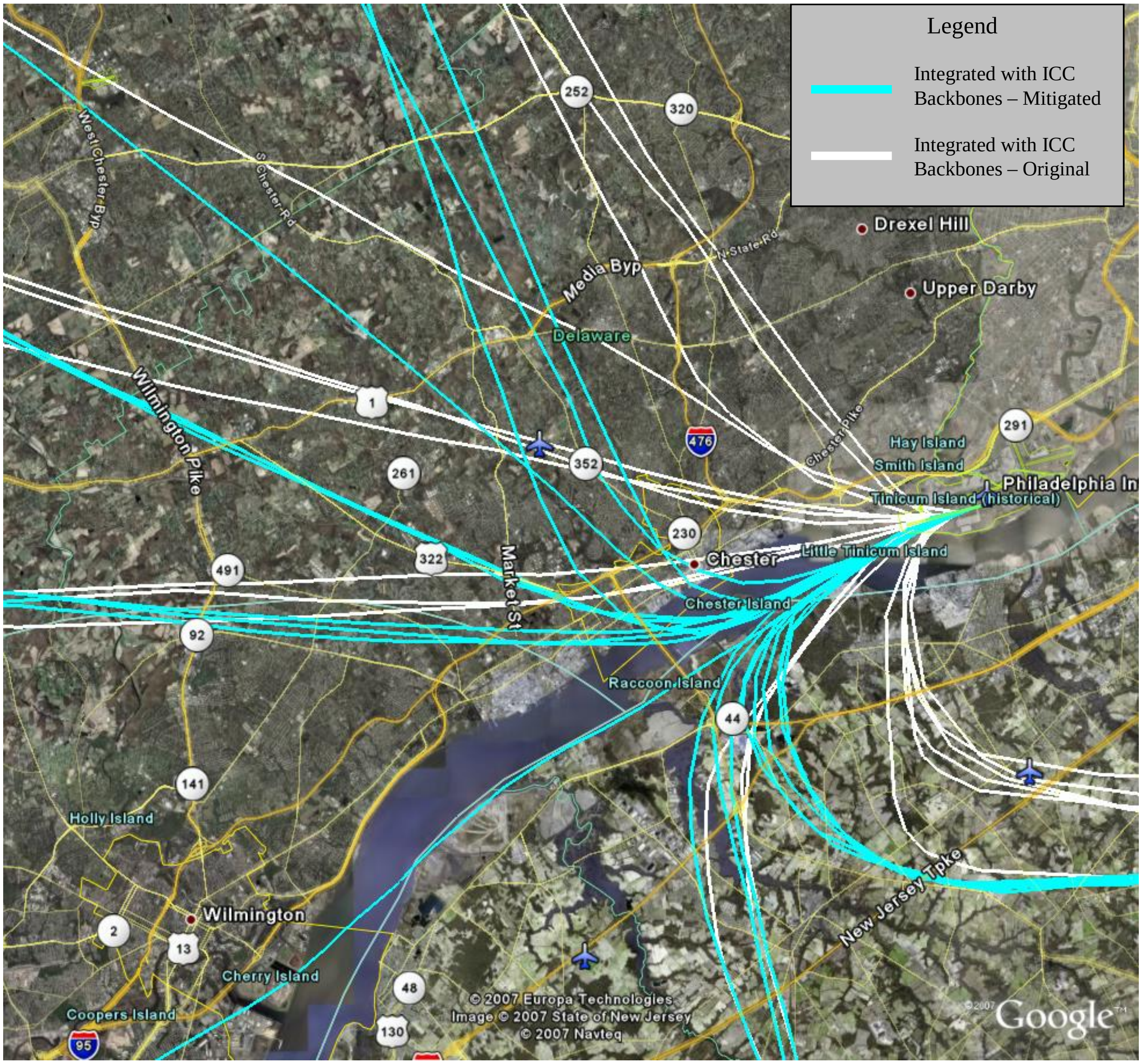

Figure 16: PHL Preferred Alternative West Flow Nighttime Departures – Mitigated vs Original

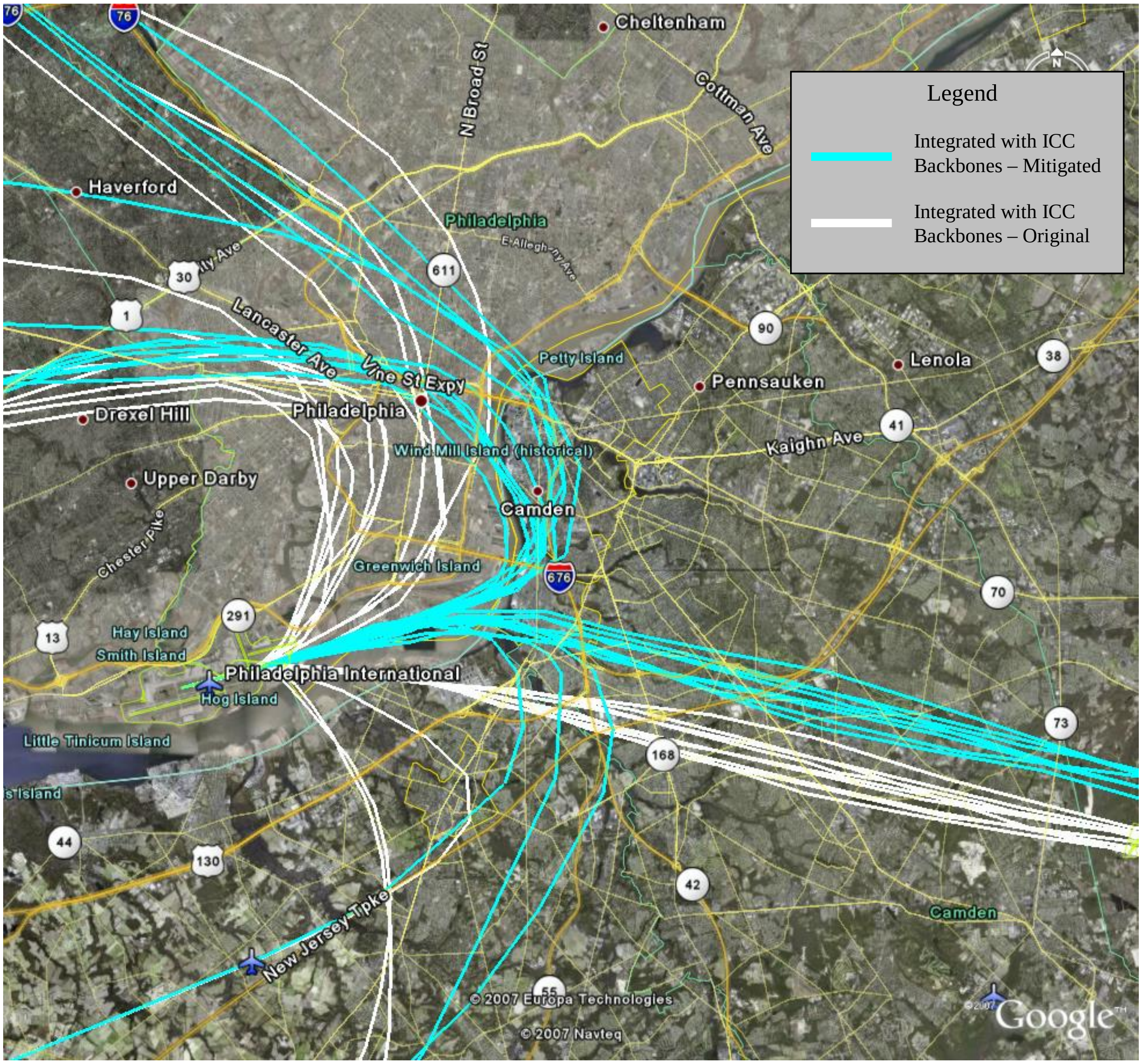

Figure 17: PHL Preferred Alternative East Flow Nighttime Departures – Mitigated vs Original

- Results – PHL Departures

The primary result sought by mitigation of PHL Departures was a reduction in the total number of people potentially impacted by noise level changes caused by the Preferred Alternative. In the noise modeling, the people who are potentially impacted are represented by the impact categories defined by FAA Policy Order 1050.1E. These categories are based both on total noise exposure levels and on the expected amount of change in noise exposure caused by implementation of a new plan. **Table 8** shows the number of people who fall in the impact categories due to PHL departure changes under the original Preferred Alternative, and under the mitigated Preferred Alternative.

Table 8
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative vs Mitigated Preferred Alternative for PHL Departures

	DNL Noise Exposure With Proposed Action		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated Airspace ICC	251	3,637	113,288
Mitigation Integrated Airspace ICC	0	0	6,920
Noise Decreases			
Integrated Airspace ICC	0	0	175
Mitigation Integrated Airspace ICC	0	0	67

Examining the table, it can be seen that the mitigated plan for PHL departures is not projected to create any significant impacts whereas the original Preferred Alternative would put 251 people in the significant impact category. It can also been seen that mitigation would lead to great reductions of the number of people in the slight to moderate impact categories. Both sets of impacts are determined in the exactly the same manner; by examining the differences between the proposed plan and the No-Action scenario.

Figure 18 and **Figure 19** show the geographic details of how mitigation would potentially affect the population experiencing noise impacts surrounding PHL. In both figures, a satellite image shows PHL and the surrounding area. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Preferred Alternative. The colored dots are the population block centroids which are deemed to be areas of potential noise impact. In **Figure 18** the colored dots are the potential impacts under the original Preferred Alternative compared to the Future No Action, and **Figure 19** shows impacts under the mitigated Preferred Alternative compared to the Future No Action. The dots which are predominately caused by departure changes in the Preferred Alternative are circled and annotated.

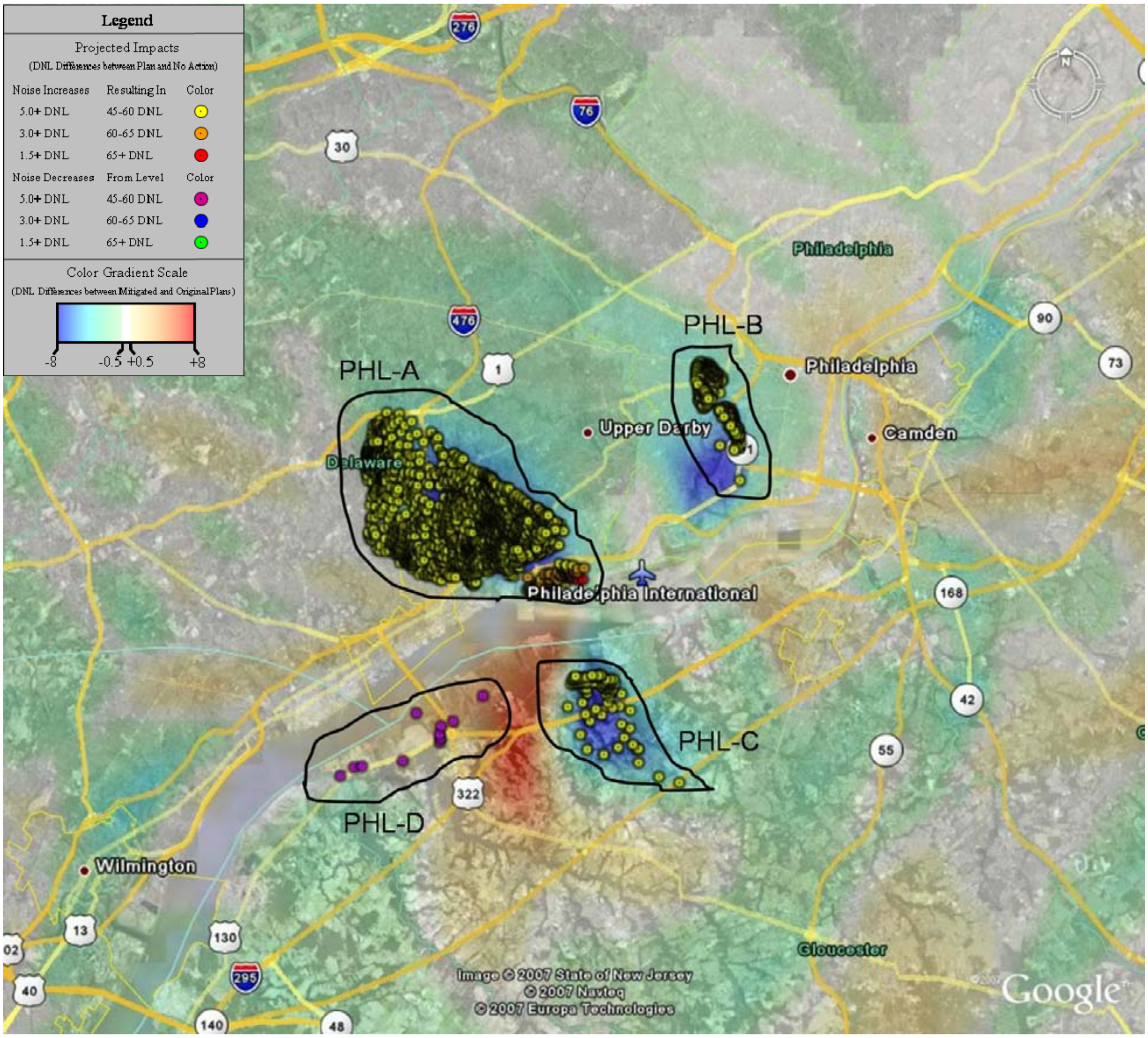

Figure 18: PHL Original Preferred Alternative – Departure Impacts

A review of the figures reveals that the mitigation strategy would be successful in reducing the levels of noise over areas of potential impact. In **Figure 18** the color gradient map shows that the mitigation would reduce noise levels in the predominant areas of red, orange, and yellow impact dots in the original Preferred Alternative. In **Figure 19** it can be seen that most of the areas of potential population impact are no longer impacted due to these reductions. In mitigating departures all significant impacts of the Preferred Alternative would disappear. This consists of the 251 people in zone PHL-A. The 116,925 people experiencing slight to moderate impacts in the original Preferred Alternative would be reduced to only 6,920 people in the mitigated version all of which would remain in zone PHL-A. Zones PHL-B and PHL-C would no longer have any people experiencing impacts as defined by FAA Policy Order 1050.1E. There are additional purple zones of beneficial impact shown in **Figure 19**, but these are due to mitigation changes for arrivals which will be discussed later.

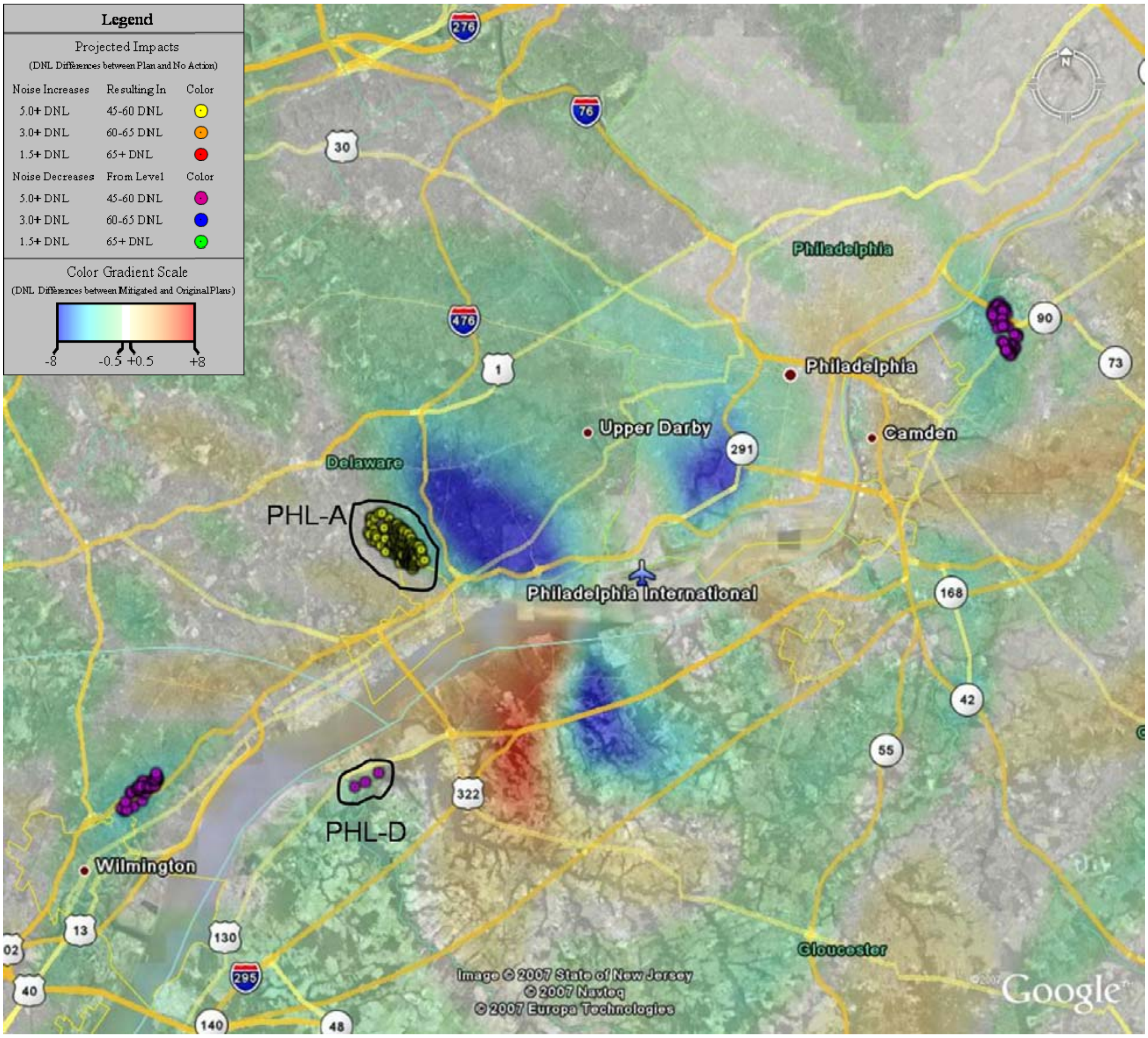

Figure 19: PHL Mitigated Preferred Alternative – Departure Impacts

PHL Arrivals

- Mitigation Strategy – PHL Arrivals

One strategy for mitigation that was often discussed in the public meetings for the Draft EIS was the possibility of using Continuous Descent Approaches (CDA) at PHL. The basic benefit of using CDA procedures is that arrivals would descend at very specific and continuous trajectories which would minimize the amount of thrust and noise emitted by the aircraft engines. The difficulty in implementing CDA procedures is the plausibility for their use in a complex and/or crowded airspace environment. This is because air traffic controllers often need arrivals to maintain level trajectories to sequence aircraft properly in a busy airspace environment. With these considerations in mind, a mitigation strategy was developed for the Preferred Alternative where CDA procedures could be used at PHL during nighttime hours when the airspace is less congested.

In addition to discussion of CDA procedures, feedback was also received during the meetings for the Draft EIS which led to consideration of heavier usage of the river corridor for arrivals in east flow. Use of the river corridor exists in current conditions, but its use is limited to times of low traffic congestion and clear weather. After some consideration it was determined that if an RNAV procedure were built to mimic the river approach, the river corridor could accommodate more east flow arrival traffic. Thus a mitigation strategy was developed for the Preferred Alternative whereby certain arrivals during slow traffic periods could take advantage of a river approach.

Both strategies of CDA approaches at night and the increased usage of the east flow river approach during east flow arrivals have been incorporated in the noise modeling for mitigation of the Preferred Alternative.

- Specific Methodology – PHL Arrivals

The decision to model CDA procedures as part of the mitigation of the Preferred Alternative required that an operational analysis be performed to determine which routes could be converted to a CDA, when the CDA could be used, and how the routing would be affected. This analysis determined that CDA procedures could be used for arrivals from the north, northwest, and southwest and that CDA use could be possible during the entire nighttime (10 pm to 7 am) period. Revised routing was developed from the arrival airspace fixes to the primary arrival runways for east and west flow at PHL. The CDA routing required moderate modification from the original Preferred Alternative routes so that aircraft could fly an approach precisely putting them at precisely the correct spatial locations to maintain the appropriate descent trajectories. **Figure 20** shows these moderate routing changes to accommodate the CDA procedures. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

The illustration reveals that there are some subtle differences in routing for the mitigated version of the Preferred Alternative's model flight tracks. Take particular note of the generally longer downwind and final approach segments designed for the CDA approaches. In changing to a CDA approach, traffic would be constrained to flying fairly precise routes which would not allow them to take more direct routings as they often do in current conditions and the original version of the Preferred Alternative. Consequently, the CDA route moves traffic to a longer downwind and longer final approach.

The other necessary component for modeling of the CDA flights was ensuring that the designed descent trajectories were incorporated in the routes. To accomplish this, the aircraft were forced to fly strict altitude vs. distance profiles.

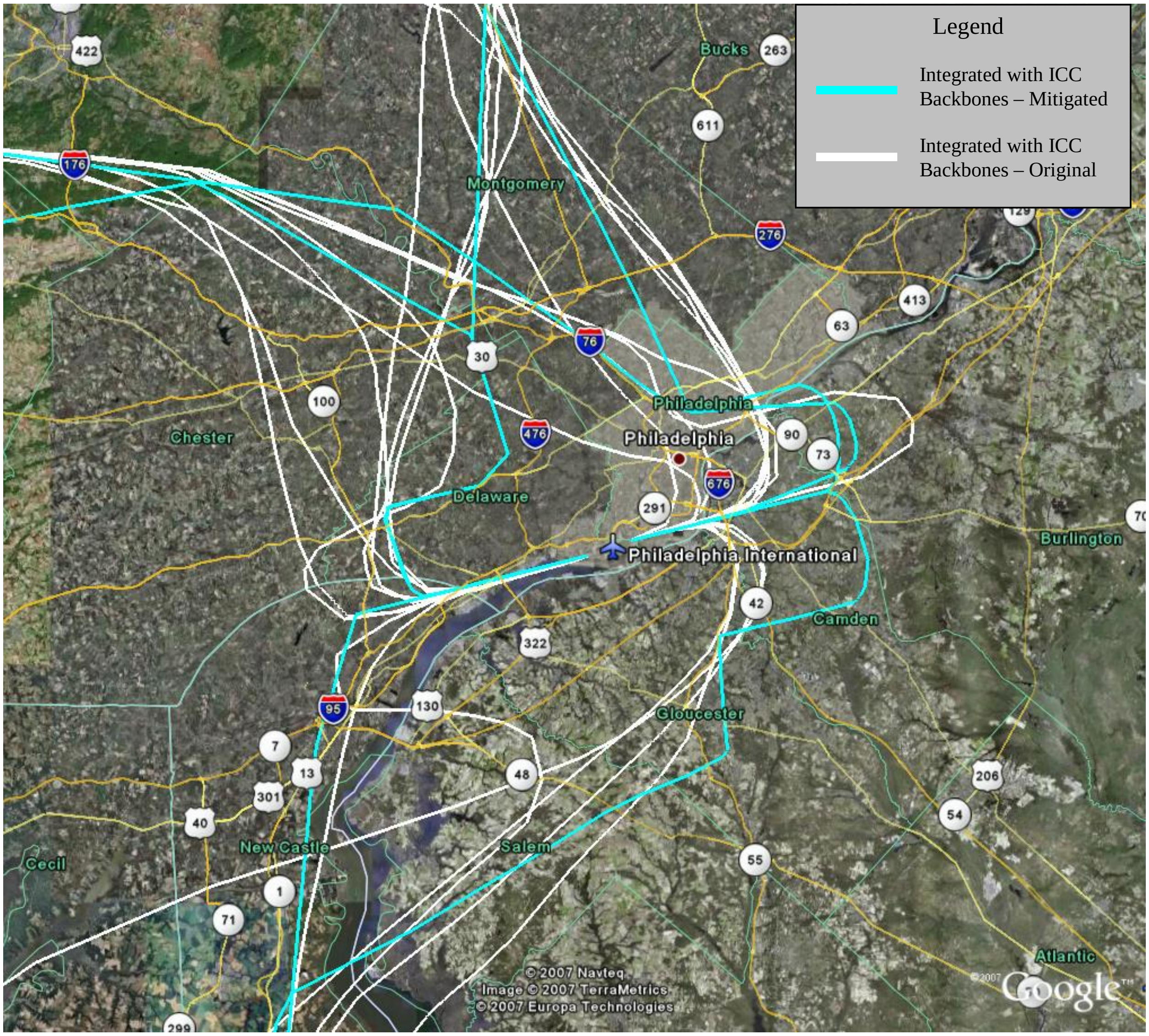

Figure 20: PHL Arrivals – Mitigated (CDA) vs Original

Figure 21 shows the modifications that were made to the descent profiles of the aircraft flying the CDA procedures. The graph shows altitude in hundreds of feet on the vertical axis vs ground track distance from the airport on the horizontal axis. It can be seen that the CDA procedures generally approach the airport at a steeper descent angle between 15,000 feet and 4,000 feet in altitude before intercepting a similar glide slope closer in to the airfield.

In addition to incorporating CDA procedures at PHL, a further mitigation strategy was developed to place more east flow arrivals over a river approach corridor through use of RNAV procedures. Once again an operational analysis was required to determine which traffic could use river approaches, when the river approaches could be used, and how the routing would be affected.

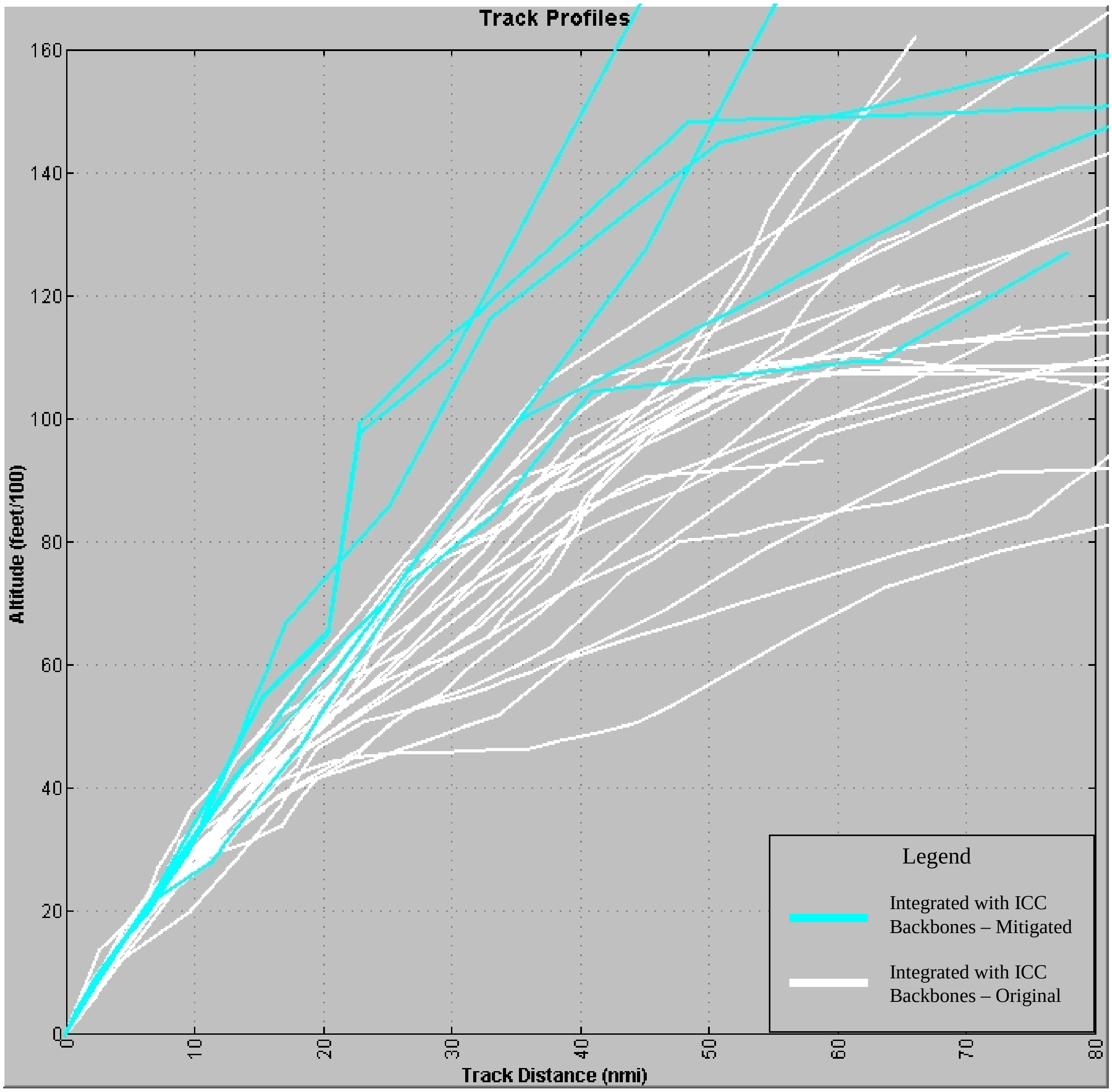

Figure 21: PHL Arrival Profiles – Mitigated (CDA) vs Original

The results of the analysis showed that additional arrivals from the southwest and southeast would be able to use the river approach for runway 09R during limited periods of lower than normal operational demand during daytime hours (7 am to 10 pm). This extra usage would be possible through developing an RNAV route to formalize the river approach. The relatively short time periods when the river approach could be used would allow for an average of 15% of daytime arrivals to runway 09R to use the RNAV river approach or 31 average daily operations in 2011. Thus, as part of mitigation for the Preferred Alternative, 31 daily operations coming from fixes southwest and southeast of PHL were moved to use the river approach. The revised routing of the river approach is shown in **Figure 22.**

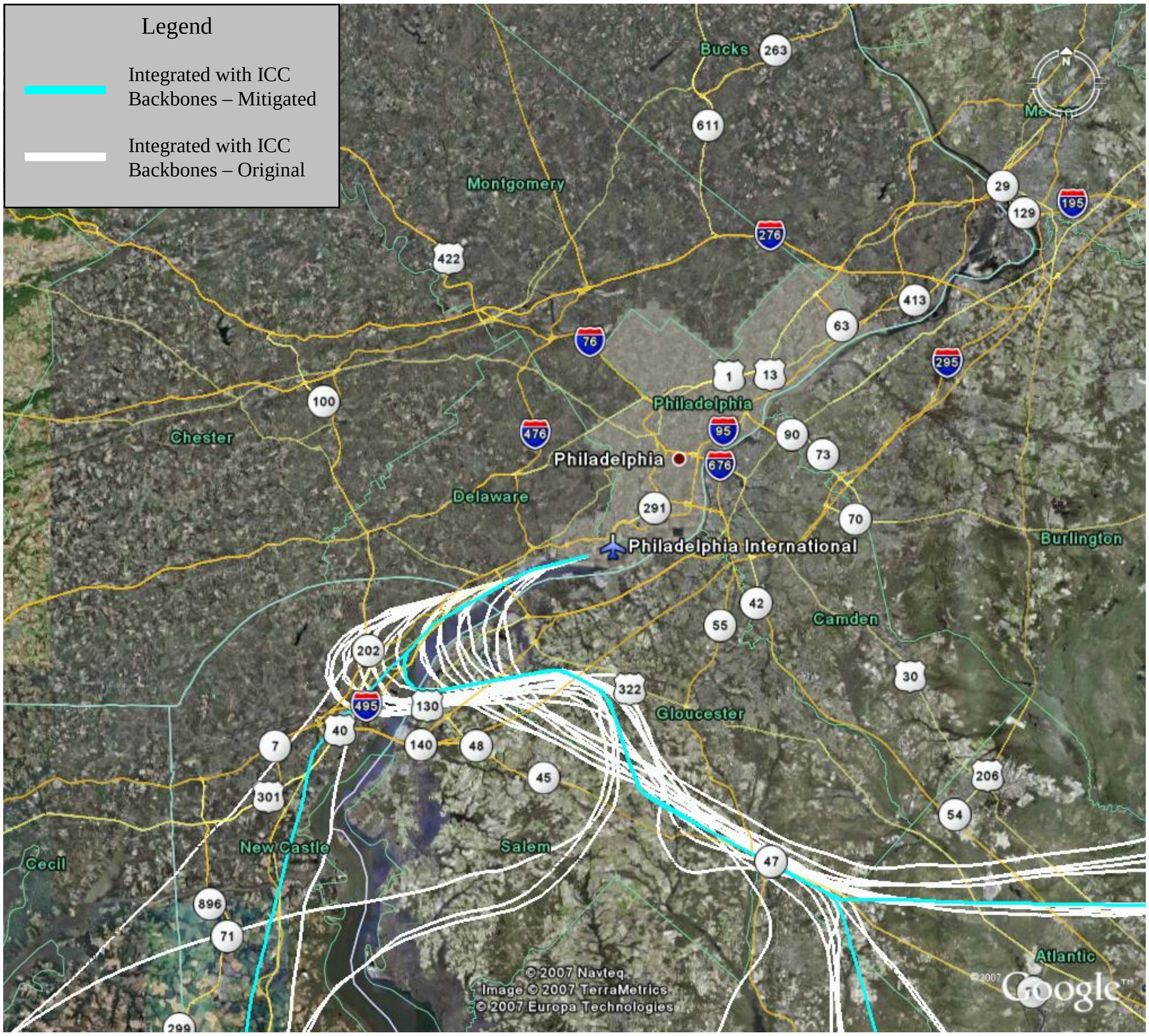

Figure 22: PHL Arrivals – Mitigated (River Approach) vs Original

In reviewing **Figure 22**, keep in mind that the routes shown for the original Preferred Alternative are still flown in the mitigated Plan, just at a lower overall traffic volume. About 15% of the traffic on the original Plan's model tracks will move to the RNAV river approach routes in the mitigated version of the Preferred Alternative. In examining the route changes, take particular note of how the mitigation flight tracks are flying near the north bank of the Delaware River as they approach the runway end. This routing over the north bank does generally move air traffic away from the zones of greater population. Restrictions on RNAV procedure turn angles prevent the possibility that the designed river approach could fly directly over the center of the river and still land on the primary arrival runway at PHL.

- Results – PHL Arrivals

Noise mitigation of PHL Arrivals was not performed in an attempt to reduce the predicted impacts to any specific groups or locations which had impact centroids in the original Preferred Alternative. In fact, there were no such predicted impacts directly caused by changes made to arrivals in the Preferred Alternative. Instead mitigation was performed in a general effort to reduce the Preferred Alternative noise levels in areas around PHL. The nature of the mitigation strategies for PHL arrivals meant that overall there should be net decreases in noise levels, and that possibly there could be some areas which would fall into beneficial impact zones (i.e. considerable reductions in noise). In fact, these were the results that were found based on using the mitigation strategies for PHL arrivals.

Table 9 shows the number of people who fall into the FAA defined impact categories due to changes in PHL arrivals under the original Preferred Alternative, and under the mitigated Preferred Alternative.

Table 9
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative vs Mitigated Preferred Alternative for PHL Arrivals

	DNL Noise Exposure With Proposed Action		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated Airspace ICC	0	0	0
Mitigation Integrated Airspace ICC	0	0	0
Noise Decreases			
Integrated Airspace ICC	0	0	515
Mitigation Integrated Airspace ICC	0	0	3,895

The table indicates that arrivals are not projected to create any significant impacts in either the original or mitigated version of the Preferred Alternative. Note that there would be some increase in the number of people receiving beneficial impacts in the mitigated version of the Preferred Alternative. Both sets of impacts are determined in the exactly the same manner, by examining the differences between the proposed plan and the No-Action scenario.

Figure 23 and **Figure 24** show the geographic details of how arrival mitigation would potentially affect the population experiencing noise impacts surrounding PHL. **Figure 23** overlays the noise results with model flight tracks associated with the CDA procedures. **Figure 24** overlays the noise results with the tracks associated with the RNAV river approach. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Preferred Alternative. The colored dots are the population block centroids which are identified as areas of potential noise impact under the mitigated version of the Preferred Alternative as compared to the Future No Action Alternative.

When examining the figures keep in mind that the noise results shown are from the accumulation of noise for both arrivals and departures at PHL, and in fact all study airports. Some of the noise results displayed on the map such as the intense red and blue color gradients and yellow dots immediately northwest of PHL are due to effects of PHL departures – not arrivals. Black ovals and annotations indicate two areas of particular interest for PHL arrivals

Figure 23 identifies two areas where purple dots arise in mitigation due to arrivals that were not present in the results for the original Preferred Alternative. These are the areas of potential beneficial impact created by mitigating arrivals. There are 1,773 people and 1,226 people in zones PHL-F and PHL-G respectively, who would potentially receive a beneficial impact in the mitigated version of the Preferred Alternative. Zone PHL-E already existed in the original Preferred Alternative but there are a few extra centroids in the mitigated version, bringing the zone's total people from 515 to 896. Examining the color gradient map and the track positions, it is clear that changing to the CDA model tracks is a major influence on creating those zones of reduction.

Figure 24 below shows that using a river approach more heavily for east flow arrivals does help create overall noise reductions in the PHL vicinity. The purple noise reduction impact dots highlighted in zone PHL-G influenced by the river approach in the same manner they were influenced by the CDA. These represent 1,226 people receiving beneficial impacts under the mitigated version of the Preferred Alternative. The purple dots west of the airport but south of the river are not as heavily influenced by these arrival changes as they are influenced by changes for departures in the original Preferred Alternative.

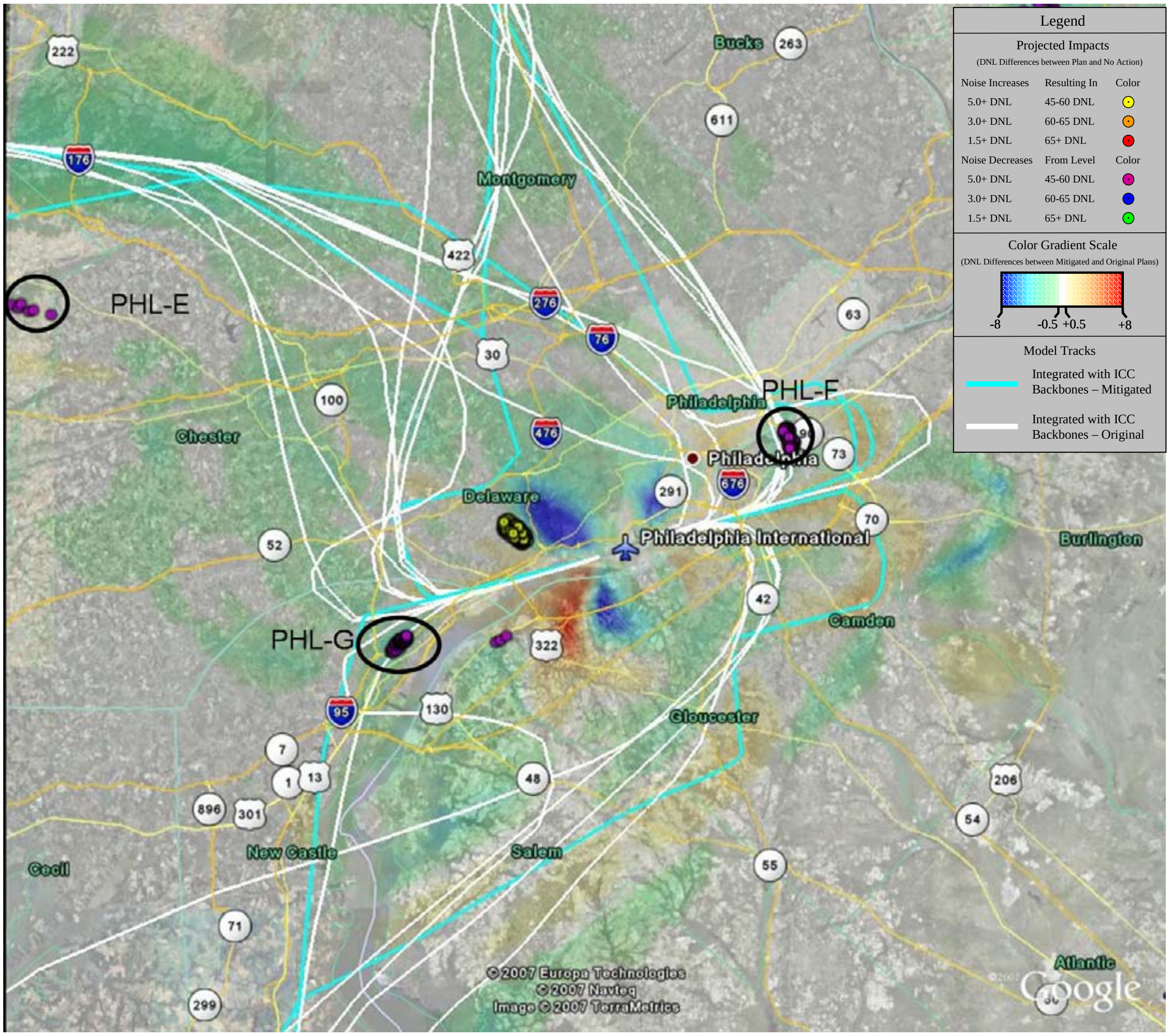

Figure 23: PHL Mitigated Preferred Alternative – CDA Arrival Impacts

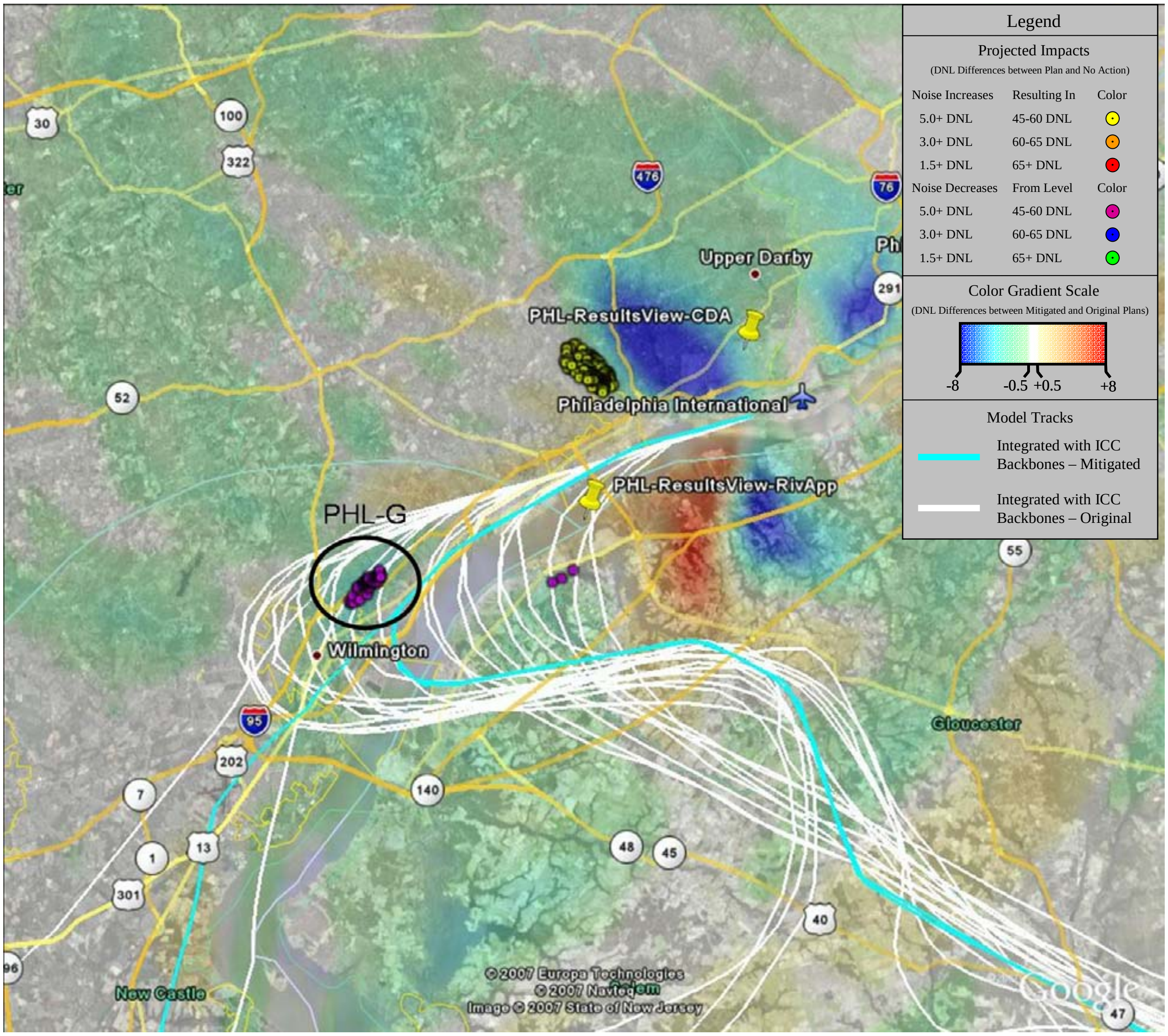

Figure 24: PHL Mitigated Preferred Alternative – RNAV River Approach

LGA Departures

- Mitigation Strategy – LGA Departures

At LGA the Preferred Alternative called for use of three initial departure headings from runway 31. This was designed to improve the operational efficiency of the airspace because there are just two departure headings used for LGA runway 31 under current conditions. Since noise modeling in the Draft EIS showed that a three-heading scenario would potentially cause noise impacts, a strategy was developed to investigate the possibilities of only using all three headings during times of high operational demand. A two-heading scenario similar to the current condition could be used during the rest of the day and night.

- Specific Methodology – LGA Departures

The periods of time during which LGA runway 31 would require a three-departure heading scenario were determined by the operational analysis. This analysis concluded that LGA would actually only need the three simultaneous headings during the morning departure push from 6 am to 7 am. In terms of noise modeling this time period represents 70% of the nighttime departure operations (between 10 pm and 7 am) at LGA and 0% of the daytime departure operations (between 7 am and 10 pm).

Based on the results of the operational analysis, the mitigation strategy for departures on runway 31 at LGA involved moving all of the modeled daytime traffic and 30% of the modeled nighttime traffic to a 2-heading scenario similar to current conditions. Since impacts in the original Preferred Alternative were caused by a general move of initial headings to the east, the 2-heading scenario was crafted by eliminating the use of the most easterly heading for all but the time period between 6 am and 7 am. Specifically, departure traffic in the original Preferred Alternative flew in balanced proportions on the departure headings 350, 005, and 020. In the mitigated version of the Preferred Alternative the vast majority of the traffic was flown on the 350 and 005 headings leaving the 020 heading only necessary for the morning departure push.

Figure 25 shows the changes that were made to the model routes to incorporate the mitigation strategy for LGA runway 31 departures in the Preferred Alternative. Only the routes which were changed as part of mitigation measure are shown. It can be seen in the figure that many of the tracks which would be on initial headings of 005 and 020 in the original Preferred Alternative have moved west to headings of 350 and 005 respectively in the mitigated Preferred Alternative. These tracks represent the changes for all hours except 6 am to 7 am. Flights between 6 am and 7 am stayed on their original Preferred Alternative routes. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

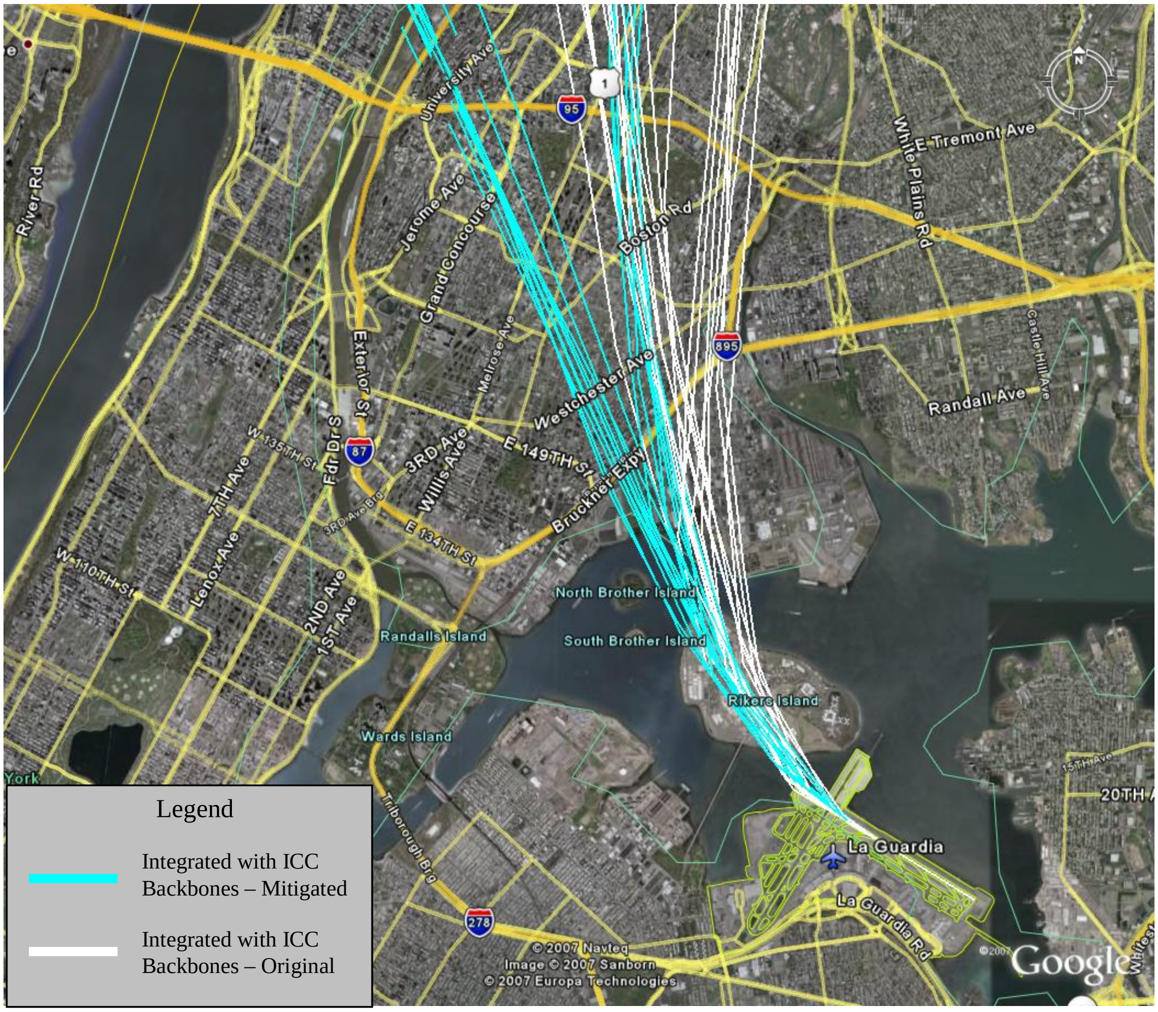

Figure 25: LGA Changes Runway 31 – Preferred Alternative

- Results – LGA Departures

The primary result sought by mitigation of LGA Departures was a reduction in the total people potentially impacted by noise level changes caused by the Preferred Alternative. In the noise modeling, the people who are potentially impacted are represented by the impact categories defined by FAA Policy Order 1050.1E. These categories are based both on total noise exposure levels and on the expected amount of change in noise exposure caused by implementation of a new plan. **Table 10** shows the number of people who fall in the impact categories due to LGA departure changes under the original Preferred Alternative, and under the mitigated Preferred Alternative.

Examining the table, it can be seen that the mitigated plan for LGA departures is not projected to create any impacts (noise increase) whereas the original Preferred Alternative would put 12,846 people in the significant impact category and 26 people in the slight to moderate impact category. Both sets of impacts are determined in the exactly the same manner, by examining the differences between the proposed plan and the No-Action scenario.

Table 10
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative vs Mitigated Preferred Alternative for LGA Departures

	DNL Noise Exposure With Proposed Action		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated Airspace ICC	12,846	26	0
Mitigation Integrated Airspace ICC	0	0	0
Noise Decreases			
Integrated Airspace ICC	0	0	0
Mitigation Integrated Airspace ICC	0	0	0

Figure 26 and **Figure 27** show the geographic details of how mitigation would potentially affect the population who could experience impacts under the Preferred Alternative. In both figures, a satellite image shows LGA and the surrounding area. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Preferred Alternative. The colored dots are the population block centroids which are deemed to be areas of potential noise impact. In **Figure 26** the colored dots are the potential impacts under the original Preferred Alternative. These dots are circled and annotated in the figure. **Figure 27** shows no such colored dots because there would be no impacts under the mitigated Preferred Alternative.

A review of the figures reveals that the mitigation strategy would be successful in reducing the levels of noise over areas of potential impact. In **Figure 26** the color gradient map shows that the mitigation would reduce noise levels in the area labeled as LGA-A. This area includes the red impact dot on Rikers Island representing 12,846 people and the orange impact dots in Hunts Point region of the Bronx representing 26 people. In **Figure 27** it can be seen that the impacts which would potentially exist under the original Preferred Alternative have disappeared under the mitigated Plan.

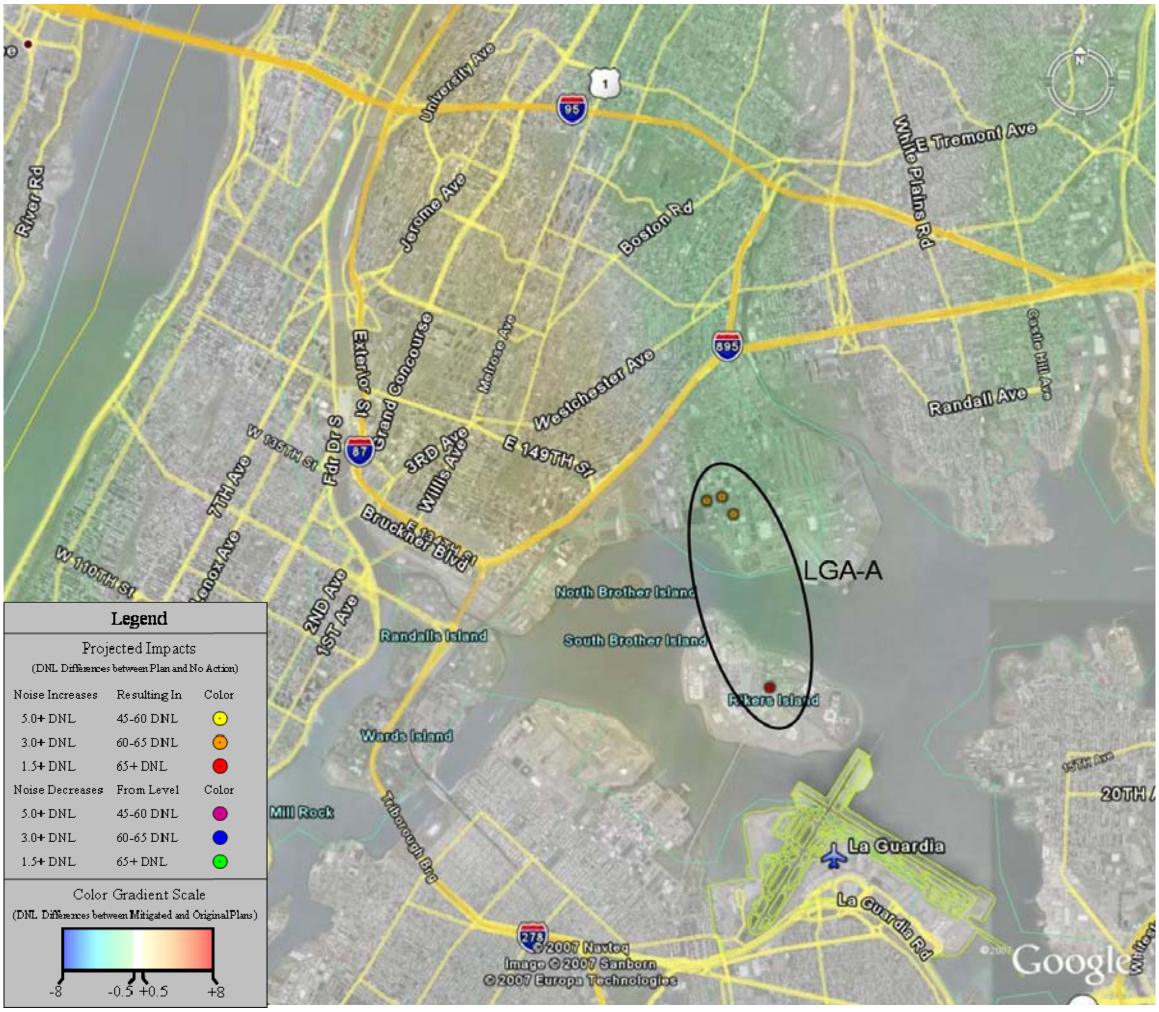

Figure 26: LGA Original Preferred Alternative – Departure Impacts

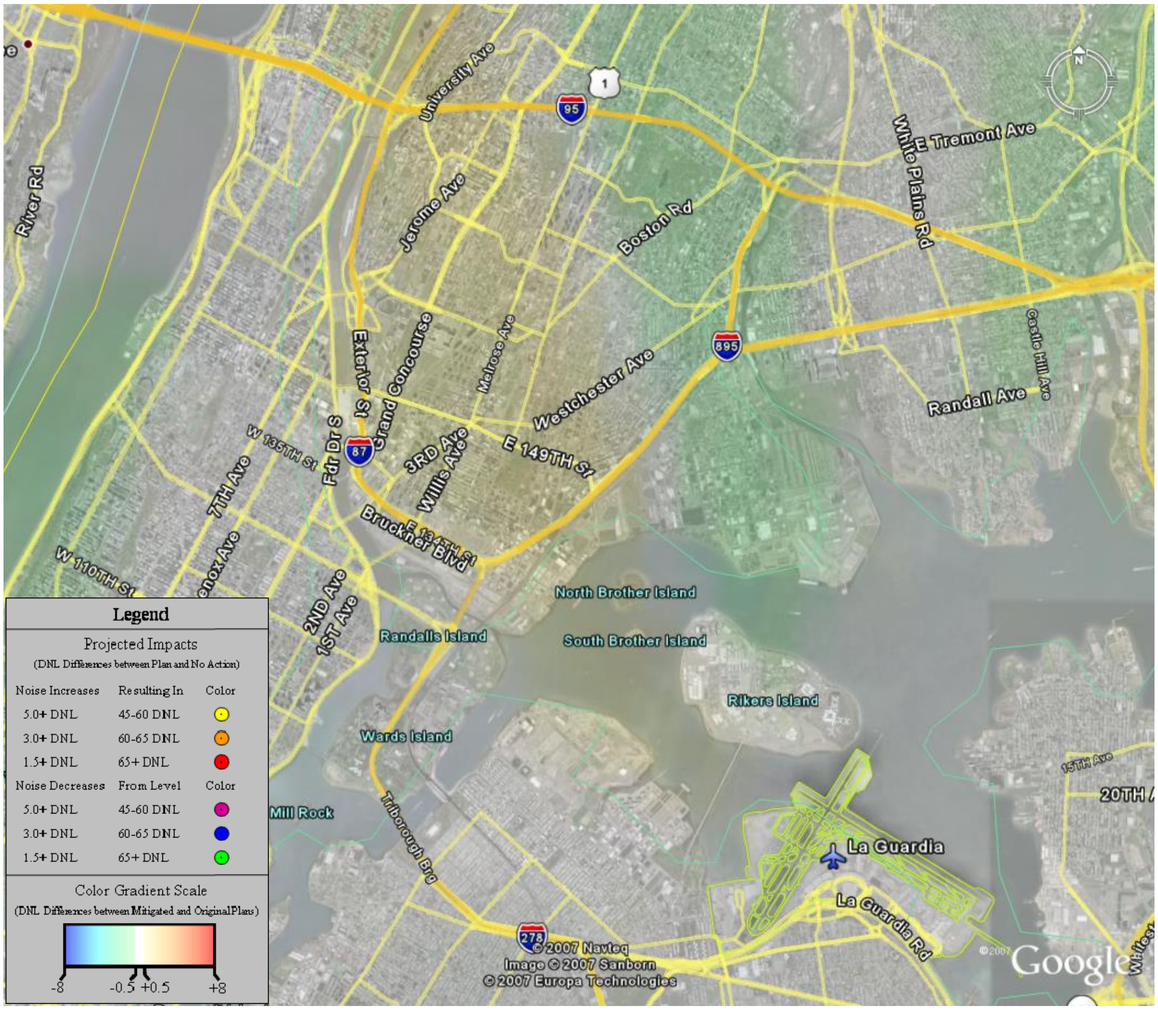

Figure 27: LGA Mitigated Preferred Alternative – Departure Impacts

LGA Arrivals

-Mitigation Strategy – LGA Arrivals

At the meetings for the Draft EIS a major topic of concern for the public was arrivals to runway 22 at LGA. Under current conditions, there are 2 types of approaches to runway 22, the Instrument Landing System (ILS) and the Localizer Directional Aid (LDA). The ILS procedure is aligned with the runway heading which dictates that aircraft fly over populated areas north of LGA on as they approach. In contrast, the LDA approach is offset from runway heading in such a way that aircraft fly over Long Island Sound (water) as they approach. Obviously, the LDA is the preferred approach from the standpoint of reducing aircraft noise over population. Unfortunately, there are safety considerations and constraints on the airspace which do not allow full time use of the LDA. Still, a mitigation strategy was undertaken to examine the possibility of increased usage of the LDA to mitigate noise levels north of LGA in the Preferred Alternative.

- Specific Methodology – LGA Arrivals

The model tracks that were developed to represent the two approach types at LGA are shown in **Figure 28**. Both sets of tracks shown are taken from the model routes for the Preferred Alternative, although approach segments are identical in the No Action scenario. It can be seen that north of LGA the ILS approach puts aircraft over land whereas the LDA approach puts aircraft over water. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks).

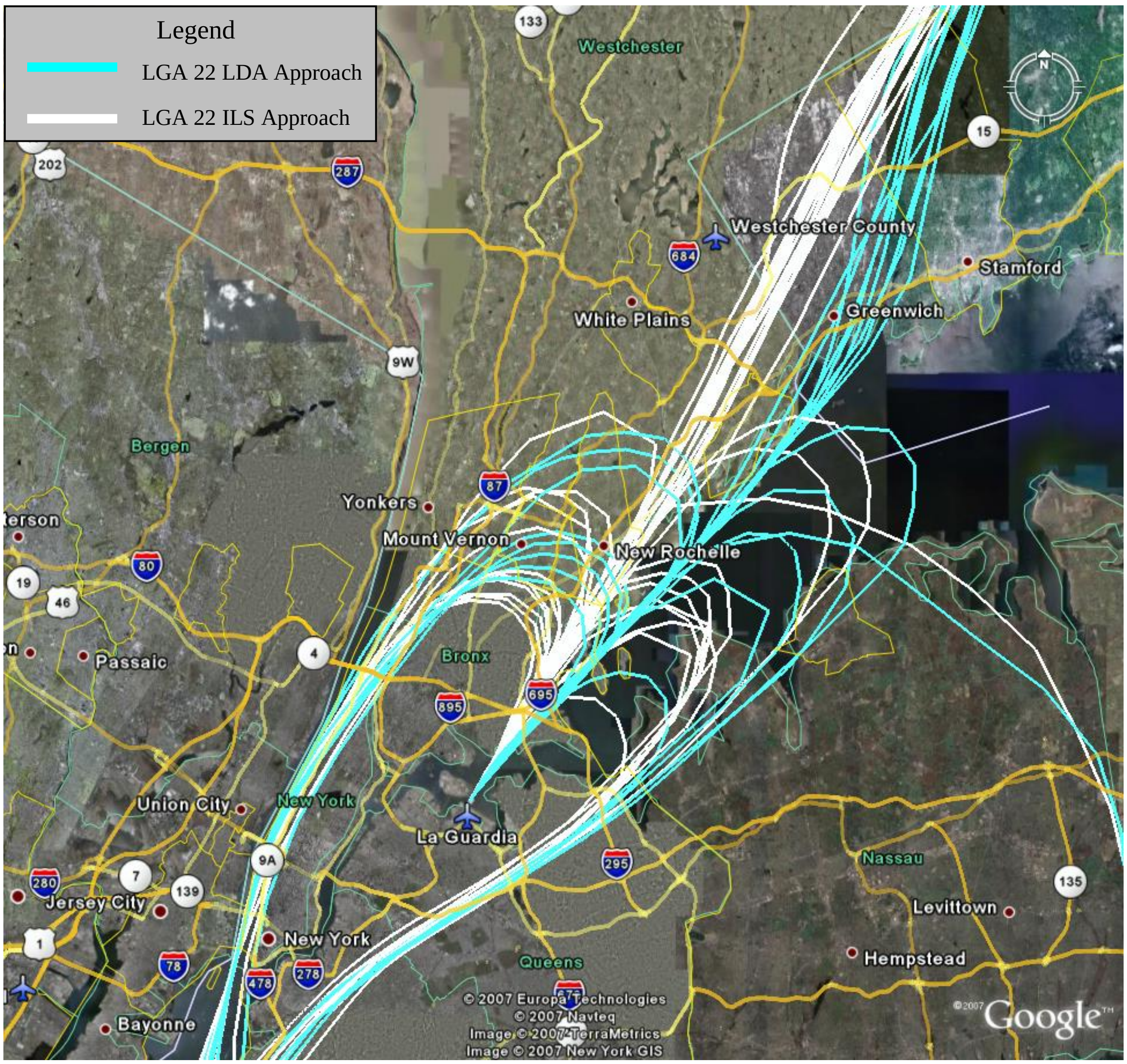

Figure 28: LGA Arrivals Runway 22 – Preferred Alternative

To determine whether there was opportunity to increase usage of the LDA for arrivals to runway 22 at LGA, an operational evaluation of the airspace in the Preferred Alternative was performed. This evaluation determined that when LGA is using runway 13 for departures, an annual average of 45% of arrivals to runway 22 would be able to use the LDA. When LGA is using runway 31 for departures, an annual average of 34% of arrivals to runway 22 would be able to use to LDA. Factoring relative runway configuration usage at LGA, this corresponds to an overall average of 40 % of arrivals to runway 22 being able to use the LDA. This would represent an increase from the modeling of the original Preferred Alternative which only placed 29% of arrivals on the LDA. The difference represents about 30 average daily operations at LGA. Thus using the calculated percentages, a mitigation strategy was carried forward whereby arrivals to LGA runway 22 would be flown less on the ILS approach more on the LDA approach.

- Results – LGA Arrivals

Noise mitigation of LGA Arrivals was not performed in an attempt to reduce the predicted impacts to any specific groups or locations which had impact centroids in the original Preferred Alternative. In fact, there were no such predicted impacts directly caused by changes made to LGA arrivals in the Preferred Alternative. Instead mitigation was performed in a general effort to reduce the Preferred Alternative noise levels in populated areas north of LGA.

Figure 29 is a map which shows how successful the mitigation strategy would be for the areas north of LGA affected by LGA arrivals. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. Applicable areas of increase and decrease have been highlighted by ovals and annotation. Other areas of increase and decrease can be observed on the map, but they are due to other mitigation strategies detailed in this report.

Examining the color gradient map it can be seen that increasing the usage of the LDA would result in a noise reduction in the areas over flown by arrivals on the ILS, and a noise increase in the areas over Long Island Sound which are over flown by arrivals on the LDA. Ultimately, the noise level decreases for population under the ILS from the mitigated version of the Preferred Alternative are not enough to meet the FAA’s thresholds for classifying impacts. However, it can be seen that there would be some moderate noise benefit to the general population based on this mitigation strategy.

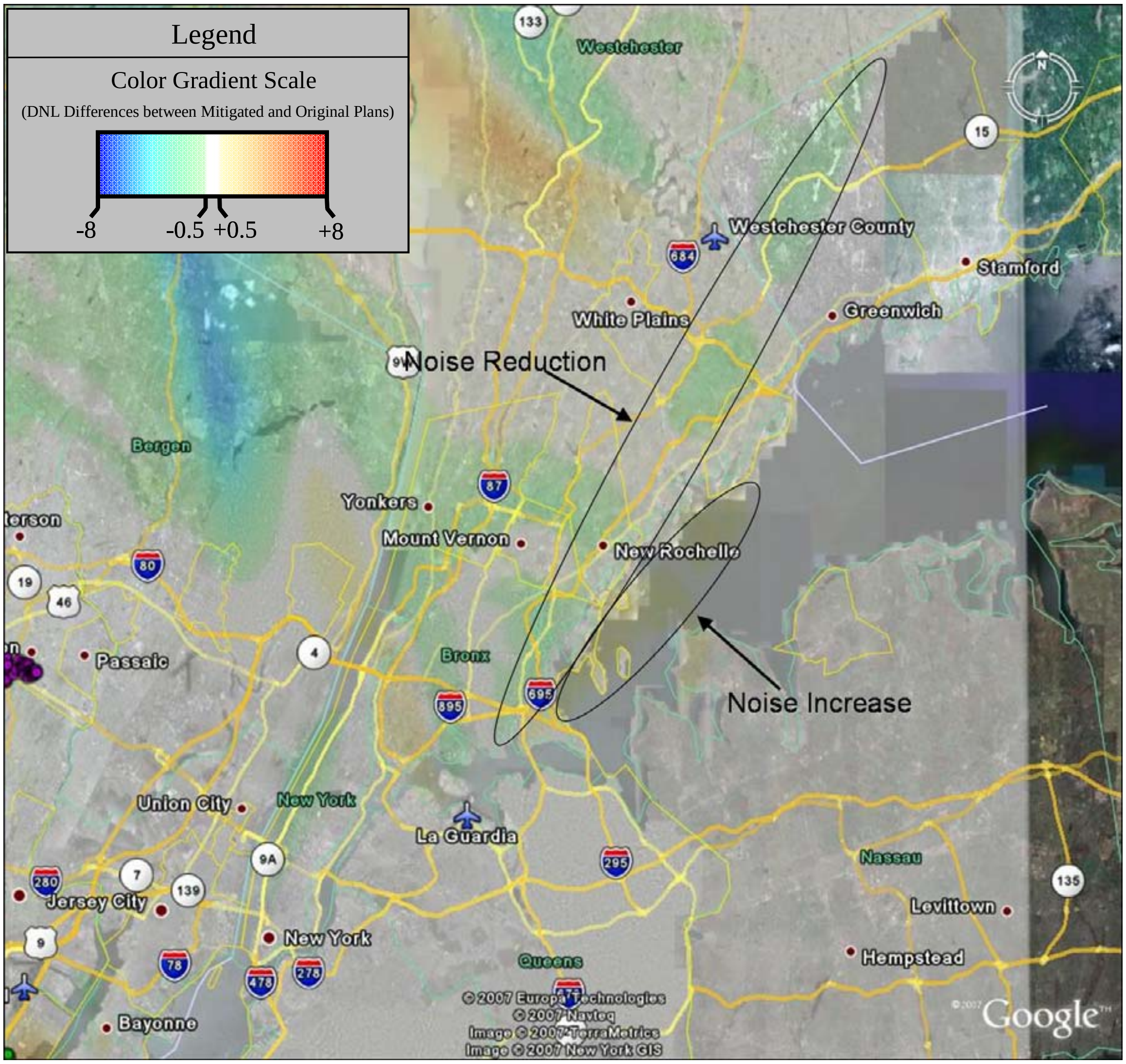

Figure 29: LGA Original Preferred Alternative vs Mitigated – Changes in Noise

HPN Departures

As discussed earlier in this report, one of the refinements to the noise analysis methodology presented in the DEIS related to the rounding of the resulting noise values to one decimal point rather than the six decimals that is used internally within the NIRS software. This refinement tended to result in the same noise levels at most population points, however, some points went up slightly due to the rounding. In some cases a few of the points where noise levels went up slightly actually tripped FAA's thresholds for reportable change. Most of these occurrences were immediately adjacent to areas where points with similar threshold-based increases were already shown in the DEIS. However, the population point located about six and a half miles northwest of HPN near Pleasantville also tripped the FAA threshold of +5 DNL at a 45-60 DNL level for a slight to moderate noise increase. This point in conjunction with numerous comments related to mitigating the changes to HPN departures that were in the Preferred Alternative with the ICC variation prompted an investigation into mitigation for HPN departure routes.

- Mitigation Strategy – HPN Departures

At HPN the Preferred Alternative called for a shifting of the current departure route to the north beginning approximately at the western shore of the Kenisco Reservoir west of the Rye Bridge. The portion of the departure routes between that location and the airfield would remain as they are currently. The proposed change in routing is required as a result of the expansion of EWR arrival airspace boundaries north of EWR that allow for dual arrival streams into EWR in the Preferred Alternative. Similarly, HPN departures destined to the southwest or south would have to circle around the airport to the north in order to gain altitude before crossing into LGA airspace. **Figure 30** provides an illustration showing the No Action departure flight tracks for Runways 16 and 34 at HPN in comparison to the preferred alternative version of the same tracks. The figure also identifies the single yellow population centroid that exceed FAA's threshold of noise change resulting from the Preferred Alternative.

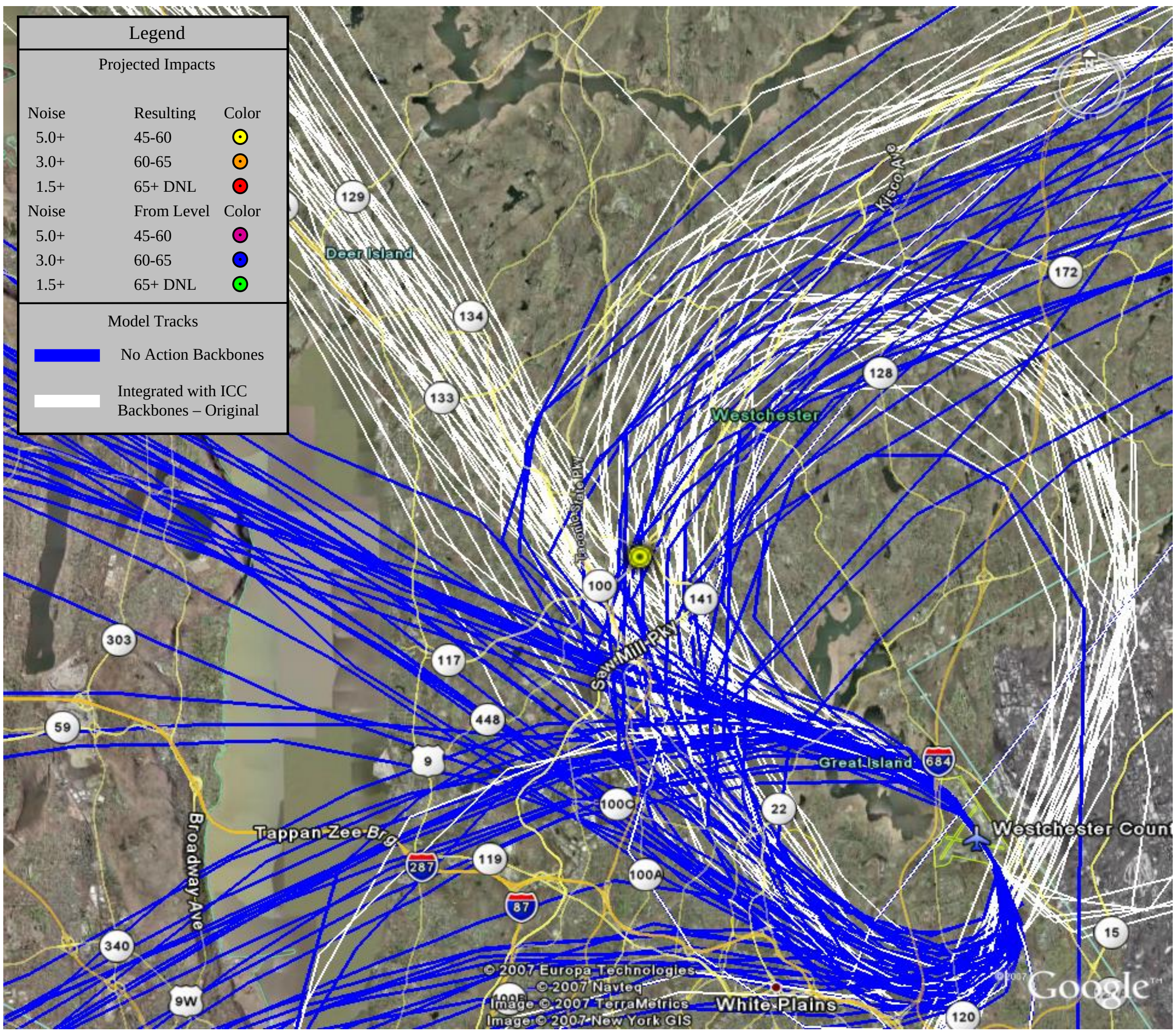

Figure 30: HPN Departures – No Action vs Preferred Alternative

A detailed review of the preferred alternative design revealed that the departure routes that are shifted to the north in the alternative might be able to be brought back closer to their original locations while still avoiding the new EWR arrival airspace. This would tend to keep the departure tracks very near their No Action locations for a greater distance beyond HPN.

- Specific Methodology – HPN Departures

The starting point for finding the mitigation routes for the Preferred Alternative at HPN was for the ATC and operational simulation professionals to identify how close to the EWR arrival airspace that the HPN departures could pass while meeting all FAA safety standards. This buffer geometry was passed to the noise modeling team and the HPN departure tracks were adjusted to follow their No Action routes as closely as possible while staying out of the EWR airspace buffer area. The resulting jet departure routes modeled for the mitigated version of the Preferred Alternative, as well as for the original Preferred Alternative are shown in **Figure 31**. It should be noted that for simplicity of presentation, these graphics only show the center model tracks (backbones) without their associated geographic dispersion (subtracks). Also, model tracks for only the primary departure runways are shown. In the actual noise modeling, the mitigation routes were applied to secondary runways as well.

- Results – HPN Departures

The primary result sought by mitigation of HPN Departures was a reduction in the total number of people potentially impacted adversely by noise level changes caused by the Preferred Alternative. In the noise modeling, the people who are potentially impacted are represented by the impact categories defined by FAA Policy Order 1050.1E. These categories are based both on total noise exposure levels and on the expected amount of change in noise exposure caused by implementation of a new plan. **Table 11** shows the number of people who fall in the impact categories due to HPN departure changes under the original Preferred Alternative, and under the mitigated Preferred Alternative.

Examining the table, it can be seen that the mitigated plan for HPN departures effectively reduces the population in the slight to moderate impact categories to zero. Both sets of impacts are determined in the exactly the same manner, by examining the differences between the proposed plan and the No-Action scenario.

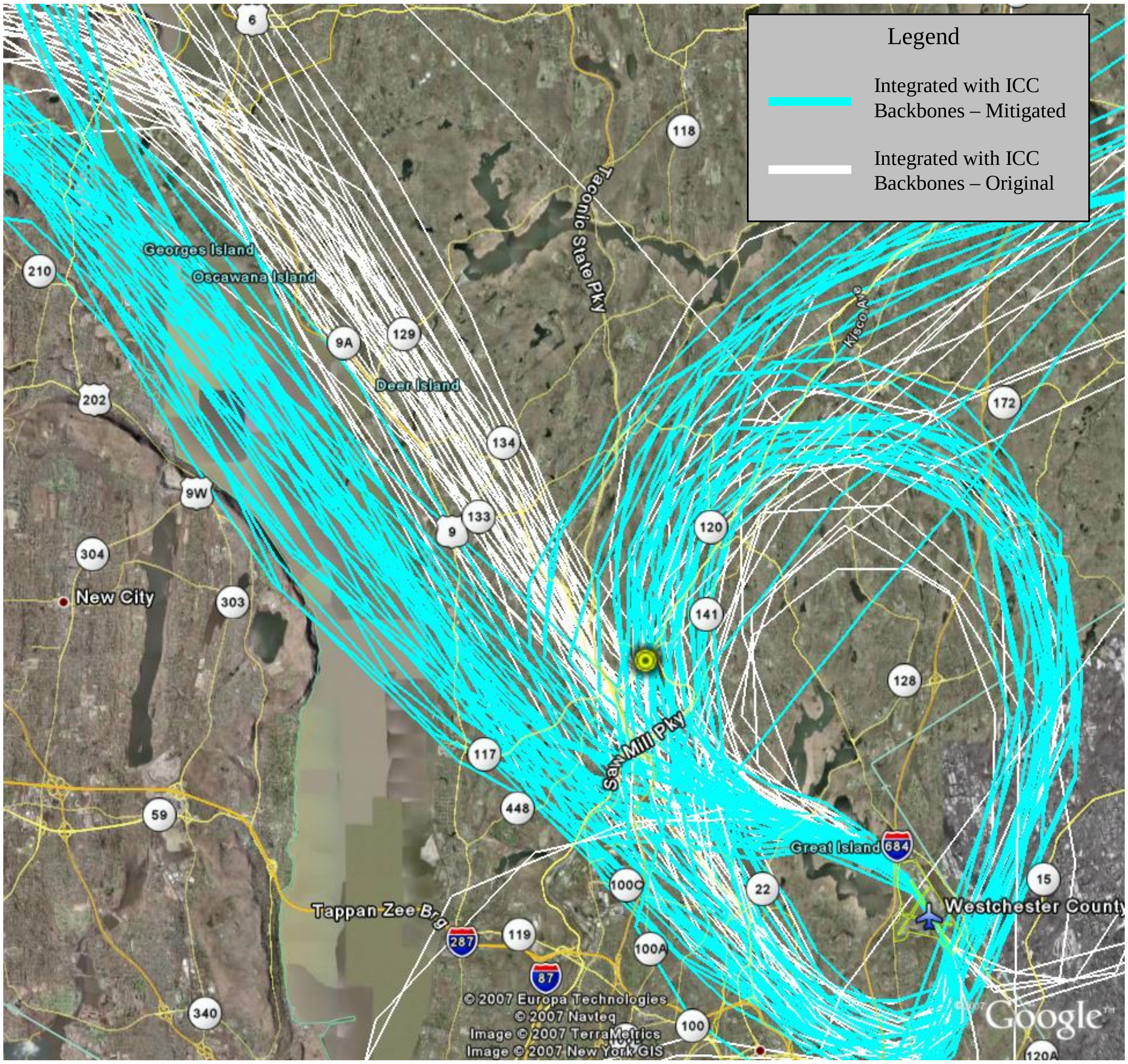

Figure 31: HPN Preferred Alternative Departures – Mitigated vs Original

Figure 32 shows the geographic details of how mitigation would potentially affect the population experiencing noise impacts surrounding near HPN. A satellite image shows HPN and the surrounding area. The semi-transparent colored map overlaying the area uses a color gradient to convey the difference in noise levels between the mitigated version of the Preferred Alternative and the original version of the Preferred Alternative. This color gradient map directly illustrates how much influence the mitigation strategies would have on the Preferred Alternative. Note that the yellow centroid shown in **Figure 31** is no longer present as a result of the mitigation package.

Table 11
Estimated 2011 Population Impacts - Change Analysis Summary
Original Preferred Alternative vs Mitigated Preferred Alternative for HPN Departures

	DNL Noise Exposure With Proposed Action		
	65 DNL or higher	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated with ICC - Original	0	0	40
Integrated with ICC - Mitigated	0	0	0
Noise Decreases			
Integrated with ICC - Original	0	0	0
Integrated with ICC - Mitigated	0	0	0

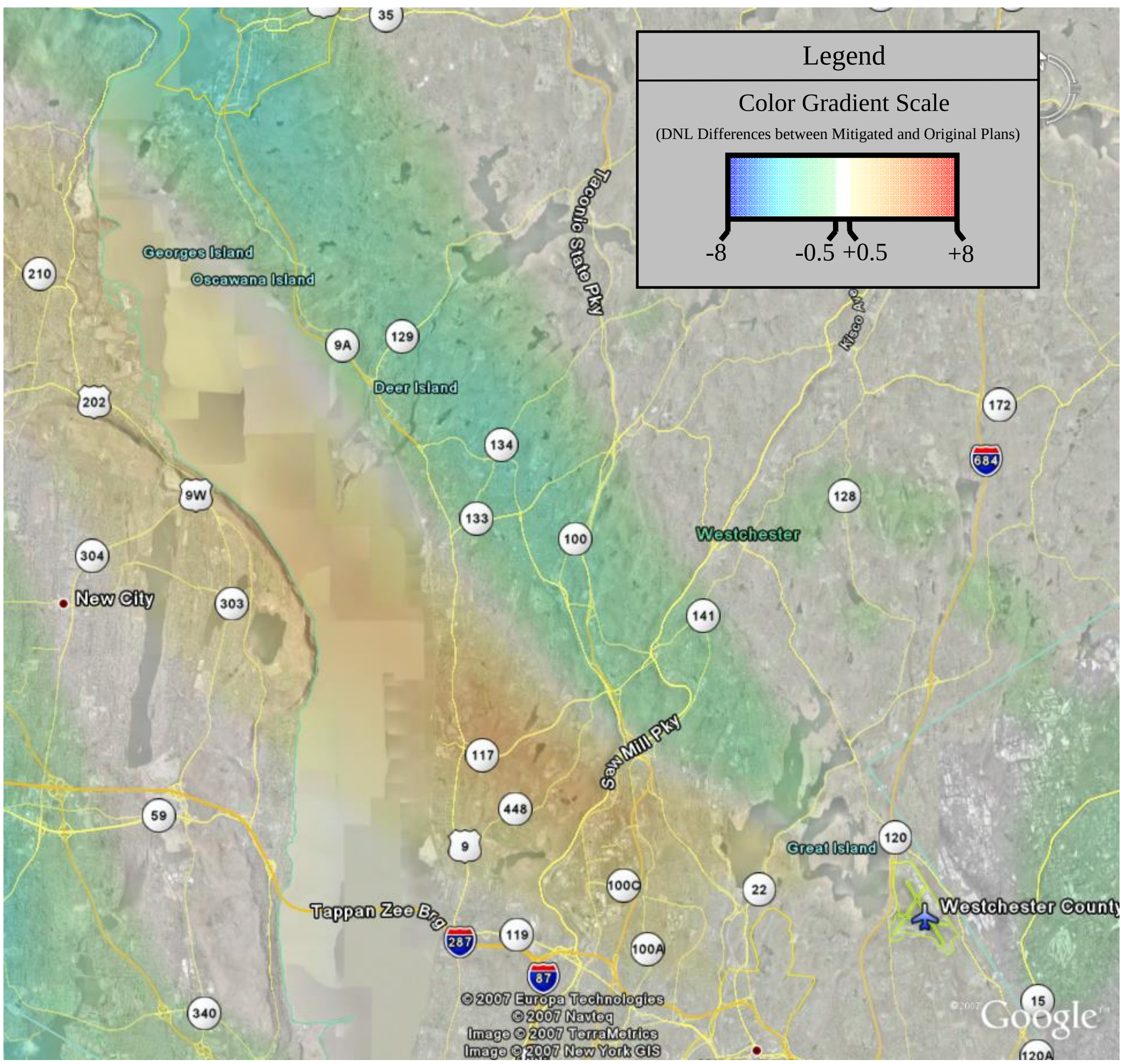

Figure 32: HPN Original Preferred Alternative vs Mitigated – Changes in Noise

Summary

The preceding sections have provided detailed descriptions of the proposed noise mitigation procedures identified for the Preferred Alternative mitigation package. The results of the noise evaluation have been presented in terms of the 2011 conditions for the Integrated Airspace Alternative Variation with ICC. The results of the noise analysis have been presented in detail for specific geographical areas and specific airports. While these details are indeed important to citizens in each area, it is also important for decision makers to understand the overall effect of the proposed alternative and its total mitigation package on the entire Study Area.

Table 12 presents the noise exposure associated with the Future No Action conditions, the Preferred Alternative, and the Preferred Alternative with mitigation. The exposure is presented in terms of the estimated population expected to be exposed to various ranges of DNL noise levels for each scenario. The 2006 scenario for the Integrated Airspace Alternative Variation without ICC is also presented in both its original and mitigated form as it represents the expected first phase of implementation for the Preferred Alternative. As previously discussed, the mitigation procedures for the Integrated Alternative Variation without ICC are generally a subset of those described in detail in the previous section. However, there are some differences where design elements in the Variation with ICC were not present in the variation without ICC.

The table also presents comparisons between the Preferred Alternative, the Preferred Alternative with mitigation, and the Future No Action Airspace Alternative for each year of analysis. These comparisons highlight the effectiveness of the mitigation package in terms of the original alternative starting point as well as relative to the conditions that would be expected if no action is taken as a result of this project.

Table 12

Comparison of Estimated Population within DNL Ranges

2006	**65 +**	**60-65**	**55-60**	**50-55**	**45-50**	**Total 45+**
No Action	72,141	213,692	1,008,370	3,600,506	7,165,570	12,060,279
Integrated without ICC	78,866	252,590	1,136,431	3,680,715	6,952,002	12,100,604
Mitigated - Integrated w/o ICC	74,460	236,706	1,099,431	3,567,077	6,535,685	11,513,359
Mitigated vs w/o Mitigation	-4,406	-15,884	-37,000	-113,638	-416,317	-587,245
Mitigated vs Future No Action	2,319	23,014	91,061	-33,429	-629,885	-546,920
2011	**65 +**	**60-65**	**55-60**	**50-55**	**45-50**	**Total 45+**
No Action	75,459	209,793	919,396	3,612,159	7,157,243	11,974,050
Integrated w/ICC	74,833	252,361	1,039,049	3,590,613	7,592,618	12,549,474
Mitigated - Integrated w/ICC	74,681	240,387	999,209	3,431,748	6,609,002	11,355,027
Mitigated vs w/o Mitigation	-152	-11,974	-39,840	-158,865	-983,616	-1,194,447
Mitigated vs Future No Action	-778	30,594	79,813	-180,411	-548,241	-619,023

As the comparisons between the Preferred Alternative and the Preferred Alternative with mitigation indicate, the mitigation package was successful at reducing the estimated population exposed to all noise levels, especially the higher significant noise levels of 65 DNL or more. Additionally, when compared to the Future No Action Airspace Alternative, the Preferred Alternative with mitigation also showed some noise reductions at various noise levels. **Ultimately, the mitigation package for the Integrated Airspace Alternative Variation with ICC will reduce the population exposed to significant aircraft noise levels of 65 DNL or greater as compared to what would be expected if no actions were taken by 2011.** The Preferred Alternative with mitigation also effectively reduces the number of persons exposed to aircraft noise of 45 DNL or greater as compared to the Future No Action Airspace Alternative.

Another important indication of the effectiveness of the Preferred Alternative and the mitigation package is in terms of the population exposed to changes in noise at the FAA threshold levels. These threshold-based changes were presented in the DEIS for all alternatives and represent FAA's primary areas of consideration for noise impacts based on FAA policy outlined on FAA order 1050.1E.

It is important to note that FAA's policy requires that the change analysis be conducted within a given year of interest and not across different time frames. Consequently, the noise changes considered are referenced to the No Action noise levels for the year of interest. As discussed in the DEIS, increases of 1.5 DNL above 65 DNL are considered significant. When these significant impacts occur, further analysis should be conducted to identify noise sensitive areas between 60 and 65 DNL that have an increase in noise of 3.0 DNL or more. These increases are considered to be "slight to moderate impacts" as are increases of 5 DNL or greater at levels between 45 DNL to 60 DNL because increases at these levels may not be noticeable or potentially disturbing to some people to be considered a significant impact.

Table 13 presents the estimated population exposed to changes in noise levels at the FAA thresholds for the 2006 conditions for both the Preferred Alternative (Integrated Airspace Alternative Variation without ICC) and the Preferred Alternative with mitigation.

When considering the threshold based noise increases for the Preferred Alternative the table reveals that there are sizable populations that would experience both a significant noise change as well as various degrees of slight to moderate changes. In aggregate, the Preferred Alternative would result in exposure of some 200,000+ persons to noise increases that triggered one of the three FAA thresholds. However, when the mitigation package is applied to the Preferred Alternative, this total drops dramatically to some 37,600+ persons for more than a 80 percent reduction in the persons expected to be exposed to noise increases that triggered one of the three FAA thresholds. At the significant threshold of +1.5 DNL at 65+ DNL, the mitigation package creates a 97 percent drop in the number of persons that would be expected to experience a significant increase in noise.

Table 13
Preferred Alternative Comparison – Estimated 2006 Population Impacts
Change Analysis Summary

	DNL Noise Exposure With Proposed Action		
	65+ DNL	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative>	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact>	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated Airspace Variation without ICC	21,399	37,558	142,517
Mitigated Integrated Airspace Variation without ICC	545	21,626	15,509
Noise Decreases			
Integrated Airspace Variation without ICC	5,970	1	39,400
Mitigated Integrated Airspace Variation without ICC	310	1	35,684

Table 14 presents the estimated population exposed to changes in noise levels at the FAA thresholds for the 2011 conditions for both the Preferred Alternative (Integrated Airspace Alternative Variation with ICC) and the Preferred Alternative with mitigation. This represents the full implementation of the FAA's Preferred Alternative.

Table 14
Preferred Alternative Comparison – Estimated 2011 Population Impacts
Change Analysis Summary

	DNL Noise Exposure With Proposed Action		
	65+ DNL	60 to 65 DNL	45 to 60 DNL
Minimum Change in DNL With Alternative>	1.5 DNL	3.0 DNL	5.0 DNL
Level of Impact>	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
Integrated Airspace Variation with ICC	15,826	34,824	290,758
Mitigated Integrated Airspace Variation with ICC	0	16,803	50,392
Noise Decreases			
Integrated Airspace Variation with ICC	6,984	22	62,537
Mitigated Integrated Airspace Variation with ICC	3,201	1	207,629

As the table indicates, in terms of the noise increases there are again sizable populations that would experience either a significant noise change or various degrees of slight to moderate changes with the original Preferred Alternative. In aggregate, the Preferred Alternative would expose some 341,000+ persons to noise increases that triggered one of the three FAA thresholds. However, as with the 2006 conditions, when the mitigation package is applied to the Preferred Alternative, this total drops dramatically to some 67,000+ persons. Again, this represents more than an 80 percent reduction in the persons expected to be exposed to noise increases that triggered one of the three FAA thresholds as a result of the mitigation effort. At the significant threshold of +1.5 DNL at 65+ DNL, the mitigation package eliminates all impacts in this category for a 100 percent drop in the number of persons that would be expected to experience a significant increase in noise.

The comparisons presented in this section clearly illustrate the effectiveness of the mitigation package identified for the Preferred Alternative. **Not only is the proposed mitigation effective at reducing overall noise exposure as compared to the original Preferred Alternative, but it also reduces noise relative to the Future No Action Airspace Alternative for persons exposed to 65 DNL or greater noise levels in 2011.** Similarly, the changes in noise identified by FAA's thresholds are also substantially reduced through the application of the mitigation package. Earlier sections of the report and the separate operational analysis report confirm that the proposed procedures incorporated into the final mitigation package for the Preferred Alternative are indeed feasible and maintain the operational gains achieved by the original alternative design.