

Final Environmental Assessment
for
Greener Skies Over Seattle;
Proposed Arrival Procedures to
Seattle-Tacoma International Airport

Volume 1 – Main Document

31 October 2012

Prepared by:
United States Department of Transportation
Federal Aviation Administration



Renton, Washington



Federal Aviation Administration

Finding of No Significant Impact (FONSI) & Record of Decision (ROD)

For the Implementation of RNAV/RNP Procedures at Seattle-Tacoma International Airport (Greener Skies over Seattle)

31 October 2012

I. INTRODUCTION

This document serves as the Federal Aviation Administration's (FAA) Finding of No Significant Impact and Record of Decision (FONSI/ROD) and provides final agency determinations and approvals for the proposed action, namely utilization of Performance-Based Navigation (PBN) by implementing new Area Navigation (RNAV) procedures, including Required Navigation Performance (RNP) and Optimized Profile Descent (OPD), at Seattle-Tacoma International Airport (SEA). The proposed routes and procedures are designed to improve the safety and efficiency of the SEA airspace, which includes the Terminal Radar Approach Control (TRACON) as well as high-altitude Air Route Traffic Control Center (ARTCC) airspace. This FONSI/ROD is based on the information and analysis contained in the Final Environmental Assessment (Final EA) dated October 2012 attached hereto.

Furthermore, this FONSI/ROD:

- 1) Completes the FAA's required environmental review and decision making process. It is prepared and issued to announce and document certain Federal Actions and decisions in compliance with the National Environmental Policy Act of 1969 (NEPA) [42 U.S.C Section 4321, et seq.], the implementing regulations of the Council on Environmental Quality (CEQ) [40 CFR Parts 1500-1508] and FAA Orders [Order 1050.1E, Change 1, Environmental Impacts: Policies and Procedures (March 20, 2006) and Order JO 7400.2J, Procedures for Handling Airspace Matters (February 09, 2012)]. This FONSI/ROD is also used by the FAA to

demonstrate and document its compliance with the several procedural and substantive requirements of aeronautical, environmental, programmatic, and other statutes and regulations that apply to FAA decisions on proposed actions;

- 2) Provides the final Federal determinations and approvals based on environmental analysis and findings in the attached Final EA. The FAA's decisions are based on the information and analysis contained in the Final EA and all other applicable documents which were available and considered, and which constitute the administrative record; and
- 3) Approves certain Federal actions associated with the implementation of the proposed RNAV/RNP procedures for appropriately equipped aircraft and certified aircrews arriving at SEA from the northwest and southwest. Implementation of the Proposed Action will result in no airport-related development.

In reaching its determination, FAA has given consideration to 49 U.S.C. § 40101(d)(4), which governs FAA's responsibility to carry out its mission while considering safety and the public interest when controlling the use of navigable airspace and regulating civil and military operations in that airspace in the interest of safety and efficiency of both of these operations. Additionally, consideration has been given to 49 U.S.C § 40103(b)(2) which authorizes and directs the FAA Administrator to prescribe air traffic rules and regulations governing the flight of aircraft, for the navigation, protection, and identification of aircraft, and the protection of persons and property on the ground, and for the efficient utilizations of the navigable airspace, including rules as to safe altitudes of flight and rules for the prevention of collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects.

Furthermore, the FAA has given careful consideration to: the aviation safety and operational objectives of the project in light of the various aeronautical factors and judgments presented; the need to enhance efficiency of the national air transportation system; and the potential environmental impacts of the project.

I. BACKGROUND

The FAA is in the process of implementing NextGen, the FAA's plan to modernize the National Airspace System (NAS) through 2025. NextGen is a complex program intended to develop and implement new technologies and adapt the air traffic management system to a new way of operating. NextGen represents an evolution from an air traffic management system that is primarily ground-based to a system that is satellite-based and will allow the FAA to guide and track air traffic more precisely and efficiently. To achieve NextGen goals, the FAA is implementing new RNAV and Required Navigation Performance (RNP)-based air traffic routes and instrument procedures around the country that leverage emerging technologies and aircraft navigation capabilities. The implementation of RNAV and RNP enable the use of other PBN technology in the NAS, including Optimized Profile Descents (OPD).

In 2009, Alaska Air Group (AAG, the holding company for Alaska Airlines and Horizon Air) and Seattle-Tacoma International Airport staff, in cooperation with The Boeing Company and the FAA,

initiated development of a plan to investigate new PBN flight procedures for SEA that would utilize these latest navigational technologies and allow aircraft operators to fly optimal descent paths, while reducing their environmental impact during approaches to land. The “Greener Skies over Seattle” initiative, as it was named, or just “Greener Skies”, consists of procedural changes that begin in the Seattle ARTCC, continue into Seattle TRACON airspace, and eventually end in the airspace controlled by Seattle Tower as aircraft descend from cruising altitude all the way to landing on one of SEA’s six runway ends.

In 2010, the FAA took over responsibility for completing the final design and implementation of the procedures, consistent with the Agency’s functional role in controlling aircraft, and also to assure broad availability of the new procedures to all appropriately equipped aircraft, advancing the use of the technology in SEA’s complex airspace that includes step-down approaches, confliction points and frequent pilot/controller radio communications. Since 2010, the preliminary design has been finalized and this Final EA has been prepared to identify potential environmental effects associated with the proposed new procedures and their future usage.

II. PROPOSED ACTION

The Proposed Action, also referred to as the I-1 procedures of Greener Skies, considered in the Final EA is the design, publication and implementation by the FAA of optimized standard instrument arrival procedures serving air traffic flows from the northwest and southwest into SEA.

The Proposed Action consist of a set of proposed new PBN arrival procedures originating at current navigational “waypoints” – points in space identified by their latitude, longitude, and altitude – that will provide new guidance to appropriately equipped aircraft and certified aircrews so that they may fly shorter routes to the runways than they are able to at present, and to do so with less pilot-controller interaction and at lower throttle settings.

The starting points of the proposed procedures are approximately 40 miles away from SEA to the northwest and as much as 140 miles away to the southwest. Farther out from these existing waypoints no changes are being proposed, nor are there procedural changes planned or anticipated for any portions of any arrivals coming into SEA from the eastern side of the Airport. Those flights will continue to operate as they do today. In addition, no procedural changes are planned or anticipated for aircraft taking off from SEA. All of those flights also will continue to operate as they do today. Furthermore, the set of new procedures that are being proposed for the northwest and southwest arrivals serve to supplement (not replace) current procedures, so that unequipped aircraft arriving from those areas also will continue to operate on existing procedures as they do today.

The Proposed Action evaluated in the attached Final EA is the implementation of new RNAV procedures, including RNP and OPD procedures for SEA in order to improve the safety and efficiency of the SEA airspace. The Proposed Action includes:

- A new Standard Terminal Arrival Route (STAR) procedure for traffic arriving from the northwest to land on any of the six runway ends at SEA.
- A new STAR for aircraft arriving from the southwest that would reduce the number of flight miles flown when landing on any of the six runway ends.
- Implementation of 21 new RNP and RNP-to- Instrument Landing System (ILS) procedures northwest and southwest of SEA
- Optimized Profile Descents from both the northwest and southwest.

III. PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to implement standard instrument arrival procedures to improve the predictability and repeatability of flight routes and more efficiently serve SEA's six runway ends, and to redesign the supporting airspace management structure to increase flight path predictability and flexibility, decrease communication requirements between controllers and pilots (thereby reducing radio frequency congestion and the likelihood of hear-back/read-back errors), and provide more direct routings that are not dependent on ground-based navigational aids.

The Proposed Action is needed to improve efficiency in a complex airspace while maintaining and enhancing safety in accommodating current and forecast air traffic demand.

IV. ALTERNATIVES

Alternatives involving use of other modes of transportation, use of other airports, or changes in airport layout were not considered because such alternatives would not have met the purpose and need for the Proposed Action. The FAA's investigation of alternatives to enhance efficiency in the SEA Airspace began in 2010. Starting with a preliminary identification of measures aimed at reducing flight times, level-off segments, and confliction points in this complex airspace, the consideration of concepts to enhance airspace efficiency focused on measures that could be implemented with little potential for adverse environmental impacts, particularly noise. For this reason, the consideration of alternatives centered on areas west of SEA along the three- to five-mile wide band of Puget Sound. The FAA examined the feasibility of measures to enhance airspace efficiency in this area and eliminated those that created conflicts that could not have been resolved or did not prove to enhance efficiency.

Ultimately, this screening and evaluation of individual proposals resulted in the elimination of measures found to be ineffective, while those found to be viable and effective at reducing inefficiencies collectively became the Proposed Action. FAA Order 1050.1E, Chapter 4, Section 405(d) states that there "is no requirement for a specific number of alternatives or a specific range of alternatives to be included in an EA. An EA must consider the proposed action and a discussion of the consequences of taking no action and may limit the range of alternatives to action and no-action

when there are no unresolved conflicts concerning alternative uses of available resources.”¹ The No-Action and Proposed Action therefore were the only alternatives considered.

V. AFFECTED ENVIRONMENT

FAA Order 1050.1E identifies the maximum altitude for environmental consideration of airspace actions as 10,000 feet above ground level (AGL). Additionally, FAA Order JO7400.2J recommends considering proposed changes up to 18,000 feet AGL when the proposed changes are over a National Park, Wilderness Area, or Tribal Lands where natural quiet may be an attribute of the land use. Because of the proximity of Olympic National Park to the northwest and Mount Rainier National Park to the southeast, and the presence of tribal lands in the region, the study area examined in this EA encompasses all areas over which the proposed changes to aircraft routes would occur below 18,000 feet AGL to assure that any areas of natural quiet were included. The resulting rectangle, depicted in Figure 5.1-1 of the Final EA, covers slightly less than 3,200 square miles, including part or all of 10 counties in the state of Washington.

VI. ENVIRONMENTAL CONSEQUENCES

Implementation of the Proposed Action involves aircraft route changes and does not entail any physical development. For this reason, many of the environmental resource categories described in FAA Order 1050.1E, Chapter 4, Paragraph 403, Impact Categories, would not be affected. These resources include Coastal Resources, Construction Impacts, Farmlands, Hazardous Materials, Pollution Prevention and Solid Waste, Water Quality, Wetlands, and Wild and Scenic Rivers. Chapter 5 of the Final EA provides a brief description of the rationale for dismissing these impact categories from consideration in the analysis of the Proposed Action’s potential effects.

No significant impacts to the quality of the human or natural environment were identified for any of the remaining categories evaluated in the EA. No Environmental Impact Statement is required to be, or has been, prepared. Therefore, the potential environmental impacts from the Proposed Action were evaluated in the attached Final EA for each of the following impact categories.

Noise

Noise exposure was modeled for the Proposed Action and the No Action alternatives. The Proposed Action would not result in a significant noise impact, i.e., an increase of 1.5 decibels (dB) or more at a Day-Night Average Sound Level (DNL) of 65 dB or more, at any noise sensitive receptor. However, reduced dispersion of aircraft over areas directly beneath the proposed RNAV procedures would slightly increase noise at some population centroids, while slightly decreasing noise at others. The narrowing of flight corridors would not result in reportable changes of 3 dB or more between DNL values of 60 and 65 dB, nor would it result in changes of 5 dB or more between DNL values of 45 and 60 dB. In 2014, implementation of the Proposed Action would newly expose areas with a population of 396 to DNL 65 or above. In 2018, the population newly exposed to DNL 65 or above would be 43.

¹ FAA Order 1050.1E, Chg. 1, Ch. 4, Sec. 405(d), pg. 4-10; 20 March 2006.

In 2023, the population newly exposed to DNL 65 or above would be 214. All of these areas would experience an increase in DNL of less than 1 dB.

Compatible Land Use

Because the Proposed Action is not expected to have significant noise impacts (as measured by change in noise exposure in populated census block centroids), there will be no impacts to compatible land use. Additionally, existing non-compatible land uses currently exposed to DNL noise levels greater than or equal to 65 dB will not experience significant increases in noise levels as a result of the Proposed Action.

Air Quality

The U.S. EPA has established National Ambient Air Quality Standards (NAAQS) for ambient (i.e., outdoor) concentrations of a number of “criteria pollutants”. On July 30, 2007, the FAA issued a list of actions “presumed to conform” under General Conformity [72 Fed. Reg. 41565 (July 30, 2007)]. In this notice, the FAA summarized documentation and analysis which demonstrated that certain actions will not exceed the applicable *de minimis* emissions levels for nonattainment and maintenance areas as specified under 40 CFR 93.153(b). The FAA includes air traffic control activities and adopting approach, departure and enroute procedures for air operations in their list of “presumed to conform” actions thereby indicating that these types of actions will not exceed *de minimis* emissions levels.

The Proposed Action includes airspace and air traffic actions (*e.g.*, changes in routes, flight patterns, and arrival and departure procedures) above the mixing height (generally 3,000 feet AGL) that are needed to enhance safety and increase the efficient use of airspace by reducing congestion, balancing controller workload and improving coordination between controllers handling existing air traffic. The FAA’s “presumed to conform” list is therefore applicable to the Proposed Action. Since the Proposed Action is presumed to conform and would have no effect on vehicle traffic, no further analysis is required.

Climate

The CEQ has indicated that climate should be considered in NEPA analyses. While no criteria for determining significance exist, implementation of the Proposed Action would result in a net decrease in greenhouse gas (GHG) emissions and would not, therefore contribute to climate change. A summary of the effects of implementing the Proposed Action on GHG emissions and fuel consumption follows:

- In 2014, the Proposed Action would decrease daily CO₂ emissions by 42.9 metric tons (47.3 US tons) compared to the No Action Alternative and would reduce daily aircraft fuel consumption by over 13,000 kg (nearly 30,000 pounds).

- In 2018, the Proposed Action would decrease daily CO₂ emissions by 43.2 metric tons (47.6 US tons) compared to the No Action Alternative and would reduce daily aircraft fuel consumption by 13,704 kg (30,212 pounds).
- In 2023, the Proposed Action would decrease daily CO₂ emissions by 48 metric tons (47.6 US tons) compared to the No Action Alternative and would reduce daily aircraft fuel consumption by 15,200 kg (33510 pounds).

Natural Resources and Energy Supply

The CEQ has indicated that impacts to natural resources and energy supply should be considered in NEPA analyses. Although no criteria for determining significance exist, the changes in energy use are summarized above under Climate and indicate that implementation of the Proposed Action would not adversely affect natural resources or energy supply.

Socioeconomic Impacts, Environmental Justice, and Children’s Environmental Health and Safety Risks

The Proposed Action will not involve any construction of physical facilities or property acquisition that would entail relocation of residents or community businesses, disruption to local traffic patterns, loss of community tax base, or changes to the fabric of the community. Implementation of the proposed procedures would not significantly increase noise exposure levels at any location. Accordingly, there would be no significant socioeconomic impacts.

Because there are no significant impacts as a result of the Proposed Action, there are no adverse human health or environmental effects associated with the Proposed Action (including the noise, air quality, water quality, hazardous materials and cultural resources categories), which would exceed applicable thresholds of significance. No minority or low income populations would therefore be disproportionately impacted by implementation of the Proposed Action and there would be no significant environmental justice impacts. Also, implementation of the Proposed Action would not affect products or substances that a child is likely to come in contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately increase children’s environmental health and safety risks.

Secondary/Induced Impacts

The Proposed Action does not involve development, and would not be expected to result in shifts in population and growth, increase demand for public services, or changes in business and economic activity. Therefore, there would be no potential for significant secondary or induced impacts.

Historical, Architectural, Archaeological, and Cultural Resources

The Proposed Action involves Air Traffic Control (ATC) routing changes for airborne aircraft only and does not entail any ground-based development. Therefore, there would be no direct impacts on properties listed on or eligible to be listed on the National Register of Historic Places. The Proposed Action Area of Potential Effect (APE) was defined as the area exposed to a DNL of 65 dB or more at

SEA, which covered approximately 4,986 acres. None of the sites listed on the National Register of Historic Places, and one unevaluated archaeological site, are located within the APE. As stated in Section 6.1 of the Final EA, the change in the noise levels resulting from the Proposed Action are so small, that even if this archaeological site has quiet as one of its recognized attributes, this characteristic would not be diminished as a result of the Proposed Action. FAA Order 1050.1E, Change 1, Appendix A, Paragraph 12.2b states that the sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact. Changes in aircraft routes associated with the Proposed Action would generally occur at altitudes above 3,000 feet AGL; therefore the changes in the location of aircraft and aircraft lights would not be considered intrusive over historic resources. Consequently, the Proposed Action would not result in significant visual impacts.

Implementation of the Proposed Action would not result in significant direct or indirect adverse effects to historic properties. Appendix I provides the State Historic Preservation Officer's written concurrence with both the definition of the APE and the finding of no adverse effect, in accordance with Section 106 of the National Historic Preservation Act.

Department of Transportation Section 4(f) and Land and Water Conservation Fund Act Section 6(f)

The Proposed Action involves ATC routing changes for airborne aircraft only and does not entail any ground-based development or direct impacts to Section 4(f) or 6(f) resources. Similarly, no Section 4(f) or 6(f) resource would be indirectly affected by the noise exposure, according to the criteria of significance listed in Section 6.1 of the attached Final EA.

Fish, Wildlife and Plants

In compliance with Section 7(c) of the Endangered Species Act of 1973 (ESA), as amended, (16 U.S.C §1531 et seq.), a list of threatened, endangered, candidate and proposed species by county was reviewed using the U.S. Fish and Wildlife Service website in January 2012. The Proposed Action involves only ATC routing of changes for airborne aircraft and does not entail any ground-based development that could destroy or modify critical habitat for any protected species. Therefore, there are no significant direct impacts to fish, non-avian wildlife, and plants which would exceed the threshold of significance defined in FAA Order 1050.1E, Appendix A, Section 8. Under the Proposed Action, aircraft noise levels at two of the three National Wildlife Refuges (NWR) in the study area (Dungeness NWR and Nisqually NWR) would decrease when compared to the No Action alternative. Aircraft noise levels at the third refuge (Protection Island NWR) would increase by less than 1.0 dB DNL, and aircraft noise levels at all three refuges would remain well below DNL 45 dB. Implementation of the Proposed Action would not alter maximum (L_{max}) noise levels at any of the three refuges.

Generally, any changes to flight paths/patterns due to the Proposed Action would occur above 3,500 feet AGL, at a higher altitude than where the majority of bird strikes occur. Therefore, the potential for bird strikes is expected to remain the same as current conditions.

Light Emissions and Visual Impacts

There is no defined threshold of significance for light emissions or visual impacts. Visually sensitive lands evaluated include National Parks, National Forest Wilderness Areas, and Tribal lands. No change to lighting is proposed at SEA as part of the project; therefore the only potential for visual change or light emissions would be related to the change in aircraft flight paths. The Proposed Action would not materially alter the final approach paths to the runways at SEA because aircraft on final descent are already concentrated on the centerlines of the runways and would not alter light emissions. The Proposed Action also would not introduce flight activity into any area that does not currently experience routine overflights and would concentrate those aircraft using the new procedures toward the center of existing routes.

Cumulative Impacts

Three projects were identified at SEA that could have the potential to contribute to cumulative impacts when combined with the Proposed Action.

One project, construction of Runway 16R/34L occurred in the past. At the time of the Record of Decision for that project, the FAA required the Port of Seattle to expand its ongoing noise remedy program to include the areas newly exposed to significant (DNL 65 dB or greater) noise levels. The Proposed Action does not alter flight profiles or tracks within the area exposed to noise levels of the DNL 65 dB or above and would have a negligible effect on noise levels this close to the runway ends. The effects of the Proposed Action, when considered in combination with the effects of Runway 16R/34L, would not be significant.

The rehabilitation of Runway 16C/34C is expected to begin in 2016. Approximately 45% of current arrivals and 25% of current departures utilize Runway 16C/34C. Once this runway is closed for rehabilitation, these operations will be shifted in the short term to Runways 16 R/L and 34 R/L. While the distribution of operations for this short term change would be unaffected by the implementation of the Proposed Action, since the Runway Rehab is still in the planning stages it is unknown what the short or long term impact would be of the project. Given the minimal level of noise impacts from the Proposed Action, as described in Section 6.1, it is not expected that the cumulative impacts of the Proposed Action combined with the operational shift from the Runway Rehab would result in permanent significant noise impacts. Therefore, the effects of the Proposed Action, when considered in combination with the effects of rehabilitating Runway 16C/34C, would not be significant.

The third project is the I-2 measures. These measures are hoped to improve air traffic control efficiency and increase the use of the Proposed Action approach procedures by allowing ATC to apply reduced separation standards to curved RNP and RNP-to-ILS approaches. The FAA is currently undergoing modeling and simulation analysis of the potential reduced separation standards, with a report due by the end of the calendar year. By the end of 2013, a safety analysis of these reduced separations is intended to be completed, at which point the safety management system process will

be initiated. All of this needs to be completed prior to the initiation of the policy change process, which would then implement the reduced separation standards. There is no time line for the completion of the implementation of the I-2 initiative as a whole. In summary, at this point in time, it is not certain that the I-2 initiative will be approved, and in what form. Even though the I-2 measures may enhance the I-1 procedures, it is not reasonably foreseeable that the implementation of the I-2 measures would increase operations over those already analyzed for the I-1 procedures at SEA.

A fourth project, the Port of Seattle is conducting a Part 150 Noise Study for SEA. A draft report is due for public comment by the end of the year. The Part 150 Study process is designed to identify noise incompatibilities due to current and forecast operations, and to recommend measures to both correct existing incompatibilities and to prevent future incompatibilities. To this end, noise incompatibilities are defined as residences or public use noise-sensitive facilities (libraries, churches, schools, nursing homes, and hospitals) within the 65 DNL noise contour. Given that the Proposed Action does not change the 65 DNL at SEA and a Part 150 study does not increase the 65 DNL and may even mitigate the impact of the existing 65 DNL, there would be no cumulative impact resulting from the Proposed Action and the Part 150 study.

Other Considerations

The Proposed Action involves ATC routing changes for airborne aircraft only. The United States Government has exclusive sovereignty of airspace in the United States [49 U.S.C § 40103(a)]. Congress has provided extensive and plenary authority to the FAA concerning the efficient use and management of the navigable airspace, air traffic control, air navigation facilities, and the safety of aircraft and person and property on the ground [49 U.S.C. § 40103(b)(1) & (2)]. Therefore, any applicable community planning initiatives may be preempted by Federal law. To the extent applicable, and as there are no significant impacts under noise or compatible land use, the Proposed Action is consistent with the plans, goals and policies for the area and with the applicable regulations and policies of Federal, State and local agencies.

Mitigation

Thresholds of significance for any environmental impact category will not be exceeded due to the Proposed Action, therefore, no mitigation is being proposed as part of the project.

VII. PUBLIC INVOLVEMENT

Public participation occurred throughout the duration of the project. Federal, State and local agencies received scoping letters describing the project and requesting comments in January 2012; an Agency Scoping Meeting, and a Tribal Consultancy Meeting were held on January 26, 2012 at FAA offices in Renton, WA. Public Scoping Meetings were held at two different locations on January 25th and 26th, 2012, with one meeting located in Shoreline, central to the area where procedures would be changing north of the airport, and the other in Federal Way, central to the area where

procedures would be changing south of the airport. A total of thirteen written comments were received during the scoping period.

One Agency Meeting, one Tribal Consultancy Meeting, and two public meetings were held during the comment review period for the Draft EA. The Draft EA was made available 30 days prior to the first public meeting, and was available for a total of 39 days prior to the conclusion of the comment period. A total of 208 written comments were received from the public, local agencies, businesses, local and state elected officials, and community organizations. A total of 15 Native American Tribes were solicited for comment during the scoping process and again following publication of the Draft EA; none responded. All agency and public correspondence, including comments received on the draft EA and responses to those comments, is included in Appendices K and L of the attached Final EA. Section 106 consultation is also included. Comments pertaining to the Proposed Action were addressed as applicable in the Final EA.

VIII. THE AGENCY'S FINDINGS

This section describes the FAA's findings with respect to compliance with applicable environmental laws and regulation, and with respect to consistency of the Proposed Action with the FAA's mandate to consider the public interest in carrying out its responsibilities for the safe and efficient use of the National Airspace System.

A. ENVIRONMENTAL FINDINGS:

The environmental findings are based upon a careful review of the attached Final EA, comments on the Draft EA, the supporting administrative record and appropriate supporting information.

- 1) **The FAA has given the Proposed Action the independent and objective evaluation required by the Council on Environmental Quality (40 CFR Section 1506.5).** The FAA's environmental process included the rigorous exploration and objective evaluation of reasonable alternatives and probable environmental consequences, and regulatory agency and Native American consultations, and public involvement. FAA furnished guidance and participated in the preparation of the EA by providing input, advice, and expertise throughout the planning and technical analysis, along with administrative direction and legal review of the EA. FAA has independently evaluated the EA, and takes responsibility for its scope and content.
- 2) **The Proposed Action does not result in a significant noise impact over noise sensitive areas.** There are no noise sensitive areas exposed to DNL 65 or higher that experience a 1.5 dB or greater increase in exposure.
- 3) **The Proposed Action does not include a direct or constructive use of any resources protected under Sections 4(f) of the DOT Act or Section 6(f) of the Land and Water Conservation Fund Act.** No physical development or land acquisition is associated with the Proposed Action, thus there is no potential for direct use of any Section 4(f) or 6(f) resource. In addition, there would be no significant noise increases over parks, cultural, historic, archeological site or other potential 4(f) or 6(f) properties under the Proposed Action.

Therefore, the FAA determined that the Proposed Action would not cause any constructive use of any 4(f) or 6(f) resource.

- 4) **The Proposed Action does not affect Historical, Architectural, Archaeological, or Cultural Resources.** Following consultation pursuant to Section 106 of the Historic Preservation Act, the SHPO has concurred with the FAA's finding that implementation of the Proposed Action would not adversely affect any Historical, Architectural, Archaeological or Cultural Resources.
- 5) **The Proposed Action does not have a significant impact on Air Quality.** The Proposed Action is listed as presumed to conform, under General Conformity [FR 41565]. Therefore the Proposed Action has already been demonstrated to have *de minimis* emission levels under 40 CRF 93.153(b). The GHG emissions associated with the Proposed Action at SEA in 2023 would represent a decrease of 1 percent, when compared to the No Action Alternative.
- 6) **All practicable means to avoid or minimize environmental harm from the Proposed Action have been adopted.** The PBN design process took place over several years, and the proposed final RNAV procedures, inclusive of RNP and OPD procedures, were ultimately finalized for SEA in September of 2012. As part of the NEPA process, the FAA solicited comments from agencies and the community to ensure noise sensitive resources were considered.

B. Findings Pursuant to the Purpose and Need:

The Purpose and Need for the Proposed Action is consistent with the Agency's responsibility to consider the public interest in controlling the use of navigable airspace for the safe and efficient operation of the National Airspace System (NAS). In establishing the Proposed Action, the FAA is acting to enhance the safety and efficiency of SEA airspace to accommodate today's level of air traffic and to position the SEA airspace to better accommodate future levels of air traffic.

Based on the final EA prepared for the Proposed Action, this FONSI/ROD is issued. Both the Final EA and the FONSI/ROD are hereby incorporated into this decision.

IX. DECISIONS AND ORDERS

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal Action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(c) of NEPA.

I, the undersigned, have reviewed the attached Final EA including the evaluation of the purpose and need that this Proposed Action would serve, the alternative means of achieving the purpose and need, and the environmental impacts associated with these alternatives. I find the Proposed Action

described in the Final EA is reasonably supported and issuance of a finding of no significance is appropriate. Therefore, an environmental impact statement will not be prepared.

I have carefully considered the FAA's statutory mandate under 49 U.S.C. §40103 to ensure the safe and efficient use of the national airspace system as well as the other aeronautical goals and objectives discussed in the Final EA. Accordingly, under the authority delegated to me by the Administrator of the FAA, I approve and direct that actions be taken which will enable implementation of the Proposed Action. This consists of the development of RNAV and RNP procedures, including OPD procedures, to establish and maintain safe and efficient handling and movement of traffic into and out of the Seattle Complex Airspace.

Approved: _____ Date: _____

Elizabeth L. Ray
Vice President, Mission Support Services

RIGHT OF APPEAL

This FONSI/ROD constitutes a final order of the FAA Administrator and is subject to exclusive judicial review under 49 U. S.C. §46110 by the U.S. Circuit Court of Appeals for the District of Columbia or the U.S. Circuit Court of Appeals for the circuit in which the person contesting the decision resides or has its principal place of business. Any party having substantial interest in this order may apply for review of the decision by filing a petition for review in the appropriate U.S. Court of Appeals no later than 60 days after the order is issued in accordance with the provisions of 49 U. S.C. §46110. Any party seeking to stay implementation of the ROD must file an application with the FAA prior to seeking judicial relief as provided in Rule 18(a) of the Federal Rules of Appellate Procedure.

Executive Summary

Overview

This Final Environmental Assessment (FEA) addresses the potential environmental impacts associated with the implementation of proposed new arrival procedures into Seattle-Tacoma International Airport (SEA). Designed to increase air traffic control efficiencies through the use of new Area Navigation (RNAV) and Optimized Profile Descent (OPD) procedures, the project is popularly referred to as “Greener Skies”. Elements of the project include the following major additions to the set of existing approach procedures into SEA

- *A new Standard Terminal Arrival procedure (STAR) for traffic arriving from the northwest to land on any of the six runway ends at SEA.* The new procedure is expected to increase slightly the number of flight miles flown for some aircraft, taking them farther north than at present. Instead of overflying northern portions of Kitsap County as now, more of that traffic would approach the runways from over Hansville and Puget Sound south of Island County. However, compensating benefits derived from aircraft operating at slightly higher altitudes, undergoing fewer level-off segments, and maintaining lower thrust settings during the approach offset the disbenefit of increased flight miles.
- *A new STAR for aircraft arriving from the southwest that would reduce the number of flight miles flown when landing on any of the six runway ends.* In particular, the removal of a significant “dog leg” to the west over Olympia, Washington would be replaced by more direct routings generally over the former Fort Lewis Military Reservation and to either side of the former McChord Air Force Base, the two installations now collectively merged and known as Joint Base Lewis-McChord (JBLM).
- *Implementation of new Required Navigation Performance (RNP) and RNP-to-Instrument Landing System (ILS) procedures northwest and southwest of SEA.* New approach procedures would provide high-precision extensions of the STARs onto curved approach paths and short straight-in final approaches to touchdown with less need for intervening interaction by air traffic controllers.
 - *Fifteen of the RNP procedures would provide instrument guidance for landings on runways 16L, 16C, and 16R (five to each runway end).* Twelve of the 15 would lead aircraft in over Elliott Bay and the industrial area south of Harbor Island, and the other three would provide guidance to aircraft generally overflying areas of north Seattle subject to overflights now but guided by instructions from Air Traffic Control (ATC).
 - *An additional six RNP procedures would guide aircraft along curved approach paths over the Port of Tacoma, keeping them north of Interstate Route I-5 and lining them up to land on runways 34L, 34C and 34R.* Three other procedures represent transitions to longer straight-in instrument approaches very similar to now.
- *Optimized Profile Descents from both the northwest and southwest.* Appropriately-equipped aircraft would begin their descents at cruise altitudes with near-idle thrust (referred to as “flight idle”) and concomitant reductions in fuel burn, and would largely be able to maintain those thrust and fuel burn conditions along the STARs and RNP procedures all the way to touchdown.

Guidance for considering environmental impacts of aviation projects is found within FAA Order 1050.1E, entitled “Environmental Impacts: Policies and Procedures”¹, and also in the Council on Environmental Quality’s (CEQ’s) “Regulations for Implementing NEPA.”² Specifically, FAA Order 1050.1E requires

¹ FAA Order 1050.1E, Chg. 1, FAA National Policy, Subj: Environmental Impacts: Policies and Procedures, March 20,2006

² 40 Code of Federal Regulations (CFR), Part 1500.

environmental assessment of any new instrument approach procedures, departure procedures, en route procedures, or modifications to currently approved instrument procedures which routinely route aircraft over noise-sensitive areas at less than 3,000 feet above ground level (AGL). Several such routings are considered in this assessment, but no changes are being proposed to alter the runways, taxiways, navigational aids or other infrastructure on SEA itself. Thus, a number of environmental resource categories are unaffected by the proposed action.

Public Participation

Under 40 CFR 1501.7 (NEPA and Agency Planning), scoping for a Draft Environmental Assessment (DEA) is optional, but because the FAA considered an open public process to be an important component of the Greener Skies DEA, the Agency decided to conduct scoping with the following specific goals in mind:

- Identify significant issues to be analyzed in greater depth;
- Clarify legal responsibilities and areas of environmental analysis requiring special expertise;
- Encourage the public to provide their input and concerns;
- Identify and eliminate from detailed study any issues that are insignificant or which have been covered by prior environmental review;
- Establish the extent of the study area; and identify available technical information.

The process included two public scoping meetings – one held south of SEA on January 25, 2012 in Federal Way and one north of SEA on January 26, 2012 in Shoreline – as well as an Agency scoping session and a Tribal scoping session each held at FAA’s offices on January 26, 2012 in Renton. The content for all four meetings was the same -- FAA and its consultant participated in an introductory workshop session, disseminated project information, made two formal presentations and solicited comments. Primary issues and concerns raised by members of the public focused on potential noise impacts, the NEPA process, and air quality. A complete record of the outreach process, including public notices, copies of the boards and PowerPoint presentations, and comments received, is contained in Chapter 7 and Appendices K and L of this FEA.

In addition, throughout the development of the RNAV and RNP procedures, the FAA met frequently with other agencies, airport sponsors, cities and counties, as well as interested citizen groups to disseminate information on the procedure development and to better understand potential concerns regarding the proposed procedures.

Following completion of the resource analyses in the environmental assessment process, a DEA was released for public comment on August 7, 2012. That was followed by new Tribal and Agency meetings and by two public workshops, which were held to present the findings of the analyses and give attendees the opportunity to discuss concerns with subject matter experts. The Tribal and Agency meetings were held consecutively on the morning of September 5, 2012. The first public workshop was held later that evening from 6:00 to 7:30 p.m. at the main library in Federal Way. The second workshop was held the

following evening September 6, 2012 at the Ballard Branch Library, also from 6:00 to 7:30 p.m. Similar to the scoping meetings, the content of each session was identical and consisted of an initial 30 minutes for informal question and answers at a series of workstations with boards and members of the FAA and consulting team in attendance. That was followed by a 30-minute presentation explaining the proposed new procedures, the resulting noise, and fuel burn findings. The final 30 to 45 minutes was again open to informal questions and answers at the workstations. A court reporter was in attendance at both workshops to take verbatim transcripts of public comments as one of several means available for submitting formal comments on the draft document.

A total of 210 comments were received on the DEA, many of them criticizing the meeting format at the Ballard Branch Library. Others raised questions regarding the magnitude of the expected changes in noise exposure, and still others asked about getting noise monitoring stations in their neighborhoods. Further details on the final set of meetings and workshops is contained in Chapter 7. Copies of sign-in sheets for each meeting, the workstation boards, a representative power point presentation, and a compilation of every comment received and the FAA's response to each comment are included in Appendix L.

Purpose and Need

The FAA's mission is "to provide the safest, most efficient aerospace system in the world"³. The "need" faced in the complex airspace surrounding SEA is the lack of efficiency associated with existing standard instrument arrival procedures into SEA, both in terms of the throughput of traffic to the runways as well as the significant need for controller interaction to maintain safe separation standards between aircraft arriving on closely-spaced parallel runways. Current instrument procedures and related airspace management tools and structure do not provide the flexibility and predictability that current space-based technologies can offer. During periods of high traffic demand, the lateral and vertical separation between arrival and departure flight routes is not sufficient for the airspace to be used without controllers carefully observing aircraft activity along the proximate or crossing flight routes and actively managing aircraft to maintain safe separations. Inefficiencies include level-offs, vector headings, speed changes, and added communications potentially leading to "hear-back/read-back" errors and corrections. All of these contribute to interrupted climbs and descents, increased flight times and additional fuel burn and emissions.

The "purpose" of the Greener Skies project is therefore to provide a partial solution to the inefficiencies of the existing air traffic control system. Greener Skies seeks to achieve this purpose by leveraging existing NextGen performance-based technology enhancements to reduce controller and pilot workloads, reduce the complexity of operations within the Seattle airspace, and increase system flexibility and predictability. The proposed new procedures accomplish this by providing:

- More efficient lateral and vertical flight profiles that reduce the need for level-offs during descent to land, also reducing energy consumption, engine emissions, and noise
- Increased options for arrival paths, which will remove bottlenecks for aircraft approaching SEA from the northwest and southwest during busy times of day
- Reduced frequency of long downwind legs and extended final approaches that require extra flying miles

³ FAA web site: <http://www.faa.gov/about/mission/>

- Increased precision of the procedures to land under Instrument Meteorological Conditions (IMC) on runways that normally cannot accommodate traffic during more adverse weather
- Implementation of more direct flight paths that will reduce flight times and have the added benefit of reducing fuel consumption and engine emissions
- New RNAV/RNP arrival routes and RNP/RVFP approaches that will permit ATC to issue simpler instruction and let the aircraft's Flight Management System (FMS) fly the preprogrammed route, including vertical and lateral track information all the way to the landing runway.

Alternatives

FAA's development of alternatives for Greener Skies began in 2010. Evolving from a preliminary identification of measures aimed at reducing flight times, level-off segments, and confliction points in the Seattle-Tacoma airspace, concepts for airspace efficiencies tended to focus on measures that would minimize difficulties with implementation. Proposals that reduced the likelihood of adverse environmental impacts, particularly noise, thus focused on areas west of SEA where 70 percent of the arriving aircraft were already flying over large expanses of water. Along the three- to five-mile wide band of Puget Sound, FAA began to examine the feasibility of various measures, eliminating options that created unresolvable conflicts or did not otherwise improve inefficiencies. Additional measures were added for consideration if they resulted in fewer level-off segments and reduced radio communications while still maintaining safe separation standards.

Ultimately, this screening and evaluation of individual proposals resulted in the elimination of measures found to be ineffective, while those found to be viable and effective at reducing inefficiencies collectively became the Proposed Action. The No Action and Proposed Action scenarios are described in detail in Chapter 4 of this FEA and no other alternative is under consideration.

Summary of Environmental Consequences

Chapter 6 of this FEA describes the effects of the Proposed Action compared to No Action on the following environmental resource categories:

- Noise
- Compatible Land Use
- Air quality
- Climate
- Natural resources and energy supply (fuel usage)
- Socioeconomic effects
- Secondary (induced) impacts
- Historical, architectural, archeological, and cultural resources
- Department of Transportation Act 4(f) sites (parks and natural areas)
- Fish, wildlife and plants (flyways for migratory birds)
- Light emissions and visual impacts

Other resource categories were considered for their potential environmental impacts but are unaffected by the Proposed Action and are not addressed further.

Noise was examined for three study years – 2014, 2018 and 2023 – using the FAA's Noise Impact Routing System (NIRS) noise model. Computations of noise exposure were made at 40,788 population centroids and nearly 15,000 additional points disassociated with population but useful for representing

noise levels in more remote areas such as parks or wildlife refuges. Several hundred additional points were selected to represent schools, specific historic sites and several locations directly under proposed flight paths or in areas of variable terrain representative of additional potentially sensitive locations.

Conclusions from the noise analysis are that:

- Of the 3,171,686 residents represented by the 40,788 population centroids in the study area, no one would be exposed to an increase in noise exposure that exceeds FAA’s criterion for significant impact (a 1.5 dB or greater increase to a DNL of 65 dB or greater) as a result of the Greener Skies Proposed Action for any of the study years examined.
- No one would be exposed to increases in noise exposure from the Proposed Action that exceed any of FAA’s other criteria for reportable changes – either a 3 dB or greater change in DNL from 60 to 65 dB, or a 5 dB or greater change in DNL from 45 to 60 dB – for any of the study years examined.
- In each of the three study years, there are residents exposed to noise greater than DNL 45 who will experience slight increases in exposure due to the Proposed Action, and others who will experience slight decreases, none of them greater than approximately ± 1 dB. Those experiencing decreases outnumber those experiencing increases by more than 2 to 1.
- For each study year, there are population centroids that are newly exposed to DNL values greater than 65 dB as a result of the Proposed Action. Two occur in 2014, and one each in 2018 and 2023. Three of those locations are 3 to 3½ miles north of the runway ends and one is about ¾ miles to the south. All are on extended runway centerlines where there is expected to be slightly less dispersion in flight tracks as aircraft make their approach to land. However, the maximum increase in DNL attributable to the Proposed Action along these final approach paths is only 0.1 dB in 2014 and 2018 and only 0.2 dB in 2023. Such changes are extremely small and not likely even to be noticed. The results are summarized in the table that follows.

Table ES-1 Summary Results for Greener Skies Proposed Action

Study Year	Greatest Change in DNL Relative to No Action		Population Experiencing Change		Population Exceeding FAA Order 1050.1E Criteria			Population Newly Exposed to DNL 65 or above
	Increase	Decrease	Increase	Decrease	>1.5dB, DNL 65 or above	>3dB from DNL 60 - 65	>5dB from DNL 45 - 60	
					0	0	0	
2014	0.9dB	-0.8dB	120,386	277,754	0	0	0	396
2018	0.9dB	-0.8dB	123,081	290,391	0	0	0	43
2023	1.1dB	-0.7dB	132,484	311,122	0	0	0	214

Because the expected increases in noise levels are not significant, no mitigation of the Proposed Action is necessary and there are no related effects of noise on land use compatibility; historical, architectural, archeological, and cultural resources; or parks and natural areas. Even in areas where natural quiet is valued, noise exposure in the three National Wildlife Refuges (NWRs) in the study area are at levels of 35 dB DNL or lower and in the case of the Dungeness and Nisqually NWRs, those levels are even projected to decrease slightly under the Proposed Action.

Fuel burn and resultant greenhouse gas emissions in the form of equivalent metric tons of CO2 are also summarized here.

Table ES-2. NIRS Model Output for Daily Fuel Burn and CO2 Emissions

Condition	No Action		Proposed Action		Percent Change (Proposed Action vs. No Action)
	Fuel (kg)	MT CO2e	Fuel (kg)	MT CO2e	
2014	1,197,628	3778.5	1,184,022	3735.6	-1.14%
2018	1,315,623	4150.8	1,301,919	4107.6	-1.04%
2023	1,519,014	4792.5	1,503,814	4744.5	-1.00%

Notes: MT CO2e denotes metric tons of CO₂-equivalent.

The Proposed Action, with its shorter routes of flight and use of Optimized Profile Descents, reduces daily fuel usage by 13,000 to 14,000 kilograms per day (approximately 30,000 pounds), representing a decrease of 1.00 to 1.14 percent compared to No Action for each of the three study years 2014, 2018, and 2023. During the same periods, carbon dioxide emissions are reduced by 43 to 48 metric tons daily, or approximately 15,700 to 17,500 metric tons annually. Reductions are not large for airport operations as a whole because no changes are being proposed for arrivals from the east side of SEA nor are any changes proposed for departures. New arrival tracks do, however, provide large individual benefits, reducing fuel burn as much as 30 to 32 percent on the new HAWKZ STAR entering the Seattle airspace from the southwest to land on runways 34L, 34C, or 34R.

These and other analyses of the Proposed Action discussed in the body of the FEA indicate that there are no significant environmental impacts associated with the Proposed Action.

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1 PROJECT INTRODUCTION AND BACKGROUND

1.1 Introduction

The Federal Aviation Administration (FAA) has prepared this Final Environmental Assessment (FEA) to identify the potential environmental effects associated with adding Area Navigation (RNAV) procedures and implementing Optimized Profile Descents (OPDs) at Seattle-Tacoma International Airport (referred to in this document by the FAA's three-letter identifier, SEA). The project is referred to as the "Greener Skies over Seattle" initiative or, more popularly, just "Greener Skies".

Federal actions such as the addition of the new procedures proposed by the FAA at SEA must be reviewed for compliance with the National Environmental Policy Act of 1969 (NEPA), the Airport and Airway Improvement Act of 1982 as amended and other pertinent laws. Guidance for considering environmental impacts of aviation projects is found within FAA Order 1050.1E, entitled "Environmental Impacts: Policies and Procedures"⁴, and also in the Council on Environmental Quality's (CEQ's) "Regulations for Implementing NEPA."⁵ Specifically, FAA Order 1050.1E requires environmental assessment of any new instrument approach procedures, departure procedures, en route procedures, or modifications to currently approved instrument procedures which routinely route aircraft over noise-sensitive areas at less than 3,000 feet above ground level (AGL). Several such routings are being considered in this assessment, but no changes are being proposed to alter the runways, taxiways, navigational aids or other infrastructure on SEA itself.

The FEA provides background to the proposed project, describes the Purpose and Need for the Proposed Action, identifies and evaluates reasonable alternatives to the proposed action, and provides full disclosure of the potential environmental impacts associated with implementation of the Proposed Action.

1.2 Project Background

Seattle-Tacoma International Airport serves the cities of Seattle and Tacoma, Washington, as well as the western portion of the entire state. SEA is the primary hub for Alaska Airlines, whose headquarters are located in the immediate vicinity, and also for its low-cost sister company Horizon Air. SEA has service to destinations throughout North America, Europe and East Asia. In 2011, SEA served over 32.5 million passengers, making it the 17th busiest airport in the United States. It ranks 24th in total annual aircraft operations (311,791) and 21st in total cargo volume (279,625 metric tonnes)⁶. The top five airlines operating at SEA, in terms of the percentage of passengers carried in 2011, were Alaska Airlines (35.7%), Horizon Air (14.1%), Delta Air Lines (11.6%), United Airlines (11.3%), and Southwest Airlines (8.9%). Together, the carriers account for more than 80% of the total passenger traffic there.

In 2009, Alaska Air Group (AAG, the holding company for Alaska Airlines and Horizon Air) and Seattle-Tacoma International Airport staff, in cooperation with The Boeing Company and the FAA, developed a plan to evaluate new flight procedures that would utilize the latest navigational technologies and allow all appropriately equipped operators, which included Alaska Airlines and Horizon Air, to fly optimal descent paths, while reducing their environmental impact during approaches to land at SEA. The "Greener Skies" project is a prime example of an initiative where key industry stakeholders have innovatively combined their expertise to maximize use of new technologies for efficient direct approaches into SEA, and also reduce aviation's impact on the environment.

⁴ FAA Order 1050.1E, Chg. 1, FAA National Policy, Subj: Environmental Impacts: Policies and Procedures, March 20, 2006

⁵ 40 Code of Federal Regulations (CFR), Part 1500.

⁶ Airports Council International – North America (ACI-NA), Airport Traffic Reports, <http://aci-na.org/content/airport-traffic-reports>

In 2010, the FAA took over responsibility for completing the final design and implementation of the procedures, consistent with the Agency's functional role in controlling aircraft, and also to assure broad availability of the new procedures to all appropriately equipped aircraft advancing the use of the technology in a complex airspace. Since 2010, the preliminary design has been finalized and this FEA has been prepared to identify potential environmental effects associated with the proposed new procedures and their future usage.

1.3 Project Context – the National Airspace System

The Federal Aviation Act of 1958, re-codified as 49 U.S.C. 40101 et seq., delegates various responsibilities to the FAA. These include controlling the use of the nation's navigable airspace and regulating civil and military operations in that airspace in the interest of the safety and the efficiency of each⁷. The National Airspace System (NAS) now includes a combination of infrastructure (such as air traffic control facilities), people (such as air traffic controllers, maintenance and support personnel), and technology (sensors such as radar, communications equipment, weather gathering instrumentation, lighting, etc.), as well as rules and regulations that govern the operation of the system.

Because the NAS comprises one of the most complex aviation networks in the world, the FAA's primary mission is always to assure aviation safety, security, and efficiency. When changes are proposed to the NAS, FAA's priorities are to (1) maintain or improve system safety; (2) improve efficiency and reduce delays; (3) increase system flexibility and predictability; and (4) promote aviation advancement through implementation and evolution of emerging technologies. The FAA's Air Traffic Organization (ATO) is the division within the FAA responsible for the safe and efficient use of navigable airspace. In designing or redesigning airspace and procedures for use in the NAS, ATO must comply with NEPA and other applicable laws and regulations.

1.3.1 Current Air Traffic Control within the NAS

The combination of people and the software, hardware, and facilities they use to guide or direct aircraft on their route of flight is collectively referred to as "air traffic control," or ATC. ATC is responsible for separating aircraft operating under Instrument Flight Rules⁸ (IFR) to maintain safety and expedite the flow of traffic operating in the NAS. ATC maintains the separation of aircraft by directing pilots to fly specific routes, altitudes and airspeeds. As aircraft move from origin to destination, ATC personnel function as a team and transfer control of aircraft from controller to controller.

Air traffic control of a typical commercial aircraft flight begins with a controller, in an Airport Traffic Control Tower (ATCT), issuing departure instructions to the pilot. Each instruction issued by a controller (throughout a flight) is read back by the pilot, confirming that the instruction was heard properly. "Hear-back/read-back" errors, when they occur, are corrected immediately, and the pilot carries out the instruction promptly. Tower personnel control departing and arriving flights that are normally within a few miles of the airport as well as aircraft moving on the ground ("taxiing"). The controllers use visual contact as the primary means to identify and track aircraft in the ATCT's airspace and when taxiing to and from the runways.

Once the aircraft leaves the vicinity of the airport, a Terminal Radar Approach Control (TRACON) facility normally assumes responsibility for guiding the flight. Air traffic controllers in TRACONs use

⁷ Title 49 United States Code, Section 40101(d)4.

⁸ Instrument Flight Rules are a set of regulations and procedures for flying aircraft when separation from other aircraft and terrain is maintained with reference to aircraft instruments. It is an alternative to Visual Flight Rules (VFR), where the pilot is responsible to "see-and-avoid." All commercial air carrier aircraft are required to operate under Instrument Flight Rules. (See Appendix A)

short-range radar to identify and track aircraft out to a distance of approximately 50 miles from the airport. Airspace assigned to a TRACON is divided into sectors⁹ and a controller, or a team of controllers, manages the safe, orderly and expeditious flow of air traffic within the sector. As aircraft move through the TRACON controlled airspace, management responsibility is transferred and the aircraft is “handed off” from a controller in the previous sector to the controller in the new sector. Within the TRACON (or “terminal”) airspace, FAA typically requires three nautical mile¹⁰ (NM) lateral and 1,000-foot vertical separation of aircraft.¹¹

As the aircraft proceeds further from the airport and climbs to higher cruising altitudes, control is passed to an Air Route Traffic Control Center (ARTCC). Air traffic controllers in ARTCCs or “Centers” use long-range radar to identify and track aircraft. Within Center or “enroute” airspace, FAA typically requires a larger lateral separation of five nautical miles (approximately six statute miles)¹². This is because the update rate on long-range radar is not as frequent as with the short-range radar used by TRACONs that manage smaller volumes of airspace. As the aircraft continues towards its destination, control is typically transferred to succeeding Centers along the flight route and then to a TRACON and ATCT as the aircraft approaches its destination airport.

Figure 1.3-1 illustrates these various phases of flight as currently structured within the NAS.



Figure 1.3-1. Current Phases of Flight within the National Airspace System

Source: <http://www.betterairportsnow.org/2009/10/the-analog-airspace-existing-air-traffic-control.html>

The Greener Skies initiative considered in this FEA consists of procedural changes that begin in the Seattle ARTCC (designated by the three letter identifier ZSE), continue into the Seattle TRACON (S46)¹³, and eventually end in the airspace controlled by Seattle Tower as aircraft descend from cruising altitude all the way to landing on one of SEA’s six runway ends.

⁹ A sector is a portion of airspace having defined geographic and altitude boundaries. (See Appendix A)

¹⁰ 6,080 feet, as opposed to a statute mile whose length is 5,280 feet. (See Appendix A)

¹¹ Aeronautical Information Manual, Change 1, August 3, 2006, Chapter 4.

¹² Ibid.

¹³ ZSE and S46 are facilities that control or direct air traffic in the enroute and terminal airspace environments.

1.3.2 Efficiency of the NAS

As aircraft transition between runways and areas of airspace managed by different ATC facilities, inefficiencies in air traffic control during any phase of flight can affect the efficiency on the NAS. These include the need for controllers to vector aircraft (give the pilot manual headings to avoid other traffic, thunderstorms, etc.), change aircraft speed to maintain safe separation distances, hold aircraft in the air or on the ground, or require level off of an aircraft during ascent or descent.

Other inefficiencies exist due to runway and taxiway configurations.

At an airport such as SEA, which is served by three runways (six runway ends), runway operating configurations are established to accommodate arriving and departing aircraft under different operating conditions including weather, prevailing winds, predominance of arrivals or departures, and total volume of traffic. Typically only one end of a runway is used in an operating configuration to accommodate departing and/or arriving aircraft to ensure that all aircraft are operating in the same direction, termed flow. Furthermore, to ensure safe separation of aircraft on arrival or departure, the use of one runway end for an operation may be dependent on how another runway end is being used. Additional complexities to the runway operating configurations can occur throughout the day as ATC adjusts to changing weather, wind, and traffic conditions. Therefore, both the throughput of a single runway as well as the airfield throughput can vary as the runway operating configuration varies.

1.3.3 Next Generation Air Transportation System

Over the next two decades the FAA will face major challenges meeting future demand while improving safety, reducing delays, and protecting the environment. The Next Generation Air Transportation System (NextGen) represents the FAA's chief means of transforming the national air transportation system – from a ground-based system of air traffic control to a space-based system using the Global Positioning Satellite (GPS) system and aircraft sensing and communications technologies to accommodate these challenges. Figure 1.3-2 summarizes the major technology improvements anticipated throughout the phases of flight described in Section 1.3.1.

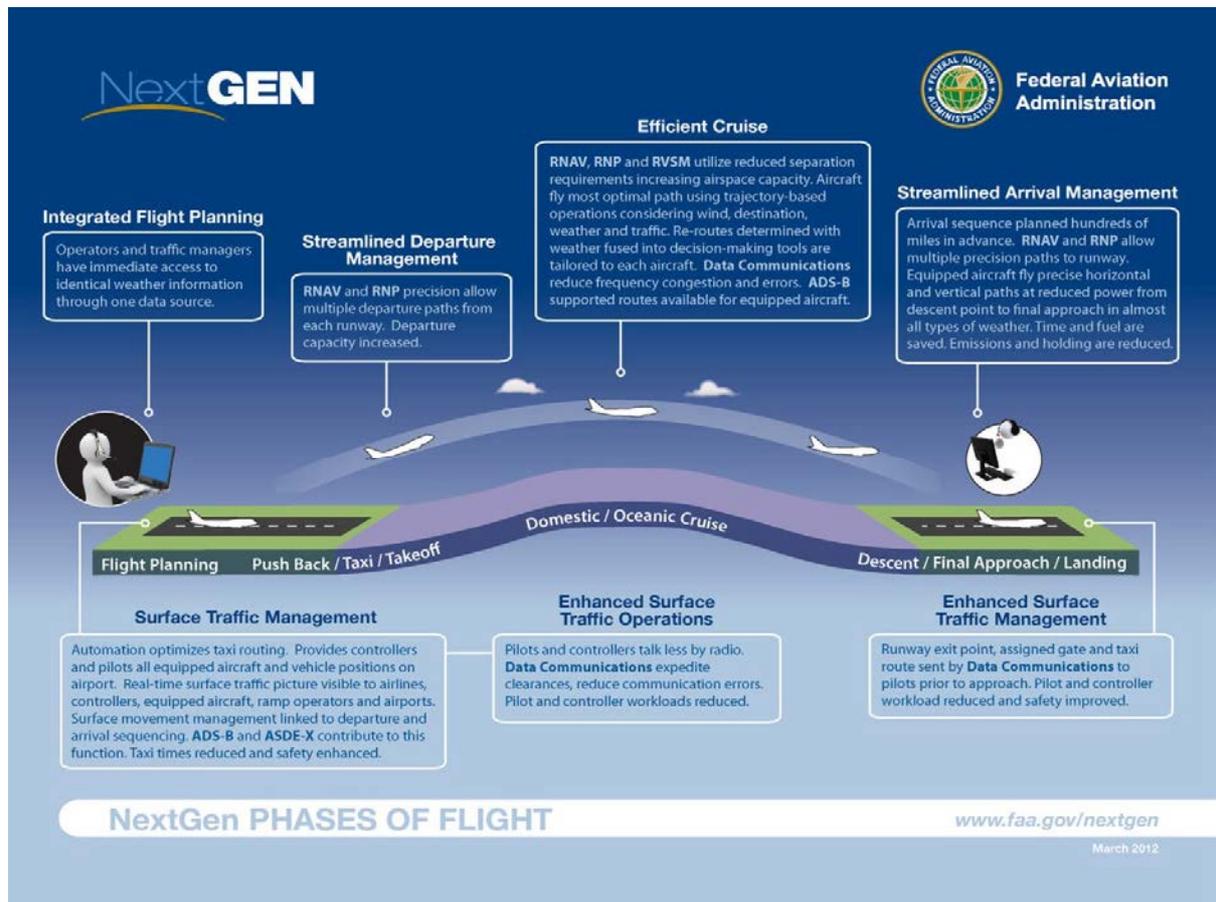


Figure 1.3-2. NextGen Technologies Applicable to Various Phases of Flight

In September 2009, the FAA received an industry task force report¹⁴ containing recommendations to expedite implementation of NextGen's top initiatives. A key component of the recommendations was the formation of study teams to leverage FAA and industry expertise to facilitate the design and implementation of optimized airspace. The new technology arrival and departure procedures that are required to implement the optimized airspace designs are referred to generally as Performance Based Navigation (PBN).

PBN encompasses a variety of specific procedure types including RNAV procedures, which, themselves include OPDs, and Required Navigation Performance (RNP) procedures. All rely on GPS guidance rather than radar and air traffic control interaction for point-to-point navigation; and on-board instrumentation now permits aircraft to make curved flight paths between points. The characteristics of each procedure type are described briefly below.

- **RNAV Procedures:** A suitably-equipped aircraft flying an RNAV procedure is able to fly on any desired flight path within tighter tolerances than previously able, as long as the aircraft is within

¹⁴RTCA's Task Force 5 Final Report on Mid-Term NextGen Implementation. The executive summary is available at http://www.faa.gov/nextgen/media/nextgen_progress_report.pdf. The full report is copyrighted and only available through RTCA. RTCA (Radio Technical Commission for Aeronautics) is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues. RTCA functions as a Federal Advisory Committee. Its recommendations are used by the FAA as the basis for policy, program, and regulatory decisions and by the private sector as the basis for development, investment and other business decisions. <http://www.rtca.org/>

the coverage of ground- or space-based navigation aids, or within the limits of its own self-contained system, or a combination of both. As such, RNAV aircraft have better access and flexibility for efficient point-to-point operations in all phases of flight, including departure, enroute, arrival, and approach to land.

- **RNP Procedures:** RNP is RNAV with the addition of an on-board performance monitoring and alerting capability. A suitably-equipped aircraft on an RNP procedure is able to monitor its own navigational performance and alert its crew if the procedure is not being flown within its design tolerance. The increased situational awareness means that the aircraft are usually on an even narrower course than those associated with standard RNAV procedures. In fact, certain Authorization Required (AR) RNP procedures can only be flown using advanced features of the on-board navigation functions if the aircrews have undergone approved training and certification.
- **OPD Procedures:** As a component of its Trajectory-Based Operations initiative, FAA has authorized development of arrival procedures with vertical profiles optimized to facilitate a continuous descent from the top of descent to touchdown. OPDs are designed to reduce fuel consumption, air emissions, and noise during descent by allowing pilots to set aircraft engines near idle throttle while they descend, instead of flying the more typical “step-down” approaches with intervening level flight segments, increased throttle settings, and added fuel burn.

Figure 1.3-3 illustrates a simple comparison between the step-down approach and an Optimized Profile Descent .

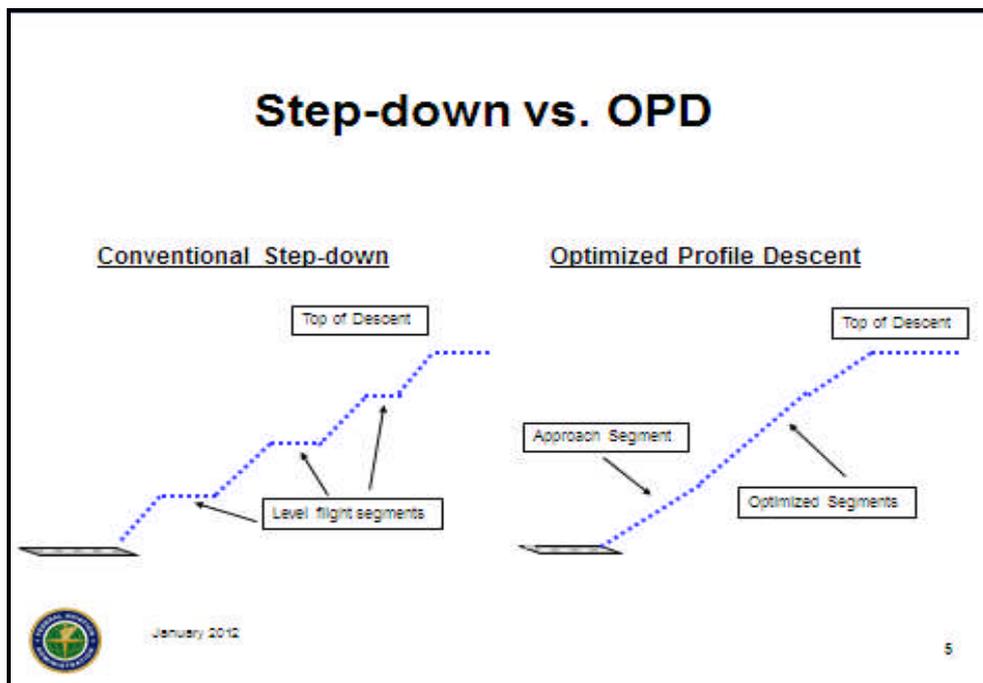


Figure 1.3-3. Illustration of a Typical Step-Down Approach Compared to an OPD

Greener Skies proposes to add each of these new procedure types to the set of existing approaches into SEA.

1.4 Document Organization

The format and content of this FEA conforms to requirements established in CEQ regulations that implement the procedural provisions of NEPA and also to the requirements of FAA Order 1050.1E. Listed below is a summary of the contents of each section of this document.

- **Chapter 1. Introduction & Background** – Introduces the project and provides a general description of the navigational elements that comprise the Proposed Action. It also provides an overview of how the proposed procedures fit within the FAA’s plans to update the NAS for the next generation Air Traffic Control System.
- **Chapter 2. Proposed Action** – Describes the Proposed Action and the federal actions that are required to implement it.
- **Chapter 3. Purpose & Need** -- Provides a discussion of the need for the Proposed Action and the purpose that the action must fulfill.
- **Chapter 4. Alternatives** – Describes the No Action alternative as well as the proposed new procedures that comprise the Proposed Action. The chapter also addresses the implementation process and schedule.
- **Chapter 5. Affected Environment** - Provides a discussion of existing environmental conditions of the potentially affected geographic area.
- **Chapter 6. Environmental Consequences** - Provides a comparative discussion of the potential direct, indirect and cumulative environmental impacts associated with the alternatives.
- **Chapter 7. Agency and Public Coordination** - Provides a discussion of the coordination and public involvement opportunities associated with the FEA. This section includes a list of Federal, state, and local agencies and other interested parties that were consulted during the FEA process.
- **Chapter 8. List of Preparers** - Provides a list of the key individuals, their titles and their role in preparing the FEA .
- **Appendices** – Appendices are bound in a separate document and contain detailed background or technical information that has been used to support the main body of the FEA. Specific appendices include:
 - **Appendix A. Acronyms, Abbreviations, and a Glossary of Terms** - Provides a common list of the acronyms and other terminology used in the document.
 - **Appendix B. Categorical Exclusion for Limited Testing** - Contains the document authorizing the testing of the procedures for purposes of evaluating.
 - **Appendix C. Current Published Approach Procedures Affected By The Proposed Action** -
 - **Appendix D. FAA TARGETS Files for the New Proposed Routes** - Includes maps and tables of waypoints used in the development of the Proposed Action and from which all noise, air quality, and fuel burn modeling was developed.

- **Appendix E. NIRS Aircraft Substitution Request and FAA Response** – Contains copies of letters to and from the FAA regarding the use of certain aircraft types for use in modeling special procedures.
- **Appendix F. Noise and its Effects on People** – Includes a general summary of noise effects on annoyance, speech interference and sleep disturbance.
- **Appendix G. Noise Modeling Technical Report** – Presents a technical memorandum outlining the aircraft operations and operational conditions at SEA that were used as inputs to the NIRS noise model.
- **Appendix H. Detailed NIRS Calculations** – Presents a summary table and information on how to obtain an electronic copy of the NIRS output at grid locations used in the noise analysis.
- **Appendix I. Historic Resources** – Presents a listing of historic sites in the Greener Skies Study Area that were examined for noise effects.
- **Appendix J. Endangered Species Act Compliance** – Includes a copy of the memorandum to the U.S. Fish and Wildlife Service regarding the effects of the project on listed species.
- **Appendix K. Agency Coordination and Outreach** – Contains information distributed or made available to federal, state and local agencies and tribes describing the project and its effects. Appendix K also includes all Agency comments received on the DEA and responses to those comments. No comments were received from tribes.
- **Appendix L. Public Outreach** – Contains information distributed or made available to the general public describing the project and its effects. Appendix L also includes all comments received on the DEA from the general public and responses to those comments.

2 PROPOSED ACTION

The Proposed Action considered in this FEA is the design, publication and implementation by the FAA of optimized standard instrument arrival procedures serving air traffic flows from the northwest and southwest into SEA. These procedures are also referred to as the I-1 procedures of the Greener Skies project.

The initiative consists of a set of proposed new PBN arrival procedures originating at current navigational “waypoints” – points in space identified by their latitude, longitude, and altitude -- that will provide new guidance to appropriately-equipped aircraft and certified aircrews so that they may fly shorter routes to the runways than they are able to at present, and to do so with less pilot-controller interaction and at lower throttle settings than now.

The starting points of the Proposed Action are approximately 40 miles away from SEA to the northwest and as much as 140 miles away to the southwest. Farther out from these existing waypoints no changes are being proposed, nor are there procedural changes planned or anticipated for any portions of any arrivals coming into SEA from the eastern side of the airport. Those flights will continue to operate as they do today. In addition, no procedural changes are planned or anticipated for aircraft taking off from SEA. All of those flights also will continue to operate as they do today. Furthermore, the set of new procedures that *are* being proposed for the northwest and southwest arrivals serve to *supplement* (not *replace*) current procedures, so that unequipped aircraft arriving from those areas also will continue to operate on existing procedures as they do today.

2.1 Key Elements of the Proposed Action

The Proposed Action contains the following major additions to the current set of existing approach procedures used by pilots and air traffic controllers to guide aircraft to land at SEA.

- *A new Standard Terminal Arrival procedure (STAR) for traffic arriving from the northwest to land on any of the six runway ends at SEA* (see Chapter 4 for additional explanation of SEA’s runway layout and operation). The new procedure is expected to increase slightly the number of flight miles flown for some aircraft, taking them farther north than at present. Instead of overflying northern portions of Kitsap County as now, more of that traffic would approach the runways from over Hansville and Puget Sound south of Island County. However, compensating benefits derived from aircraft operating at slightly higher altitudes, undergoing fewer level-off segments, and maintaining lower thrust settings during the approach (see below) offset the disbenefit of increased flight miles.
- *A new STAR for aircraft arriving from the southwest that would reduce the number of flight miles flown when landing on any of the six runway ends.* In particular, the removal of a significant “dog leg” to the west over Olympia, Washington would be replaced by more direct routings generally over the former Fort Lewis Military Reservation and to either side of former McChord Air Force Base, the two installations now collectively merged and known as Joint Base Lewis-McChord (JBLM).
- *Implementation of new Required Navigation Performance (RNP) and RNP-to-ILS procedures northwest and southwest of SEA.* New approach procedures would provide high-precision extensions of the STARs onto curved approach paths and short straight-in final approaches to touchdown with less need for intervening interaction by air traffic controllers.
 - Fifteen of the RNP procedures would provide instrument guidance for landings on runways 16L, 16C, and 16R (five to each runway end). Twelve of the 15 would lead aircraft in over

Elliott Bay and the industrial area south of Harbor Island, and the other three would provide guidance to aircraft generally overflying areas of north Seattle subject to overflights now but guided by instructions from ATC.

- For arrivals to the north on the 34s, an additional six RNP procedures would guide aircraft along curved approach paths over the Port of Tacoma, keeping them north of Interstate Route I-5 and lining them up to land on runways 34L, 34C and 34R. Three other procedures represent transitions to longer straight-in instrument approaches very similar to now.
- *Optimized Profile Descents from both the northwest and southwest.* Appropriately-equipped aircraft would begin their descents at cruise altitudes with near-idle thrust and concomitant reductions in fuel burn, and would largely be able to maintain those thrust and fuel burn conditions along the STARs and RNP procedures all the way to touchdown.

The most common aircraft types flying in and out of SEA and currently able to utilize these proposed new procedures include, from the Boeing family, 767-300s and multiple models of the 757 and 737; the Airbus A-319, -320, and -321; and Canadair's CRJ-700 and -900 regional jets. Of these, the most common at SEA are 737-800s, both now and over the next ten years of the forecast. The Proposed Action would help to increase the efficiency with which these aircraft enter the airspace and descend to land at SEA.

Because the Proposed Action consists only of procedural changes, it does not increase the number of aircraft operations at SEA or at any other airport in the area, nor does it involve physical construction of any facilities, such as additional runways or taxiways. The Proposed Action does not require any state or local actions. The implementation of the Greener Skies Proposed Action would not require physical alterations to any environmental resource identified in FAA Order 1050.1E, nor would it require changes to any Airport Layout Plans (ALP) -- the scaled drawings of airports that depict existing and future facilities and property necessary for the operation and development. In short, the Proposed Action would utilize only the space-based GPS system and instrumentation on board each aircraft.

2.2 Timeframes for the Proposed Action

The FAA completed its preliminary design of the Proposed Action in December 2011, conducted simulation tests to prove the feasibility of the Proposed Action, and, in accordance with a Categorical Exclusion (CATEX) issued by the FAA on February 21, 2012 under the provisions of FAA Order 1050.1e, paragraph 311n, flight tested the new designs from June 11 through August 2, 2012. FAA carried out the testing in association with Alaska Airlines, US Air, Sky West, and Horizon Air. The intent of the flight trials was two-fold:

- To test the usability of the proposed Greener Skies procedures from both an Air Traffic Control and pilot perspective (otherwise known as the I-1 procedures), and
- To obtain data as part of an ongoing research initiative that is investigating the safety aspects of reducing aircraft separation standards for these types of procedures (otherwise known as the I-2 Measures) (see Section 2.3 below).

The trials consisted of approximately 2,000 flights and showed that the Proposed Action was largely well-designed. Several small changes were made, which overall make the procedures easier to use by both pilots and air traffic controllers. None of the changes resulted in the need to alter any of the

environmental analysis. The results of the trials may also be used in the separate research project – the I-2 Measures -- regarding the potential changing of separation standards on a national level..

Individual elements of the Proposed Action are addressed in detail in the discussion of alternatives in Chapter 4. The first full year of operations with the proposed procedures in place is expected to be 2014. That serves as the initial study year for the analyses in Chapter 6 (Environmental Consequences). The Proposed Action is also evaluated for future study years 2018 and 2023, four and nine years after implementation, respectively. A complete summary of the study years and operational conditions assessed in this FEA is included in Table 2.2-1 that follows.

Table 2.2-1. Summary Study Years and Corresponding Operational Scenarios

Study Year	No Action	Proposed Action
2012	X	
2014	X	X
2018	X	X
2023	X	X

2.3 I-2 Measures

A second initiative associated with the Greener Skies project includes the evaluation of concepts, research alternatives, ATC tools, and policy changes that could potentially redefine safe separation standards nationally, and if so, could enhance the usage of the proposed I-1 procedures at SEA. Referred to as the I-2 Measures, the initiative will not add any new flight procedures beyond those of the Proposed Action, and implementation of the I-2 Measures will only occur if the I-1 procedures have previously been implemented and the I-2 study team determines that certain measures currently under development are deemed feasible and safe.

Work on the concepts, policies, and management tools for the I-2 Measures began in 2011 and remains on-going. The measures under consideration are being designed and evaluated to supplement the I-1 procedures, potentially allowing more aircraft to utilize the I-1 procedures in the future. However, because specific elements of the I-2 Measures still lack adequate definition for full analysis in this FEA, the I-2 Measures are considered a reasonably foreseeable future project rather than a part of the Proposed Action. The potential effects of the I-2 Measures are addressed as Cumulative Impacts in this document (see Section 6.12). There is no time line for the completion of the implementation of the I-2 Measures as a whole.

2.4 Federal Actions Required to Implement the Proposed Action

Implementation of the Proposed Action procedures for the Greener Skies project requires that the following actions be taken by the FAA:

- Formal design and Safety Management System review of each proposed procedure to insure that the changes maintain and improve the safety of the air traffic control system
- Publication of the individual STARS and RNP procedures that comprise the Proposed Action so that operators may utilize them during their approaches to SEA. Prior to publication, the FAA must approve the procedures, provide quality assurance testing, and conduct flight validation (flight checks).

- Training of ATC personnel to utilize appropriate communications and traffic flow management procedures

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3 PURPOSE AND NEED

The CEQ regulations implementing NEPA require that EAs include a “brief discussion of the need for a proposal.”¹⁵ FAA Order 1050.1E expands on this requirement, stating that an EA must include a discussion that “identifies the problem facing the proponent (that is, the need for an action), the purpose of the action (that is, the proposed solution to the problem), and the proposed timeframe for implementing the action.”¹⁶ Each of these items, as it relates to the Greener Skies over Seattle project, is discussed below.

3.1 Need

The FAA’s mission is “to provide the safest, most efficient aerospace system in the world”¹⁷. The “need” faced in the complex airspace surrounding SEA is the lack of efficiency associated with existing standard instrument arrival procedures into SEA, both in terms of the throughput of traffic to the runways as well as the significant need for controller interaction to maintain safe separation standards between aircraft arriving on closely-spaced parallel runways. The instrument procedures and related airspace management tools and structure that still depend on the U.S.’s ground-based air traffic management system date back to early days of World War II and do not provide the flexibility and predictability that current space-based technologies can offer.

The Greener Skies project that is addressed in this FEA consists of proposed measures including the addition of new RNAV, RNP, RNP-to-ILS, and OPD arrival procedures into SEA. They comprise the Proposed Action in this document. The procedures, if implemented, would increase efficiency with which the aircraft are controlled and reduce fuel burn thereby reducing carbon emissions. Specific problems that the Proposed Action is intended to address are:

- *Inefficiency due to a complex airspace structure*
 - During periods of high traffic demand, the separation between arrival and departure flight routes is not sufficient for the airspace to be used without controllers carefully observing aircraft activity along the proximate or crossing flight routes and actively managing aircraft to maintain safe separations. These areas are referred to as “confliction points” in ATC phraseology and require controller intervention.
- *Limited flight path predictability and flexibility*
 - Where arrival and/or departure flight routes intersect, air traffic controllers may require flight level-offs for either arrivals or departures to ensure adequate vertical separation between aircraft
 - Similar conflictions may require air traffic controllers to issue vector headings to arriving and/or departing aircraft on nearby flight routes so as to turn aircraft away from each other and give greater lateral separation
 - When neighboring airspace sectors are controlling aircraft headed for confliction points, ATC must communicate not only with individual pilots but also must coordinate with other controllers responsible for the neighboring airspace sector regarding the proximity of nearby aircraft (“point-outs”).
- *Increased communications between controllers and pilots, which lead to increased workload and hear-back/read-back errors*

¹⁵ 40 Code of Federal Regulations (CFR), Part 1500.

¹⁶ FAA Order 1050.1E, para. 405c.

¹⁷ FAA web site: <http://www.faa.gov/about/mission/>

- All of these actions necessitate multiple verbal communications among controllers or between controllers and pilots, increasing workload, the possibility of missed communications, and the complexity of the entire airspace surrounding SEA.
- *Increased flight track length which leads to more fuel burn*
 - Vectoring and level-offs interrupt the normal flow of operations and reduce the efficiency of the airspace and the movement of aircraft within it. The longer flight routes caused by vectoring and the interrupted climbs and descents add distance and time that lead to additional fuel burn, which, in turn, result in higher emissions of hydrocarbons and greenhouse gasses.

3.2 Purpose

The “purpose” of Greener Skies is therefore to provide a partial solution to the inefficiencies of the existing air traffic control system. Greener Skies seeks to achieve this purpose by leveraging existing NextGen performance-based technology enhancements to reduce controller and pilot workloads, reduce the complexity of operations within the Seattle airspace, and increase system flexibility and predictability. Through Greener Skies, FAA intends to:

- Implement standard instrument arrival procedures to improve the predictability and repeatability of flight routes and more efficiently serve SEA’s three runways and
- Redesign the supporting airspace management structure to enable the efficient use of optimized standard instrument procedures.

Consistent with the FAA’s responsibility for safe and efficient operation of the NAS, the Proposed Action is expected to address the need by having the following purpose:

- *Improve efficiency in a complex airspace while maintaining and enhancing safety through:*
 - More efficient lateral and vertical flight profiles that reduce the need for level-offs during descent to land, also reducing energy consumption, engine emissions, and noise
 - Increased options for arrival paths, which will remove bottlenecks for aircraft approaching SEA from the northwest and southwest during busy times of day
 - Reduced frequency of long downwind legs and extended final approaches that require extra flying miles
- *Increase flight path predictability and flexibility by:*
 - Utilizing the increased precision of the procedures to land under Instrument Meteorological Conditions (IMC) on runways that normally cannot accommodate traffic during more adverse weather
 - Allowing aircraft to use flight paths under IMC weather conditions that are similar to the shorter paths used in Visual Meteorological Conditions (VMC)
- *Decrease communication requirements between controllers and pilots, thereby reducing radio frequency congestion and the likelihood of hear-back/read-back errors. For example:*

- Proposed new RNAV/RNP arrival routes and RNP/RVFP approaches will permit ATC to issue simpler instruction (“Descend via [name of STAR] after [name of IF/IAF] Cleared for [name of approach]”) and let the aircraft’s Flight Management System (FMS) fly the preprogrammed route, which includes vertical and lateral track information all the way to the landing runway. Current procedures require ATC to issue multiple altitude, speed, or heading instructions, each of which must also be read back by the pilot for confirmation.
- *Create efficiencies by providing more direct routings that are not dependent on ground-based navigational aids*
 - Implement more direct flight paths that will reduce flight times and have the added benefit of reducing fuel consumption and engine emissions
 - Make it easier for the FAA to accommodate the forecast growth in operations, which at SEA, are projected to increase 30.7 percent between 2012 and 2023. The increase represents a growth in demand for air travel to and from the Seattle area and is unrelated to whether the Proposed Action is ever implemented.

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4 ALTERNATIVES

The FAA's development of the Proposed Action began in 2010. Evolving from a preliminary identification of measures aimed at reducing flight times, level-off segments, and confliction points in the Seattle-Tacoma airspace, concepts for airspace efficiencies tended to focus on measures that would minimize difficulties with implementation. Proposals that reduced the likelihood of adverse environmental impacts, particularly noise, thus focused on areas west of SEA where aircraft were already flying over large expanses of water. Along the three- to five-mile wide band of Puget Sound, FAA began to examine the feasibility of various measures, eliminating options that created unresolvable conflicts or did not otherwise improve inefficiencies. Additional measures were added for consideration if they resulted in fewer level-off segments and reduced radio communications while still maintaining safe separation standards.

Ultimately, this screening and evaluation of individual proposals resulted in the elimination of measures found to be ineffective, while those found to be viable and effective at reducing inefficiencies collectively became the Proposed Action. FAA Order 1050.1E, Chapter 4, Section 405(d) states that there "is no requirement for a specific number of alternatives or a specific range of alternatives to be included in an EA. An EA must consider the proposed action and a discussion of the consequences of taking no action and may limit the range of alternatives to action and no-action when there are no unresolved conflicts concerning alternative uses of available resources."¹⁸ The No Action and Proposed Action alternatives are described in detail below and no other alternative is under consideration.

4.1 No Action

Seattle-Tacoma International Airport has three parallel runways aligned generally in a north/south direction on headings of 340 degrees and 160 degrees, depending on whether they are viewed from the south or from the north. Their layout and that of the taxiways, ramps and gate areas near the main terminal, and various other buildings on the airfield are shown in Figure 4.1-1. The runways are labeled 34L(eft), 34C(enter), and 34R(ight) when viewed from the south (at the bottom of the figure); but the same pieces of pavement are labeled 16R(ight), 16C(enter), and 16L(eft) when viewed from the north.

Aircraft normally land and take off into the wind, so that when the wind is blowing from the north, traffic will flow towards the north using runways 34L, 34C or 34R; if it is blowing from the south, the traffic will flow towards the south using runways 16R, 16C and 16L.

Aircraft coming into the Seattle area to land typically arrive from one of four "cornerposts", or navigational fixes, located away from the airfield to the northeast, southeast, southwest and northwest. The general flow of traffic from those cornerposts to the runways will depend largely on the direction of the wind at the time. To get aligned with a specific runway for final approach and landing, pilots utilize a combination of published procedures that begin at one of the cornerposts and guide the aircraft into closer vicinity of the airfield; they then depend on guidance from air traffic controllers in the Seattle TRACON who, viewing the aircraft on radar, transmit appropriate headings, altitudes and airspeeds that must be followed to safely merge the aircraft into line behind others. Controllers issue their turn instructions at different points in the traffic pattern so as to maintain safe separation distances until each aircraft is aligned with the runway for final approach and touchdown. Meanwhile, aircraft taking off from one of the runways are getting similar guidance from controllers and published departure procedures.

To illustrate the complexity of the airspace and the variability of operations within it, and also to serve as a database for modeling the existing environment, a one-week-per-month sample of radar data was

¹⁸ FAA Order 1050.1E, Chg. 1, Ch. 4, Sec. 405(d), pg. 4-10; 20 March 2006.

obtained for 2011; it included 71,139 operations, or approximately 847 flights per day. The data have been sorted to indicate the two basic traffic flows at SEA. Figure 4.1-2 shows aircraft landing and taking off to the south on runways 16L, 16C and 16R; Figure 4.1-3 shows aircraft landing and taking off to the north on runways 34L, 34C and 34R. Arrivals are color-coded in red; departures are in green. Where arrivals and departures appear to overlap, they are separated by altitude and/or time.

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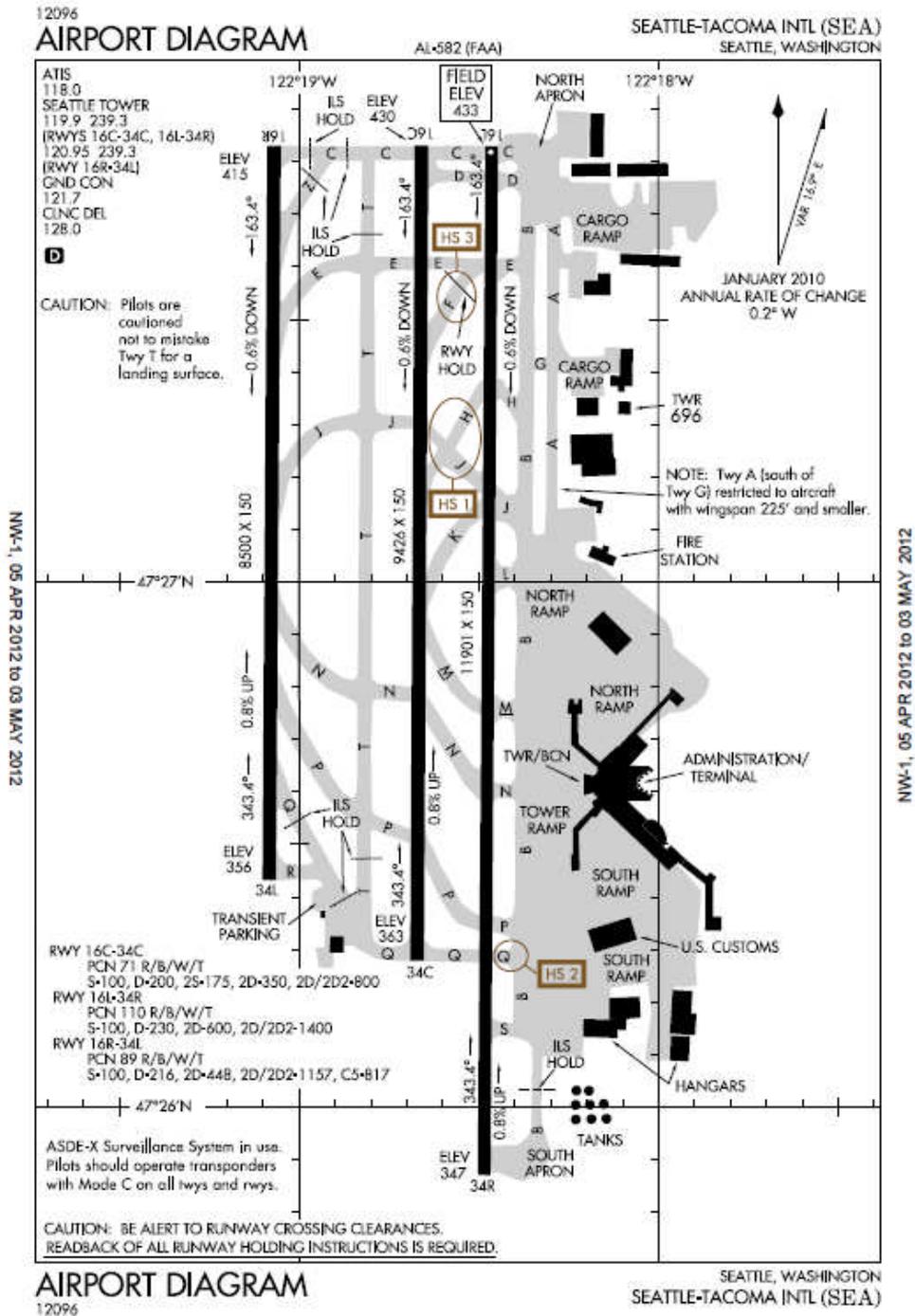


Figure 4.1-1. Airport Diagram Showing Runway Layout at SEA

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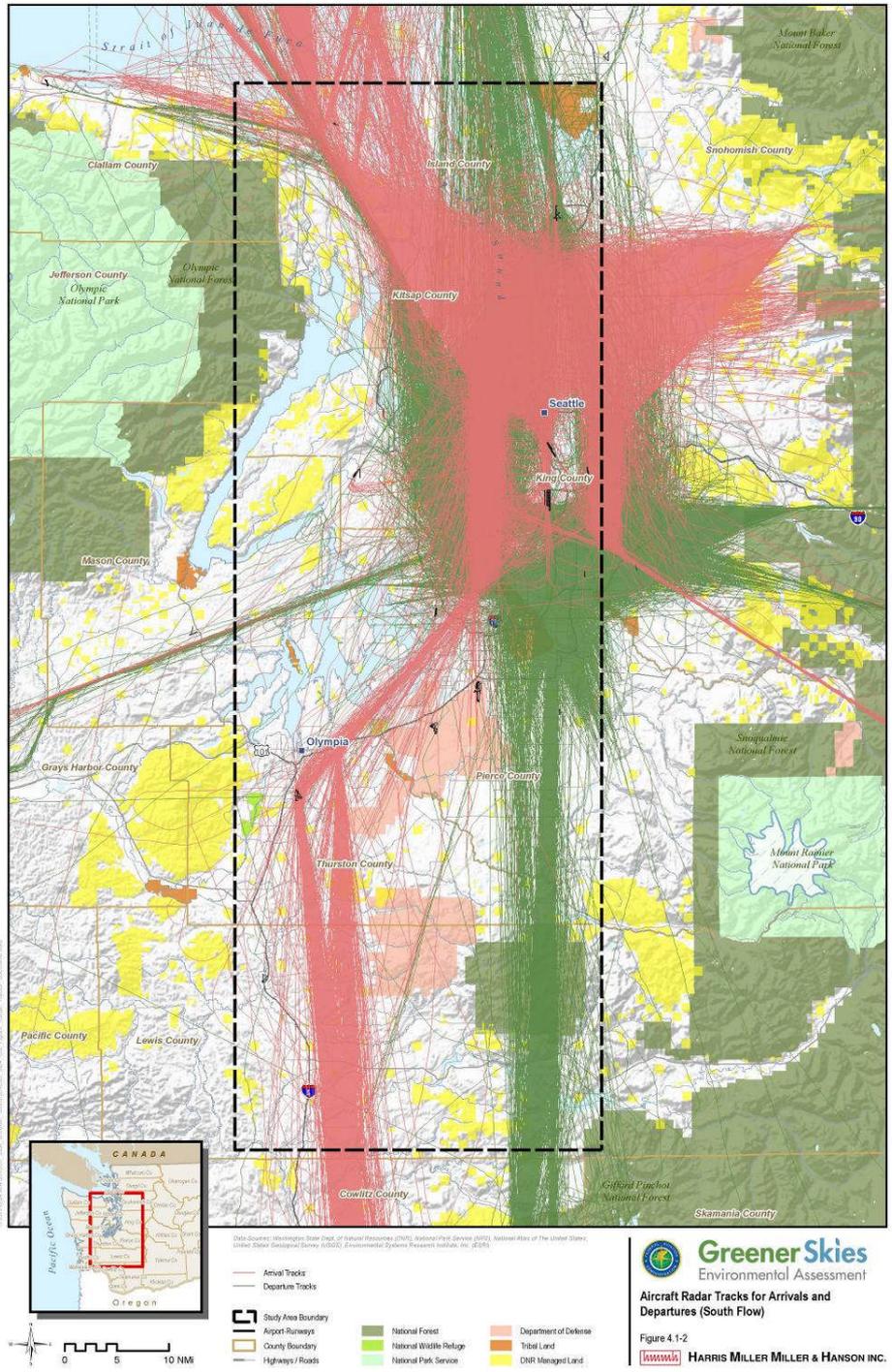


Figure 4.1-2. Aircraft Radar Tracks for Arrivals and Departures (South Flow)

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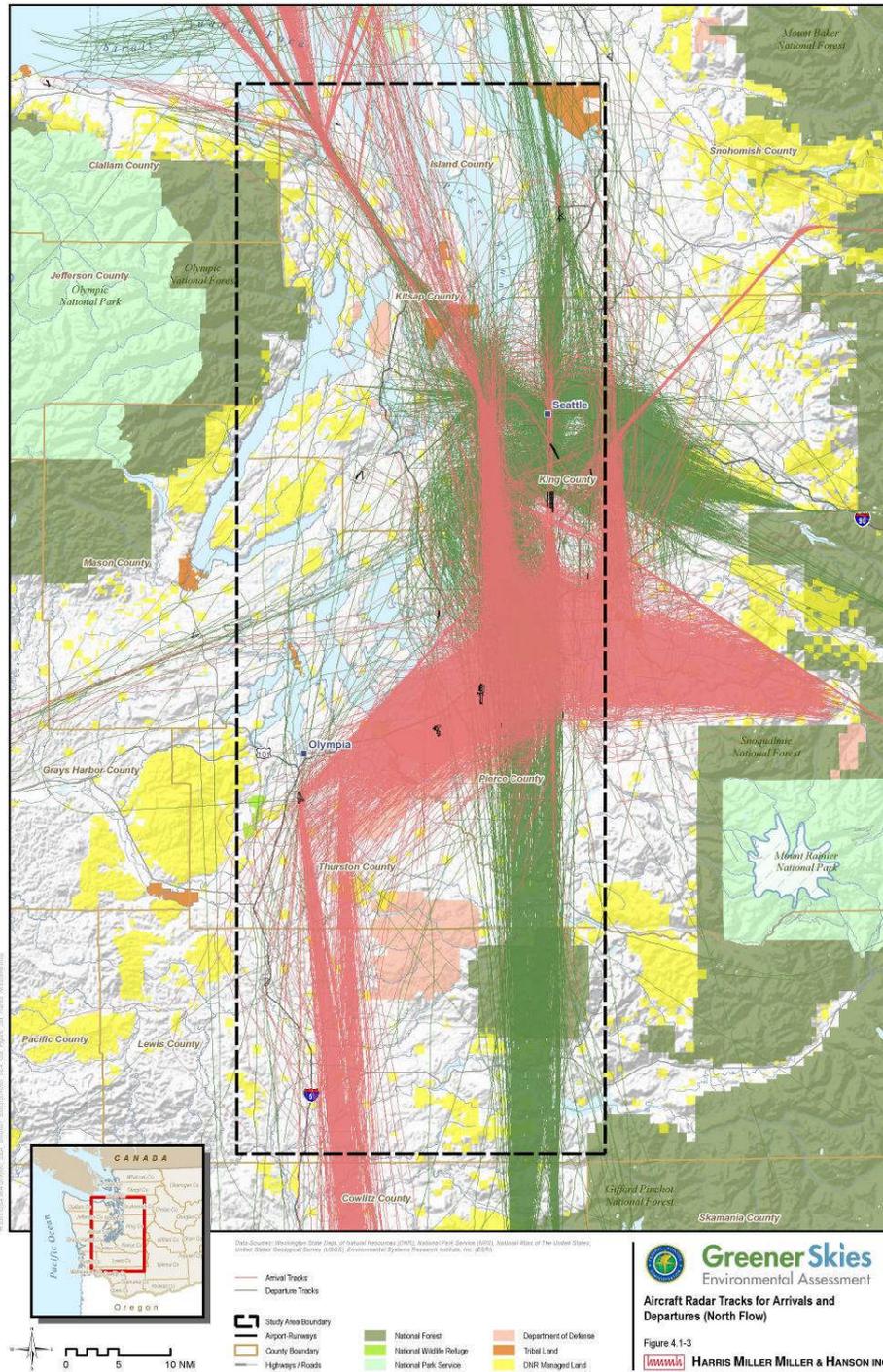


Figure 4.1-3. Aircraft Radar Tracks for Arrivals and Departures (North Flow)

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Two areas northwest and southwest of SEA deserve particular attention. The current primary arrival routes into SEA from the northwest and southwest are identified by pronounceable navigational fixes, JAWBN and OLYMPIA. Each route has undergone minor updating in the past, so that the current versions of the procedures are known as the JAWBN THREE ARRIVAL and the OLYMPIA SEVEN ARRIVAL. These published procedures are shown in chart form in Appendix C.

4.1.1 Existing Approach Procedures to Runways 16L, 16C, and 16R (“South Flow”)

To illustrate how these procedures are utilized, Figures 4.1-4 and 4.1-5 take the 12-week sample of radar data for south flow arrivals (the red traces in Figure 4.1-2) and instead of showing them as individual radar tracks, combine them into a density plot of the landings to runways 16L, 16C, and 16R to depict concentrations of traffic. The warmer the color in each figure, the higher the concentration. Figure 4.1-4 zooms in on the landing traffic generally to the north of SEA, and Figure 4.1-5 zooms in on the traffic generally to the south; however, all of the aircraft are landing on one of the 16s. Also shown in each figure, are thick dark blue lines and several open triangles that are representations of the published JAWBN THREE and OLYMPIA SEVEN approach procedures. Each also includes certain key named navigational waypoints that are used by pilots and ATC to guide aircraft into the proximity of the airfield for final instructions to land.

At the top left corner of Figure 4.1-4 (northwest of SEA), traffic converges on the point labeled JAWBN and begins to follow the dark blue route towards SEA. Almost immediately, however, the underlying density plot shows large numbers of aircraft (light blue radar traces) getting slight left turns towards the east from ATC personnel as they interleave and eventually align aircraft one behind the other to land. At that point, the aircraft are so precisely lined up with the runways (with the aid of an Instrument Landing System, or ILS) that one can see the individual spikes of red and yellow indicating the high density of traffic over very narrow paths as the aircraft fly straight to touchdown. The complexity of the airspace is reflected in the fact that nearly all aircraft illustrated in the underlying density plot required interaction with an air traffic controller to complete the approach and landing.

An additional band of high-density traffic also shows up approximately six miles to the west of SEA on a path that parallels the three runways. Those aircraft are coming into the area from the southwest on a “downwind” leg travelling south to north, seen most easily in Figure 4.1-5. Traffic arriving from the southwest converges on the point named OLYMPIA (OLM) and to a lesser degree on a secondary point, LACEE, which is used if needed to facilitate separation between aircraft as planes arrive into the Seattle airspace. In either case, the aircraft then follow the dark blue line to FOURT at the termination of the published procedure. In this case, unlike arrivals from the northwest, aircraft are able to follow a very tight pattern using Global Positioning Satellite (GPS) technology until they reach the end of the procedure. At that point, flight paths become more spread out, or dispersed, as ATC uses visual cues to turn each aircraft onto a downwind leg parallel to the landing runways, eventually instructing the pilot to implement a 180 degree turn to line up with one of the south runways. Again, the process involves multiple communications between controller and pilot to get the aircraft safely into an arrival stream for landing.

4.1.2 Existing Approach Procedures to Runways 34L, 34C, and 34R (“North Flow”)

Figure 4.1-6 and Figure 4.1-7 present the mirrored images of the conditions described in Figures 4.1-4 and 4.1-5, respectively. In Figure 4.1-6, aircraft arriving from the northwest are concentrated on the dark blue path of the arrival procedure using GPS guidance from JAWBN to the termination of the procedure at ALKIA. From there, aircraft are guided by ATC making slight right turns onto a downwind leg until receiving a 180-degree left turn back to the north to line up and land on one of the 34s. Figure 4.1-7 illustrates traffic patterns similar to those of Figure 4.1-5, in this case showing aircraft entering the area

over OLYMPIA and LACEE but veering off the published approach under instructions from ATC prior to reaching FOURT -- just as they do when converging on JAWBN to the northwest and then are vectored off of the procedure before reaching ALKIA. The relative lack of yellows, orange and red in Figures 4.1-6 and 4.1-7 reflect the fact that the prevailing winds at Seattle are from the south so that the majority of traffic follows the patterns of Figures 4.1-4 and 4.1-5 rather than those in 4.1-6 and 4.1-7.

No Action as addressed in this FEA considers the option of doing nothing to any portion of this complex airspace, other than to maintain the existing equipment, procedures, and communications that keep the system in operation at present. In that scenario, ATC will continue to accommodate any expected growth in traffic as best it can. As operations increase so too will the potential for hear-back/read-back errors as well as inefficiencies that extend traffic patterns and flight miles flown, result in increased fuel burn, create delays, and produce an environment of noise levels, engine emissions, and other environmental factors not unlike the present. Plots of future air traffic in the area would look very much like those in Figure 4.1-2 and Figure 4.1-3 if the status quo is maintained.

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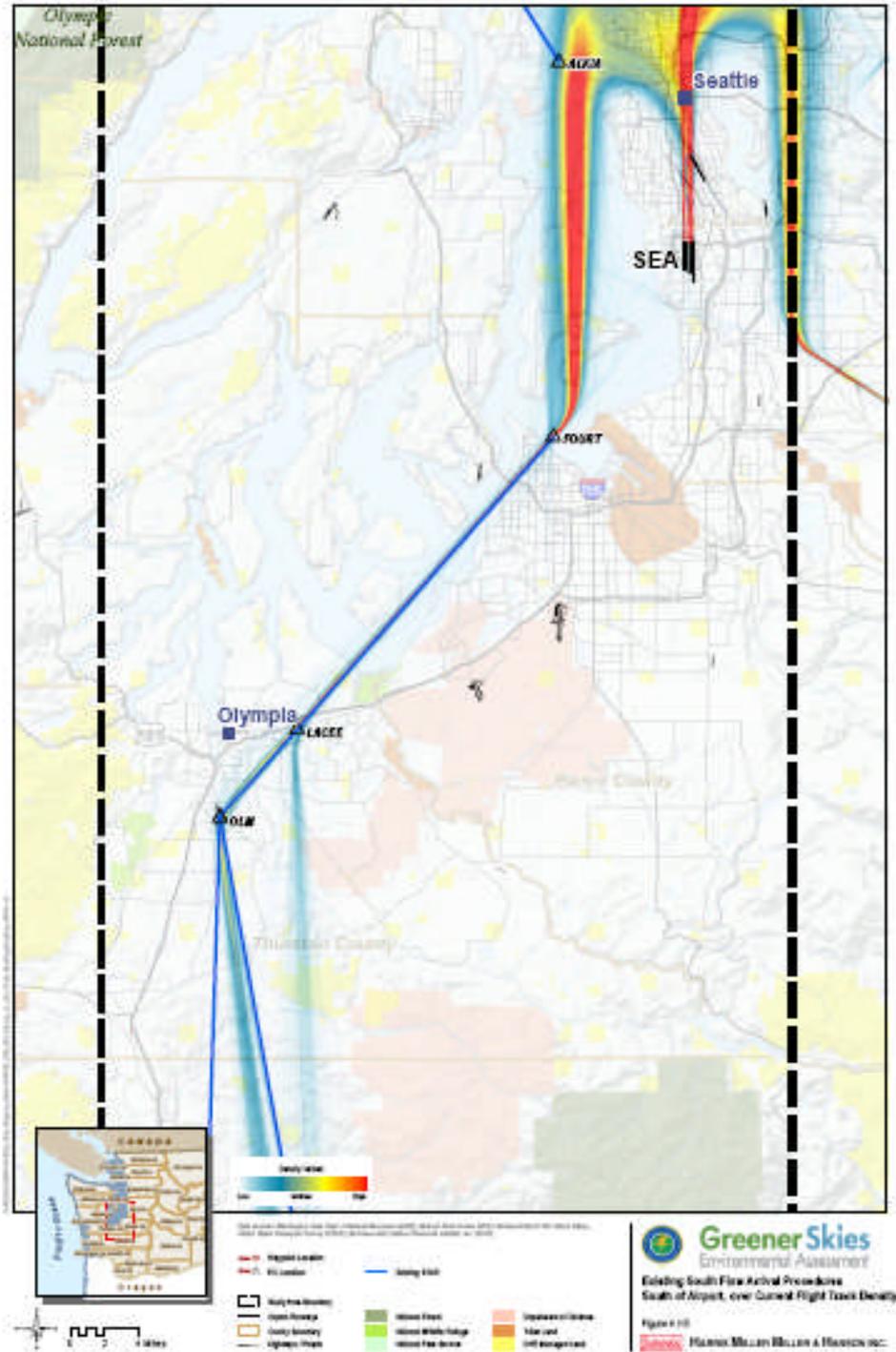


Figure 4.1-5. Existing South Flow Arrival Procedures South of SEA over Current Flight Track Density

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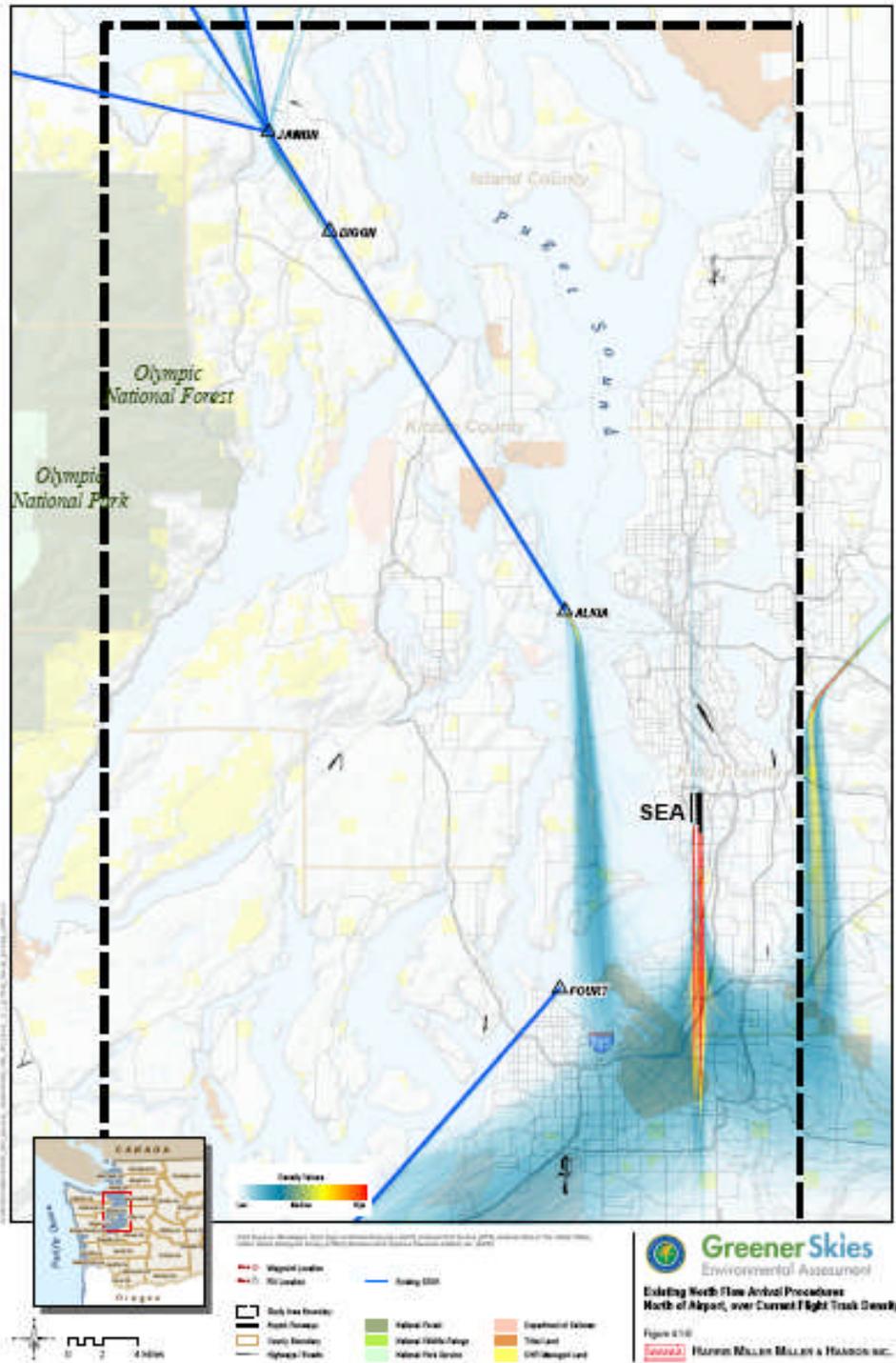


Figure 4.1-6. Existing North Flow Arrival Procedures North of SEA, over Current Flight Track Density

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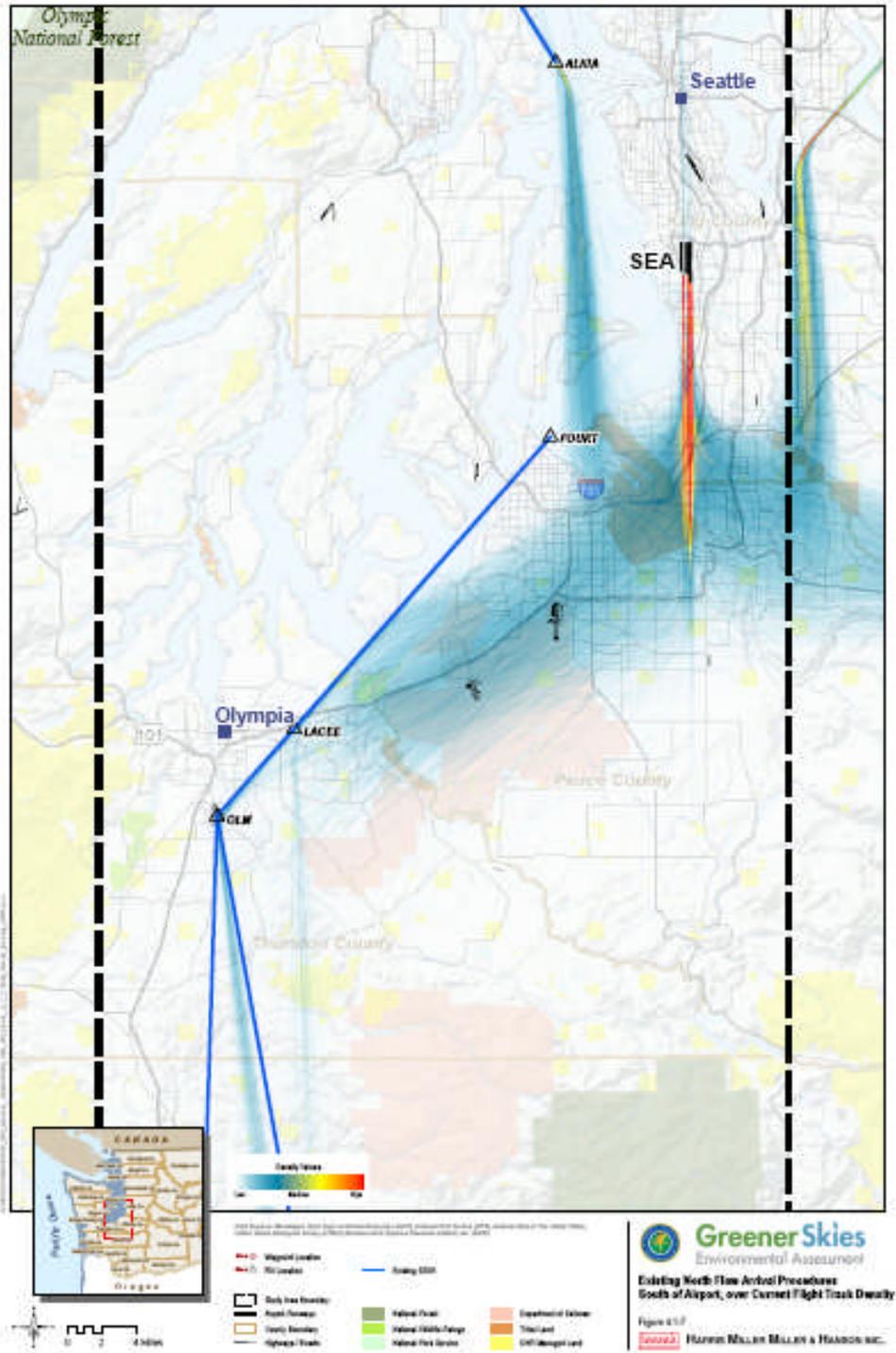


Figure 4.1-7. Existing North Flow Arrival Procedures South of SEA, over Current Flight Track Density

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4.2 The Proposed Action

The second alternative considered in this FEA is the Proposed Action, which utilizes new technologies available in 93 percent of the aircraft that currently operate in and out of SEA and for which even more aircraft will be suitably equipped in the future¹⁹. The new instrumentation and related flight procedures are designed to streamline routes of flight and reduce communications and inefficiencies of the present ATC system. Many other airports surrounded by complex airspaces already utilize some of the procedures of the kind being considered in the Proposed Action. Palm Springs, CA has three RNAV (RNP) procedures to its Runways 13R and 31L, with curved approaches to stay clear of tall mountain peaks; Los Angeles International has four RNAV (RNP) procedures that guide aircraft in over the ocean to each of its four parallel runways and also has three STARS that are designed as OPDs starting at altitudes of 25,000 to 28,000 feet; McCarran International Airport in Las Vegas has four OPDs with vertical guidance at interim waypoints; and Washington National Airport has two RNAV (RNP) approach procedures that guide aircraft over the Potomac River involving so many turns that, previously, they could only be flown as visual approaches in Visual Meteorological Conditions (VMC; i.e., good weather).^{20, 21}

Design of each measure in the Proposed Action was an iterative process conducted over several years. A Greener Skies Design Team consisting of FAA Headquarters, Northwest Region, Western Service Center, and local Seattle ATC personnel, as well as FAA contractors and airline and Port of Seattle representatives identified the primary confliction points and areas of greatest potential improvement. Arrivals into Seattle from the northwest and southwest cornerposts were identified as having the most promising benefits. Proposed changes to existing procedures were modeled by FAA using their Terminal Area Route Generation, Evaluation, and Traffic Simulation Tool (TARGETS), then tweaked to eliminate further confliction points, reduce flight miles flown, smooth descent profiles, and optimize the west side of the Seattle airspace to the maximum extent practicable. The new procedures were then tested for flyability in aircraft flight simulators until designs for a single optimized Proposed Action were chosen in January 2012. The resulting TARGETS files identifying the waypoints, altitudes and airspeeds for each new flight procedure serve as the basis for the environmental analyses of the FEA. Copies of the files are included in Appendix D.

The dark blue lines and related triangles marking key flight paths and fixes in the previous discussion of No Action will remain unchanged in the Proposed Action and will still be utilized by some aircraft. What will be different is that a variety of new arrival procedures will be added to those shown in Figures 4.1-2 through 4.1-7, and future density plots of underlying radar data for aircraft flying the new procedures will shift to follow the new navigational fixes. In 2014 -- the first full year of proposed implementation -- the amount of traffic following the new routes will be relatively light, but by 2018 the frequency of use represented by the density plots will increase, based on the projected forecast of equipped aircraft.

Using the same graphical approach to illustrate differences between current and proposed operations, Figures 4.2-1, 4.2-2, 4.2-3, and 4.2-4 address the Proposed Action.

Looking first at Figure 4.2-1, it shows new procedures against the density plot of current operations shown earlier in Figure 4.1-4. The Figure portrays the south flow of aircraft as generally seen north of SEA:

¹⁹ Mitre CAASD, "Performance Based Navigation, Capability Report 2010"

²⁰ <http://smartech.gatech.edu/bitstream/handle/1853/34378/Arrighi%20PBN%20update%20051810.pdf.txt?sequence=3>

²¹ http://aeronav.faa.gov/digital_tpp.asp?ver=1208&eff=07-26-2012&end=08-23-2012

- A new STAR arrival for landings from the northwest is proposed to begin at MARNR (collocated with JAWBN) and guide RNAV-equipped aircraft in a southeasterly direction over the northern tip of Kitsap County near Hansville. Aircraft are proposed to remain south of Island County, following the new procedure (in dark red) to STURM, at which point they would turn further southeast to GRIFY crossing the shoreline slightly south of Richmond Highlands to join one of the three new RNP or current ILS procedures (in gold; see below) in order to land. The procedure is designed in part to accommodate arriving aircraft, that in the No Action scenarios (and the underlying density plot in Figure 4.2-1), are seen following individually assigned ATC headings to final approach. Those aircraft that still must be pulled off the new RNAV procedure to achieve adequate separation or avoid air traffic conflicts, will receive heading, altitude and speed instructions from ATC, as now, but are expected to be fewer in number and to be distributed over the dashed tracks, which represent radar transitions to final approach.
- A total of 24 new RNP and RNP-to-ILS procedures are included in the Proposed Action. The 15 designed for landings to the south on runways 16L, 16C and 16R are shown (in gold) in Figure 4.2-1²². Three of these were identified above as extensions of the new STAR from GRIFY to each runway end. The remaining 12 are designed to guide aircraft down the middle of Elliott Bay:
 - Three RNPs and one RNP-to-ILS would take aircraft off of the MARNR STAR at the new navigational waypoint, DLTNN, located over the eastern shoreline of Kitsap County between Hansville and Eglon. From there, aircraft would head south along Puget Sound then make a relatively tight “S” turn, first to the left and then to the right, down the Bay and crossing over the port facilities on Harbor Island and areas south before landing.
 - An additional three RNPs and one RNP-to-ILS would follow the path of the existing arrival procedure but use the new RNAV waypoints MARNR and MOONZ, the latter a few miles short of the existing waypoint ALKIA. At MOONZ, the RNP-equipped aircraft would make a more gradual “S” turn than those on the DLTNN RNP, but essentially follow the same track from Harbor Island southward to land.
 - The remaining three RNPs and one RNP-to-ILS are for aircraft coming northward up the west side of SEA to turn inbound and land to the south. Those aircraft pass several waypoints along the downwind leg of the pattern but at HEDDR, follow the RNP and make a right turn inbound to a short straight-in final approach to land. Aircraft which are not adequately equipped and cannot complete the RNP approach are expected to receive verbal turn-in instructions from ATC, as now; the radar transitions from downwind to final approach are shown as single-dashed lines and are spread northward to accommodate extensions of the downwind for flights that are delayed in falling into line behind other landing aircraft when arrivals are closely spaced.
- All of the proposed RNP procedures incorporate Optimized Profile Descents (OPDs) as well. OPD’s are assumed to begin at top-of-descent and continue all the way to touchdown, with only minor changes in throttle settings needed on occasion.

²² Note that not all navigational points required for each procedure are shown on the various figures. A number of the additional waypoints that are necessary for a smooth RNP or OPD arrival are used to specify altitudes that must be achieved during the procedure.

Figure 4.2-2 shows the north flow of traffic as generally seen south of SEA. As above, the existing arrival procedure to OLYMPIA, with off-loads to LACEE for spacing when needed, will remain in place under the Proposed Action, but a new STAR is proposed to be added from the southwest.

The procedure starts at either of two fixes, BATTLE GROUND or NEWBERG, well to the south of Figure 4.2-2, but at altitudes that are higher than any required for the evaluation of environmental resources (see later in Chapter 5). The practical start of the new RNAV procedure is at the new waypoint HAWKZ at the bottom of the page. From there, aircraft fly direct to NETTZ on a considerably shorter flight path as much as 12 miles to the east of the older dogleg to OLYMPIA. From NETTZ, the route continues along the downwind to HEDDR until reaching the RNP portion of the procedure described earlier for Figure 4.2-1.

Looking at Figures 4.2-3 and 4.2-4 depicting traffic landing to the north on any of the runways 34L, 34C, or 34R, here again a symmetry exists with Figures 4.2-1 and 4.2-2 just presented.

- Traffic arriving into the area from the northwest over MARNR proceeds via the new STAR to MOLDY, approximately opposite the mouth of Elliott Bay, and about 6 miles west of downtown Seattle. Aircraft on the new approach would then make slight right turns onto a downwind leg, passing SEA on their left until they reach SHIPZ at which point they follow one of the three new RNP and one RNP-to-ILS curved approaches, turning 180 degrees to line up with the assigned runway.
- Those aircraft unable to complete the RNP portion of the approach will be given vectors by ATC to a point along the downwind where the aircraft can be turned to merge in with the flow of other aircraft arriving from the south. The single dashed lines in the Figure indicate the approximate range of distances over which such a turn is apt to occur.
- OPDs are expected to be utilized on the new STAR and RNP procedures whenever feasible.

Figure 4.2-4 shows a similar procedure when arriving from the southwest.

- An aircraft on the new STAR will pass over HAWKZ to FAANZ over the western edge of the Gifford Pinchot National Forest, then rather than head to FOURT (as it would if landing on one of the 16s), will follow the route to FOOTT, GOALZ and SONDR, in succession, picking up one of the final three RNP and one RNP-to-ILS procedures to 34L, 34C or 34R for landing.
- Aircraft which are unable to complete the RNP portion of the approach will pick up ATC instructions at FOOTT and receive radar vectors to a final approach course for touchdown.
- Similar to traffic arriving from the northwest, traffic over HAWKZ would be expected to utilize OPDs as they follow the new STAR when feasible.

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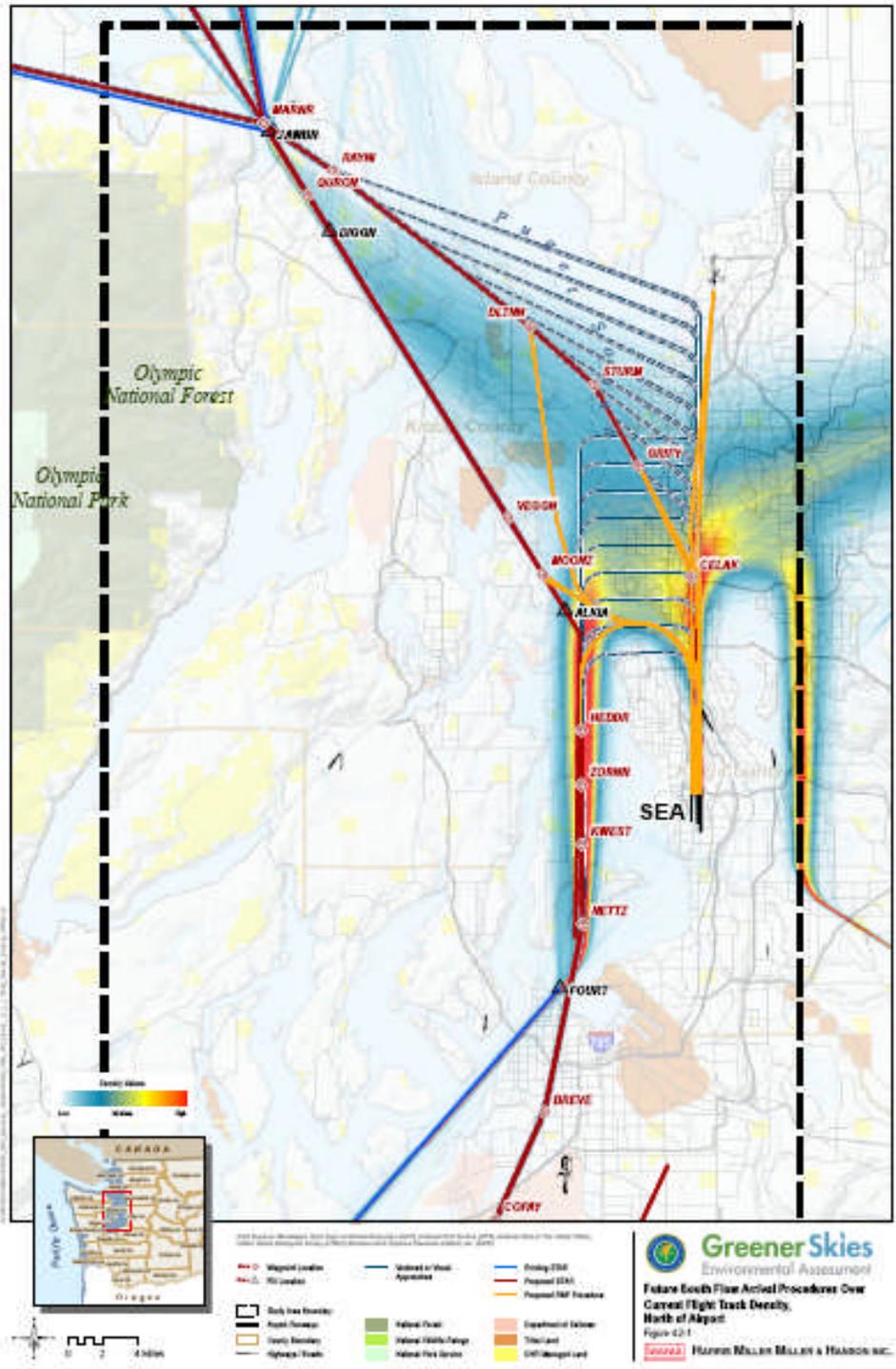


Figure 4.2-1. Future South Flow Arrival Procedures North of SEA, over Current Flight Track Density

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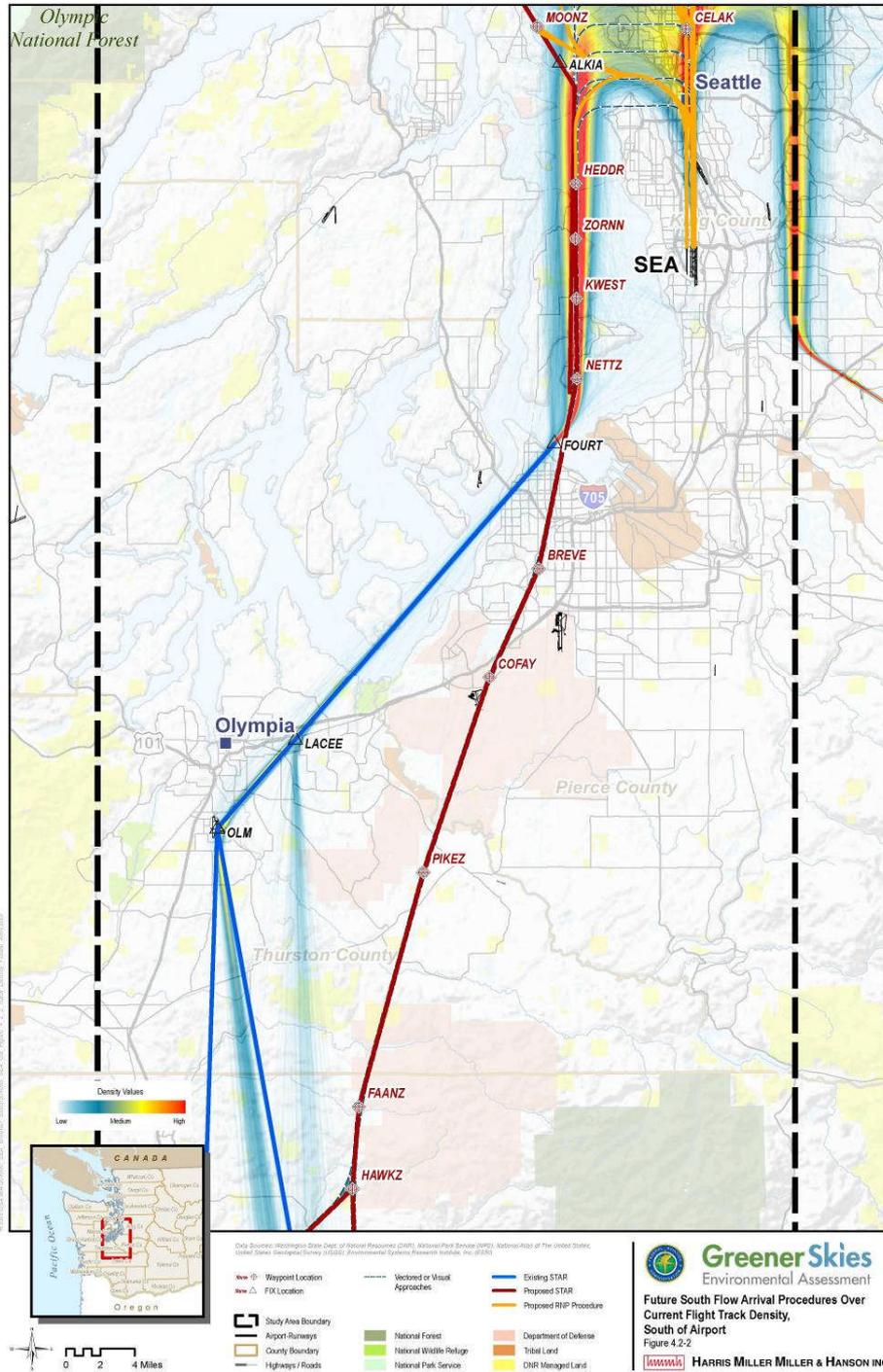


Figure 4.2-2. Future South Flow Arrival Procedures South of SEA, over Current Flight Track Density

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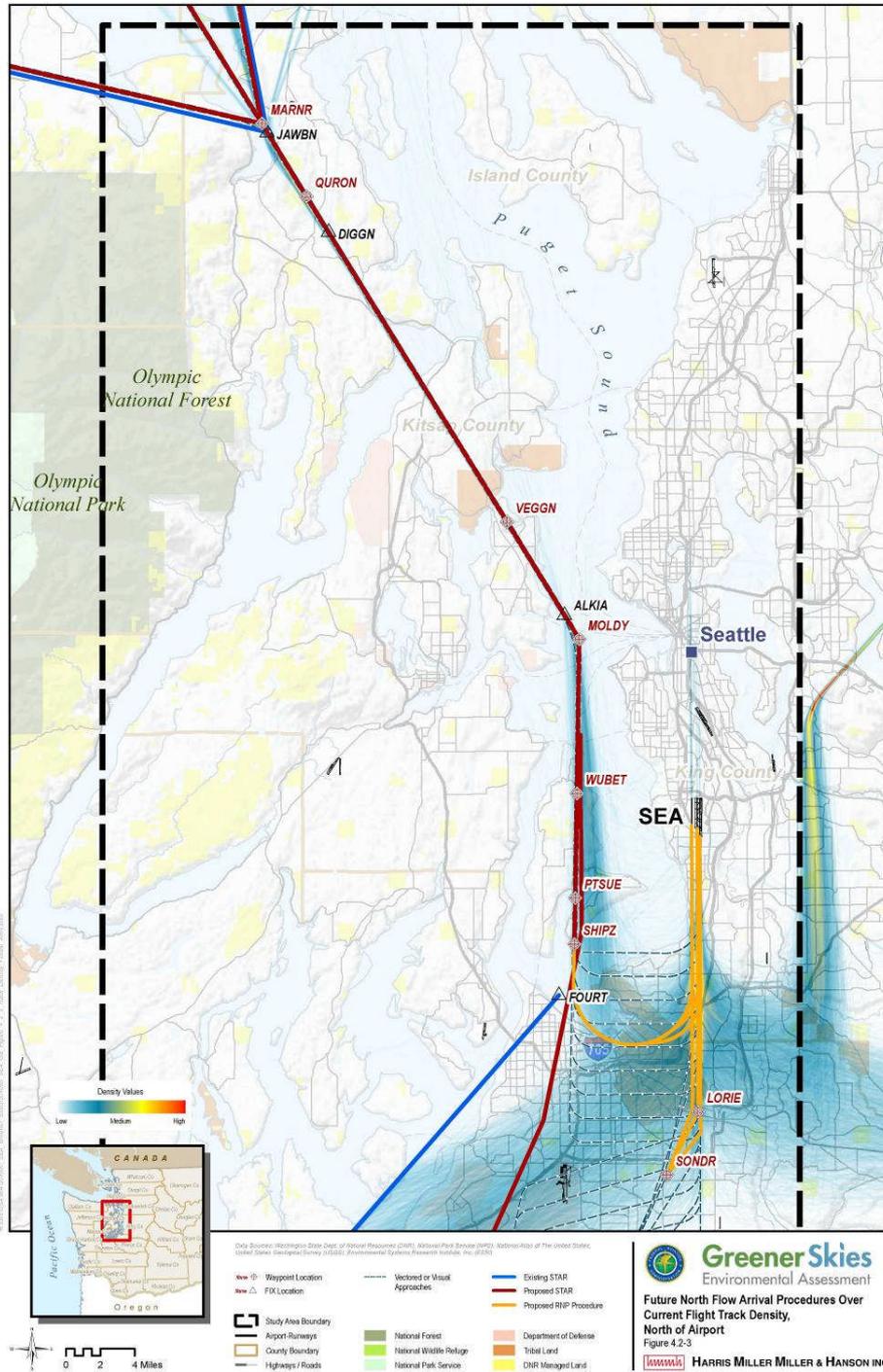


Figure 4.2-3. Future North Flow Arrival Procedures North of SEA, over Current Flight Track Density

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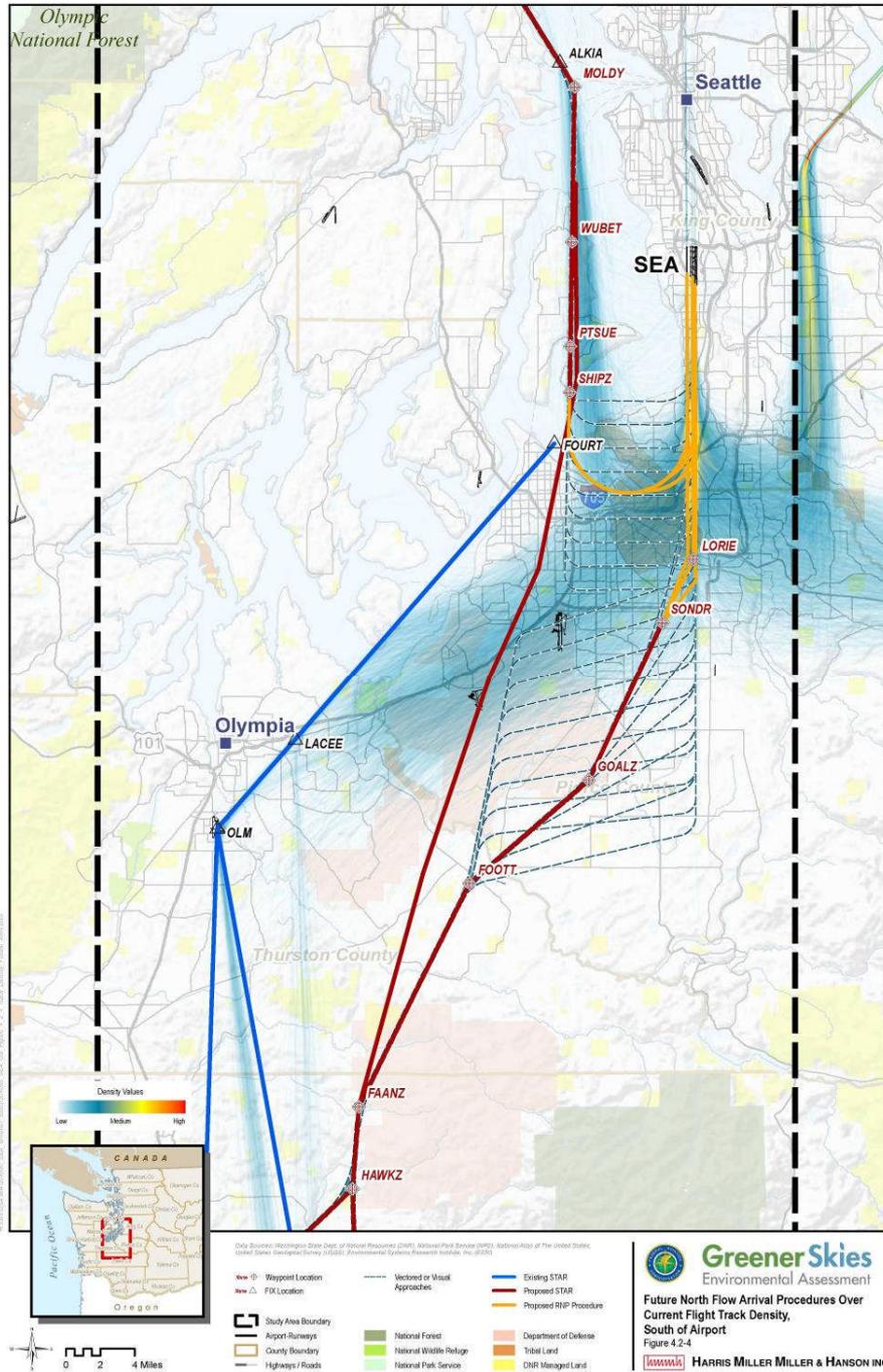


Figure 4.2-4. Future North Flow Arrival Procedures South of SEA, over Current Flight Track Density

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4.3 Operational Changes Resulting from the Proposed Action

Table 4.3-1 provides a brief summary of the projected shift in traffic from the current arrival routes to the new RNAV STARS, if approved.

Table 4.3-1. Major Changes in Operations with the Proposed Action

New STAR	Key Arrival Points	Operational Changes
MARNR	At start of procedure	70% of existing JAWBN traffic (up to 25 arrivals per hour) will be cleared for the MARNR STAR. Remainder will stay on JAWBN THREE
	For MARNR landings to south on Runways 16L, 16C and 16 R	10% will be cleared to RAYNI then vectored to final approach by ATC. 88% will be cleared to GRIFY or CELAK then vectored to final. Initially, only 2% will be cleared to DALTN for RNP through Elliott Bay due to complexity and length of route. Only 1 Dash-8 per day is expected to use MOONZ RNP
	For MARNR landings to north on Runways 34L, 34C, and 34R	15% of arrivals will go to SHIPZ to follow RNP; 85% will be cleared to MOLDY on downwind and vectored to final approach; visual approaches will turn to final approach sooner than now due to lower altitudes on downwind
HAWKZ	At start of procedure	70% of existing OLYMPIA traffic (up to 25 arrivals per hour) will be cleared for the HAWKZ STAR. Remainder will stay on OLYMPIA SEVEN
	For HAWKZ landings to south on Runways 16L, 16C and 16 R	10% will go to HEDDR to follow RNP through Elliott Bay. 90% will be cleared to NETTZ on downwind, then vectored to final approach; Visual approaches will turn to final approach sooner than now due to lower altitudes on downwind
	For HAWKZ landings to north on Runways 34L, 34C, and 34R	80% will be cleared to SONDR for RNP or ILS 20% will be cleared to FOOTT then vectored to ILS for final approach

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5 AFFECTED ENVIRONMENT

Chapter 5 describes the existing environmental conditions of the potentially affected geographic area influenced by the Proposed Action. FAA Order 1050.1E identifies 18 potential impact categories that should be considered for evaluation of environmental effects²³; however, of those, the primary impact categories likely to be affected by the proposed flight procedures are more limited and include:

- Noise
- Compatible land use
- Department of Transportation Act Section 4(f) sites (parks and natural areas)
- Historical, architectural, archeological, and cultural resources
- Air quality
- Natural resources and energy supply (fuel usage)
- Fish, wildlife, and plants (flyways for migratory bird)
- Secondary (induced) impacts (from related actions)
- Socioeconomic impacts, environmental justice, and children's environmental health and safety risks
- Visual and aesthetic resources

In addition, recent guidance from FAA contained in a January 12, 2012 memo entitled "Considering Greenhouse Gases and Climate Under the National Environmental Policy Act (NEPA): Interim Guidance" supplements FAA Order 1050.1E explicitly adding Climate as a category of potential environmental impact that also should be considered in an EA.

The following other resource categories listed in FAA Order 1050.1E were considered for potential environmental impacts but are unaffected by the Proposed Action and are not addressed in detail for the reasons listed:

- Coastal resources – Coastal barriers and coral reefs are not present in Washington State. For other coastal resources, the Washington Coastal Zone Management Act applies and is administered by the Washington Department of Ecology through incorporated cities and counties which maintain Shoreline Management Plans (RCW 90.58.020). These plans define allowed uses for different areas of shoreline, specifically identifying areas for conservation and for public access. The Proposed Action would not directly affect any shorelines or change the use of shoreline zones.
- Construction impacts – No construction activities would take place as a result of implementing the Proposed Action; therefore, there is no potential for construction impacts.
- Farmlands – The Farmland Protection Policy Act (FPPA) (7 CFR Part 658) regulates federal actions having the potential to convert farmland to nonagricultural uses. Implementation of the Proposed Action does not involve the development of any land regardless of use, nor does it have the potential to convert any farmland to nonagricultural uses.
- Floodplains – Without construction or land disturbing activities associated with the Proposed Action, there is no potential for the Proposed Action to affect natural and beneficial floodplain values.
- Hazardous materials, pollution prevention, and solid waste – The Proposed Action would not require any construction activities or operational changes at ground facilities, and thus would not generate, disturb, or treat hazardous materials or solid waste.

²³ FAA Order 1050.1E, page. A-1.

- Water quality – The Proposed Action would not result in any changes to existing discharges to water bodies, create a new discharge that would result in impacts to water quality, or modify a water body. The Proposed Action would, therefore, not result in any direct or indirect impacts on water quality.
- Wetlands – Although some waters of the U.S., including wetlands, are present on and around SEA, the Proposed Action would not involve any physical changes at SEA or elsewhere in the study area (defined in the next section), and therefore, there is no potential for direct or indirect impacts to wetlands.
- Wild and Scenic Rivers -- According to the National Wild and Scenic Rivers System (www.rivers.gov) there are no designated Wild and Scenic Rivers in the study area.

5.1 Study Area

FAA Order 1050.1E identifies the maximum altitude for environmental consideration of airspace actions as 10,000 feet above ground level (AGL). Additionally, Section 32-2-1 of FAA Order JO7400.2J recommends considering proposed changes up to 18,000 feet AGL when the proposed changes to flight procedures are over a National Park, Wilderness Area, or Tribal Lands where natural quiet may be an attribute of the land use. Because of the proximity of Olympic National Park to the northwest and Mount Rainier National Park to the southeast, and the presence of tribal lands in the region, the study area examined in this FEA was conservatively created to encompass the geographic areas anywhere that the proposed changes to aircraft routes would occur below 18,000 feet AGL so as to assure that any areas of natural quiet were included.

Figures 4.2-1 through 4.2-4 in the previous chapter illustrate the proposed procedural changes for the project and show that they occur northwest and southwest of SEA. No changes are being planned or proposed for areas east of SEA. A rectangular study area was therefore created, oriented in a north/south direction with SEA towards the eastern edge.

To the northwest, the northern and western boundaries of the study area are positioned approximately 5 NM beyond the co-located waypoints JAWBN and MARNR. Traffic coming into the area to join either of those two fixes will be flying along the same flight paths and at the same altitudes as they do now. It is from those waypoints inbound that flight procedures are proposed to change. The resulting northern boundary is approximately 36 NM north of SEA and the western boundary is approximately 30 NM west of SEA.

To the southwest, proposed new procedures extend to co-located waypoints BATTLE GROUND and NEWBERG approximately 110 to 130 NM south of SEA (see Appendix C). All traffic entering the airspace at either of these two fixes will be flying over the same flight paths and at the same altitudes as now, and only from those waypoints inbound are new flight procedures to be implemented. In this case, however, the altitudes of aircraft crossing BATTLE GROUND and NEWBERG are generally in excess of 25,000 feet, well above the 18,000-foot-AGL limit where FAA requires any environmental analysis. As a result, the southern boundary of the study area is positioned closer to SEA than the common waypoints – in this case approximately 60 NM south of SEA about where aircraft are descending below the 18,000-foot AGL altitude limit as they are sequenced on their approach to land..

To the east and west, the study area extends to boundaries that are approximately 5 NM beyond any procedural changes proposed. The width of the area is approximately 33 NM. The entire rectangle covers slightly less than 3,200 square miles and is shown in Figure 5.1-1. (Portions of the study area also appear in earlier figures).

5.1.1 Airport Facilities

Within the project study area are two primary airports – Seattle-Tacoma International Airport (SEA) and Boeing Field/King County International Airport (BFI), approximately six NM to its north. Three reliever airports are also within the study area -- Paine Field approximately 25 NM north of SEA, and Renton Municipal and Auburn Municipal, respectively just northeast and southeast of SEA along the eastern edge of the study area. Two military airfields – Joint Base Lewis-McChord and Gray Army Airfield – are 20 and 25 NM to the southwest of SEA. None of the new arrival procedures in the Proposed Action are intended to be published or implemented as arrival procedures to any of these or to any other facilities within the study area. Thus, the analyses of the FEA focus entirely on SEA and its surrounding airspace where changes will occur.

SEA, itself, is located eight to ten miles south of downtown Seattle, is owned by the Port of Seattle, and is operated by the Port's Aviation Division. In 2011, flights in and out of SEA totaled 314,944, of which 295,763 (94 percent) were by air carrier operators and 15,324 (about 5 percent) were by air taxi operators. The remaining one percent included approximately 1,600 general aviation operations and less than 100 military flights²⁴. Collectively, these accounted for an average of just under 863 operations per day.

For 2012, projected rather than historical operations are used in the analyses of the existing environment; they total approximately 925 daily flights -- an interpolation of the FAA-approved forecast that has been developed by the Port in conjunction with its on-going 14 CFR Part 150 Noise and Land Use Compatibility Study. By utilizing the same reference data as the Port's Part 150 study, both projects maintain an important consistency of projected growth that is expected to occur whether or not the Proposed Action is approved and implemented.

A further description of SEA, its runway configuration, and the surrounding airspace that would be affected by the Proposed Action were described in detail previously in Chapter 4. The detailed fleet mix of aircraft developed from the FAA-approved forecast is described in Appendix G along with other operational parameters.

5.1.2 Population

Within the study area are major portions of six counties, including Island, King, Kitsap, Lewis, Pierce and Thurston Counties. Smaller portions of Clallam, Jefferson, and Mason Counties fill in the western edge of the study area, and a small portion of Snohomish County fills in the corner to the northeast.

Population counts and demographic characteristics of the residential population that lives within the study area are based on the U.S. Census Bureau's 2010 census data, using the collection of Bureau-defined population centroids – single geometric points within each U.S. Census block at which all residents within the block are assumed to reside and have the demographic characteristics of the block as a whole. These points are utilized to summarize the number of people exposed to different noise exposure levels and also to address Environmental Justice concerns for minority and low-income populations within the study area. Noise results for 2012 operations are reported later in this Chapter. Comparative results for future years under the operational assumptions of No Action and the Proposed Action are reported in the Environmental Consequences discussion in Chapter 6. A total of 40,788 population centroids representing 3,173,686 residents were used in these calculations for each analyzed scenario.

Slightly less than 15,000 additional points, disassociated with Census Bureau data, were also incorporated into the analyses of alternatives, each of these spaced on a uniform grid at half-mile intervals covering the

²⁴ FAA Air Traffic Activity System (ATADS), Tower Operations: Standard Report for calendar year 2011.

entire study area. Calculations of noise at these locations were available to address noise exposure at noise-sensitive sites for which specific population points may not have been available (for example in park areas or on tribal lands away from population centroids).

A final set of grid points was added to represent specific locations such as close-in schools, specific historic sites, locations directly under approach paths, and locations in areas of variable terrain. For sites in King County where the points represent specific noise-sensitive land uses, the locations were cross-checked with the Port of Seattle's land use database developed for their on-going Part 150 study, thereby establishing a further consistency between the two projects (though King County is the only one within the Greener Skies study area for which such data have been developed).

A map showing all 55,786 grid points where noise was calculated is shown in Figure 5.1-2.

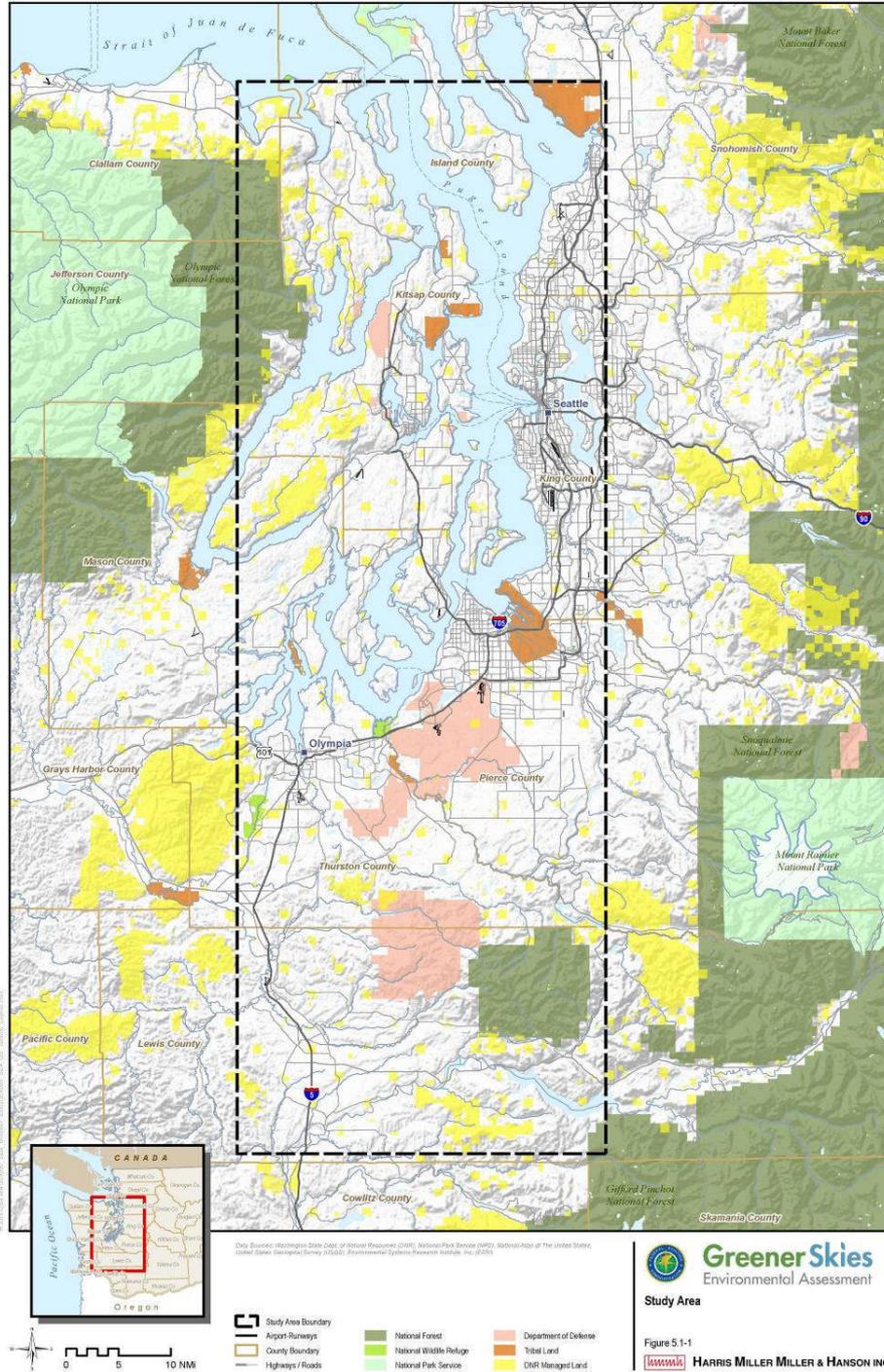


Figure 5.1-1. Study Area

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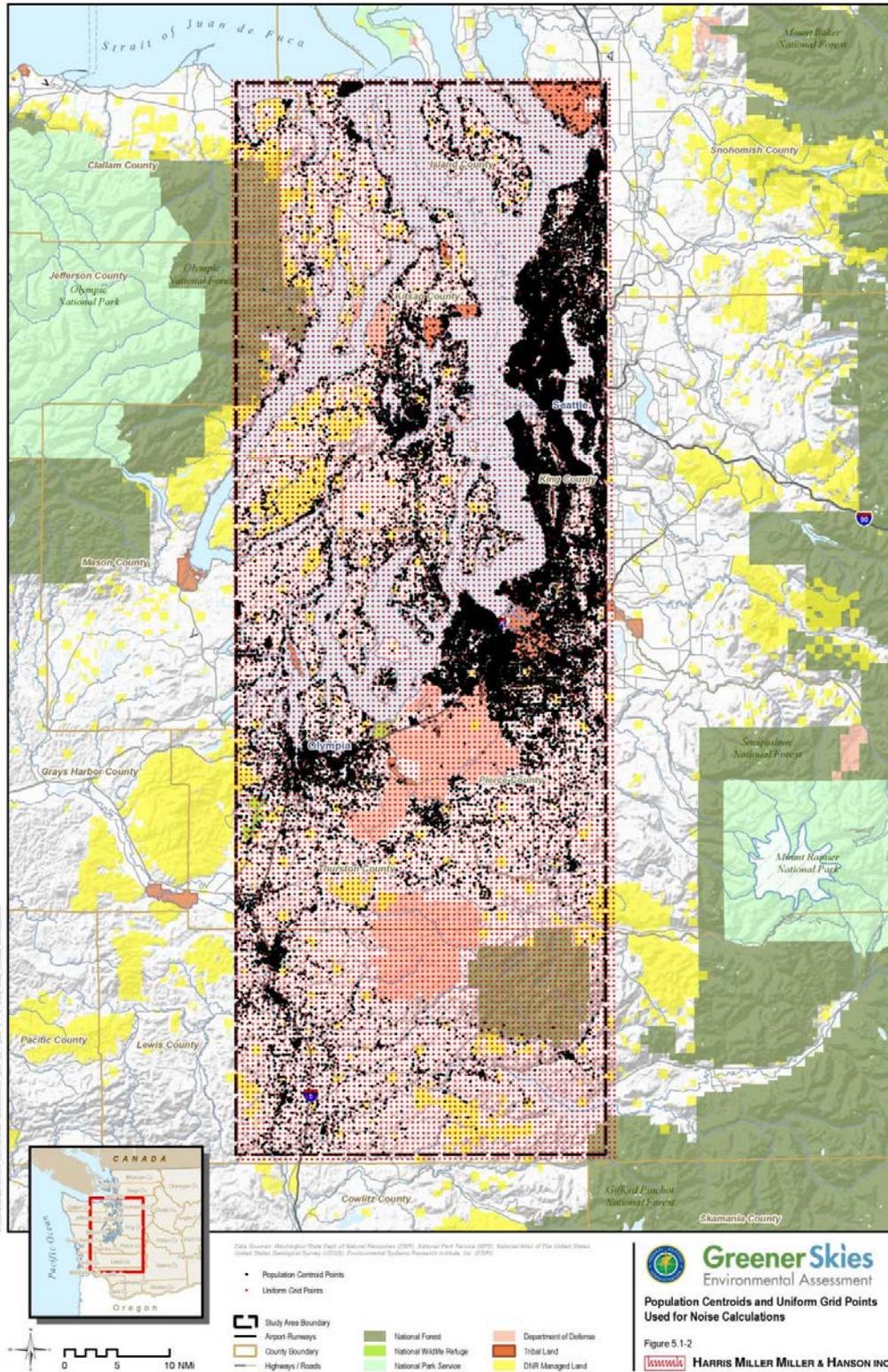


Figure 5.1-2. Population Centroids and Uniform Grid Points Used for Noise Calculations in Study Area

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5.1.3 Weather

Meteorological conditions pertinent to the environmental analyses of this FEA include temperature, barometric pressure, and relative humidity, all of which affect aircraft performance and/or sound propagation and thus are useful in predicting noise of each operational scenario. Aircraft generally perform better (climb faster) and engines produce more thrust per pound of fuel burned the colder, heavier, and drier the air, with temperature usually having the greater effect. Seattle’s monthly average temperatures, rainfall and fog days are shown below in Table 5.1-1, suggesting that aircraft will climb faster and be higher overhead on departure during the cooler days of February and March than the warmer days of July and August.

Wind speed and direction influence which runways are used. Because aircraft operate most effectively *into* the wind, and winds are always reported in the direction *from* which they are blowing, September is the most likely month to experience the use of northerly-oriented runways 34L, 34C, and 34R. Other months, the winds would tend to favor use of southerly oriented runways 16L, 16C, and 16R. However, wind and weather conditions on any single day, or for that matter during any several-hour period of a day can shift as fronts pass through and will dictate use of particular runways more so than the average winds indicated in the table.

Table 5.1-1. Long Term Average Weather Conditions for Seattle-Tacoma International Airport

	Temperature (°F) ¹			Wind ²		Rainfall ¹	Snow Days ¹	Fog Days ¹
	Low	Average	High	Speed (mph)	Direction	(inches/month)	(avg./month)	(avg./month)
January	36.0	41.5	47.8	9.5	S	5.56	3	15
February	35.4	42.5	50.5	9.4	S	3.50	2	13
March	38.3	46.0	54.7	9.4	S	3.72	2	12
April	41.9	50.5	60.1	9.4	SSW	2.71	1	8
May	46.8	56.0	66.2	8.9	SSW	1.93	0	7
June	51.3	61.0	71.2	8.6	SSW	1.56	0	5
July	55.2	66.0	77.5	8.1	SSW	0.70	0	5
August	55.2	66.0	77.5	7.8	SSW	0.88	0	6
September	51.6	61.5	72.5	8.0	N	1.45	0	10
October	45.3	53.0	61.0	8.3	S	3.48	0	16
November	39.4	45.5	52.0	9.1	S	6.57	1	16
December	35.4	40.5	46.9	9.6	S	5.35	3	17

Sources: 1. www.meoweather.com/history/United%20States/na/47.6063889/-122.3308333/Seattle.html
2. National Climate Data Center, NOAA Online Weather Data, 1981-2010

For noise modeling, annual average weather data are incorporated into the calculations, rather than for any given day or month. The annual data were acquired by the Port of Seattle from the National Climatic Data Center (NCDC) 29 for SEA (WBAN #24233) and shared with the FAA for this FEA. The average annual temperature at SEA is 52.8 °F, the sea level pressure averages 29.92 inches of mercury (Hg), and the relative humidity averages 70 percent. Operational summaries of runway use were provided by the Port of Seattle and indicate that aircraft operate on the northerly runways approximately 35 percent of the time, and in the opposite direction approximately 65 percent of the time.

The following subsections describe the affected environment for resources that are evaluated for potential impacts in Chapter 6, Environmental Consequences..

5.2 Noise

5.2.1 Regulatory Environment

The noise analyses for the SEA Greener Skies FEA have been conducted in accordance with FAA Order 1050.1E, Change 1 entitled *Environmental Impacts: Policies and Procedures*²⁵, and the National Environmental Policy Act as specified in the Council on Environmental Quality's *Regulations for Implementing the National Environmental Policy Act* (40 CFR 1500-1508).

FAA Order 1050.1E, in particular, specifies a number of requirements for EA noise analyses, including use of the yearly Day/Night Average Sound Level (DNL) as the noise metric of record. The DNL is a measure of cumulative noise exposure that takes into account all of the aircraft operations that occur during an "average" 24-hour day, except events occurring after 10:00 p.m. at night and before 7:00 a.m. in the morning are penalized as if they were louder than they actually are. The penalty, or weighting, on each nighttime operation is 10 decibels (dB), equivalent in terms of its effect on DNL, to adding 10 daytime operations of the same aircraft. A detailed description of DNL and the relationship between it and the effects of noise on people is contained in Appendix F of this FEA. Other requirements from 1050.1E are summarized briefly below.

- Order 1050.1E, Appendix A, Section 14.4b, requires that the Integrated Noise Model (INM), the Helicopter Noise Model (HNM), or the Noise Integrated Routing System (NIRS) be used to determine the significance of changes in exposure. Later, Section 14.5e requires that only NIRS can be used to conduct noise modeling for air traffic airspace actions when the study area extends beyond the immediate vicinity of an airport, or includes actions above 3,000 feet AGL. The Greener Skies project does both. NIRS must then be used to determine noise impacts from the ground to 10,000 feet AGL.

Section 14.5e goes on to state that the noise analysis should *not* include noise contours or a focus on population and demographic effects but instead *focus* on changes in noise levels. NIRS is to be used to produce change-of-exposure tables and maps using the following criteria:

- For DNL values from 60 to 65 dB, identify changes of ± 3 dB or more.
- For DNL values from 45 to 60 dB, identify changes of ± 5 dB or more.
- FAA Order 1050.1E addresses the degree of change above which aircraft noise causes adverse effects on people. Order 1050.1E, Appendix A, Section 14.3 states: a "significant noise impact" would occur if the NIRS analysis shows that the Proposed Action will cause noise sensitive areas to experience an increase in DNL of 1.5 dB or more at or above DNL 65 dB noise exposure when compared to No Action for the same timeframe.²⁶ Section 14.3 of Order 1050.1E further elaborates on the meaning of significant impact, indicating that special consideration needs to be given to the evaluation of sensitive areas within national parks, national wildlife refuges, and certain other uses such as traditional cultural properties. In summary, Table 5.2-1 below lists the criteria used in the noise analyses of this FEA to evaluate both the existing DNL exposure levels as well as the changes in future exposure levels resulting from the proposed new flight procedures. The table also includes characterizations of the magnitude of those changes.

²⁵ U. S. Department of Transportation, FAA, Office of Environment and Energy, "Policy and Procedures for Considering Environmental Impacts", FAA Order 1050.1E, Change 1. March 20, 2006.

²⁶ FAA Order 1050.1E, Change 1, Appendix A, Section 14.3, pg. A-61.

Table 5.2-1. Basis for Characterization of Changes in Noise

DNL Exposure Interval	Change in DNL	Characterization of Change
Greater than or equal to 65dB	1.5 dB or more	Significant impact
60 to less than 65dB	3 dB or more	Can receive consideration for mitigation, if there is a significant noise impact, i.e., 1.5 dB or more increase in DNL greater than or equal to 65 dB
45 to less than 60dB	5 dB or more	Requires disclosure

Source: 1. FAA Order 1050.1E, Change 1, Appendix A, paragraphs 14.3, 14.4c, 14.5c, 14.5e, pgs. A-61 to A-64

As an additional rule of thumb in judging noise level changes, it is generally accepted that a shift in DNL of 0 to 2 dB may be perceived, a change of 2 to 5 dB is generally perceived, and a change of 5 dB or more is likely to produce a change in community reaction²⁷.

DNL analyses may be supplemented on a case-by-case basis with additional assessments of noise using other metrics tailored to characterize and address related noise issues. Order 1050.1E states that supplemental analyses are most often used to consider effects of noise at sensitive locations and to aid in the public’s understanding of the effects. Typical reasons for supplemental analyses include evaluations of speech interference, sleep disturbance, sound insulation effectiveness, and assessments of natural quiet in special areas such as national parks. Which metrics to use will depend on the circumstances of the sites or situations of interest.

5.2.2 Methodology

Version 7.0b.2 of NIRS was used to compute all noise levels for the Greener Skies FEA. Released in February 2012, the model not only has the capability of computing DNL and other special-use noise metrics; it also incorporates EUROCONTROL’s “Base of Aircraft Data” (or BADA). Developed with the close cooperation of aircraft manufacturers and airlines, the new data base makes feasible trajectory-based simulations used in support of new Air Traffic Management (ATM) systems, and it provides users with the ability to address fuel burn and aircraft emissions assessments. The model is licensed from EUROCONTROL by the FAA.

5.2.2.1 Operational Inputs for 2012

Operational inputs to NIRS include datasets such as the annual average numbers of aircraft operations, the split of traffic into different aircraft types and models, their further split into daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) periods, runway geometries and traffic use, and flight track definitions and usage. These are discussed in the Noise Modeling Technical Report in Appendix G, and several key parameters are included here for context.

From Table 5-2.2 below, total annual operations for the current year, 2012, are expected to reach an estimated 337,541, or 925 per day based on the Port of Seattle’s recently approved forecast. Future study years, each matching key implementation dates for the new RNAV and RNP procedures are also shown and illustrate the projected growth in traffic that is expected to occur through 2023.

²⁷ Miller, N.P., Von Gierke, H.E., and Eldred, K.M., “Impact Assessment Guidelines for the Effects of Noise on People”, prepared for Transport Canada, Toronto, ON, October 1991.

Table 5.2-2. Summary of Annual Operations by Aircraft Group

Operations Category	2012	2014	2018	2023
Jet w/RNAV	235,967	248,066	277,356	321,655
Jet	12,591	10,455	9,043	9,949
Dash 8 w/RNAV	71,167	76,248	86,153	96,363
Prop	17,816	14,912	12,643	13,257
Total	337,541	349,618	385,195	441,224

The four groupings of aircraft types in the left column of Table 5.2-2 represent a basic breakdown of jets and propeller or turboprop aircraft that are equipped (“w/RNAV”) to fly the proposed new routes and those that are not. Currently, approximately 91% of the total traffic at SEA is so equipped. Over time, that percentage of annual operations keeps increasing – to almost 95% in 2023 – indicating that more and more flights will be able to utilize the new procedures into the future. A further breakdown of this fleet into 146 specific aircraft types and models is included in Appendix G.

Not all of the 146 types that operate in and out of SEA are necessarily available for modeling using the NIRS program; some are not represented in the model’s database. For these, the FAA requires a formal approval from Headquarters in order to assure the best available substitutions are made. Matching an aircraft that is unrepresented in the database with one that is available is typically based on characteristics such as maximum gross takeoff weight, number and type of engines, total thrust, fuselage type and other factors. The correspondence pertaining to this substitution process is included as Appendix E.

Other key inputs to NIRS are the modeled flight tracks used to represent existing flight procedures, and how often they are utilized. Samples of radar data shown earlier in Chapters 3 and 4 were used to develop these modeled tracks, again with attention to coordinating inputs with the Port’s Part 150 Study. Differences between the tracks developed for the FEA and those of the Port’s study are explained by the fact that the study area for the FEA is so much larger and thus requires significant extensions of tracks in order to reach the higher altitudes and longer distances necessary to accurately compute noise.

Figures 5.2-1 and 5.2-2 depict the modeled tracks used in the 2012 NIRS calculations. Figure 5.2-1 shows traffic in a northerly flow, the blue tracks representing departures from 34L, 34C, and 34R, and the orange tracks arrivals to the same runways. Figure 5.2-2 illustrates the modeled tracks for flow in the opposite direction.

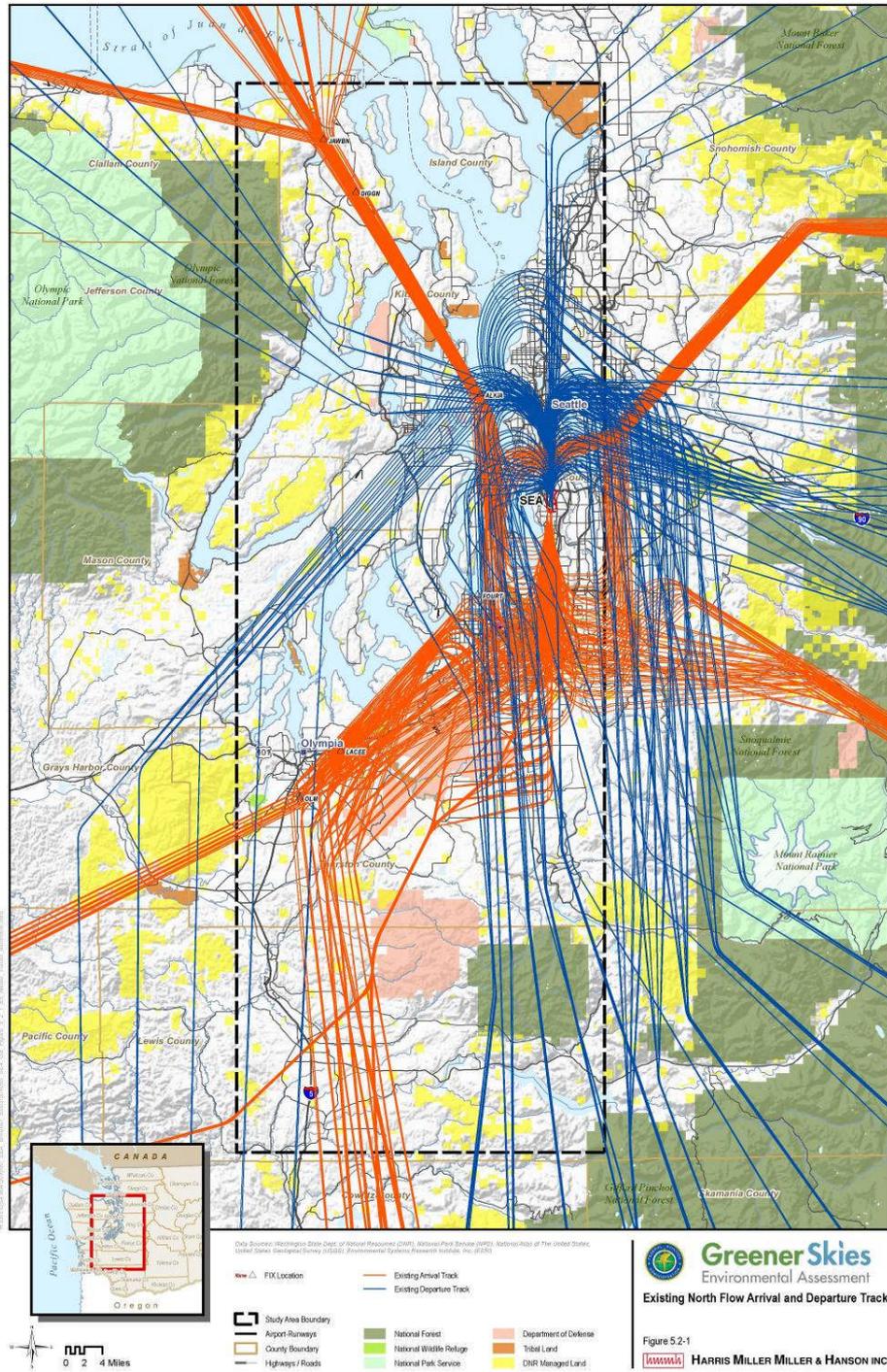


Figure 5.2-1. Existing North Flow Arrival and Departure Tracks

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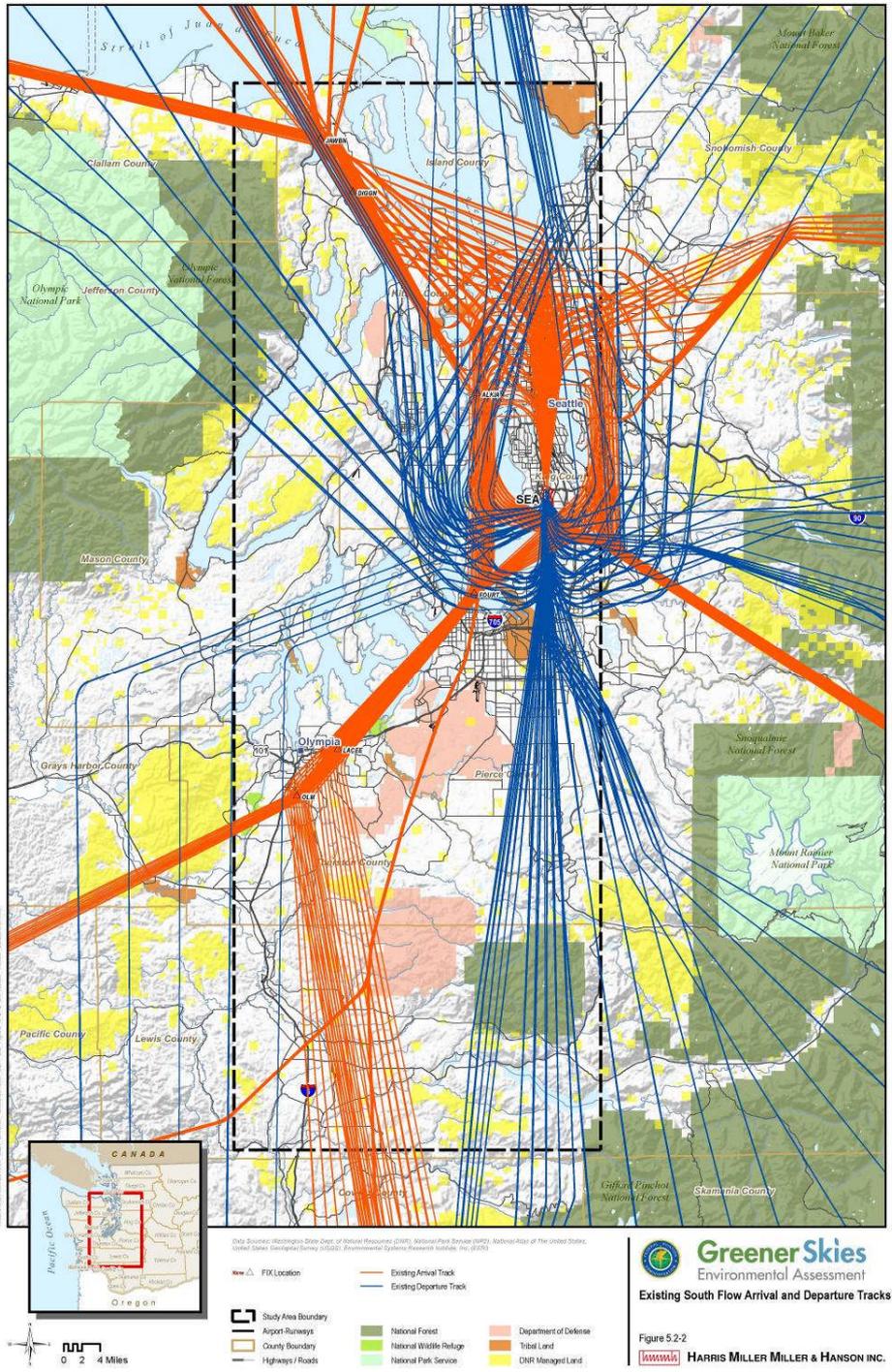


Figure 5.2-2. Existing South Flow Arrival and Departure Tracks

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5.2.3 Existing Conditions

Using the inputs described above and in Appendix G, NIRS was exercised to compute existing DNL noise exposure levels at the nearly 56,000 population centroids, uniform grid points, and specific sensitive sites that were depicted earlier in the chapter. The resulting DNL values are shown in Figure 5.2-3, color-coded in 5-decibel (dB) increments from 45 dB to 65 dB DNL and above. NIRS does not compute or generate noise contours from these calculations, but the density of the centroids and the color-coding of the results illustrate quite clearly a pattern of exposure that mimics typical DNL contours.

Table 5.2-3 summarizes the population associated with the computed noise levels at each of the grid points. The ranges of DNL levels shown in the table are those identified in FAA Order 1050.1E as important for the evaluation of future air traffic changes. Of the 40,788 populated centroids in the study area, a total of 9,845 are exposed to DNL values above 45 dB; the remaining 30,943 centroids representing 2,330,069 people are exposed to DNL values less than 45 dB.

Table 5.2-3 Population Exposed to Ranges of DNL Values Due to 2012 Operations

Range of DNL Values	Centroids Exposed	Population Exposed
≥ 65	74	6,027
≥ 60 to 65	460	48,236
≥ 45 to 60	9,311	789,354

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5.3 Land Use

FAA Order 1050.1E addresses land use compatibility as an issue that normally arises in conjunction with airport development projects. Such projects tend to affect noise levels in close proximity to runway ends where exposure is highest. Guidelines for determining the compatibility of different uses with those noise levels are contained in Title 14 of the Code of Federal Regulations, Part 150. FAA Order 1050.1E cites those guidelines as well, and they are reproduced in this FEA as Table F.8-1 of Appendix F.

In general, the compatibility guidelines state that, with some exceptions for land use where natural quiet is an expected attribute, all noise sensitive land use is compatible with DNL values less than 65 dB.

However, in notes to its land use compatibility guidelines, FAA indicates that residential uses and schools can be compatible with levels higher than 65 dB if appropriate sound insulation treatments are applied. The Port of Seattle engaged in a large residential and school sound insulation program starting more than 25 years ago and according to the Port's web site, has treated:

- At least 9,300 single family homes
- Six condominium complexes with a combined total of 236 individual units
- Seven of 15 schools in the Highline School District
- Twelve of 22 buildings at Highline Community College
- Three private school, two churches and a convalescent center²⁸.

Thus, it is highly likely that most, if not all of the 6,027 residents are in structures that have received mitigation.

5.4 Air Quality

Existing air quality conditions of all or portions of the ten counties within the study area are discussed below, including a description of the current attainment status of the study area and a summary of local air monitoring data.

5.4.1 Regulatory Environment

5.4.1.1 National Ambient Air Quality Standards

Pursuant to the Federal Clean Air Act of 1970 (CAA)²⁹, the US Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for major pollutants, called "criteria pollutants." Currently there are six criteria pollutants: ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), particulate matter, and lead (Pb). Particulate matter (PM) includes particles with a diameter less than 10 micrometers (PM₁₀) and with a diameter of less than 2.5 micrometers (PM_{2.5}).

Table 5.2-8 shows the primary and secondary NAAQS for the criteria pollutants. The NAAQS are two-tiered. The first tier (primary) is intended to protect public health; the second tier (secondary) is intended to prevent further degradation of the environment.

²⁸ <http://www.portseattle.org/Environmental/Noise/Sound-Insulation/Pages/default.aspx>

²⁹ 42 U.S.C. §§ 7401 – 7676.

Table 5.2-8. National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards ^[1,2]	Secondary Standards ^[1,3]
CO	8- hour	9 ppm (10 mg/m ³)	None
	1- hour	35 ppm (40 mg/m ³)	None
Lead ^[4]	Rolling 3-Month Average ^[5]	0.15 µg/m ³	Same as Primary
NO ₂	Annual Arithmetic Mean	0.053 ppm (100 µg/m ³)	Same as Primary
	1-hour	0.100 ppm ^[6]	None
PM ₁₀	Annual Arithmetic Mean	None	None
	24-hour	150 µg/m ³	Same as Primary
PM _{2.5}	Annual Arithmetic Mean	15 µg/m ³	Same as Primary
	24-hour	35 µg/m ³	Same as Primary
O ₃	8-hour	0.075 ppm (147 µg/m ³)	Same as Primary
	1-hour	0.12 ppm ^[7]	Same as Primary
SO ₂	1-hour	75 ppb ^[8]	None
			3-hour

Notes:

- National standards (other than ozone, particulate matter, and those based on annual averages) are not to be exceeded more than once per year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or is less than the standard. For PM₁₀, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m³ is equal to or is less than one. For PM_{2.5}, the 24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or are less than the standard.
- Primary Standards: Levels necessary to protect public health with an adequate margin of safety.
- Secondary Standards: Levels necessary to protect the public from any known or anticipated adverse effects.
- Lead is categorized as a “toxic air contaminant” with no threshold exposure level for adverse health effects determined.
- National lead standard, rolling three-month average: final rule signed October 15, 2008.
- To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).
- EPA revoked the 1-hour ozone standard in all areas; however, some areas have continuing obligations under that standard.
- Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

5.4.1.2 Attainment Status

The standards in Table 5.2-8 apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area meets or exceeds the national standard, it is designated an attainment area. Areas that do not meet the national standard are designated non-attainment areas. If there is insufficient information to classify an area as attainment or non-attainment for a particular air pollutant, the area is designated unclassifiable for that pollutant. Once a non-attainment area meets the standards, the EPA will redesignate the area as a “maintenance area”.

Each state is required to draft a State Implementation Plan (SIP) to further improve the air quality in non-attainment areas and to maintain the air quality in attainment and maintenance areas. The SIP outlines the measures that the state will take in order to improve air quality.

Table 5.2-9 presents the EPA-designated attainment status for the Seattle-Tacoma area corridor. The EPA has designated the King County area as a maintenance area for CO and ozone. Parts of the downtown Seattle area (e.g. Duwamish) are designated a maintenance area for PM10 which includes Boeing Field/King County International Airport but not the Seattle-Tacoma International Airport. Other counties such as Pierce county are designated maintenance for ozone, CO and PM10 for the Tacoma Tideflat area and non-attainment for PM2.5 in the Wapato Hills-Puyallup River Valley area. A portion of Snohomish county is designated maintenance for ozone and CO while parts of Thurston county in the

cities of Olympia, Tumwater and Lacey are designated a maintenance area for PM₁₀. The remaining pollutants such as CO, SO₂, NO₂, PM₁₀ and lead are considered in attainment for the NAAQS.

Table 5.2-9. EPA Designated Attainment Status for the Seattle-Tacoma Study Corridor

County	Pollutant	Designated Attainment Status
Pierce	PM _{2.5} ¹	Non-Attainment
	Ozone 1-hour ¹ , CO, PM ₁₀ ²	Maintenance
	Ozone 8-hr, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5}	Attainment
Kitsap	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Island	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Snohomish	Ozone 1-hour ³ , CO	Maintenance
	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5}	Attainment
King	Ozone 1-hr ³ , CO	Maintenance
	PM ₁₀ ⁴	Maintenance
	Ozone 8-hr, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5}	Attainment
Clallam	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Jefferson	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Lewis	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Mason	Ozone, SO ₂ , NO ₂ , Pb, PM ₁₀ /PM _{2.5} , CO	Attainment
Thurston	Ozone, SO ₂ , NO ₂ , Pb, PM _{2.5} , CO	Attainment
	PM ₁₀ ⁵	Maintenance
Notes:		
1. PM _{2.5} non-attainment with 2006 standard at Wapato Hills-Puyallup River Valley area in Pierce County.		
2. PM ₁₀ maintenance area only applicable for a portion of Pierce County in Tacoma Tideflat area.		
3. No longer subject to the 1-hour ozone standard, as of June 15, 2005.		
4. PM ₁₀ maintenance area only applicable for a portion of King County in Seattle-Duwamish area.		
5. PM ₁₀ maintenance area only applicable to the cities of Olympia, Tumwater and Lacey.		

5.4.2 Existing Conditions

EPA and local state agencies operate ambient monitoring stations that are used to assess air quality in each state. To characterize the existing conditions of the counties in the study area, the most recent data from the Washington State Department of Ecology and the EPA AirData database were reviewed. The Department of Ecology operates these monitoring stations to measure ambient air quality and ensure compliance of the NAAQS. Since SEA is located in King County, the highest monitored values recorded within King County or surrounding counties were chosen. This is conservative since the highest values were chosen regardless of location or how well they represented SEA. The analysis consisted of regulated air pollutants contained in the NAAQS; including sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), lead (Pb), and particulate matter (PM₁₀ and PM_{2.5}). Table 5.2-10 presents a summary of the background air quality concentrations.

Data in the table show that there were no violations of the NAAQS from any of the monitor locations. The monitoring station with the highest measured 1-hour and 8-hour CO concentration in the region for 2011 is located at 4103 Beacon Hill S, (approximately 7 miles to the north of SEA). The CO monitoring results of 1 ppm for both the 1-hour and 8-hour averaging periods are well below the 1-hour and 8-hour CO NAAQS of 35 ppm and 9 ppm, respectively. The Beacon Hill site also collected PM₁₀ data and the results for the 24-hour averaging period were 23 µg/m³ which is also well below the 24-hour PM₁₀ NAAQS of 150 µg/m³. The monitoring location with the highest 8-hour ozone value occurred at 30525 SE Mud Mountain Road monitor, located approximately 26 miles to the southeast of SEA. This location

reported an 8-hour ozone concentration of 0.069 ppm compared to the 8-hour NAAQS of 0.075. The 1-hour ozone standard was revoked by EPA on June 15, 2005 and was not included in this analysis. The background levels presented in Table 5.2-10 are representative of the overall air quality within the Project study area.

Table 5.2-10. Ambient Background Air Quality Concentrations

County	Carbon Monoxide (CO)		Nitrogen Dioxide (NO ₂)		Sulfur Dioxide (SO ₂)		Ozone	PM _{2.5}		PM ₁₀	Lead
	1-Hour	8-Hour	1-Hour	Annual	1-Hour	3-Hour	8-Hour	24-Hour	Annual	24-Hour	Quarterly
King	1	1	43	No Data Available	28	No Data Available	0.069	28.8	8.4	23	0.082
NAAQS	35 ppm	9 ppm	100ppb	53 ppb	75 ppb	0.14 ppm	0.075 ppm	35 µg/m ³	15 µg/m ³	150 µg/m ³	0.15 µg/m ³

Notes:
 1. CO, SO₂, PM₁₀ monitor location was at 4103 Beacon Hill S, Seattle, WA.
 2. NO₂ monitor location was at Casino Drive, Anacortes, WA.
 3. There is no monitor for lead in Washington for 2011. Lead value represents concentration at McMinnville, OR monitor.
 4. Ozone monitor location at 30525 SE Mud Mountain Road in King County.
 5. PM_{2.5} monitor location at 4401 E. Marginal Way, Seattle, WA.
 6. No data available for annual NO₂ and 3-hour SO₂ averaging periods based on review of EPA AirData website.

5.5 Climate Change

Climate changes are caused by many factors including but not limited to oceanic circulations, variations in solar radiation, gases from volcanic eruptions, and combustion emissions including greenhouse gases (GHG).

Research shows that there is a direct correlation between fuel combustion and GHG emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that according to EPA data, “domestic aviation contributes about 3 percent of the total carbon dioxide emissions” compared with other industrial sources including the remainder of the transportation section (20 percent) and power generation (41 percent). The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic GHG emissions globally. Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global environment.

The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g. NASA, NOAA, EPA, and DOE), has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for AiR Transportation Noise & Emissions Reduction (PARTNER) Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by ICAO.

As GHG emissions pertain to this FEA, the CEQ has affirmed the need to describe greenhouse gas emissions and their effect on climate as part of a NEPA analysis, but has noted that “it is not currently

useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions... The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives.”

GHG emissions for the existing environment as well as future No Action and Proposed Action scenarios will be estimated using the same operational inputs as for noise modeling. A new, recently available database of aircraft fuel burn and emissions levels (see Section 5.2.1.2) will provide the capability to estimate fuel burn and greenhouse gas emissions.

5.6 Natural Resources and Energy Supply

The effects of aviation projects on energy supply and natural resources are related to the amount of energy required for their implementation. Typical airport actions affecting energy supply include terminal buildings, airfield lighting, new or moved roadways, changes in air traffic and airfield operations, and significant construction activity. Projects affecting air traffic tend to be less significant in their effect on resources and energy supply.

However, Executive Order 13123, dated December 2000 and entitled “Greening the Government Through Efficient Energy Management”³⁰ requires agencies to reduce petroleum use, air quality emissions, and water consumption. According to FAA Order 1050.1E and consistent with NEPA and CEQ regulations, it is also the policy of the FAA that all elements of the transportation system should be “designed with a view to their aesthetic impact, conservation of resources such as energy, pollution prevention, harmonization with community environment, and sensitivity to the concerns of the traveling public.”³¹

FAA Order 1050.1E, Change 1, Appendix A, Section 13 identifies the following two applicable statutes, regulations, or policies:

- Executive Order 13123, Greening the Government through Efficient Energy Management (64 FR 30851, June 8, 1999), encourages each federal agency to expand the use of renewable energy within its facilities and in its activities. Executive Order 13123 also requires each federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in its facilities.
- It is also the policy of the FAA, consistent with the National Environmental Policy Act (NEPA) and the CEQ regulations, to encourage the development of facilities that exemplify the highest standards of design, including principles of sustainability. All elements of the transportation system should be designed with a view to their aesthetic impact and conservation of resources, such as energy, pollution prevention, harmonization with the community environment, and sensitivity to the concerns of the traveling public. This is in keeping with section 102(2)(A) of NEPA, which requires all agencies to “...utilize a systematic interdisciplinary approach, which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making...”

In addition, Code of Federal Regulations (CFR) Title 40, Section 1502.16(e) and (f) require federal agencies to assess each alternative’s energy requirements, energy conservation, and the use of natural or consumable resources.

³⁰ U.S. Dept. of Energy, Executive Order 13123: Greening the Government Through Efficient Energy Management,” Guidance Documents for Federal Agencies, December 2000.”

³¹ FAA Order 1050.1E, para. 13.1b, pg. A-58

In determining the significance of impacts, FAA Order 1050.1E, Change 1, Appendix A, Section 13 states the following:

“For most actions, changes in energy demands or other natural resource consumption will not result in significant impacts. If an EA identifies problems such as demands exceeding supplies, additional analysis may be required in an EIS. Otherwise, it may be assumed that impacts are not significant.”

In assessing the potential for significant impacts, this analysis considers the following factors in assessing the potential to cause demands that would exceed available or future (project year) natural resource or energy supplies:

- The action would cause a substantial demand on available energy or natural resource supplies.
- When compared with future no action conditions, changes in aircraft movements would cause a statistically significant increase in fuel consumption.

5.6.1 Existing Conditions

Aircraft fuel consumption for 2012 operations was estimated using the NIRS program. NIRS is a noise assessment program designed to provide analysis of air traffic changes over a broad area, but included in the program is the capability to estimate fuel consumption and CO₂ emissions using the same operational inputs as discussed in Section 5.2.2.

From the model, average daily fuel consumption and CO₂ emissions resulting from the 2012 operations was estimated at 1,051,280 kilograms and 3,316.8 metric tons of CO₂ equivalent (MT of CO₂e), respectively. Comparisons of fuel burn between No Action and the Proposed Action for future study years are addressed in the discussion of Environmental Consequences in Chapter 6.

5.7 Native American Lands

Federal agencies are required to consult with Native American tribes that might be affected by federal actions. This section identifies the applicable federal guidance and describes designated Native American lands in the Study Area.

5.7.1 Regulatory Environment

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (65 FR 67249, November 9, 2000), and the Presidential Memorandum of April 29, 1994, Government-to-government Relations with Native American Tribal Governments. Impacts identified in the following chapter that could affect Native American lands would be subject to the thresholds of significance for the individual resources.

5.7.2 Existing Conditions

Native American reservations located within the study area include the Tulalip, Port Gamble S’Klallam, Suquamish, Puyallup, Nisqually, and Muckleshoot; these areas are shown on Figure 5.2-4, Federal and Native American Lands. Consultation with Tribes might be necessary if the project could disturb areas of cultural importance, either through noise or visual impacts.

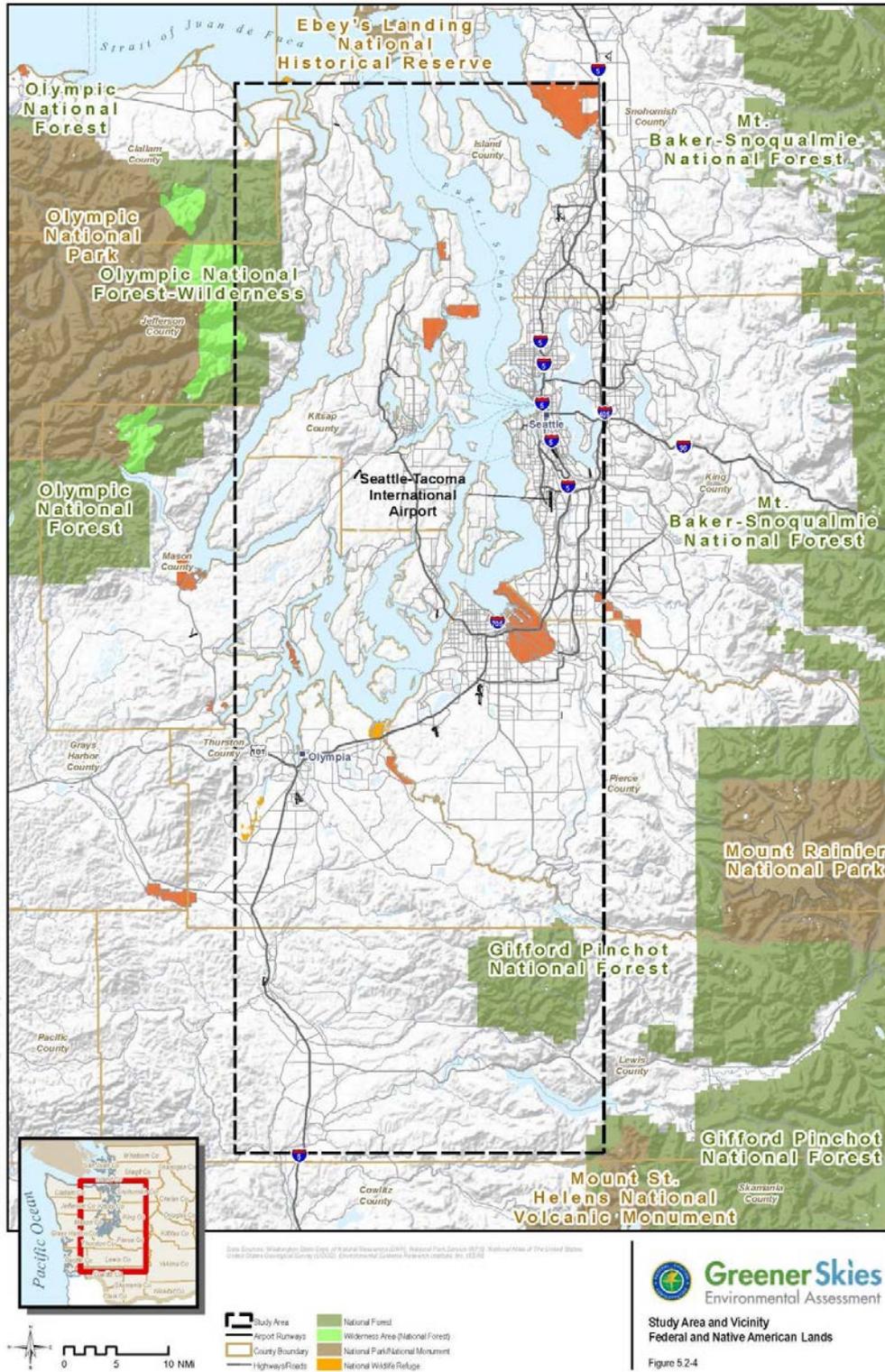


Figure 5.2-4. Federal and Native American Lands

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5.8 Socioeconomic Impacts, Environmental Justice and Children's Environmental Health and Safety Risks

Following a summary of the applicable regulations and standards, this section describes the demographic characteristics of the Study Area including: population characteristics and minority and low income populations. It is based on the demographic information associated with the U.S. Census Bureau's population centroids within the Study Area shown in Figure 5.2-5.

5.8.1 Socioeconomic Impacts

5.8.1.1 Regulatory Environment

The analysis of socioeconomic impacts draws on the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 (42 USC Section 4601, et seq.) (PL 91-646 amended by the Surface Transportation and Uniform Relocation Act Amendments of 1987, Title IV of PL 100-17, and PL 105-117) and 49 CFR Part 24 (Implementing the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970).

FAA Order 1050.1E, Change 1, Appendix A, Section 16.3c sets forth the following thresholds of significance for socioeconomic issues:

- Extensive relocation, but sufficient replacement housing, is unavailable
- Extensive relocation of community businesses that would cause severe economic hardship for affected communities
- Disruption of local traffic patterns that substantially reduce the Levels of Service (LOS) of roads serving the airport and its surrounding communities
- A substantial loss in community tax base

Guidance for assessing secondary impacts is based on CEQ Regulations Implementing NEPA (40 CFR Section 1500 et seq.). FAA Order 1050.1E, Change 1, Appendix A, Section 15 identifies potential secondary impacts as shifts in patterns of population movement and growth; public service demands; and changes in business and economic activity to the extent influenced by airport development. The Order does not identify a threshold of significance for secondary impacts, but considers that induced impacts will normally not be significant, except where there are also significant impacts in other disciplines, especially noise, land use, or direct social impacts.

5.8.1.2 Existing Conditions

Table 5.8-1 provides demographic information on the ten counties within the study area. These counties' area accounts for approximately 64 percent of the state's population and includes Seattle and Tacoma, two of the state's three largest cities.

Based on data from the 2010 U.S. Census for the ten counties within the region, median income ranged from \$42,073 in Lewis County to \$67,711 in King County, while the percentage of population living below the poverty level ranged from 8 percent in Island County to 18 percent in Mason County. The nonwhite population in this area ranged from 9 percent in Jefferson County to 31 percent in King County, the elderly population ranged from 10 percent in Snohomish County to 26 percent in Jefferson County, and the school age population ranged from 13 percent in Jefferson County to 21 percent in Pierce County.

Table 5.8-1. Study Area Demographics

County	Population	Nonwhite population (percent)	Below Poverty Level (percent)	School-age children (percent)	Elderly (percent)	Median Household Income
Clallam	71,404	13	14.9	15.8	24.1	\$44,189
Island	78,506	13.9	7.7	17.2	18.4	\$56,452
Jefferson	29,872	9	13.9	12.9	26.3	\$45,887
King	1,931,249	31.3	10.4	17.7	10.9	\$67,711
Kitsap	251,133	17.4	10	19.3	13.3	\$59,108
Lewis	75,455	10.3	14.1	19.8	17.3	\$42,073
Mason	60,699	13.9	17.9	17.4	18.3	\$47,083
Pierce	795,225	25.8	11.9	20.7	11	\$57,214
Snohomish	713,335	21.6	9.3	20.3	10.3	\$65,533
Thurston	252,264	17.6	10.5	19.6	13	\$61,289
Total/average	4,259,142	17.4	12.1	18.1	16.3	\$54,654

Source: U.S. Census Bureau (2010)³²

Table 5.8-2 compares study area averages of these demographics with state and national averages. As shown in the table, the median household income is higher than the national average but lower than the state average and the elderly population is higher than both state and national averages. The school-age and nonwhite populations are lower than both, and the low-income population is very close to both state and national averages.

Table 5.8-2. Comparison of Income and Population in Region, State, and Nation

Geographical Area	Median Household Income	Nonwhite Population (percent)	Population Below Poverty Level (percent)	Elderly Population (percent)	School-Age Population (percent)
Study area	\$54,654	17	12	16	18
Washington state	\$55,631	23	13	12	20
National	\$50,046	28	11	13	20

Source: U.S. Census Bureau (2010)

32 U.S. Census Bureau. 2010. 2010 United States Census. Available at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. Accessed January 17, 2012. U.S. Department of Commerce, Census Bureau, Washington, DC.

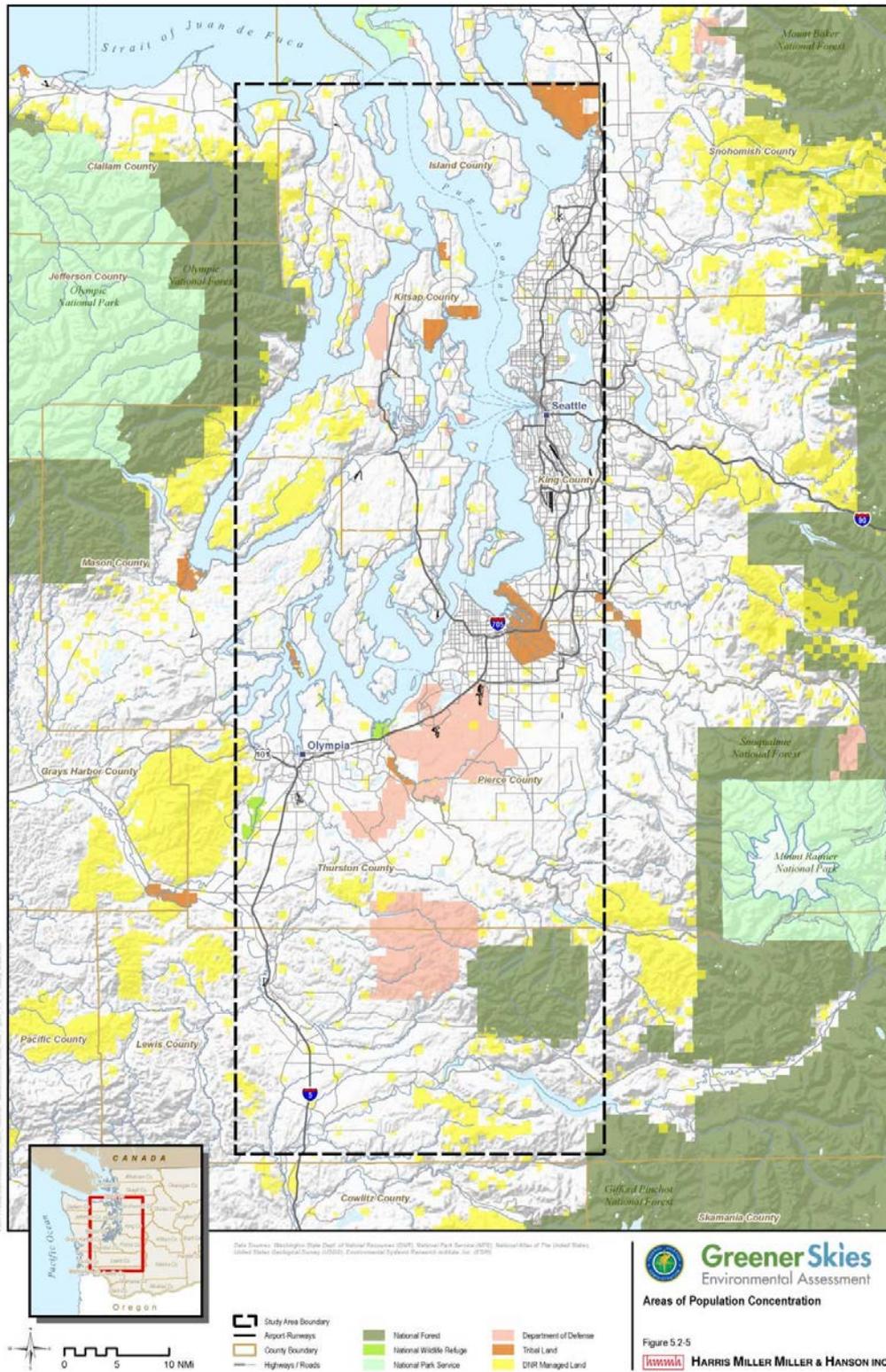


Figure 5.2-5. Areas of Population Concentration

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Employment forecasts for the entire study area are not available, but they are available for the four counties that comprise the Puget Sound Regional Council (King, Kitsap, Snohomish, and Pierce). These counties include most of the major employment centers within the study area, including Seattle, Tacoma, Everett, and Bremerton. Most employment related to operations at SEA is located within these four counties. Olympia, located in Thurston County, is the largest employment center within the study area but outside of this region.

Table 5.8-3 shows areas of population concentration as well as forecasted population and employment growth through 2040. Employment in the Puget Sound region is forecast to have average annual growth rates of approximately 1.5 percent from 2010 to 2020 and approximately 1.2 percent from 2020 to 2040. This is slightly lower than predictions for the state in the short term, but higher in the long term. The high growth rate in the next decade is likely due to recovering from the recession that began in 2008, but the economy is expected to stabilize by 2020

Table 5.8-3. Regional Population and Employment Growth Trends

	Population				Average Annual Growth (percent)		
	2010	2020	2030	2040	2010 to 2020	2020 to 2030	2030 to 2040
Population							
Puget Sound region ^a	3,695,516	4,148,693	4,544,179	4,988,135	1.2	1.0%	1.0
Washington state ^b	6,724,540	7,411,977	8,154,193	8,790,981	1.0	1.0%	0.8
Employment							
Puget Sound region	1,934,713	2,224,597	2,497,698	2,789,293	1.5	1.2	1.2
Washington state ^{c, 1}	2,782,900	3,261,900	3,634,700	N/A	1.7	1.1	N/A

^a PSRC (2006) 2006 Forecasts of Population, Households and Employment <http://psrc.org/data/forecasts/saf/>; Accessed December 19, 2011.

^b State of Washington Office of Financial Management (2011a) Forecast of the State Population, November 2011 Forecast, Forecasting Division, November 2011.

^c State of Washington Office of Financial Management (2011b), 2011 Long-Term Economic and Labor Force Forecast, February 2011

¹ Represents Non-agricultural Wage and Salary Employment
N/A not available

5.8.2 Environmental Justice

This section first identifies the applicable regulations and federal guidance documents related to the consideration of impacts to minority and/or low income populations and then draws on the socioeconomic data presented in Section 5.8.1 to summarize existing minority and low income population characteristics in the study area.

5.8.2.1 Regulatory Environment

The following executive orders and guidelines require federal agencies to consider the effects of their actions on minority and low income populations (Environmental Justice):

- Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629)*

- U.S. Department of Transportation (USDOT) Order 5610.2, *Environmental Justice in Minority and Low-Income Populations*
- *Environmental Justice: Guidance Under the National Environmental Policy Act (CEQ, 1997)*
- *Final Guidance for Consideration of Environmental Justice in Clean Air Act 309 Reviews, (EPA, 1999)*

FAA Order 1050.1E, Change 1, Appendix A, Section 16.3a sets forth the following threshold of significance for environmental justice: “*Disproportionately high and adverse human health or environmental effects on minority and low-income populations may represent a significant impact.*” The USDOT defines these and other related terms as follows:

- Disproportionately high and adverse impact on minority and low-income populations. A disproportionately high and adverse impact on minority and low-income populations is an adverse impact that (1) is predominately borne by a minority population and/or a low-income population or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse impact that will be suffered by the nonminority population and/or non-low-income population (USDOT Order 5610.2, § Appendix 1[g]).
- Low income. Low income is defined as one whose median household income is at or below the U.S. Department of Health and Human Services poverty guidelines for that size of household (USDOT Order 5610.2, § Appendix 1[b]).
- Low-income population. This population includes any readily identifiable group of low-income persons who live in geographic proximity and—if circumstances warrant—geographically dispersed and/or transient persons (i.e., migrant workers or Native Americans) who will be similarly affected by a proposed USDOT program, policy, or activity (USDOT Order 5610.2, § Appendix 1[d]).
- Minority. A minority person is one who meets any of the following criteria (USDOT Order 5610.2, § Appendix 1(c)):
 - Black. A person having origins in any of the black racial groups of Africa.
 - Hispanic. A person of Mexican, Puerto Rican, Cuban, Central America, South American, or the Spanish culture or origin, regardless of race.
 - Asian. A person having origins in any of the original people of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands.
 - American Indian or Alaskan Native. A person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition).
 - Minority population. Any readily identifiable groups of minority persons who live in geographic proximity and—if circumstances warrant—geographically dispersed and/or transient persons (i.e., migrant workers or Native Americans) who will be similarly affected by a proposed USDOT program, policy, or activity (USDOT Order 5610.2, § Appendix 1[e]).

5.8.2.2 Existing Conditions

Minority and low-income population demographics in the study area were shown earlier in Table 5.8-1 and Table 5.8-2. Figure 5.2.6 and Figure 5.2-7 show concentrations of minority and low-income populations throughout the entire Study Area.

5.8.3 Children’s Environmental Health and Safety Risks

Federal agencies are required to consider the potential for their actions to pose risks to children’s environmental health and safety. This section summarizes the applicable federal guidance and then draws

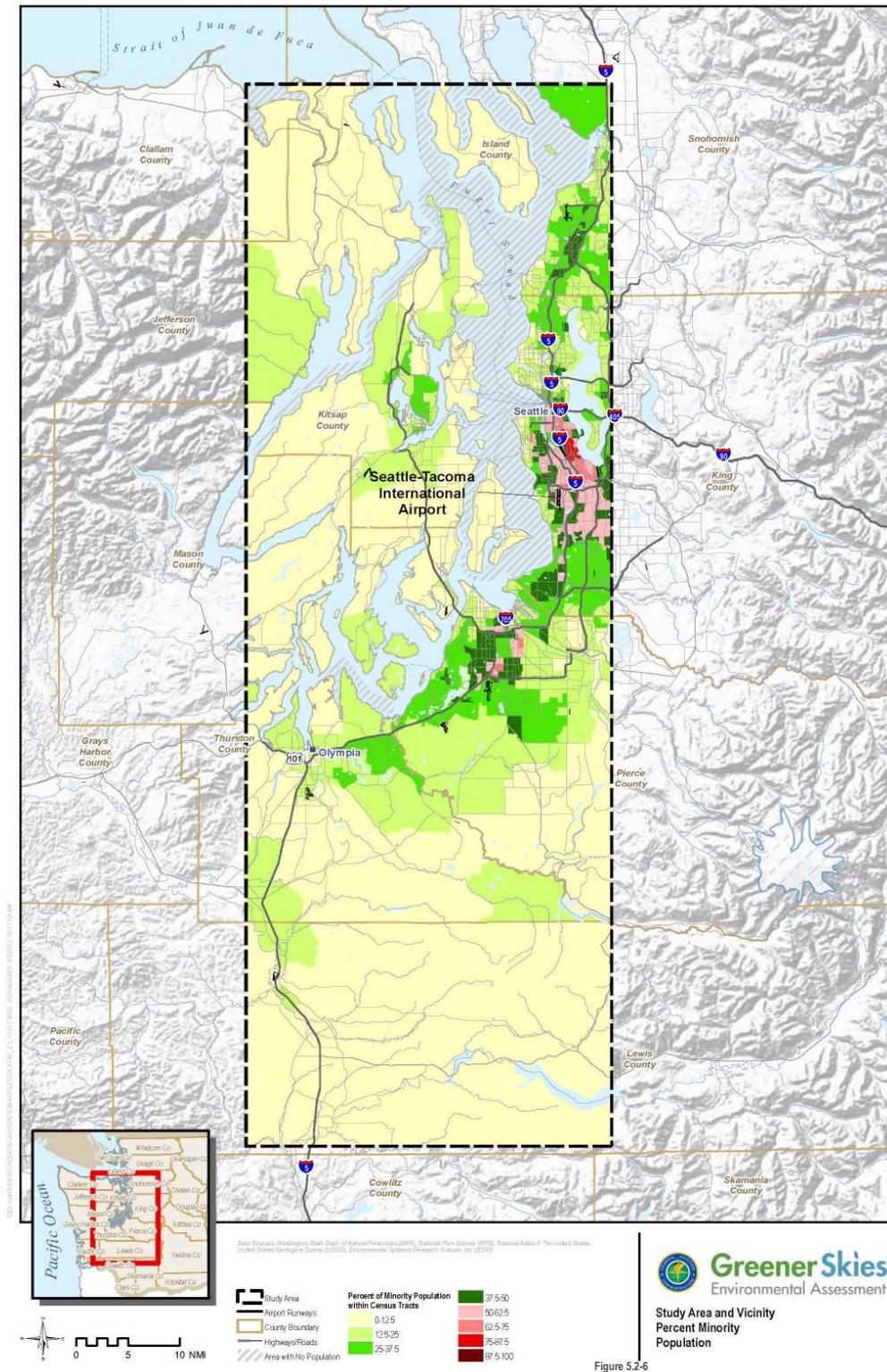


Figure 5.2-6. Percent of Minority Population within the Study Area

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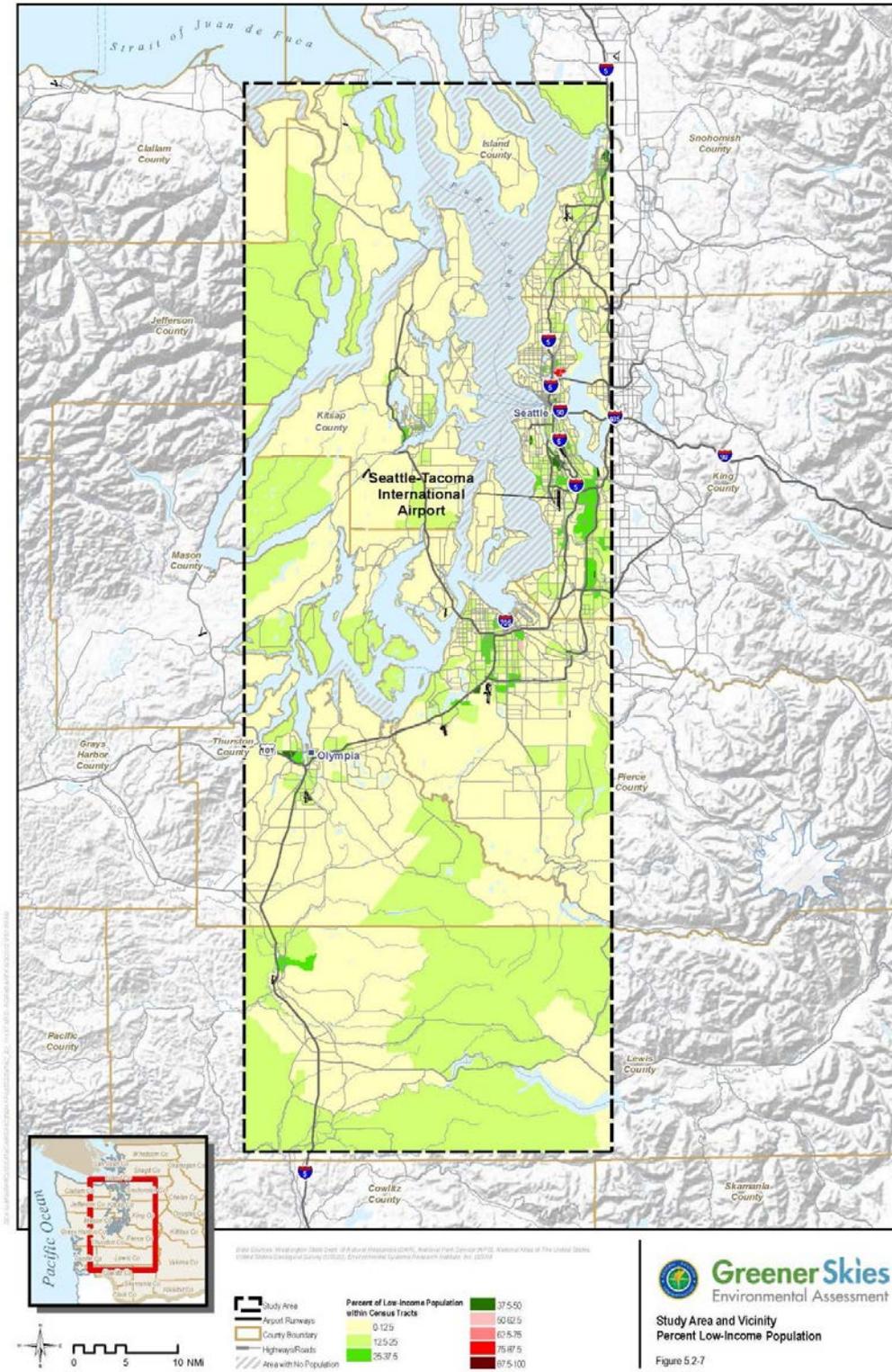


Figure 5.2-7. Percent of Low-Income Population within the Study Area

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on the socioeconomic data presented in Section 5.7.1 to summarize the distribution of school age children in the study area.

5.8.3.1 Regulatory Environment

This analysis draws on guidance from Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. FAA Order 1050.1E, Change 1, Appendix A, Section 16.3b sets forth the following thresholds of significance for children’s environmental health and safety risk issues: “*Disproportionate health and safety risks to children may indicate a significant impact.*”

5.8.3.2 Existing Conditions

The population of school-age children in the study area was shown earlier in Table 5.8-1 and Table 5.8-2.

5.9 Parks and Natural Areas

Parks and natural areas within the study area include National Park Service lands, National Forest lands, National Wildlife Refuge System lands, state parks, state forests, and local parks and open spaces. Following a review of applicable regulations and federal guidelines, this section identifies parks and natural areas in the Study Area.

5.9.1 Regulatory Environment

Parks and natural areas are protected under Section 4(f) of the U.S. Department of Transportation (USDOT) Act, which includes protection from direct impacts (land acquisition), as well as constructive impacts, which could occur if the effects of the action impaired the Section 4(f) resource. FAA Order 1050.1E, Change 1, Appendix A, Section 6.2f defines substantial impairment as follows:

“Substantial impairment occurs only when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. A project which respects a park’s territorial integrity may still, by means of noise, air pollution, or otherwise, dissipate its aesthetic value, harm its wildlife, defoliate its vegetation, and take it in every practical sense. For section 4(f) purposes, the impairment must be substantial. With respect to aircraft noise, for example, the noise must be at levels high enough to have negative consequences of a substantial nature that amount to a taking of a park or portion of a park for transportation purpose.”

FAA Order 1050.1E, Change 1, Appendix A, Section 6.2, provides the following specific guidance in determining if a constructive use would occur as a result of a federal action:

Noise and Compatible Land Use. “The land use compatibility guidelines in 14 CFR Part 150 (Part 150) may be relied upon to determine whether there is a constructive use under section 4(f) where the land uses specified in the Part 150 guidelines are relevant to the value, significance, and enjoyment of the 4(f) lands in question.” FAR Part 150 land use compatibility guidelines are based on DNL values (see Section 5.2.1). All land uses specified in FAR Part 150 are considered to be compatible with noise levels less than DNL 65 dB.

Historic Sites. The land use compatibility guidelines in Part 150 may also be used “... to evaluate impacts on historic properties that are in use as residences. Part 150 guidelines may not be sufficient to determine the noise impact on historic properties where a quiet setting is a generally recognized purpose

and attribute, such as a historic village preserved specifically to convey the atmosphere of rural life in an earlier era or a traditional cultural property. If architecture is the relevant characteristics of an historic neighborhood, then project-related noise does not substantially impair the characteristics that led to eligibility for or listing on the National Register of Historic Places.”

Section 4(f) Properties in Quiet Settings. If the Section 4(f) resource is located in a quiet setting that is “a generally recognized feature or attribute of the site’s significance” reliance on Part 150 guidelines must be carefully evaluated. “Additional factors must be weighed in determining whether to apply the thresholds listed in Part 150 guidelines to determine the significance of noise impacts on noise sensitive areas within national parks, national wildlife refuges, and historic sites including traditional cultural properties. The Part 150 land use compatibility table may be used as a guideline to determine significance of noise impacts on Section 4(f) properties to the extent that the land uses specified bear relevance to the value, significance, and enjoyment of the lands in question.”

5.9.2 Existing Conditions

Table 5.9-1 lists the parks and natural areas in the Study Area. Summaries of these parks and natural areas follow the table.

Table 5.9-1 Parks and Natural Areas within the Study Area

Name	Acres in Study Area	Total Acres	County	Land Manager
National Park Service Lands				
Klondike Gold Rush National Historical Park-Seattle Unit	Less than 1	Less than 1	King	NPS
National Forests				
Olympic	88,319	633,600	Clallam, Jefferson	USFS
Gifford Pinchot	89,435	1.4 million	Lewis	USFS
Mt. St. Helens National Volcanic Monument (within Gifford Pinchot National Forest)	45	110,300	Lewis	USFS
National Wildlife Refuges				
Nisqually	4,434	4,434	Pierce	USFWS
Protection Island	2	310	Jefferson	USFWS, WDFW
Dungeness	131	528	Clallam	USFWS
State Parks				
Sequim Bay	92	92	Clallam	DNR
Camano Island	134	134	Island	DNR
South Whidbey	347	347	Island	DNR
Fort Townsend	367	367	Jefferson	DNR
Dosewallips	425	425	Jefferson	DNR
Triton Cove	29	29	Jefferson	DNR
Shine Tidelands	13	13	Jefferson	DNR

Name	Acres in Study Area	Total Acres	County	Land Manager
Kinney Point	76	76	Jefferson	DNR
Anderson Lake	480	480	Jefferson	DNR
Mystery Bay	10	10	Jefferson	DNR
Fort Flagler	784	784	Jefferson	DNR
Bridle Trails	75	75	King	DNR
Dash Point	264	264	King	DNR
St. Edwards	313	313	King	DNR
Saltwater	96	96	King	DNR
Blake Island	475	475	Kitsap	DNR
Fay Bainbridge	16	16	Kitsap	DNR
Fort Ward	135	135	Kitsap	DNR
Illahee	73	73	Kitsap	DNR
Kitsap Memorial	15	15	Kitsap	DNR
Manchester	99	99	Kitsap	DNR
Scenic Beach	33	33	Kitsap	DNR
Square Lake	37	37	Kitsap	DNR
Lewis and Clark	621	621	Lewis	DNR
Ike Kinswa	454	454	Lewis	DNR
Belfair	65	65	Mason	DNR
Hope Island	106	106	Mason	DNR
Jarrell Cove	43	43	Mason	DNR
McMicken Island	11.5	11.5	Mason	DNR
Twanoh	182	182	Mason	DNR
Cutts Island	4	4	Pierce	DNR
Dash Point	432	432	Pierce	DNR
Eagle Island	7	7	Pierce	DNR
Joemma Beach	113	113	Pierce	DNR
Kopachuck	100	100	Pierce	DNR
Penrose Point	150	150	Pierce	DNR
Millersylvania	842	842	Thurston	DNR
Tolmie	105	105	Thurston	DNR
State Forests				

Name	Acres in Study Area	Total Acres	County	Land Manager
Capitol	3,882	91,396	Thurston	DNR
Green Mountain	14,233	14,233	Kitsap	DNR
Tahoma	3,965	22,651	Lewis	DNR
Tahuya	19,627	24,309	Mason	DNR
County and City Parks (by County)				
Clallam	20	N/A	Clallam	County and local jurisdictions
Island	48	N/A	Island	
Jefferson	267	N/A	Jefferson	
King	12,798	N/A	King	
Kitsap	2,503	N/A	Kitsap	
Lewis	978	N/A	Lewis	
Mason	25	N/A	Mason	
Pierce	8,265	N/A	Pierce	
Thurston	0	N/A	Thurston	
Snohomish	1,022	N/A	Snohomish	

Notes:

DNR Washington Department of Natural Resources
N/A Not available
NPS National Park Service
USFS U.S. Forest Service
USFWS U.S. Fish and Wildlife Service
WDFW Washington Department of Fish and Wildlife

National Parks Service Lands

No National Parks Service lands are located in the study area. Olympic National Park is located approximately 3.3 miles west of the study area, and Mt. Rainier National Park is located approximately 13 miles east of the study area. The Klondike Gold Rush National Historical Park-Seattle Unit is a visitor center that is located in Seattle; however, the National Park itself is located in Skagway, Alaska.

National Forest System

The study area includes some of the eastern side of the Olympic National Forest and the northwest corner of the Gifford Pinchot National Forest. The Mt. Baker-Snoqualmie National Forest is also located east of the study area. These areas are shown on Figure 5.2-4, Federal and Native American Lands. National Forests are used for public recreation, including campgrounds, and can also contain Wilderness Areas, which by definition have “outstanding opportunities for solitude” and that retain their “primeval character,”³³ which could be considered sensitive to noise or visual impacts. There are approximately 3,000 acres of Wilderness Areas within the study area on the east side of Olympic National Forest.

³³ 16 USC 1131-1136, Section (2)(c) http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5253940.pdf. Accessed April 9, 2012.

National Wildlife Refuge System

The Nisqually National Wildlife Refuge, Protection Island National Wildlife Refuge, and part of the Dungeness National Wildlife Refuge are located within the study area. These areas are shown on Figure 5.2-4, Federal and Native American Lands. National Wildlife Refuge System areas are protected under USDOT Section 4(f), described above.

Nisqually National Wildlife Refuge is located in Pierce and Thurston Counties at the outlet of the Nisqually River to Puget Sound, and it includes estuary, freshwater wetlands, and riparian woodlands.³⁴ The refuge is used by more than 275 migratory birds as well as threatened and endangered salmon and many other species.

Protection Island National Wildlife Refuge is in the northwest corner of the study area in Jefferson County, and approximately 70 percent of the nesting seabird population of Puget Sound and the Strait of Juan de Fuca nest on the island. The island contains the last two nesting colonies of tufted puffins in the Puget Sound area, one of the largest nesting colonies of rhinoceros auklets in the world, the largest nesting colony of glaucous-winged gulls in Washington. This area is also used by approximately 1,000 harbor seals for pupping and haul-outs.³⁵

The 772-acre Dungeness National Wildlife Refuge is primarily located on Dungeness Spit, west of the study area, but the 128-acre Dawley Unit is located within the study area, southeast of Sequim on U.S. Highway 101 in Clallam County. This unit includes freshwater wetlands and mixed coniferous forests.

State Parks, Forests and Other Areas of Significance

Within the study area there are approximately 1,460 public parks and open spaces. Of these, 38 are state parks and 4 are state forests; these are listed in Table 5.2-7 and shown on Figure 5.2-8, State DNR Lands. Table 5.2-7 also shows the total area of all County and City parks located in the study area, by county.

5.10 Historical, Archaeological, Architectural and Cultural Resources

Federal, state, and local regulations require consideration of how the Proposed Action might affect historical, archaeological, architectural, and cultural resources. This section identifies the applicable regulatory requirements and describes the historical, archaeological, architectural and cultural resources in the Study Area.

5.10.1 Regulatory Environment

Section 106 of the National Historic Preservation Act of 1966 (NHPA; Title 16, Part 470 of the United States Code [USC]), as amended, and implementing regulations Title 36, Part 800 of the Code of Federal Regulations (CFR) require consultation with others to avoid or minimize adverse effects on historical, architectural, archaeological, and cultural resources. Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on properties on or eligible for inclusion in the National Register of Historic Places (NRHP). The NRHP can include historic properties, archaeological resources, traditional cultural places, and protected Tribal resources, including Native American sacred sites. In most cases, a resource must be at least 50 years old to be considered for eligibility. To be listed on, or eligible for, listing on the NRHP, a resource must also meet one of the following requirements (36 CFR 60.4):

³⁴ USFWS. 2012. Nisqually National Wildlife Refuge. <http://www.fws.gov/refuges/profiles/index.cfm?id=13529>. Accessed April 9, 2012. U.S. Fish and Wildlife Service.

³⁵ USFWS. 2012. Protection Island National Wildlife Refuge. <http://www.fws.gov/refuges/profiles/index.cfm?id=13533> Accessed April 9, 2012. U.S. Fish and Wildlife Service.

- a. *Be associated with events that have made a significant contribution to the broad patterns of our history*
- b. *Be associated with the lives of persons significant in our past*
- c. *Embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction*
- d. *Have yielded, or may be likely to yield, information important in prehistory or history*

The magnitude of the change in aircraft noise exposure level between No Action and the Proposed Action is the primary basis for determining the effect of the undertaking on historic resources. The criteria for a significant noise impact and for disclosure of noise impacts are based on the change in cumulative noise levels when comparing the Proposed Action to No Action, as described in Section 6.1.

5.10.2 Existing Conditions

Appendix I includes a list of the 431 properties listed on the National Historic Register and the 14 National Historic Landmarks inventoried by the Washington State Department of Archaeology and Historic Preservation. Sites that are exposed to DNL values of 65 dB or above (DNL 65) are more likely to be sensitive to changes in noise. No National Register listed properties are currently exposed to levels above DNL 65 due to 2012 operations.

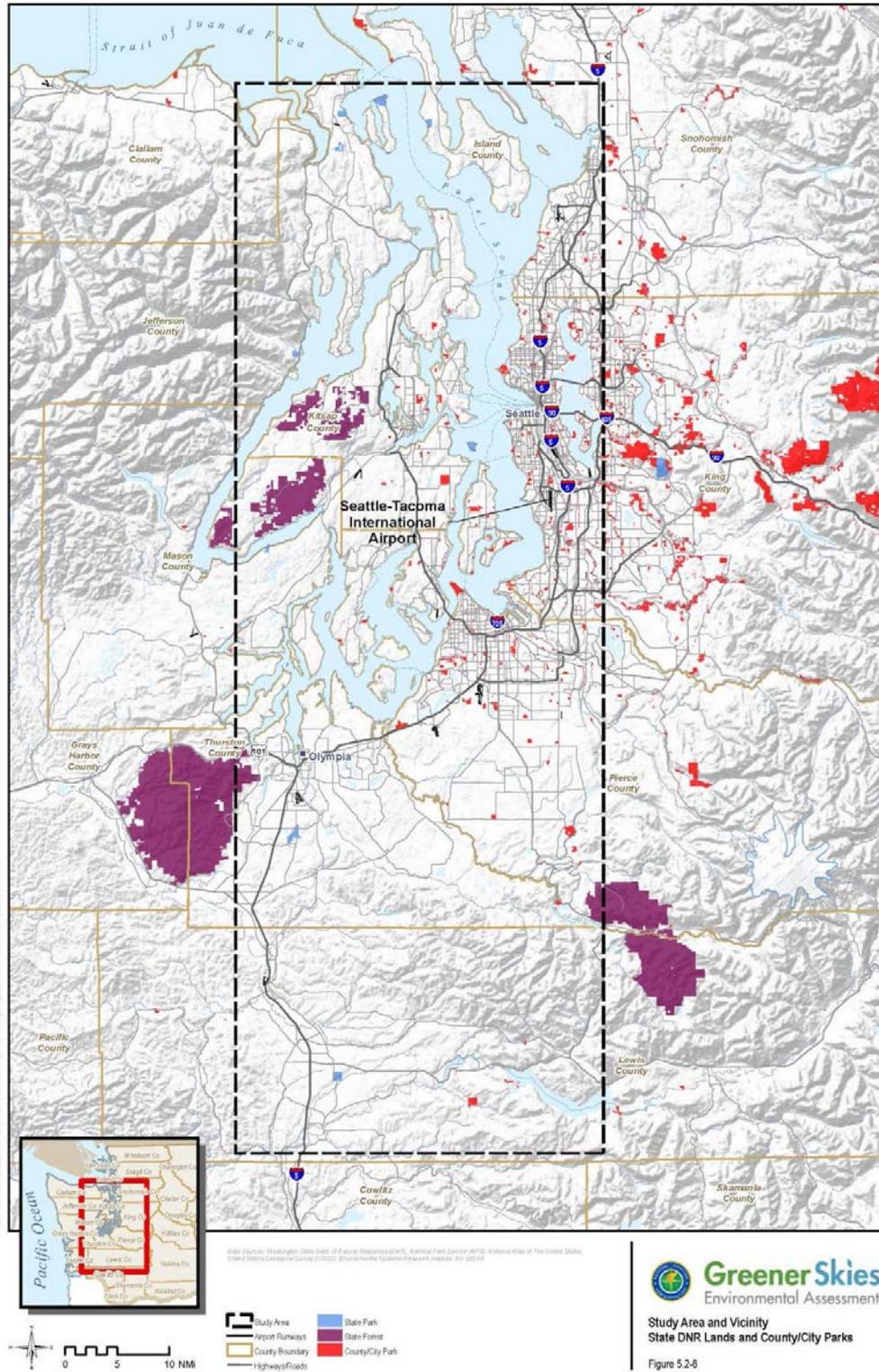


Figure 5.2-8. State DNR Lands and County and City Parks

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5.11 Fish, Wildlife and Plants

The following discussion of the natural environment focuses on threatened and endangered species and migratory birds. While the Proposed Action is not likely to have a significant adverse impact on federally listed threatened or endangered species, evaluating threatened and endangered species is required under the Endangered Species Act (ESA). Migratory birds, protected under the Migratory Bird Treaty Act of 1918, could be affected by changes in aircraft routes.

5.11.1 Regulatory Requirements

The following sections discuss the federal regulations that guide the evaluation of fish, wildlife, and plants, including federally listed threatened and endangered species.

Federal Endangered Species Act

The federal Endangered Species Act of 1973 (ESA) was enacted to protect and conserve species listed as “threatened” and “endangered.” Under the ESA, it is unlawful for anyone (private parties or state and federal entities) to “take” a listed species without authorization. To “take” is defined as to harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species. Harm includes destruction of habitat necessary for survival. Incidental take, or take that is “incidental to, not the purpose of, carrying out an otherwise lawful activity,” might be allowed subject to specific terms and conditions and with approval from the U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS). Potential effects can also include the disturbance or elimination of fish, wildlife, or plant populations.

Section 7 of the ESA requires that, through consultation (or conferencing for proposed species) with the USFWS and/or NMFS, federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of critical habitat.

The Bald and Golden Eagle Protection Act, as Amended

This law protects bald and golden eagles by prohibiting (except under certain conditions) the taking, possession, and commerce of such birds. The act allows take, possession, and transportation of bald and golden eagles for scientific, educational, and Native American religious purposes or in circumstances that might be necessary to ensure the protection of wildlife, agriculture, or other interests particular to a specific locality. The act also allows for the take of golden eagle nests that interfere with resource development or recovery operations. Prior to taking, possessing, or transporting any bald or golden eagle or golden eagle nest, a permit must be obtained from the USFWS.

Migratory Bird Treaty Act of 1918, as Amended, 16 U.S. Code (USC) Sections 703-711

The Migratory Bird Treaty Act (MBTA) prohibits intentionally taking a migratory bird, their eggs, or nests. The MBTA also prohibits taking, selling, or other activities that would harm migratory birds, their eggs or nests, unless authorized by the Secretary of the Interior.

The following thresholds of significance for potential fish, wildlife and plant impacts are provided in FAA Order 1050.1E, Change 1, Appendix A, Section 8.3:

“A significant impact to Federally-listed threatened and endangered species would occur when the FWS or NMFS determines that the proposed action would be likely to jeopardize the continued existence of the species in question, or would result in the destruction or adverse modification of Federally-designated critical habitat in the

affected area...Lesser impacts including impacts on non-listed species could also constitute a significant impact...NEPA practitioners should consider factors affecting population dynamics and sustainability for the affected species such as reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), and the minimum population levels required for population maintenance...”

5.11.2 Existing Conditions

The section identifies the threatened and endangered species found in the Study Area, provides an overview of migratory birds activity in this area, and describes the habitat and characteristics of the endangered and threatened avian species that could be affected by the Proposed Action.

Threatened and Endangered Species

Table 5.11-1 identifies federally listed threatened and endangered species within the study area, their status, the counties in which they are present and the agency regulating them.

Table 5.11-1. Threatened and Endangered Species³⁶

Species	Status	County	Regulatory Agency
Bull trout (<i>Salvelinus confluentus</i>): Coastal Puget Sound DPS (and Critical Habitat)	Threatened	Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish Critical Habitat in Clallam, Jefferson, King, Mason, Thurston, and Snohomish only)	USFWS
Canada lynx (<i>Lynx canadensis</i>)	Threatened	King, Lewis, Pierce, and Snohomish	USFWS
Gray wolf (<i>Canis lupus</i>)	Endangered	King, Lewis, Pierce, Thurston, and Snohomish	USFWS
Grizzly bear (<i>Ursus arctos</i> = <i>U. a. horribilis</i>)	Threatened	King, Lewis, Pierce, and Snohomish	USFWS
Marbled murrelet (<i>Brachyramphus marmoratus</i>) (and Critical Habitat)	Threatened	Clallam, Island, Jefferson, King, Kitsap, Lewis, Mason, Pierce, Thurston, and Snohomish Critical Habitat in Clallam, Jefferson, King, Lewis, Mason, Thurston, and Snohomish only)	USFWS
Northern spotted owl (<i>Strix occidentalis caurina</i>) (and Critical Habitat)	Threatened	Clallam, Jefferson, King, Lewis, Mason, Pierce, Thurston, and Snohomish Critical Habitat in Clallam, Jefferson, King, Lewis, Mason, Thurston, and Snohomish only)	USFWS
Short-tailed albatross (<i>Phoebastria albatrus</i>) (outer coast only)	Endangered	Clallam and Jefferson	USFWS
Water howellia (<i>Howellia aquatilis</i>)	Threatened	Pierce	USFWS
Golden paintbrush (<i>Castilleja levisecta</i>)	Threatened	Island and Thurston	USFWS

³⁶ USFWS, 2011. *List of Threatened and Endangered Species by County*. Accessed at http://www.fws.gov/wafwo/speciesmap_new.html. Accessed on December 20, 2011 and January 10, 2012. U.S. Fish and Wildlife Service.

Species	Status	County	Regulatory Agency
Southern resident killer whale (<i>Orcinus orca</i>)	Endangered	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Humpback whale (<i>Megaptera novaeangliae</i>)	Endangered	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Steller sea lion (<i>Eumetopias jubatus</i>)	Threatened	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Puget Sound Chinook salmon (<i>oncorhynchus nerka</i>)	Threatened	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Puget Sound Steelhead (<i>O. mykiss</i>) (and Critical Habitat)	Threatened	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Bocaccio (<i>Sebastes paucispinis</i>): Puget Sound DPS	Endangered	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Canary rockfish (<i>S. pinniger</i>): Puget Sound DPS	Threatened	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Yelloweye rockfish (<i>S. ruberrimus</i>): Puget Sound DPS	Threatened	Puget Sound (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Thurston, and Snohomish)	NMFS
Streaked horned lark (<i>Eremophila alpestris strigata</i>)	Proposed	King, Lewis, Mason, Pierce, Thurston	USFWS
DPS Distinct Population Segment			

Migratory Bird Patterns

The entire study area is within the Pacific Flyway, one of four pathways for migratory birds in the United States. Each year, millions of birds make the north-south migration along the Pacific Flyway that extends from Alaska south to Patagonia along the western portion of North America, generally between the Pacific Ocean and the Rocky Mountains. Migrants travel along portions of or along the entire flyway during spring and fall, following food sources en route to breeding grounds or to overwintering sites. The Pacific Flyway is managed by the Pacific Flyway Council, which includes representatives from the U.S. Fish and Wildlife Service (USFWS) and from wildlife agencies of each state within the flyway. Figure 5.2-9 shows the Pacific Flyway area and major pathways. Coordination with USFWS indicated that migratory birds within the study area likely fly primarily at lower altitudes (under 1,000 feet), and primarily along shorelines of Puget Sound, where near-shore waters are used for feeding and resting. Flight altitude can vary widely between species, individuals, time of day, weather conditions, and their destination, and there are no fixed altitudes at which specific species will fly.

The altitude of migratory flight is highly variable, especially among different groups of birds such as songbirds versus waterfowl and shorebirds versus raptors. Additionally, birds are known to alter their flight behavior according to weather and topographical changes. Songbirds typically fly at lower altitudes than do most ducks and shorebirds. Although some birds migrate during the daytime, most avian migration occurs at night. Many studies have shown that most nocturnal migration by songbirds occurs in

the first 2,000 feet above the ground surface. Moreover, radar studies have shown that more than 75 percent of songbirds migrate within this range. Some shorebirds have been shown to fly above 3,000 feet while waterfowl and waterbirds have perhaps the most wide-ranging altitudes, sometimes flying at several thousand feet and other times within 20 to 30 feet above the water. Albatrosses, petrels, shearwaters, and seabirds usually migrate within 30 to 100 feet of the water's surface. However, seabirds can also use wind deflected off the waves to migrate at around 150 to 200 feet above the water. Maximum altitude for most soaring migrants (raptors) in North America is generally less than 3,500 to 4,000 feet, with infrequent altitudes exceeding 5,000 feet.³⁷

Regional and Local Setting

There are approximately 2,500 miles of shoreline along Puget Sound and a high diversity of shoreline habitats, including rocky shorelines, beaches, embayments, and estuaries. Due to the abundant amount of shoreline and protected aquatic habitat, a diverse number of bird species breed, overwinter, and occur year round in Puget Sound. Local waterways host not only resident birds, but also migratory species that breed in arctic and subarctic regions. Approximately 165 species of birds depend on the marine environment found in and around the Sound. Wildlife refuges in the study area (discussed above under Compatible Land Use, Parks and Natural Areas) are areas of concentration for these birds.³⁸ The estuary and river system of Elliott Bay, a 13-square-mile urban embayment in central Puget Sound, supports federally protected salmon and trout, several commercially important species of flatfish and shellfish, and more than 80 species of migratory birds.³⁹

Nesting Colonies

Regionally important bird habitat and nesting colonies include Protection Island National Wildlife Refuge (NWR) in the very northwest corner of the Study Area where aircraft converge to begin their approach to SEA, as in Figure 4.1-2 and Figure 4.1-3; a small isolated portion of the Dungeness NWR on Sequim Bay, also in the very northwest corner of the Study Area; and Nisqually NWR on the Nisqually River Delta between Olympia and Tacoma closer to the center of the Study Area.

Puget Sound hosts an abundance of nesting colonies of seabirds and other marine birds. Documented colonies are scattered throughout the sound and include, but not are limited to, rhinoceros auklets (*Cerorhinca monocerata*), glaucous-winged gulls (*Larus glaucescens*), tufted puffins (*Fratercula cirrhata*), pigeon guillemots (*Cephus columba*), pelagic cormorants (*Phalacrocorax pelagicus*), double-crested cormorants (*P. auritus*), and black oystercatchers (*Haematopus bachmani*). According to data from the Washington Department of Fish and Wildlife's (WDFW's) Priority Habitats and Species (PHS) Program⁴⁰ some colonies are located in protected areas such as Dungeness and Protection Island NWRs while other colonies are located along the shores of populated areas such as Kitsap Peninsula, Commencement Bay, and near the Seattle waterfront. Specifically, colonies located within the vicinity of the proposed approach include alcids, gulls, and other seabird colonies in Commencement Bay, Poverty Bay, Seattle waterway, Seattle waterfront, Seattle downtown, Duwamish Head waterfront, and Smith Cove piers.

Threatened and Endangered Species: Marbled Murrelet

³⁷ Kerlinger, P. 1995. How Birds Migrate. Stackpole Books. Mechanicsburg, PA.

³⁸ Meeting notes, Coordination Call with USFWS, April 3, 2012.

³⁹ U.S. Fish and Wildlife Service (USFWS). 2006. The Natural Resource Damage Assessment and Restoration Program: Elliott Bay/Duwamish River, Puget Sound, Washington. Fact Sheet July 2006.

⁴⁰ Washington Department of Fish and Wildlife (WDFW). 2012. Priority Habitats and Species Digital Data for CH2M HILL Project: Environmental Assessment for New Flight Patterns Over Western Washington. June 7, 2012.

Marbled murrelets are small diving seabirds that nest in coastal coniferous forests and forage in near-shore habitats along the Pacific coast from southern California to southern Alaska and the Aleutian Islands.^{41,42,43} Available data suggest that there are three primary populations: 1) Aleutian Islands, 2) Alaska Peninsula to Puget Sound, and 3) western Washington to California. The Washington, Oregon, and California populations of marbled murrelets were listed as threatened under the federal ESA in 1992 (57 Federal Register [FR] 45328). Murrelets have a low reproductive rate and are, therefore, sensitive to small changes in adult mortality as well as other demographic parameters.

The inland distance from the nest to marine foraging habitat is variable; birds in Washington have been observed to commute longer distances than birds in Oregon and California. During the breeding season, murrelets in Washington, Oregon, and California tend to forage in marine waters within 1.2 miles of the coast.⁴⁴ Outside of the breeding season, birds are less concentrated in near-shore waters.⁴⁵

Movements

Movements of murrelets include daily foraging commutes during the breeding season, small-scale seasonal movements during the year, an influx of wintering birds in certain portions of the range, and movements of birds among watersheds from year to year. As discussed in Section 5.2.7.2, seabirds usually migrate within 30 to 100 feet of the water's surface. Where seasonal migration occurs, adults return to the breeding grounds in early to mid-April. During the breeding season, both adults make daily trips to foraging areas to feed the single nestling. Daily movements of radio-tagged breeding adults showed that mean distances between nest sites and foraging areas averaged 10 miles in Prince William Sound, Alaska⁴⁶ and 24 miles in Desolation Sound, BC⁴⁷. Juvenile movements include wide-ranging dispersal following the end of breeding season.

When murrelets are molting, they are flightless, and movements are restricted to swimming at sea for 1 to 2 months.⁴⁸ During this time, many birds that breed on the outer shores of Vancouver Island move into more sheltered waters in the Puget Sound and the Strait of Georgia.⁴⁹ Therefore, the murrelet population in Puget Sound increases in the fall and winter.

Distribution in Washington

⁴¹ Carter, H.R., and M.L. Morrison. 1992. Status and conservation of the marbled murrelet in North America (H.R. Carter, and M.L. Morrison, eds.). Proceedings of an International Symposium of the Pacific Seabird Group, Pacific Grove, California, December 1987. Published October 1992 In: Proceedings of the Western Foundation of Vertebrate Zoology, Volume 5, Number 1.

⁴² Ralph, C.J., G.L. Hunt, M.G. Raphael, and J.F. Piatt. 1995. Ecology and conservation of the marbled murrelet in North America: an overview, Pp. 3-22 In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.) General Technical Report PSW-GTR-152. Forest Service, Albany, CA.

⁴³ Nelson, K. 1997. Development of inventory techniques for surveying marbled murrelets (*Brachyramphus marmoratus*) in the central Oregon Coast Range. Unpublished report to the Nongame Program, Oregon Department of Fish and Wildlife, P.O. Box 59, Portland, OR, Publ. No. 88-6-01.

⁴⁴ Strachan, G., M. McAllister, and C.J. Ralph. 1995. Marbled murrelet at-sea and foraging behavior. Pp 247-254 In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.) General Technical Report PSW-GTR-152. Forest Service, Albany, CA.

⁴⁵ *ibid*

⁴⁶ McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, J. Kearny. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon.

⁴⁷ Hull, C.L., G.W. Kaiser, C. Lougheed, S. Boyd, and F. Cooke. 2001. Intraspecific variation in commuting distance of marbled murrelets (*Brachyramphus marmoratus* (Gmelin)). Unpublished report, Simon Fraser University, Dept. of Biological Sciences, Burnaby, British Columbia.

⁴⁸ Carter, H.R., and J.L. Stein. 1995. Molts and plumages in the annual cycle of the marbled murrelet. Pp. 99-109. In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.) General Technical Report PSW-GTR-152. Forest Service, Albany, CA.

⁴⁹ Burger, A.E. 1995. Marine distribution, abundance, and habitats of marbled murrelets in British Columbia. Pp. 295-132. In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.) General Technical Report PSW-GTR-152. Forest Service, Albany, CA.

Murrelets are widely distributed in Washington with major gaps in the at-sea distribution of murrelets in the following three areas: 1) British Columbia-Washington border region, 2) southern Puget Sound near the metropolitan areas of Seattle, Tacoma, Olympia, and surrounding urban areas, and 3) southwestern coast. According to the WDFW PHS data, there is only one marbled murrelet occurrence located near the proposed approaches. The WDFW database describes this occurrence as a biotic detection of above-canopy behavior in the Seattle South quadrangle in July 1992.⁵⁰

Noise Disturbance

There is little information regarding effects of noise disturbance on marbled murrelets; most of the information is based on anecdotal evidence provided through incidental observations during research and survey efforts. In general, the information indicates that murrelets typically exhibit a limited, temporary behavioral response to noise disturbance at nest sites and are able to adapt to background noise and specific auditory stimuli.^{51,52,53} Observed responses include modifications of posture and on-nest behavior.^{54,55,56,57}

Although field researchers have typically observed little to no response from murrelet chicks or attending adults at nest sites to aircraft and boating noise^{58,59}, low-altitude aircraft and boating activity are known to alter murrelet behavior and immediate distribution in marine environments.^{60,61,62,63} Behavioral responses to elevated noise levels in the marine environment include aborted feeding attempts, multiple delayed feeding attempts within a single day or across multiple days, multiple interrupted resting attempts, and precluded access to suitable foraging habitat.⁶⁴

Murrelet survival and successful reproduction depend upon an adequate quantity of high-quality food throughout the year. Although murrelets can adapt and use alternate foraging sites during the breeding season, many birds routinely forage in the same general areas at productive foraging sites.^{65,66,67,68,69,70} The

⁵⁰ Ibid.

⁵¹ Singer, S.W., D.L. Suddjian, and S.A. Singer. 1995. Fledging behavior, flight patterns, and forest characteristics at marbled murrelet tree nests in California. *Northwestern Naturalist* 76: 54-62.

⁵² Long, L.L., and C.J. Ralph. 1998. Regulation and observation of human disturbance near nesting marbled murrelets. 35 pp.

⁵³ Golightly, R.T., P.N. Hebert, and D.L. Orthmeyer. 2002. Evaluation of human-caused disturbance on the breeding success of marbled murrelets (*Brachyramphus marmoratus*) in Redwood National and State Parks, California. Arcata, CA, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, California Department of Fish and Game, and California Department of Parks and Recreation, 61 pp.

⁵⁴ Ibid

⁵⁵ K. Nelson, personal observation as referenced in McShane et al. 2004

⁵⁶ Simons, T.R. 1980. Discovery of a ground-nesting marbled murrelet. *Condor* 82: 1-9.

⁵⁷ Ibid

⁵⁸ Kerns, S.J., and R.A. Miller. 1995. Two marbled murrelet nest sites on private commercial lands in northern California. Pp. 40-42. In: *Biology of the marbled murrelet: inland and at sea* (S.K. Nelson, and S.G. Sealy, eds.). *Northwestern Naturalist* 76.

⁵⁹ Ibid

⁶⁰ Kuletz, K.J. 1996. Marbled murrelet abundance and breeding activity at Naked Island, Prince William Sound, and Kachemak Bay, Alaska, before and after the Exxon Valdez oil spill. *American Fisheries Society Symposium* 18: 770-784.

⁶¹ Speckman, S.G. 1996. Marbled murrelet distribution and abundance in relation to the marine environment. M.Sc. thesis, Univ. Alaska, Fairbanks, AK.

⁶² Ibid.

⁶³ Hamer, T.E., and Chris Thompson. 1997. Avoidance of boats by marbled murrelets during marine surveys. Olympia, WA, U.S. Fish and Wildlife Service, 17 pp.

⁶⁴ U.S. Fish and Wildlife Service (USFWS). 2009. Final 2009 5-Year Review for the Marbled Murrelet. U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Lacey, Washington. June 12, 2009.

⁶⁵ Carter, H. R., and S. G. Sealy. 1990. Daily foraging behavior of marbled murrelets. *Studies in Avian Biology* 14:93-102

⁶⁶ Whitworth, D.L., S.K. Nelson, S.H. Newman, G.B. Van Vliet, and W.P. Smith. 2000. Foraging distances of radio-marked marbled murrelets from inland areas in southeast Alaska. *Condor* 102:452-456

⁶⁷ Becker, B.H. 2001. Effects of oceanographic variation on marbled murrelet diet and habitat selection. PhD dissertation, University of California, Berkeley, California.

⁶⁸ Hull, C.L., G.W. Kaiser, C. Loughheed, L. Loughheed, S. Boyd, and F. Cooke. 2001. Intraspecific variation in commuting distance of marbled murrelets (*Brachyramphus marmoratus*): ecological and energetic consequences of nesting further inland. *Auk* 18:1036-1046.

study area does not include suitable nesting habitat; therefore, the proposed project is not expected to result in elevated noise levels at nesting sites. Rather, potential noise impacts might affect near-shore and marine foraging habitat.

Streaked-Horned Lark

The streaked-horned lark (*Eremophila alpestris strigata*) is a subspecies of the horned lark and is currently proposed for listing as “threatened” under the ESA.

Habitat

Streaked-horned larks breed and winter in Oregon and Washington and are associated with bare ground or sparsely vegetated habitats and nests in grass seed fields, pastures, fallow fields, and wetland mudflats. Streaked-horned larks are also found along gravel roads or roadsides. The streaked-horned lark breeds in areas with short herbaceous vegetation, open ground, and an absence of woody vegetation. Breeding sites are often located in areas of remnant dry prairie, mud flats, or oak savannas. Disturbed habitats, including sparse patches of vegetation associated with pastures or fallow fields, young Christmas tree farms, airport runways, and gravel roads, are also used.

Distribution in Washington

Streaked-horned larks migrate between Oregon and Washington. According to WDFW’s Streaked Horned Lark Assessment and Conservation Strategy⁷¹, the remaining breeding populations are found in the Puget lowlands, Columbia River, coastal Washington, and Willamette Valley. Specifically, streaked-horned larks currently breed on prairie remnants and airports in the southern Puget lowlands (Shelton and Olympia Airports, Gray Army Airfield, and McChord Air Force Base), on beaches near Grays Harbor and Willapa Bays, on dredge spoil islands in the Columbia River, an industrial site along the lower Columbia River in Oregon, and on a number of agricultural, pasture, grass, and mudflat habitats in the Willamette Valley from Portland to Eugene. In addition, streaked-horned larks have been reported as irregular breeders on the south jetty of the Columbia River (M. Patterson, personal communication, as referenced in Pearson and Altman 2005.) The only occurrence of streaked-horned lark in the WDFW database that fell within the study area was a breeding occurrence at the Olympia Regional Airport, with a location accuracy to within 1 mile⁷².

Winter distribution includes the Puget Trough, Washington coast, Lower Columbia River, and Willamette Valley.

Threats

⁶⁹ Mason, A., A.E. Burger, and B. Hansen. 2002. At-sea surveys of marbled murrelets in Clayoquot Sound, 1996-2000. Pages 15-33. In: Burger, A. and T.A. Chatwin (eds). Multi-scale studies of populations, distribution, and habitat associations of marbled murrelets in Clayoquot Sound, British Columbia. Ministry of Water, Land, and Air Protection, Victoria, British Columbia.

⁷⁰ Piatt, J.F., Kuletz, K.J., Burger, A.E., Hatch, S.A., Friesen, V.L., Birt, T.P., Arimitsu, M.L., Drew, G.S., Harding, A.M.A., and K.S. Bixler. 2007. Status review of the Marbled Murrelet (*Brachyramphus marmoratus*) in Alaska and British Columbia: U.S. Geological Survey Open-File Report 2006-1387, 258 p.

⁷¹ Pearson, S.F., and B. Altman. 2005. Range-wide Streaked Horned Lark (*Eremophila alpestris strigata*) Assessment and Preliminary Conservation Strategy. Washington Department of Fish and Wildlife, Olympia, WA. 25pp.

⁷² *ibid.*

Increased noise levels are not as much of an issue for streaked-horned larks, nor is habitat loss or human-related impacts. Streaked-horned larks are associated with sparse, open habitat that often occurs along runways and taxiway aprons at airports; also, because they nest on the ground and often near dirt roads, their nests are vulnerable to vehicle traffic especially along active airport taxiways and roads. Streaked-horned larks are often found in flocks and when flushed into the air can become a collision threat to aircraft.

According to Pearson and Altman (2005), between 1985 and 2004, there were 1,422 horned lark collisions with U.S. Air Force aircraft, which was the highest number of aircraft collisions for any species.⁷³ However, there were only 228 horned lark collisions out of 51,154 strikes with civilian aircraft reported between 1990 and 2003.⁷⁴ None of the civilian aircraft collisions resulted in injury. Of the 184 wildlife strikes reported to the Federal Aviation Administration (FAA) Wildlife Strike Database for Seattle-Tacoma International Airport during a 5-year period between January 1, 2007, and January 1, 2012, only one was identified as a horned lark. Horned larks are medium-sized birds, and positive strike identification might be difficult. Several wildlife strikes were reported as unknown bird, unknown bird-small, and unknown bird-medium; streaked horned larks could fall in any of these categories.

Bald Eagle

The Bald Eagle (*Haliaeetus leucocephalus*) was delisted from the federal ESA in 2007 and delisted in Washington; however, it is still federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Habitat

Bald eagles are closely associated with freshwater, estuarine, and marine ecosystems with abundant prey and suitable habitat for nesting and communal roosting. Breeding territories are typically located within 1.6 kilometers (1 mile) of permanent waters in predominantly coniferous, uneven-aged stands with old-growth structural components. Bald eagles winter along ice-free lakes, streams, and rivers where food and perch sites are abundant and the level of human disturbance is low. Communal night roosts are used by bald eagles primarily during the winter months. In the Pacific Northwest, communal roosts generally occur in multilayered mature or old-growth conifer stands that provide protection from weather and human disturbance.

Breeding Biology

Home-range size varies greatly, according to food abundance and the availability of suitable nest and perch trees. Favored nest trees are usually the largest trees or snags in a stand that provides an unobstructed view of the surrounding area and a clear flight to and from the nest.^{75,76} Nests are usually built on limbs just below the crown, with the canopy above providing cover. Nesting behaviors typically begin in January, followed by egg laying and incubation in February and March. Young are reared throughout April, May, and June, and fledging occurs in July and August. Bald eagles are primarily predators, but they are also opportunistic scavengers that feed on a variety of prey, including salmon and

⁷³ BASH (Bird/wildlife Aircraft Strike Hazard Team). 2004. Top 50 USAF Wildlife Strikes by Count. Aviation Safety Division, U.S. Air Force (http://afsafety.af.mil/AFSC/Bash/stats/web_spec_count_stat.html).

⁷⁴ Cleary, E.C., R.A. Dolbeer, and S.E. Wright. 2004. Wildlife strikes to civil aircraft in the United States 1990-2003. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 10

⁷⁵ Isaacs, F. B., and R. G. Anthony. 2001. Bald Eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1972 through 2001. Unpublished report prepared by Oregon Cooperative Fisheries and Wildlife Research Unit, Oregon State University, Corvallis, Oregon.

⁷⁶ Isaacs, F. 2004. Bald Eagle nest survey results for 2004. Oregon Cooperative Fisheries and Wildlife Research Unit, Oregon State University, Corvallis.

other fish, small mammals, waterfowl, seabirds, and carrion.⁷⁷ Bald eagles usually forage in large open areas with a wide visual field and suitable perch trees near the food source.

Movement

Washington has a substantial wintering population of bald eagles that consists of residents as well as migrants. As discussed in Section 5.2.7.2, raptors generally travel below 3,500 to 4,000 feet. Most wintering birds are found along the Skagit, Nooksack, and Sauk River systems, in the Puget Trough ecoregion, on the Olympic Peninsula, and in the Columbia Basin.

Noise Disturbances

Eagle sensitivity to human disturbance, including noise levels, varies among individuals and with the timing of the breeding cycle, with eagles being most sensitive during the courtship and nest-building phase. In general, bald eagles nesting in Puget Sound are thought to have acclimated to a semi-urban setting and have developed varying degrees of tolerance to disturbances such as human presence and elevated noise levels.

Movement and Distribution in Washington

As discussed in Section 5.2.7.2, raptors generally travel below 3,500 to 4,000 feet. Washington has a substantial wintering population of bald eagles that consists of residents as well as migrants. Most wintering birds are found along the Skagit, Nooksack, and Sauk River systems, in the Puget Trough ecoregion, on the Olympic Peninsula, and in the Columbia Basin. According to the WDFW PHS data⁷⁸, bald eagle nest sites are located throughout the study area. In general, nests are more abundant in the northwestern portion of the study area and to a lesser extent in the central portion, which corresponds to densely populated areas of King County with less suitable eagle nesting habitat. There are no bald eagle nests within a 1-mile radius of the airport; the closest bald eagle nest is located approximately 2.5 miles from the airport parcel boundary.

Bird Strikes

With aircraft and birds often sharing the same airspace, collisions and strikes are inevitable. Potential for bird strikes can vary with location in proximity to habitat features and concentration areas and time of year. Although most bird strikes occur between July and October,⁷⁹ the highest risk for bird strikes occurs during spring and fall migration when millions of birds move between breeding grounds and wintering habitat. Hazard potential increases with the size, with the hazard from larger birds, such as hawks and waterfowl, posing the greatest risk.

There have been over 121,000 (civilian and military) wildlife strikes between 1990 and 2010. Although 97.5 percent of all wildlife strikes involve birds, strikes with other animals such as deer, coyotes, turtles, skunks, and alligators have also been reported. Most bird strikes occur during the approach and landing roll, with 92 percent of bird strikes occurring at or below 3,000 feet above ground level (AGL)⁸⁰.

⁷⁷ Snow, C. 1981. Southern Bald Eagle and Northern Bald Eagle. Habitat Management Services for Endangered Species. Report No. 5, USDA Bureau of Land Management.

⁷⁸ Ibid.

⁷⁹ Federal Aviation Administration (FAA). Wildlife Strike Website. Accessed May 24, 2012. http://www.faa.gov/airports/airport_safety/wildlife/problem/

⁸⁰ Federal Aviation Administration (FAA). Wildlife Strike Website. Accessed May 24, 2012. http://www.faa.gov/airports/airport_safety/wildlife/problem/

The FAA Wildlife Strike Database contains records of reported wildlife strikes since 1990. Strike reporting is voluntary and, therefore, represents the information that the FAA receives from airlines, airports, pilots, and other sources. During a 5-year period between January 1, 2007, and January 1, 2012, a total of 184 wildlife strikes were reported to the FAA Wildlife Strike Database for Seattle-Tacoma International Airport. Of the 184 strikes, 181 were birds and 3 were bats. Most strikes occurred between July and October, with the highest amount occurring in September. For those strikes where height was reported, the range of strike height was 0 to 12,000 feet. The strike at 12,000 feet was with a whimbrel, a type of shorebird. Average strike height taking into account all strikes, including those encountered while on the runway at 0 feet, was 770 feet. Average strike height taking into account only those strikes encountered while the aircraft was in the air (greater than 0 feet in height) was 1,776 feet.

U.S. Fish & Wildlife Service

Pacific Flyway

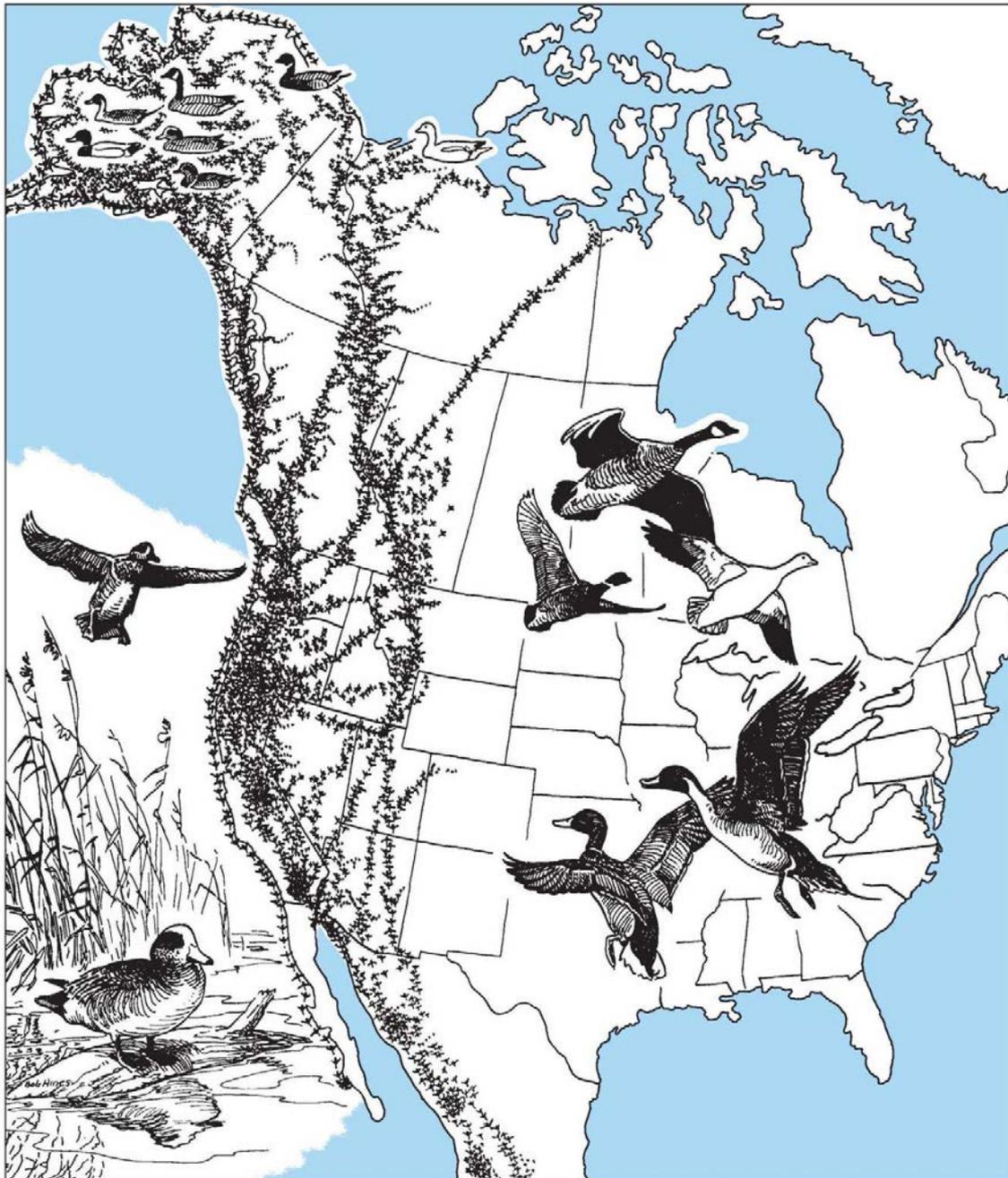


Figure 5.2-9. Pacific Flyway

5.11.3 Visual and Esthetic Resources

This section summarizes the FAA's guidelines for considering light emissions and visual impacts and describes the existing conditions in the Study Area.

5.11.3.1 Regulatory Environment

Although FAA Order 1050.1E, Change 1 does not identify specific regulatory requirements, Appendix A, Section 12.2 provides the following guidance for the assessment of light emissions and visual impacts.

Light Emissions

The responsible FAA official considers the extent to which any lighting associated with an action will create an annoyance among people in the vicinity or interfere with their normal activities. Because of the relatively low levels of light intensity compared to background levels associated with most air navigation facilities (NAVAIDS) and other airport development actions, light emissions impacts are unlikely to have an adverse impact on human activity or the use or characteristics of the protected properties. Information will be included in the environmental document whenever the potential for annoyance exists, such as site location of lights or light systems, pertinent characteristics of the particular system and its use, and measures to lessen any annoyance, such as shielding or angular adjustments.

Visual Impacts

Visual, or aesthetic, impacts are inherently more difficult to define because of the subjectivity involved. Aesthetic impacts deal more broadly with the extent that the development contrasts with the existing environment and whether the jurisdictional agency considers this contrast objectionable. Public involvement and consultation with appropriate federal, state, and local agencies and tribes might help determine the extent of these impacts. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact. The art and science of analyzing visual impacts is continuously improving, and the responsible FAA official should consider, based on scoping or other public involvement, the degree to which available tools should be used to more objectively analyze subjective responses to proposed visual changes.

FAA Order 1050.1E, Change 1, Appendix A, Section 12.3 does not identify thresholds of significance for light emissions or visual impacts. The section does, however, state that measures to mitigate light emissions and visual impacts should be further considered to reduce impacts and encourage enhancement of the environment.

5.11.3.2 Existing Conditions

Figure 5.2-8 shows that parks and other recreational uses that might be sensitive to changes in the visual environment are found throughout the Study Area. Figures 4.1-2 and 4.1-3 show that aircraft activity occurs throughout the study area. Aircraft are routinely visible in virtually all portions of the study area.

6 ENVIRONMENTAL CONSEQUENCES

Chapter 6 documents the direct and indirect impacts of the Proposed Action compared to No Action, as directed in FAA Order 1050.1E, Change 1, paragraph 405f and also in FAA's January 12, 2012 memo "Considering Greenhouse Gases and Climate Under the National Environmental Policy Act (NEPA): Interim Guidance" explicitly adding Climate as a category of potential environmental impact. The chapter addresses resources in the following order:

- Noise
- Compatible land use
- Air quality
- Climate
- Natural resources and energy supply (fuel usage)
- Socioeconomic impacts, Environmental Justice, and children's environmental health and safety risks
- Secondary (induced) impacts
- Historical, architectural, archeological, and cultural resources
- Department of Transportation Act; Sec. 4(f) sites (parks and natural areas)
- Fish, wildlife, and plants (flyways for migratory birds)
- Light emissions and visual impacts

6.1 Noise

With proposed implementation of the Greener Skies' flight procedures anticipated in the spring of 2013, the first full year of operation under the new procedures will be 2014. That, and two future analysis periods for the years 2018 and 2023 are addressed here.

6.1.1 Methodology

Consistent with the computations of noise for 2012 operations, noise calculations for the future study years have been carried out using version 7.0b.2 of the FAA's NIRS program. In each case, DNL noise exposure levels for both No Action and the Proposed Action were computed and compared for significant impacts using the criteria specified in FAA Order 1050.1E.

Forecast operations used for each of the future scenarios were based on the FAA-approved forecast conducted for the Port of Seattle's Part 150 Noise and Land Use Compatibility Study now underway at SEA. The annual operations for each year were summarized earlier in Chapter 5, Table 5.2-2, and reflected an annual growth rate of about 2.4 percent per year. The further breakdown of the fleet into daytime and nighttime takeoffs and landings by specific aircraft types is described and summarized in Appendix G, the Noise Modeling Technical Report.

With regard to future runway utilizations, because wind and weather conditions are largely responsible for the direction of traffic flow and are not expected to shift in future years, and because the Proposed Action includes new flight procedures to each of the six runway ends, nothing in the future No Action or Proposed Action would necessarily portend a shift in use of one runway to another. Hence, all runway utilizations are assumed to remain constant for all scenarios.

Flight tracks for future study year scenarios are, however, expected to differ between No Action and the Proposed Action. Chapter 4 highlighted the differences and indicated that the new Greener Skies procedures will supplement, not replace, existing ones. The combined set of procedures is illustrated in Figure 6.1-1. Existing procedures are shown in lighter shades of blue and orange (blue for south flow arrivals to the 16-ends of the runways, orange for the north flow arrivals to the 34-ends of the runways). The additional new procedures are in darker shades of the same colors. The more numerous modeled tracks that were actually used in NIRS are depicted in graphics shown in Appendix G.

Once implemented, some of the traffic that currently utilizes the existing procedures will shift over to the new Greener Skies approaches. Those shifts were summarized earlier in Table 4.3-1.

A final set of differences between No Action and the Proposed Action is reflected in the descent profiles used by NIRS to account for smooth descents from high altitudes. These differ from the current step-down arrivals characteristic of existing approaches, which, as indicated earlier, will continue to occur for those aircraft that are unable to be cleared for approach on one of the new Optimized Profile Descents.

6.1.2 Results

Resulting DNL noise exposure levels for the 2014 No Action and Proposed Action are shown in Figure 6.1-2 and Figure 6.1-3, with grid points color-coded as before in 5-dB increments from DNL 45 to DNL 65 and above.

Differences between the two figures are insignificant, but a more illustrative indication of change is seen in Figure 6.1-4 (north of SEA) and Figure 6.1-5 (south of SEA). These expand the view to provide a clearer indication of the differences in sound levels between the Proposed Action and No Action at every one of the 55,786 grid points where the DNL value of at least one of the scenarios is above 45 dB and where the difference between the two cases is at least 0.1 dB.

The color-coded grid points in each of those figures provide an immediate indication of where and by how much the noise is expected to increase or decrease due to the Proposed Action. These show that nowhere is there a grid point where the change in exposure exceeds the 1.5 dB criterion for “significant impact” above DNL 65, or that it exceeds the 3.0 dB criterion for “consideration of mitigation” from DNL 60 to 65 in cases where significant impact also occurs, or that it exceeds the 5.0 dB criterion for “disclosure” from DNL 45 to 60⁸¹.

In fact, the maximum increase in level for any point in the study area where at least one of the values is predicted to be above DNL 45 in the year 2014 is +0.9 dB DNL; the maximum decrease in level is -0.8 dB DNL for the same period.

⁸¹ See criteria listed previously in Table 5.2-1

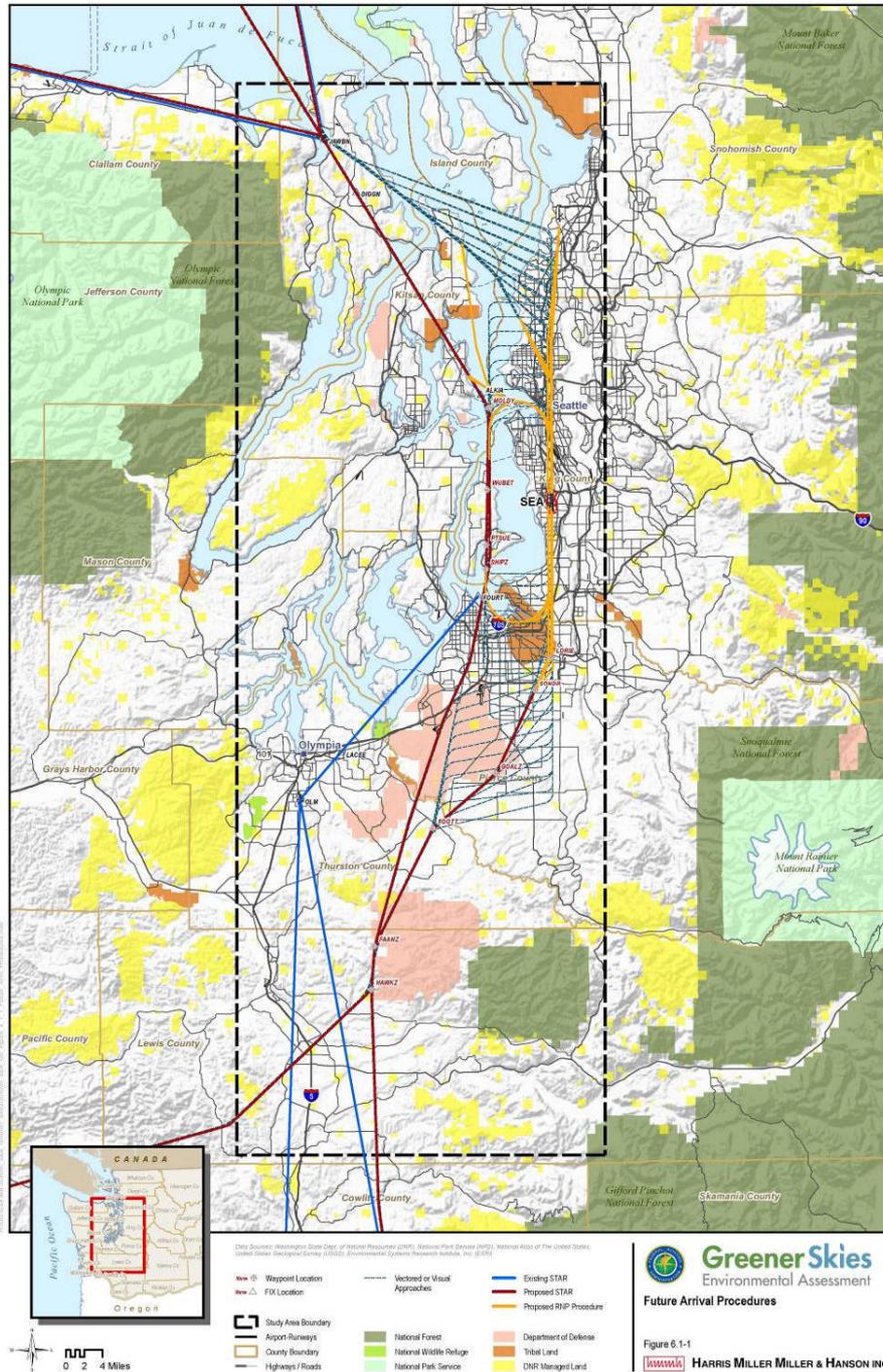


Figure 6.1-1. Future Arrival Procedures

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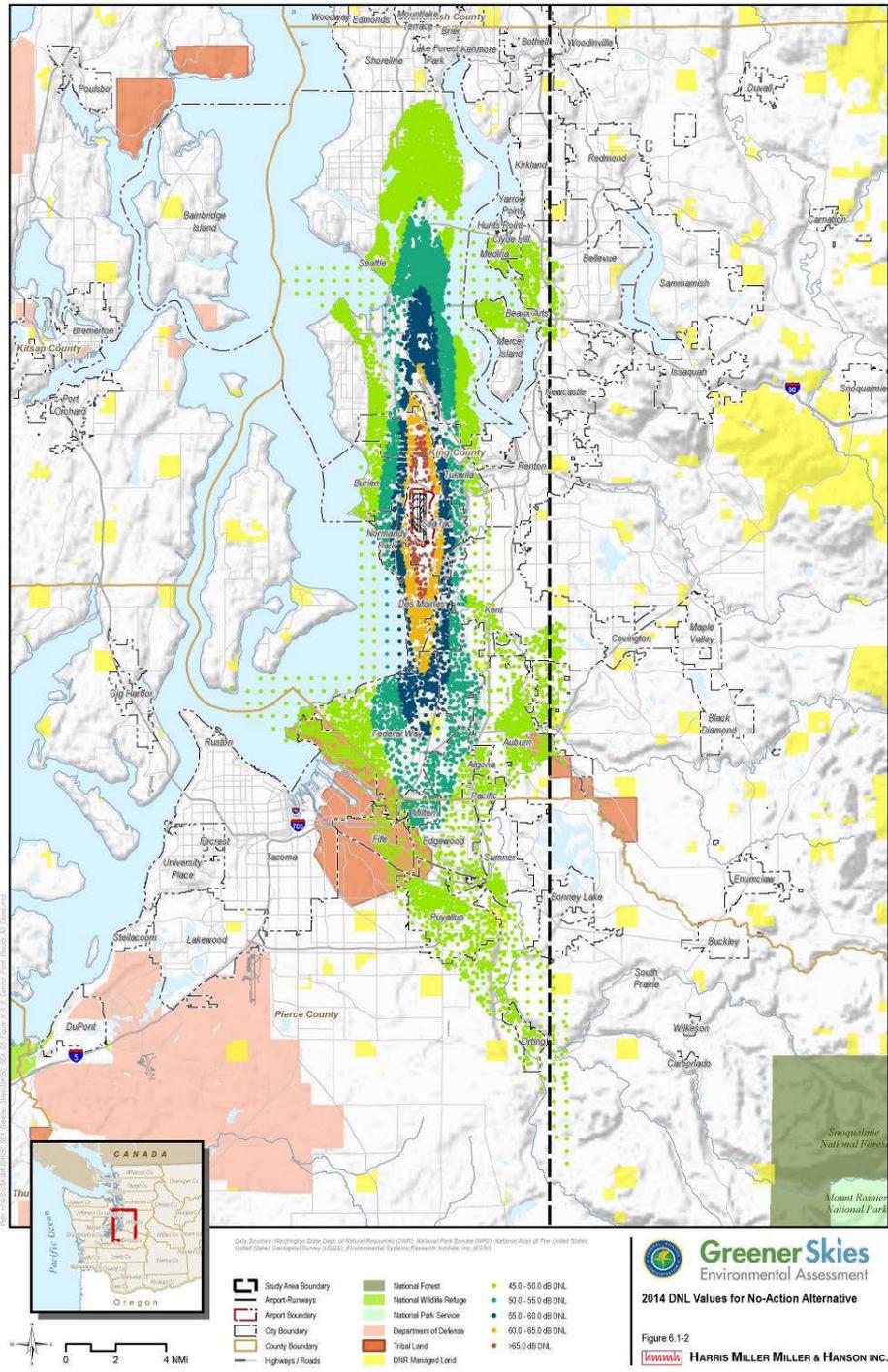


Figure 6.1-2. 2014 DNL Values for No Action

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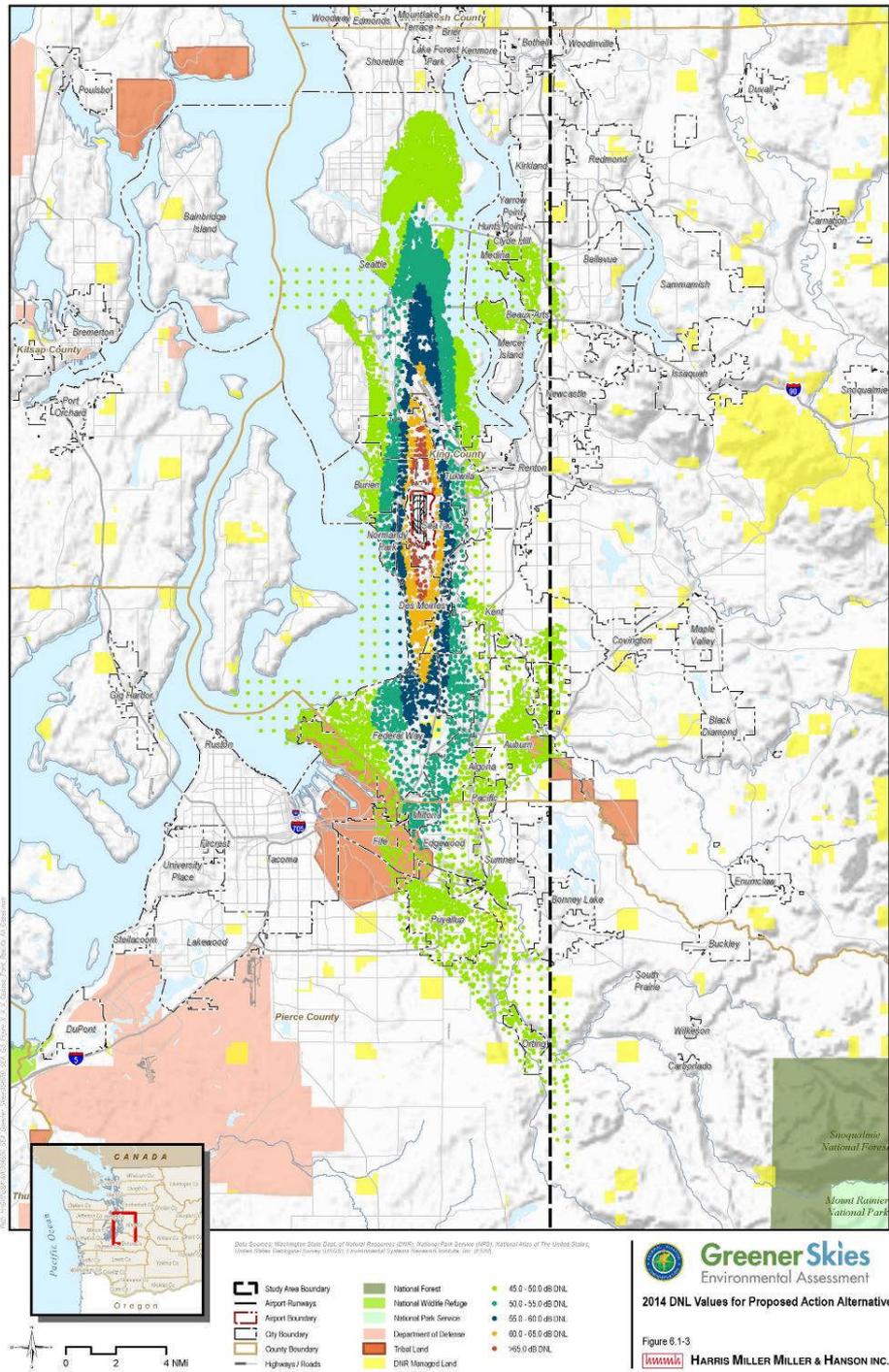


Figure 6.1-3. 2014 DNL Values for the Proposed Action

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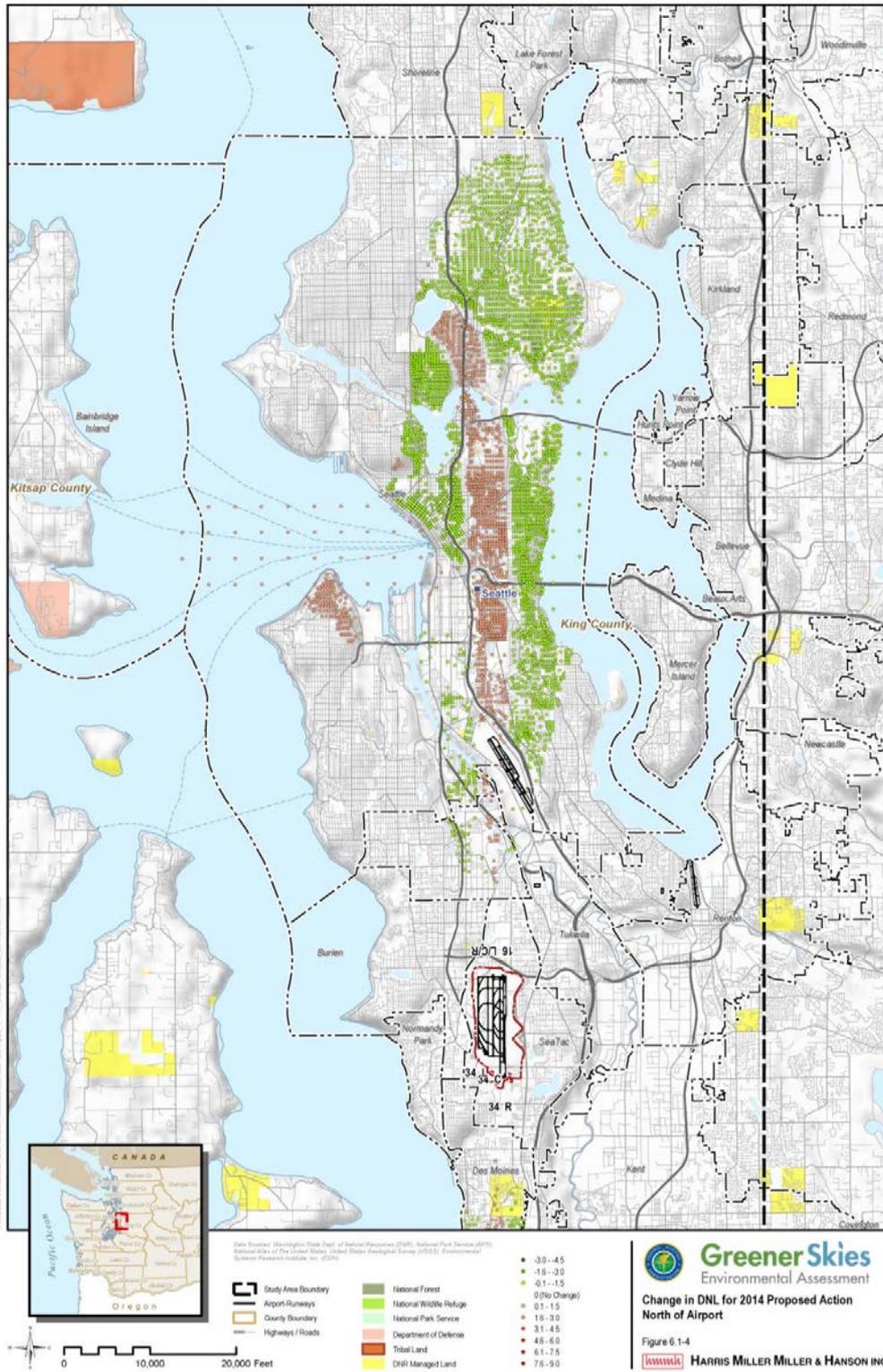


Figure 6.1-4. Change in DNL for 2014 Proposed Action, North of SEA

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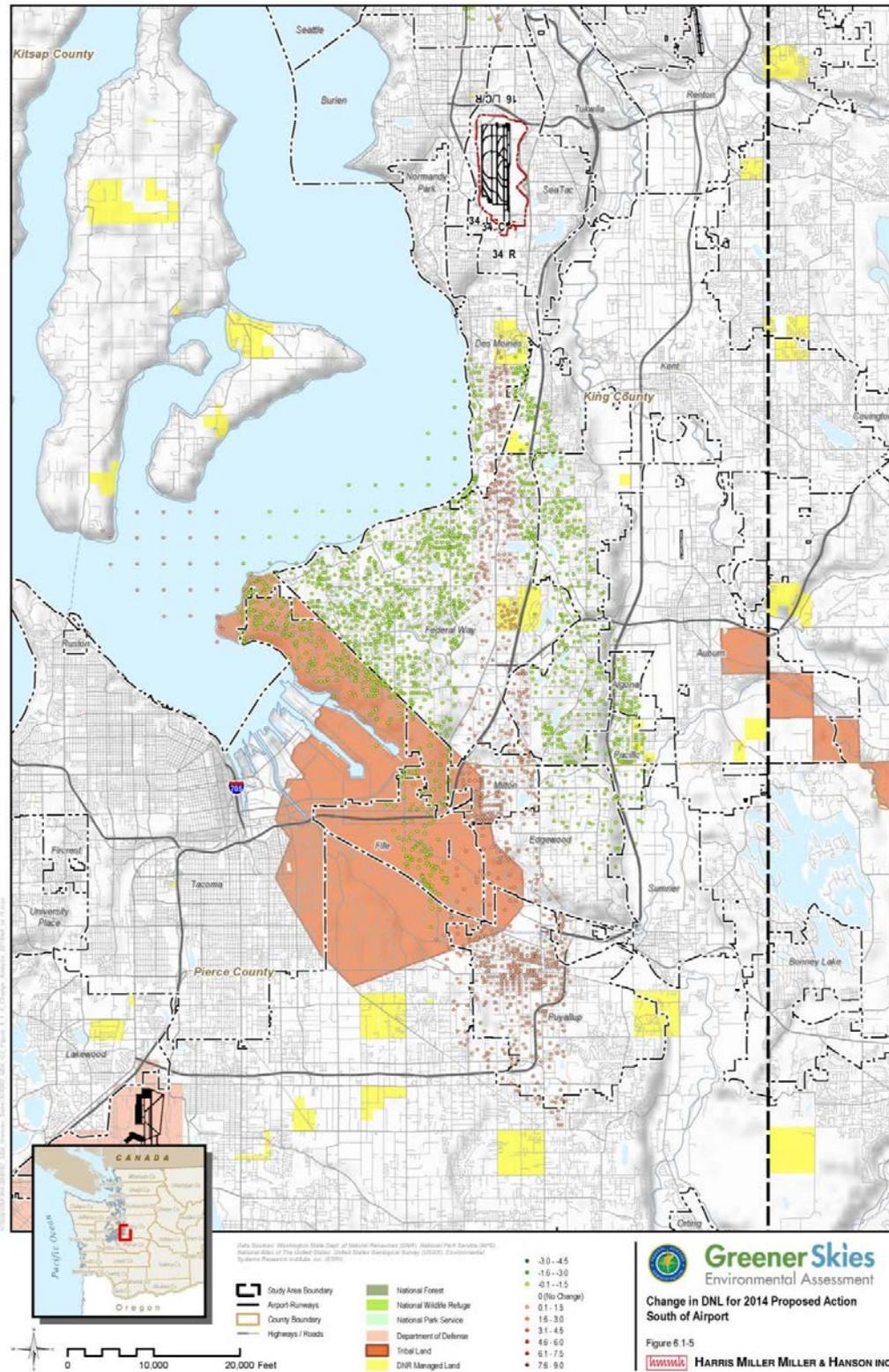


Figure 6.1-5. Change in DNL for 2014 Proposed Action, South of SEA

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A final indication of change for the 2014 study year is seen in Figure 6.1-6. A direct output of the NIRS model, it supplements the earlier figures by including the numbers of people in 5-dB increments of exposure (increases as well as decreases due to the Proposed Action). The population count from each grid point is accumulated and binned according to both its absolute noise level due to the Proposed Action and its relative noise level compared to No Action. It confirms that no one exceeds any of the criteria for substantive change as outlined in FAA Order 1050.1E (there are 0's throughout the red zone).

Looking at other results from the figure, of the 3,173,686 people represented by all the grid points in the study area (2, 265,096 of whom are exposed to noise less than DNL 45, as indicated in the white block at the top left of the graphic) there are 9,742 who are exposed to levels above DNL 65 due to No Action (see the "Baseline" count in the lower right hand corner) but 10,138 exposed above DNL 65 due to the Proposed Action resulting in 396 people "newly exposed" to DNL 65 and above, but not "significantly impacted".

The remaining study years follow a similar presentation of results. Table 6.1-1 summarizes the major findings.

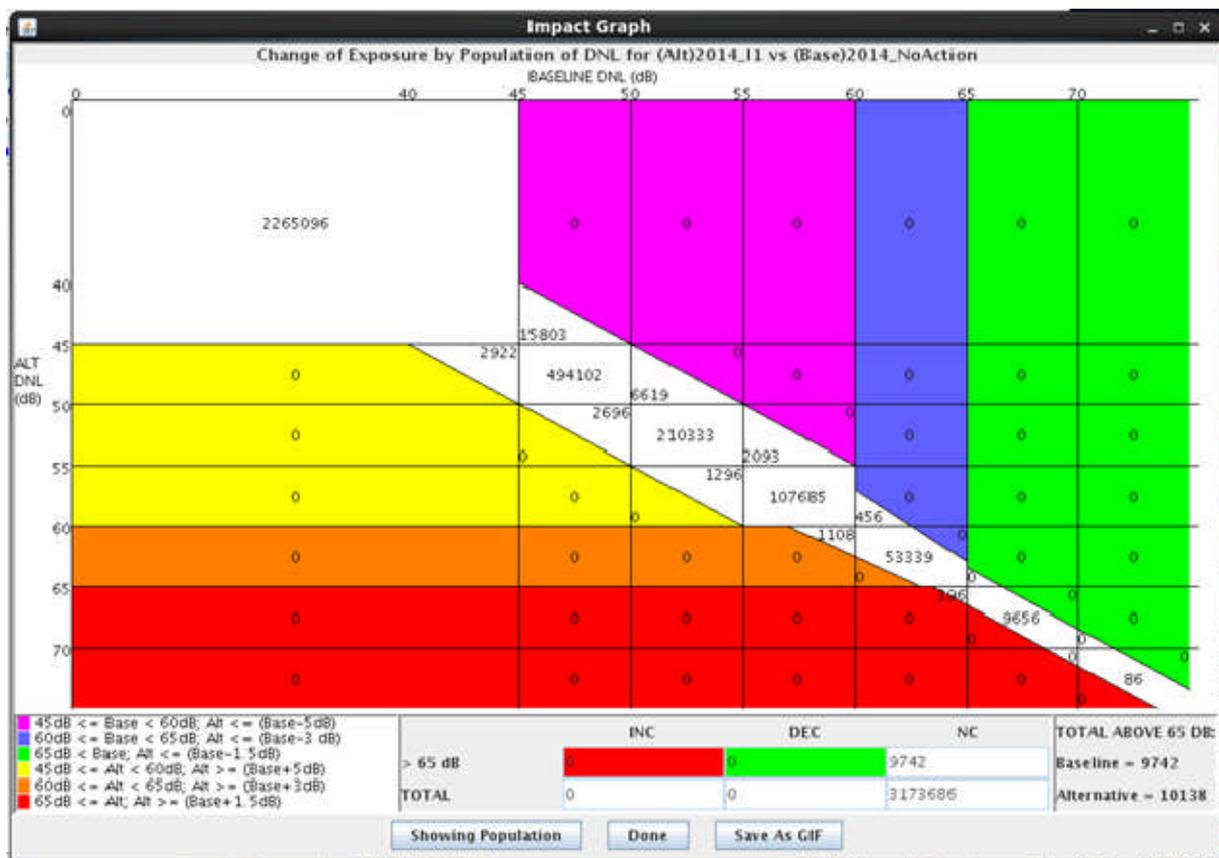


Figure 6.1-6 Population Exposed to DNL Changes for 2014 Proposed Action vs. No Action

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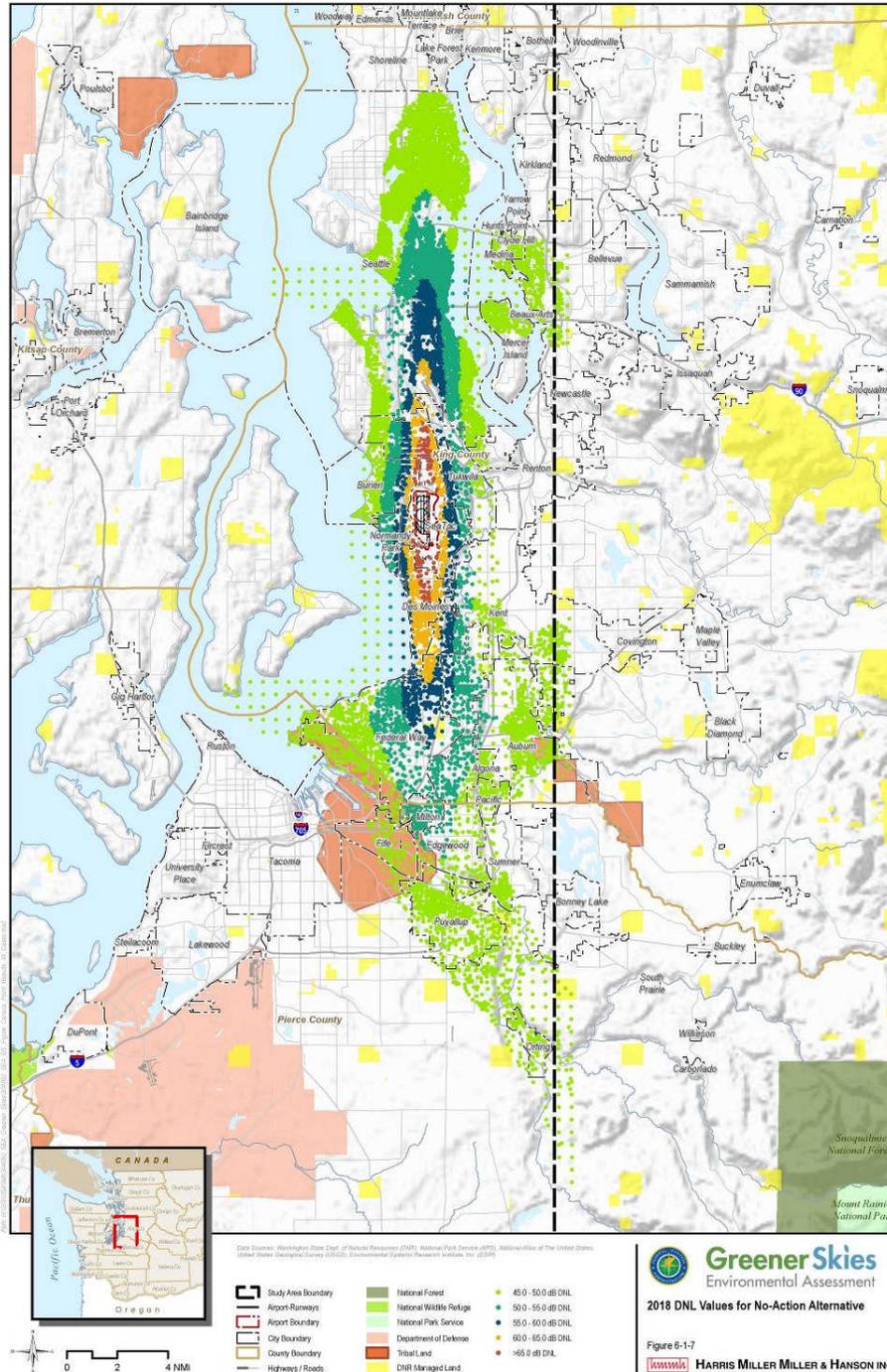


Figure 6.1-7. 2018 DNL Values for No Action

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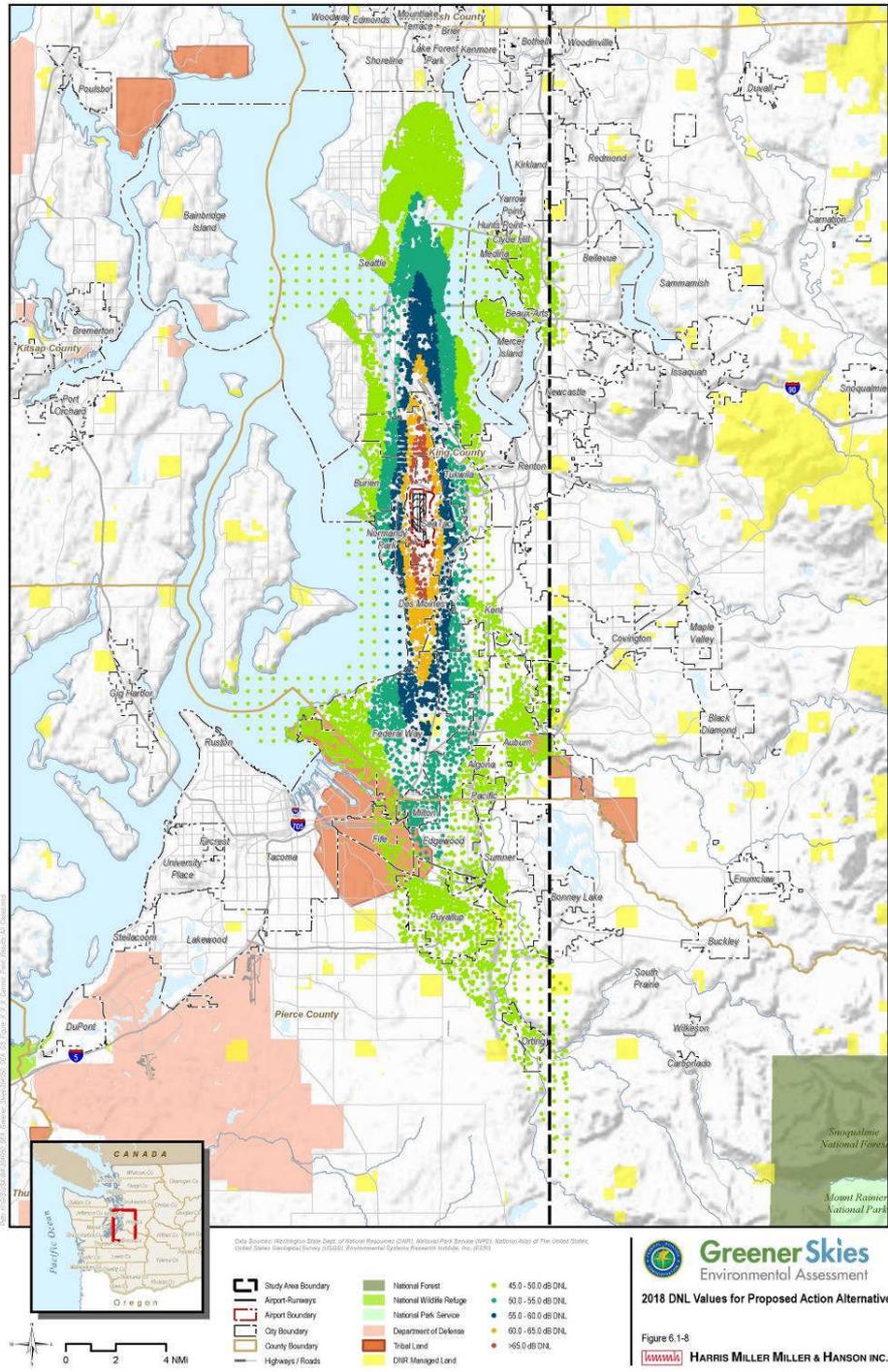


Figure 6.1-8. 2018 DNL Values for the Proposed Action

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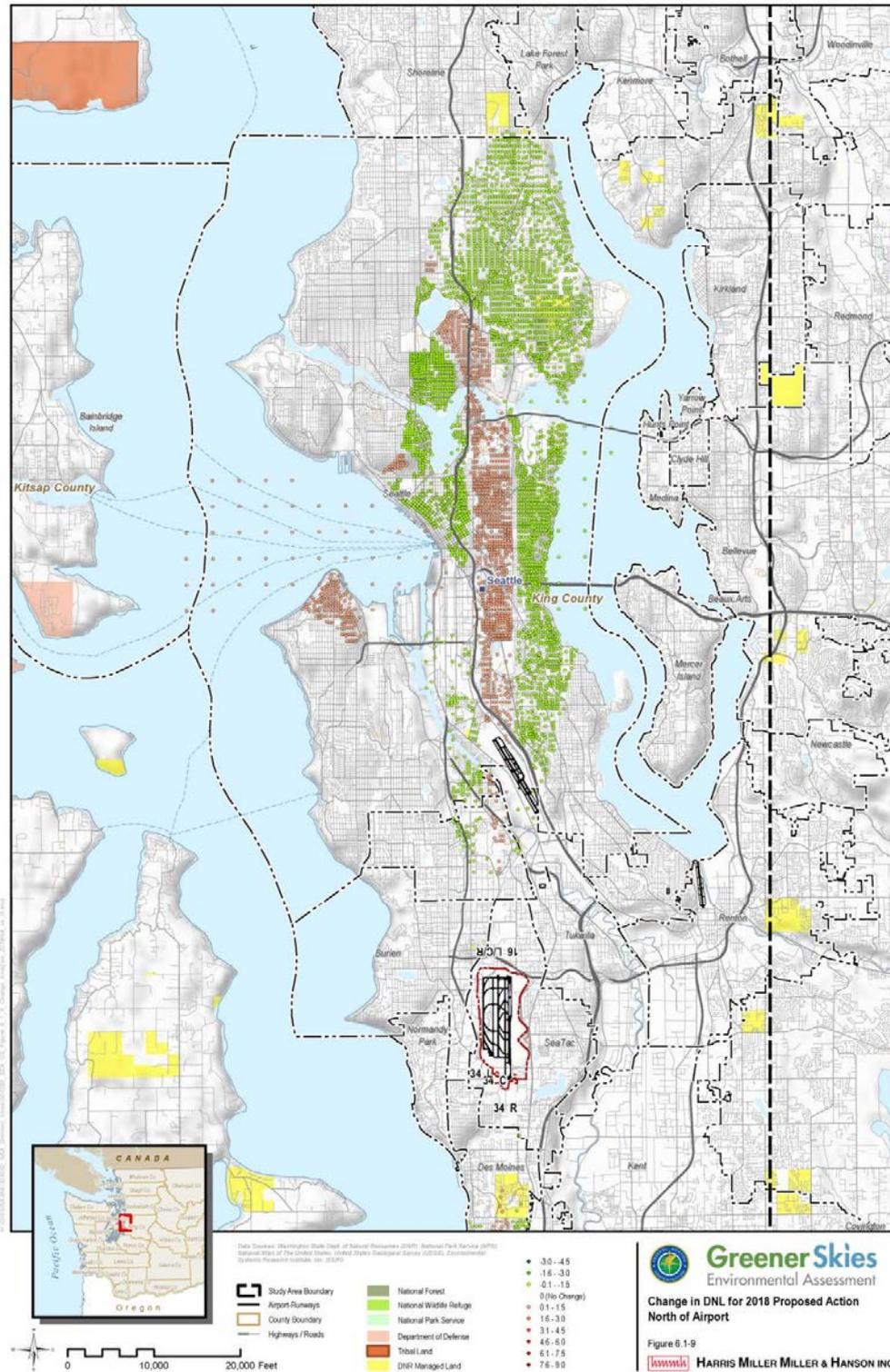


Figure 6.1-9. Change in DNL for 2018 Proposed Action, North of SEA

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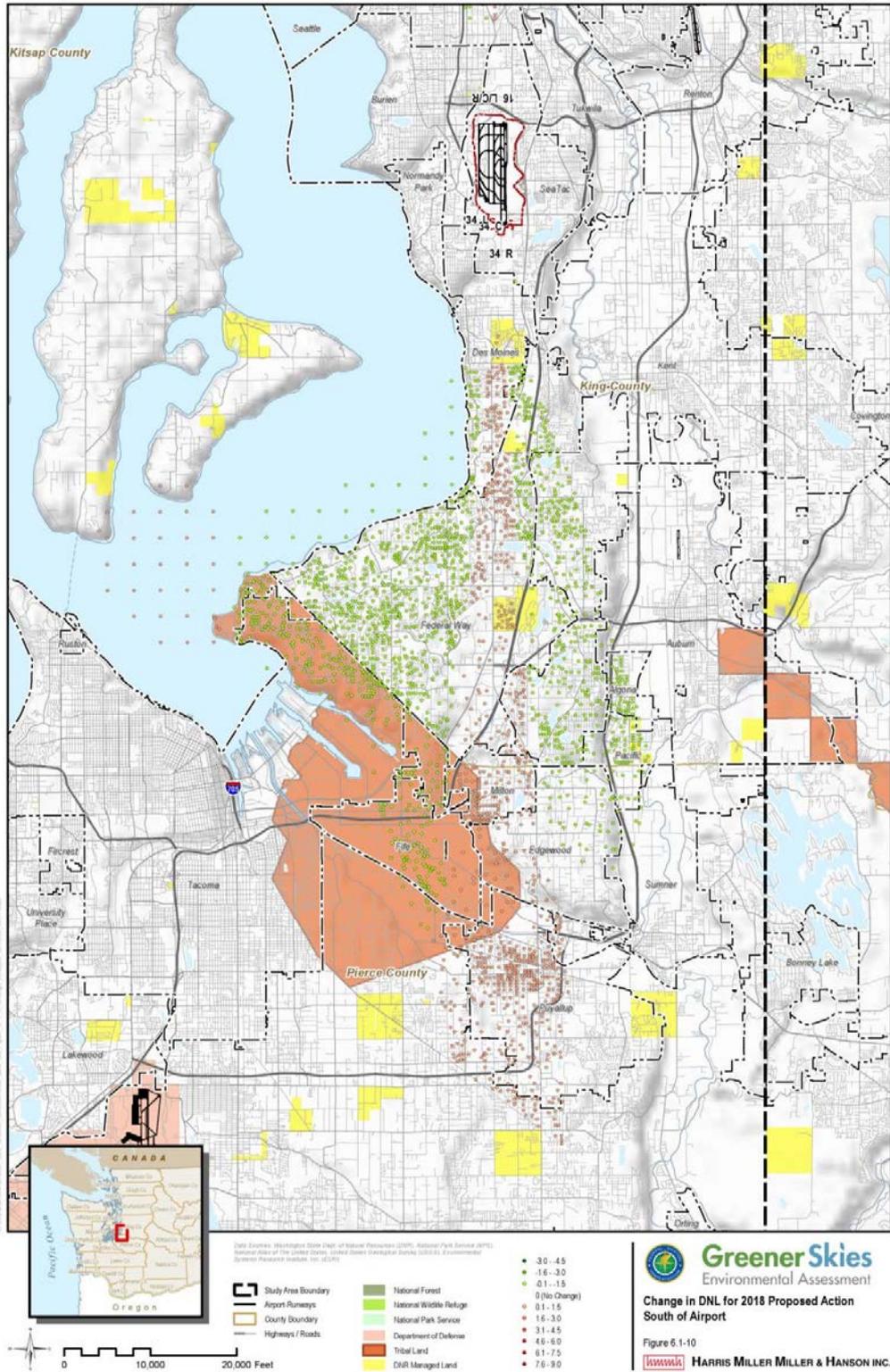


Figure 6.1-10. Change in DNL for 2018 Proposed Action, South of SEA

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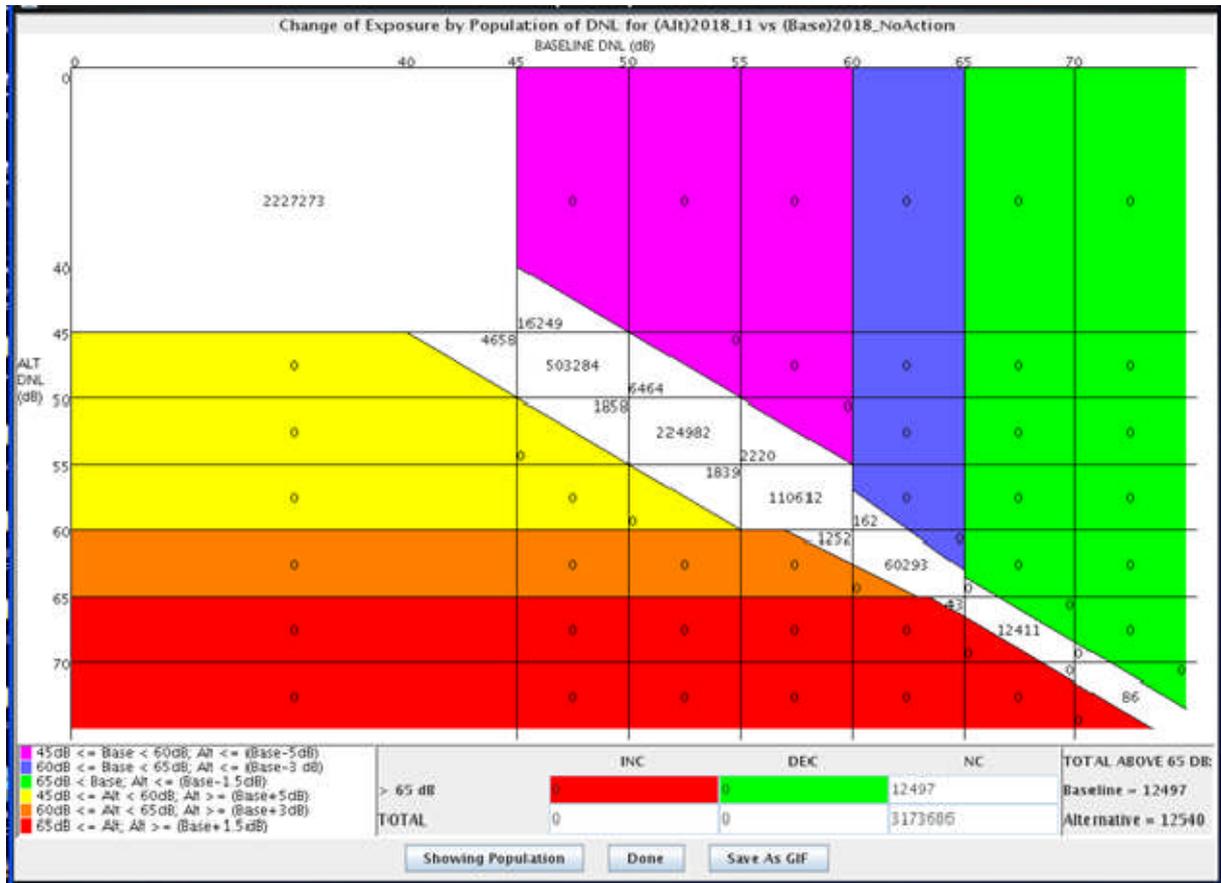


Figure 6.1-11 Population Exposed to DNL Changes for 2018 Proposed Action vs. No Action

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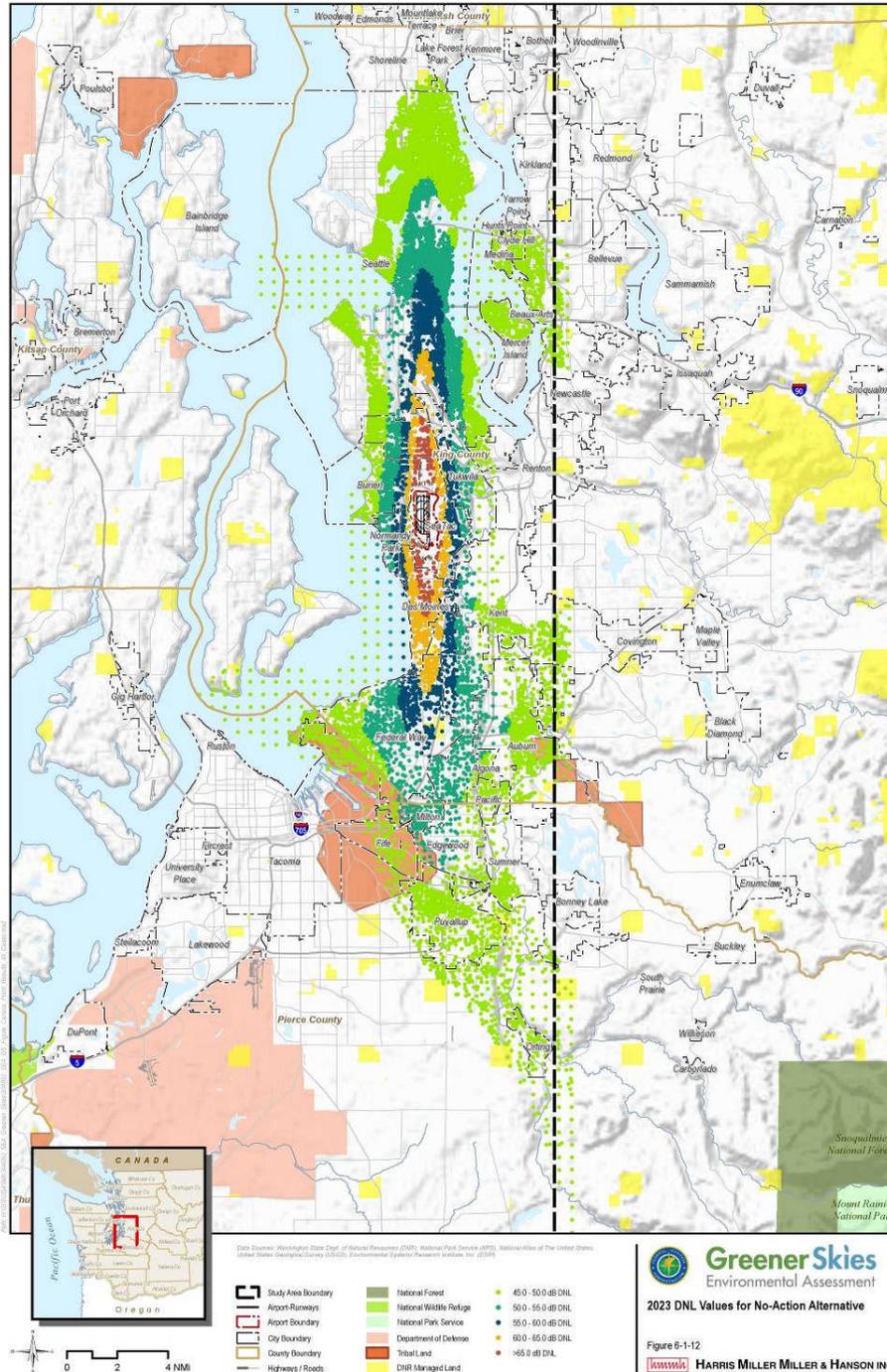


Figure 6.1-12. 2023 DNL Values for No Action

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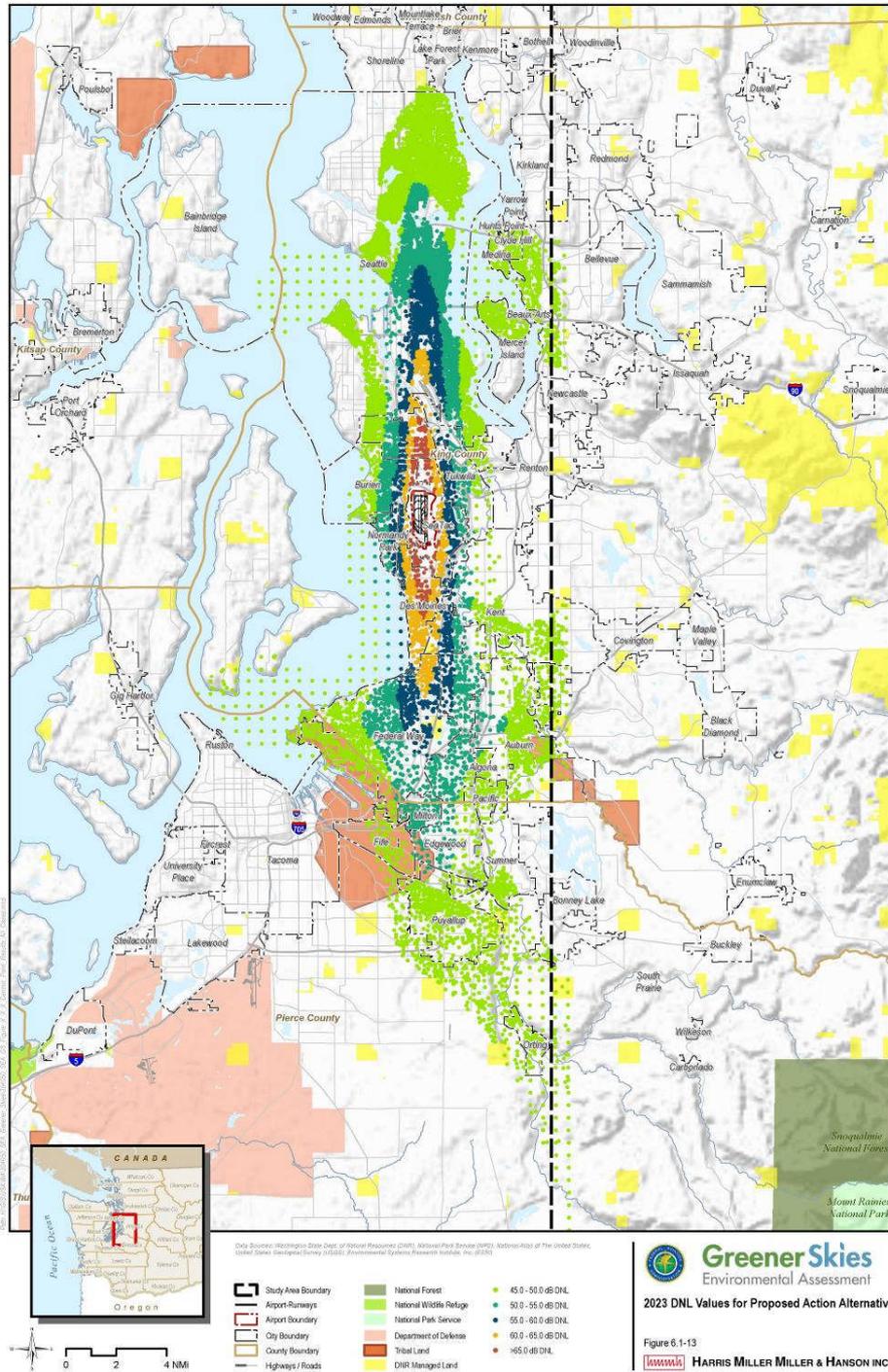


Figure 6.1-13. 2023 DNL Values for the Proposed Action

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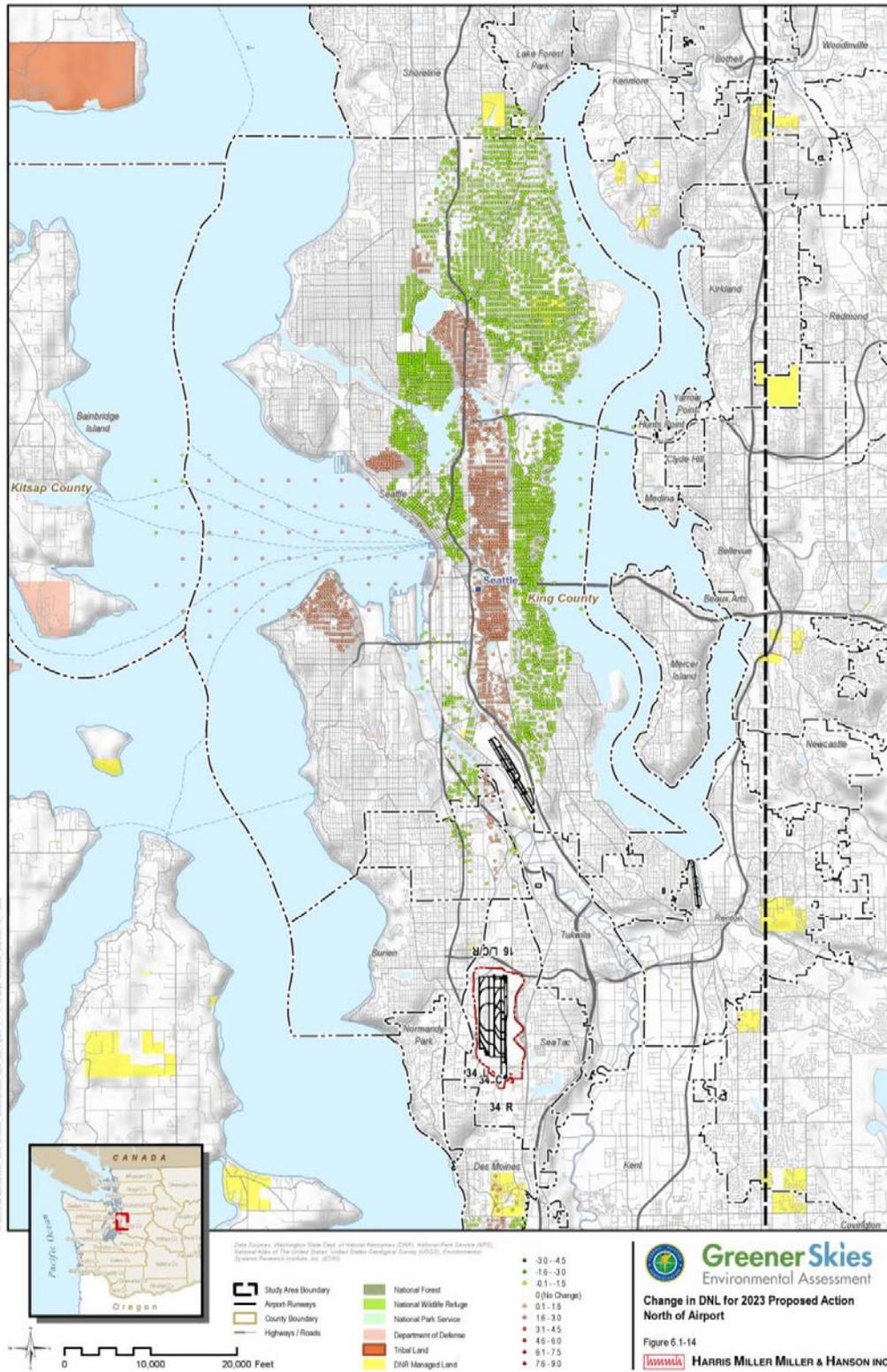


Figure 6.1-14. Change in DNL for 2023 Proposed Action, North of SEA

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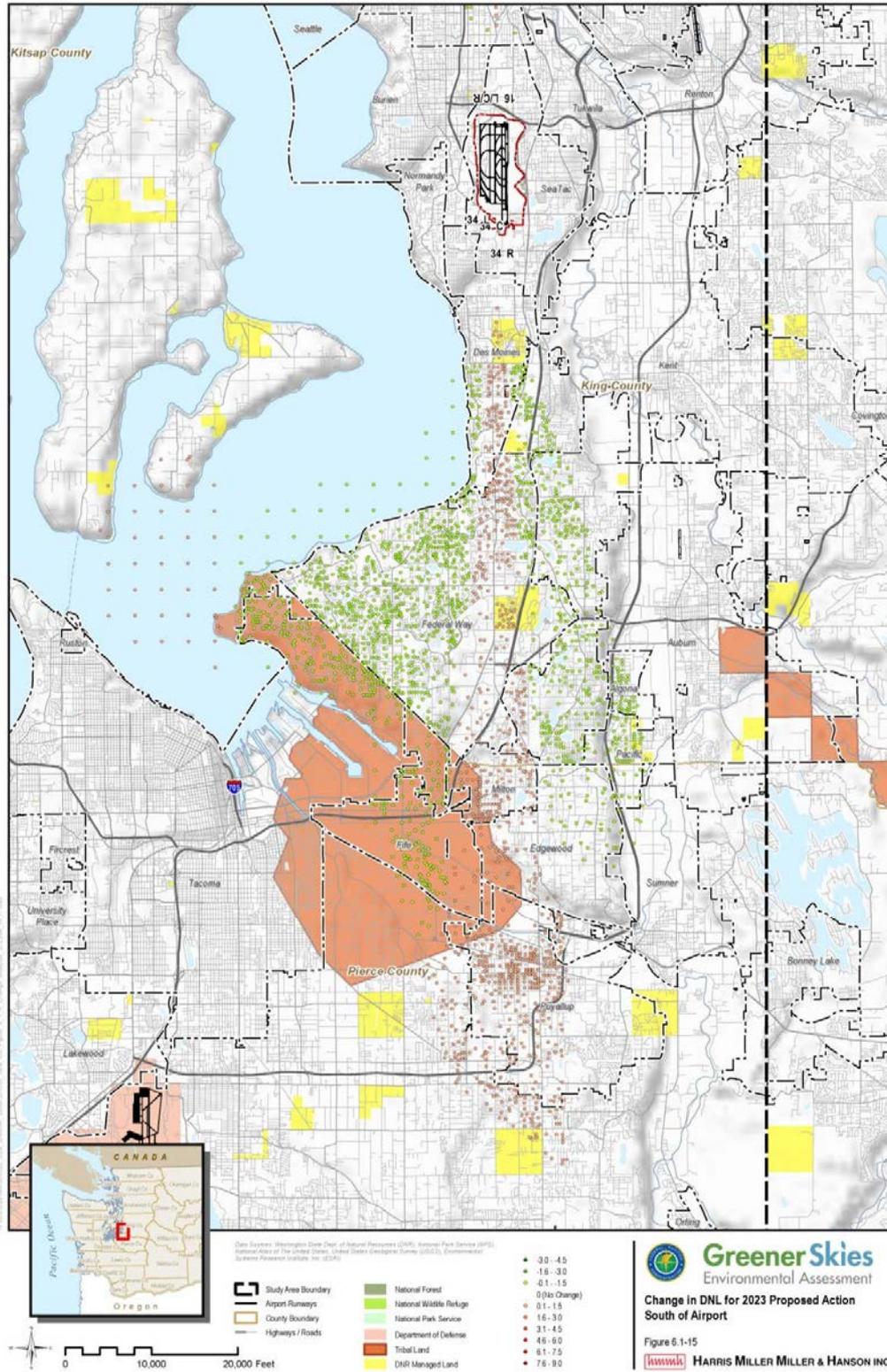


Figure 6.1-15. Change in DNL for 2023 Proposed Action, South of SEA

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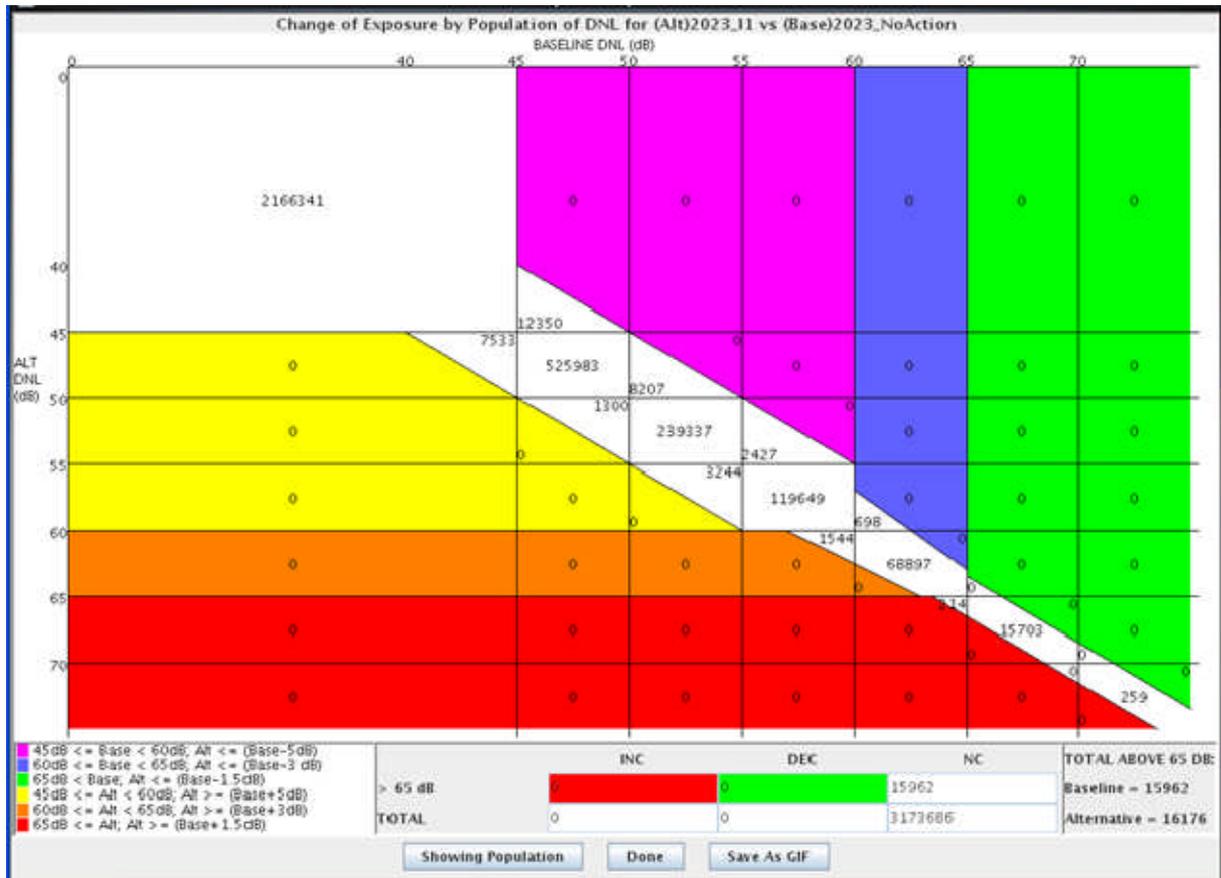


Figure 6.1-16 Population Exposed to DNL Changes for 2023 Proposed Action vs. No Action

From the various depictions of DNL values shown earlier in this section, and in particular from Figures 6.1-4, 6.1-9, and 6.1-14 for areas north of SEA, no changes in noise exposure attributable to Greener Skies are seen to exist close to SEA’s three runway ends, nor are there changes further northward along the extended centerlines of the runways until approximately 2 miles north of SEA. From there further northward, minor increases in DNL on the order of 0.1 to 0.2 dB continue to occur along the extended centerlines generally in portions of Beacon Hill east of Interstate I-5, and into neighborhoods of Cherry Hill, Capitol Hill, University District and Green Lake. Additional small increases in exposure, also of 0.1 to 0.2 dB DNL, occur in West Seattle near Duwamish Head. Changes in exposure of these small magnitudes are very minor and unlikely to be noticed. Similarly small decreases in exposure occur to the east and north in portions of Rainier Valley, Central Seattle, Madison Valley, eastern portions of Capitol Hill and large areas of Northgate, and North Seattle as well as to the northwest in Lake Union.

South of SEA, Figures 6.1-5, 6.1-10, and 6.1-15 again show no changes in exposure attributable to Greener Skies until reaching approximately 2 miles south of the three runway ends, at which point minor increases in DNL of 0.1 to 0.2 dB occur from there southward in the easternmost section of Federal Way, Milton, western portions of Edgewood, and northern sections of Puyallup west of Route 512. Further south in Puyallup and into bordering areas of Pierce County, increases in DNL are slightly larger in the range of 0.5 to 1.1 dB under the proposed RNP procedures to runways 34L, 34C and 34R beginning at SONDR, shown earlier in Figure 4.2-4. Similar-magnitude decreases in DNL occur in the western

portions of Federal Way west of 8th Avenue South and in eastern sections of Lakeland North, Lakeland South and Edgewood. See also Section 6.1.3 for specific point analyses which follow.

Table 6.1-1 summarizes several key points from the analyses depicted graphically:

- Of the 3,171,686 residents represented by the 40,788 population centroids in the study area, *no one* would be exposed to an increase in noise exposure that exceeds FAA’s criterion for significant impact (a 1.5 dB or greater increase to a DNL of 65 dB or greater) as a result of the Greener Skies Proposed Action, when implemented in 2014 or in the foreseeable future.
- No one would be exposed to increases in noise exposure from the Proposed Action that exceed *any* of FAA’s other criteria for notable changes in the noise environment for any of the study years examined.
- In each of the three study years, there are residents exposed to noise greater than DNL 45 who will experience slight increases in exposure due to the Proposed Action, and others who will experience slight decreases, none of them greater than ± 1 dB. Those experiencing decreases outnumber those experiencing increases by more than 2 to 1.
- For each study year, there are population centroids that are newly exposed to DNL values greater than 65 dB as a result of the Proposed Action. Two occur in 2014, and one each in 2018 and 2023. Three of those are 3 to 3½ miles north of the runway ends and one is about 3¼ miles to the south. All are on runway centerlines. However, the maximum increase in DNL attributable to the Proposed Action is only 0.1 dB in 2014 and 2018 and only 0.2 dB in 2023. Such changes are extremely small and not likely even to be noticed.

Table 6.1-1 Summary Results for Greener Skies Proposed Action

Study Year	Greatest Change in DNL Relative to No Action		Population Experiencing Change		Population Exceeding FAA Order 1050.1E Criteria			Population Newly Exposed to DNL 65 or above
	increase	decrease	increase	decrease	>1.5dB, DNL 65 or above	>3dB from DNL 60-65	>5dB from DNL 45-60	
2014	0.9 dB	-0.8 dB	120,386	277,754	0	0	0	396
2018	0.9 dB	-0.8 dB	123,081	290,391	0	0	0	43
2023	1.1 dB	-0.7 dB	132,484	311,122	0	0	0	214

6.1.3 Results at Selected Points

To further illustrate the DNL values at several specific locations within the Study Area -- in representative areas near SEA, on Vashon Island, under and to the side of new flight paths -- a number of single points were selected and the noise levels compared across the two alternatives and three study years. A map of the locations is shown in Figure 6.1-17 that follows. Table 6.1-2 provides the individual DNL values at each site for each of the alternatives analyzed.

Table 6.1-2. Comparisons of DNL Values for 25 Selected Sites

Point	Site description	Population	DNL Values for 2014			DNL Values for 2018			DNL Values for 2023		
			No Action	Proposed	Difference	No Action	Proposed	Difference	No Action	Proposed	Difference
1	Shoreline, on shoreline	64	40.0	40.2	0.2	40.3	40.5	0.2	40.8	41.1	0.2
2	Seattle, new dogleg to final	46	45.3	45.2	-0.1	45.7	45.6	-0.1	46.3	46.2	-0.1
3	Seattle, at RNAV to ILS	13	49.4	49.5	0.1	49.9	50.0	0.1	50.4	50.6	0.1
4	Seattle, under ILS	84	52.7	52.9	0.2	53.1	53.3	0.2	53.8	54.0	0.2
5	Seattle, to side of ILS	120	50.7	50.6	-0.1	51.1	51.1	-0.1	51.8	51.7	-0.1
6	Seattle, on PBN at shoreline	10	51.4	51.4	0.1	51.8	51.9	0.1	52.5	52.5	0.1
7	Seattle, at Elliott Bay	6	46.7	46.8	0.1	47.1	47.2	0.1	47.6	47.7	0.1
8	Seattle, where PBN joins ILS	44	58.4	58.7	0.2	58.8	59.0	0.2	59.4	59.7	0.2
9	Vashon Isl., north	35	41.2	43.1	1.9	41.5	43.4	1.9	42.1	44.0	1.9
10	Burien, to side of ILS	36	53.9	53.9	0	54.4	54.4	0	55.1	55.1	0
11	Burien, under ILS	24	65.8	65.8	0	66.3	66.3	0	66.9	66.9	0
12	Des Moines, under ILS	31	66.9	66.9	0	67.3	67.3	0	67.9	67.9	0
13	Des Moines, under ILS	42	64.6	64.5	0	64.9	64.9	0	65.5	65.5	0
14	Des Moines, towards water	41	58.7	58.7	0	59.1	59.1	0	59.8	59.8	0
15	Vashon Isl., east	39	43.5	43.5	0	43.8	43.7	0	44.3	44.3	0
16	Vashon Isl., south	46	42.9	43.9	1	43.3	44.2	1	43.8	44.8	1
17	Federal Way, under ILS	497	60.7	61.0	0.3	61.0	61.4	0.3	61.6	61.9	0.3
18	Federal Way, north at shoreline	11	47.6	47.5	-0.1	47.9	47.8	-0.1	48.5	48.4	-0.1
19	Federal Way, under ILS	24	54.6	55.1	0.5	55.0	55.5	0.5	55.6	56.1	0.5
20	Tacoma, downwind to base	23	41.2	42.1	0.9	41.4	42.3	0.9	41.9	42.8	0.9
21	Federal Way, base to final	241	48.9	48.6	-0.3	49.2	48.9	-0.3	49.9	49.6	-0.3
22	Tacoma, base leg	11	43.6	43.1	-0.5	43.8	43.3	-0.5	44.4	44.0	-0.5
23	Puyallup, on final at LORIE	225	47.1	47.8	0.7	47.4	48.1	0.7	48.0	48.7	0.7
24	New HAWKZ approach at SONDR	303	41.5	42.9	1.4	41.8	43.2	1.5	42.2	43.7	1.5
25	New HAWKZ approach at GOALZ	53	31.5	36.1	4.6	31.6	36.4	4.8	32.0	36.8	4.9

Most of the differences at sites whose levels are greater than DNL 45 are on the order of a few tenths of a decibel, both for increases and for decreases. Sites whose exposure is less than DNL 45, such as at Site 9 on the northern tip of Vashon Island, and at Sites 24 and 25 under the new HAWKZ STAR, are exposed to somewhat higher changes but the aircraft noise is below the level of exposure that is normally reportable by the FAA; such values are so low in level to begin with that noise from local community sources (vehicle pass-bys and distant traffic) is apt to partially or totally mask the changes.

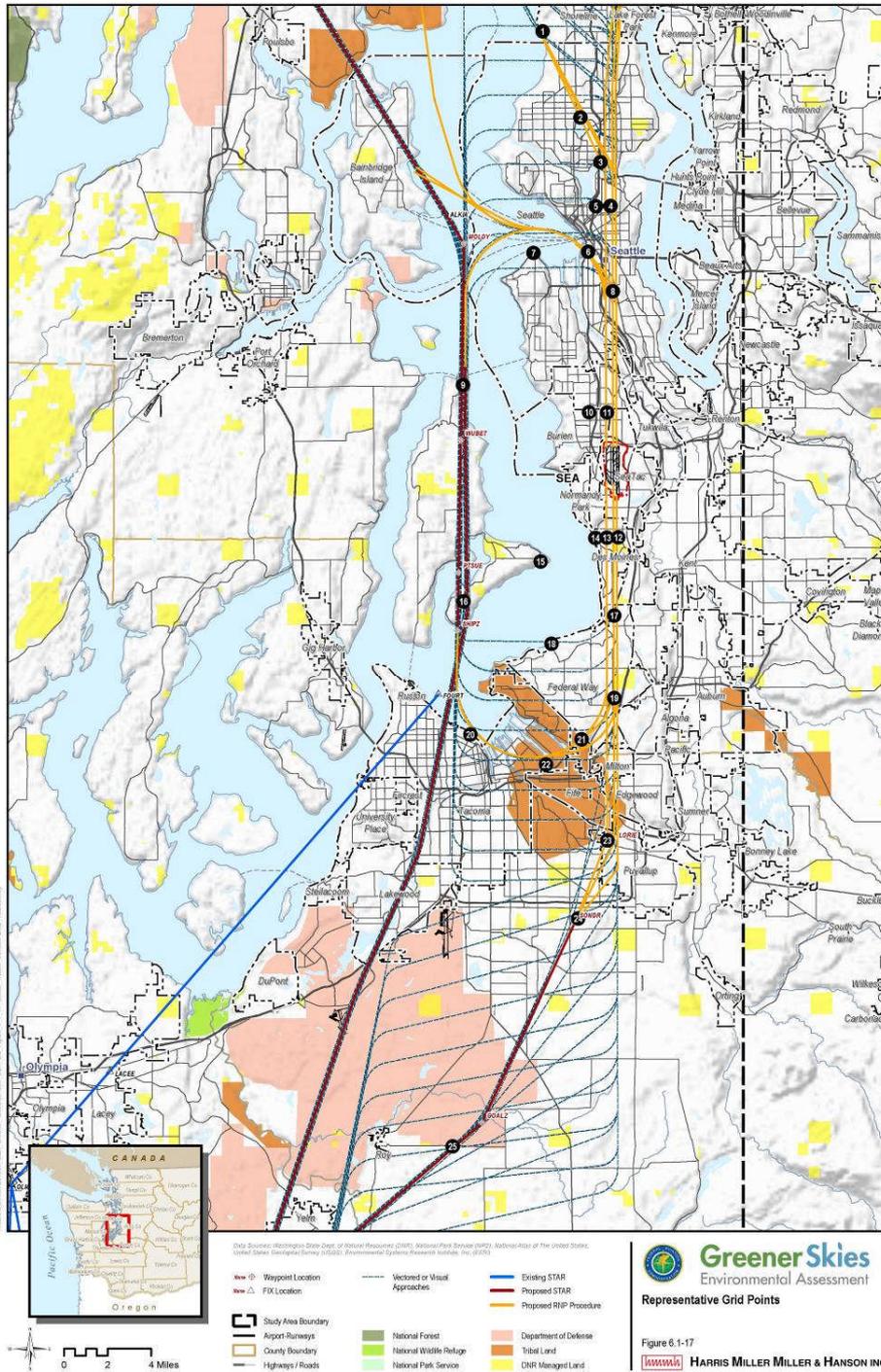


Figure 6.1-17. Representative Grid Points

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6.1.4 Determination

According to the FAA's criterion for significant impact – a 1.5 dB or greater change in noise exposure at a level equal to or greater than 65 dB DNL (see earlier Table 5.2-1) -- no significant impacts due to noise from the Proposed Action were identified. The greatest change in exposure due to proposed Greener Skies procedures for any of the study years examined and for any grid point experiencing noise above DNL 45 was 1.1 dB in 2023, well below FAA criteria for significant impact. No mitigation is required.

6.2 Land Use

FAA land use compatibility guidelines for airport projects are contained in 14 CFR Part 150, Appendix A, Table 1 and are reproduced in FAA Order 1050.1E as well as in Appendix F. The most noise-sensitive uses in that table – residential uses, schools, hospitals, churches, and the like – are considered compatible if the exposure is less than DNL 65 but they are also considered compatible if the exposure is greater than DNL 65 and the structure has been sound insulated or constructed with materials having good noise level reduction characteristics⁸².

The four population centroids that are projected to be newly exposed to levels above DNL 65 as a result of the Proposed Action experience such small increases in exposure (on the order of 0.1 dB through 2018 and up to 0.2 dB in 2023) that they fall well below the FAA criterion for significant impact. Consistent with the guidance provided in FAA Order 1050.1E, “if the noise analysis ...concludes that there is no significant impact, a similar conclusion usually may be drawn with respect to compatible land use.”⁸³ Only if the Proposed Action would result in other impacts exceeding thresholds of significance and having land use implications must the effects on land use be analyzed separately.

6.2.1 Determination

No thresholds of significance in any land use category are exceeded by the Proposed Action in any study year.

6.3 Air Quality

Air quality impacts from the proposed action were evaluated under the EPA General Conformity Regulations (40 CFR Part 93, Subpart B) to ensure the action conforms to the state implementation plan (SIP). The SIP is the strategy used by a state to control air pollution in order that the National Ambient Air Quality Standards (NAAQS) will be met and maintained. The U.S. Environmental Protection Agency (EPA) regulations require that each state devise such a plan or the EPA will impose its own plan for that state.

6.3.1 Methodology

In November 1993, the EPA promulgated two sets of regulations under Section 176C of the Clean Air Act Amendments -- Transportation Conformity Regulations and General Conformity Regulations. These regulations apply to federal actions in areas designated by EPA as non-attainment or maintenance areas.

Transportation Conformity applies to transportation plans, transportation improvement projects (TIPs), and projects funded and approved under the Federal Highway Administration (FHWA), Federal Transit Administration (FTA) or the Federal Transit Act. General Conformity Regulations apply to all other federal actions (e.g. FAA) to ensure the activities conform to SIPs. For airports, most actions, including

⁸² 14 CFR Part 150 and FAA Order 10450.1E, pp. A-15 and A-16, 20 March 2006..

⁸³ FAA Order 1050.1E, para. 4.1a, pg. A-13

this Proposed Action, are subject to the General Conformity Regulation unless they meet one of the above criteria for Transportation Conformity. The General Conformity rule applies to this Proposed Action since the action does not involve motor vehicles and SEA is located in a maintenance area for CO and PM10 (particulate matter). The purpose of the General Conformity Rule is to:

- Ensure that federal activities do not cause or contribute to a new violation of the NAAQS;
- Ensure the actions do not cause additional violations or contribute new violations of the NAAQS; and
- Ensure attainment of the NAAQS is not delayed.

In 2007, FAA issued a Draft Notice in the Federal Register of presumed-to-conform actions under General Conformity. The actions included a list of fifteen airport activities which were identified as resulting in a minimal emission increase (e.g. below *de minimis* or regional significance levels). FAA included airspace redesign as one of the fifteen categories under the title “Air Traffic Control Activities and Adopting Approach, Departure and Enroute Procedures for Air Operation”⁸⁴. FAA completed its notification requirements and published the list of presumed-to-conform actions in the July 30, 2007 Final Federal Register Notice entitled *Federal Presumed to Conform Actions Under General Conformity*⁸⁵. The General Conformity regulations were updated again on April 5, 2010; however, the FAA Presumed-to-Conform Actions remained unchanged from the 2007 update.

Proposed Actions under one of these fifteen categories are presumed to conform to the SIP, and therefore, no qualitative or quantitative air quality analyses are required.

6.3.2 Results

No Action assumes that the Proposed Action would not be implemented and air quality would remain unchanged, therefore no additional air quality impacts would occur.

The Proposed Action is considered an airspace redesign and consists of new arrival procedures known as Area Navigation (RNAV) and Required Navigational Performance (RNP) at SEA. These procedures will allow aircraft to fly more precise flight paths and allow pilots to set and maintain aircraft engines near idle throttle while descending to land. Implementing these procedures will reduce flight times and energy use (i.e. fuel consumption) thereby reducing environmental impacts while also enhancing the safety of operations in the airspace around SEA. In addition to efficiency and reliability, the Proposed Action will:

- Not increase the number of aircraft operations compared to No Action;
- Reduce fuel consumption and emissions through more efficient operations; and
- Does not involve construction or other activity (i.e. increase in ground vehicle use) that could lead to an increase in pollutant emissions when compared to No Action.

Based on FAA research, EPA states in the preamble to the General Conformity Regulations under the “Air Traffic Control Activities and Adopting Approach, Departure and Enroute Procedures for Air Operations” (i.e. Action 14) that:

⁸⁴ FAA, Federal Register, Vol. 72, No. 145, “Federal Presumed to Conform Actions Under General Conformity”, July 30, 2007.

⁸⁵ Ibid.

- Aircraft emissions released above the mixing height (e.g. typically above 3,000 feet) “do not typically have an effect on pollution concentrations at ground level. Therefore, air traffic control actions above the mixing height are presumed to conform”⁸⁶; and
- Changes in air traffic control procedures above 1,500 feet and below the mixing height “would have little if any effect on emissions and ground level concentrations. Accordingly, air traffic actions below the mixing height are also presumed to conform when modifications to routes and procedures are designed to enhance operational efficiency (i.e. reduce delay), increase fuel efficiency, or reduce community noise impacts by means engine thrust reductions”⁸⁷.

The Proposed Action will result in more efficient flight routings and less fuel burned, thereby reducing air pollutant emissions without causing an increase in ground vehicle use. This was further substantiated through the Noise Integrated Routing System (NIRS) modeling of the alternatives for each design year which showed a slight decrease in fuel consumption and emissions compared to No Action. Furthermore, a majority of the flight paths affected by the Proposed Action are above 3,000 feet with no measurable changes below this level.

The Proposed Action satisfies Action 14 (i.e., Air Traffic Control Activity) of the FAA’s Presumed to Conform action list, therefore a detailed air quality analysis was not required.

6.3.3 Determination

The No Action scenario assumes FAA would not implement the Proposed Action, therefore, no additional air quality impacts would occur.

The Proposed Action is a Presumed to Conform Action under FAA, therefore a detailed air quality analysis is not required for the FEA. The Proposed Action will not change the number of aircraft operations and will result in less fuel burned and air emissions compared to No Action.

6.4 Climate Change

Although there are no federal standards for aviation-related GHG emissions, it is well established that GHG emissions can affect climate. The CEQ has indicated that climate should be considered in the NEPA analysis and recent FAA Order 1050.1E Guidance Memo #3 entitled “Considering Greenhouse Gases and Climate under the National Environmental Policy Act (NEPA): Interim Guidance” describes how GHG emissions should be quantified for FAA NEPA reviews –

- When there is reason to quantify emissions for air quality purposes, then metric tons of CO₂ equivalent (MT CO₂e) should also be quantified and reported in the NEPA documentation; or
- When fuel burn is computed and reported in the NEPA document, quantification of MT CO₂e calculated from the fuel burned should also be included in the document.⁸⁸

GHG emissions are commensurate with fuel consumption. As explained in Section 6.3 (discussion of fuel burn) of this document, the Proposed Action will decrease aircraft fuel burn and associated GHG emissions compared to No Action for 2014, 2018 and 2023 conditions. Table 6.4-1 shows the NIRS modeling results for fuel burn and CO₂ emissions for each condition.

⁸⁶ FAA, Federal Register, Vol. 72, No. 145, “Federal Presumed to Conform Actions Under General Conformity”, July 30, 2007.

⁸⁷ FAA, Federal Register, Vol. 72, No. 145, “Federal Presumed to Conform Actions Under General Conformity”, July 30, 2007.

⁸⁸ Cuddy, T., FAA Memorandum – FAA Order 1050.1E, Change 1, Guidance Memo #3, January 12, 2012, pg. 2.

Table 6.4-1. NIRS Model Output for Fuel Burn and CO2 Emissions

Condition	No Action		Proposed Action		Percent Change (Proposed Action vs. No Action)
	Fuel (kg)	MT CO2e	Fuel (kg)	MT CO2e	
2014	1,197,628	3778.5	1,184,022	3735.6	-1.14%
2018	1,315,623	4150.8	1,301,919	4107.6	-1.04%
2023	1,519,014	4792.5	1,503,814	4744.5	-1.00%

Notes: MT CO2e denotes metric tons of CO2e –equivalent.

Based on the NIRS modeling results, GHG emissions associated with the Proposed Action would represent a decrease of 1.0 to 1.14 percent compared to No Action for the 2014, 2018 and 2023 conditions.

In sum, No Action assumes FAA would not implement the Proposed Action; therefore, no additional GHG impacts would occur.

The Proposed Action will not change the number of aircraft operations but will result in 1.14%, 1.04% and 1.0% less fuel burned with commensurately fewer GHG emissions compared to No Action for 2014, 2018 and 2023, respectively. These improvements are the result of new OPDs and shorter flight distances, particularly on the new STARS coming into the Seattle airspace from the southwest.

6.5 Natural Resources and Energy Supply

Consistent with Council on Environmental Quality (CEQ) regulations, this section addresses the potential impacts of the Proposed Action with respect to using consumable natural resources and energy demand as compared with No Action. The section also documents sustainable design aspects of the Proposed Action consistent with FAA policy supporting environmental sustainability.

6.5.1 Methodology

The proposed project would not include any physical development; therefore, only changes in natural resource use related to aircraft operations are evaluated. As described in Section 5.2.6.2, the NIRS model used for the noise analysis also calculated fuel consumption or “fuel burn” for the flights modeled and estimated annual fuel burn for No Action and the Proposed Action.

6.5.2 Results

The following subsections compare the projected energy demands and potential impacts on natural resources of No Action and the Proposed Action to determine if the Proposed Action would cause a substantial demand on available energy or natural resource supplies, or cause a statistically significant increase in fuel consumption. As noted above, the Proposed Action would not entail physically developing or using resources other than aviation fuel used by aircraft flying to and from SEA. The following analyses, therefore, address aircraft fuel consumption.

6.5.2.1 No Action

Under No Action, flight procedures will not change and any increase in fuel burn from 2012 existing conditions (1,051,280 kg) to the 2014 study year conditions (1,197,628 kg) is due to forecast growth in

aviation activity and changes in the mix of aircraft as older aircraft are replaced by newer, more efficient models of aircraft. Table 6.5-1 provides annual average day fuel burn under No Action in 2014, 2018 and 2023. Annual average day fuel burn is projected to increase over time as total operations at SEA continue to grow.

Table 6.5-1. Change in Annual Average Day Fuel Usage at SEA

	2014	2018	2023
No Action average day fuel usage in pounds (kg)	2,640,318 (1,197,628)	2,900,449 (1,315,623)	3,348,849 (1,519,014)
Proposed Action average day fuel usage in pounds (kg)	2,610,319 (1,184,022)	2,870,237 (1,301,919)	3,315,338 (1,503,814)
Total daily change in pounds (kg)	-29,996 (-13,606)	-30,032 (-13,704)	-33,510 (-15,200)
Total daily change (percent)	-1.14	-1.04	-1.00%

6.5.2.2 Proposed Action

The Proposed Action would not entail any physical development; therefore, no natural resources would be used for project construction. Table 6.5-1 provides annual average day fuel usage under the Proposed Action in 2014, 2018 and 2023. Through the study period, implementing the Proposed Action would reduce total average day fuel consumption by approximately 30,000 to 33,500 pounds (or approximately 11 to 12 million pounds annually) compared with No Action — a savings of about 1 percent. This percentage is small when considering total air traffic in and out of SEA because the Proposed Action does not affect any east side arrivals or any departures, regardless of where they are headed.

Nevertheless, there are significant fuel and carbon reductions predicted for several individual routes under the Proposed Action. A detailed analysis of select proposed procedures for all jet aircraft approaches from the northwest and southwest to the three 16 and 34 runways was conducted. The flight tracks analyzed represent the existing flight tracks compared to the implementation of either STAR, RNP or OPD procedures which are designed to reduce miles flown or engine thrust settings set to near idle.

Table 6.5-2 summarizes the jet fuel consumption for approaches into SEA from the northwest and southwest to each of the 16 and 34 runways.

Table 6.5-2 Jet Fuel Burn on Northwest and Southwest Approach Routes

Study Year	Approach	Runways	No Action Jet Fuel Burn (kg)	Proposed Action Jet Fuel Burn (kg)	Change
2014	Northwest	16s	8,793	8,523	-3%
	Northwest	34s	6,273	6,744	8%
	Southwest	16s	31,470	24,084	-23%
	Southwest	34s	18,564	12,620	-32%
2018	Northwest	16s	9,468	9,206	-3%
	Northwest	34s	6,764	7,277	8%
	Southwest	16s	33,517	26,029	-22%
	Southwest	34s	19,718	13,718	-30%
2023	Northwest	16s	10,811	10,531	-3%
	Northwest	34s	7,732	8,312	7%
	Southwest	16s	38,199	29,857	-22%
	Southwest	34s	22,434	15,786	-30%

The detailed analysis of several representative changes that are proposed under Greener Skies shows that, overall, significant fuel reductions in the range of 20 to 30 percent are expected for jets flying the Proposed Action procedures compared to No Action. Not all tracks result in decreases however. For example, in the table above, a slight increase in fuel burn is expected for some arrivals approaching SEA from the northwest, which will extend their downwind leg compared to present routings when given clearance to fly one of the proposed RNP procedures that will guide the aircraft on the curved approach path over Commencement Bay for landing on one of the 34s. Other flight tracks may also experience an increase in fuel burn, compared to No Action. However, as shown earlier in Tables 6.4-1 and 6.5-1, overall, the Proposed Action results in lower fuel use than no action at all.

Although the Proposed Action would not involve any physical development that could be evaluated for sustainability, the Proposed Action would increase overall sustainability at SEA by decreasing the annual fuel usage with additional resultant improvements to air quality (see Section 6.3). As shown in Table 6.5-1, the Proposed Action would reduce fuel consumption compared to No Action by a about 1.14 percent in 2014, and by 1.04 percent in 2018.

6.5.3 Determination

No impacts to natural resources were identified, therefore, no mitigation is needed.

6.6 Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks

This section addresses the socioeconomic impacts, impacts on minority and low-income populations, and children's environmental health and safety risks of the Proposed Action as compared with No Action. Socioeconomic, environmental justice and children's health and safety impacts can result from changes in land use or transportation patterns or from other impacts to the environment, such as noise, air quality, and water quality for example. This analysis draws on the findings of other impact analyses, particularly noise, compatible land use, and air quality.

6.6.1 Methodology

This section describes applicable regulations and standards, FAA recognized thresholds for determining the significance of impacts, and the methodologies used to assess socioeconomic, environmental justice and children's health and safety risk impacts.

6.6.1.1 Socioeconomic Impacts

The Proposed Action would not entail relocation of housing or businesses, changes to local traffic patterns, or loss of tax base. In the absence of potentially significant direct impacts, the socioeconomic analysis considered the potential for the noise or compatible land use impacts, presented in Sections 6.1 and 6.2, to cause indirect impacts through possible changes in land use that could in turn lead to residential or businesses relocation or otherwise affect the local tax base.

6.6.1.2 Environmental Justice

The environmental justice analysis examines the possibility that changes in noise, compatible land use, air quality, and energy supply, as discussed in Section 6.1 through 6.4, would cause a disproportionately high and adverse impact on minority or low-income populations.

6.6.1.3 Children's Environmental Health and Safety Risks

The analysis of children's environmental health risks and safety risks consists of identifying the distribution of persons under the age of 18 in the study area and reviewing the effects of the Proposed Action for areas having higher than average concentrations of young people. In addition, the analysis examined the noise and air quality effects of the Proposed Action in relation to any schools (public and private) based on the findings of Sections 6.1 and 6.3, respectively.

Both the Proposed Action and No Action would provide equivalent levels of safety throughout the study area. Neither alternative would pose a safety risk to persons on the ground. No further analysis of safety risk is required.

6.6.2 Results

The following subsections summarize the analysis of potential socioeconomic and environmental justice impacts and the potential for children's health and safety risks for No Action and the Proposed Action. Potentially significant impacts would be caused by extensive relocation of housing or businesses, disruption of local traffic patterns, or a substantial loss in community tax base.

6.6.2.1 No Action

Under No Action, no changes to flight procedures would occur. Conditions under No Action would differ from existing conditions in that aviation activity levels are expected to increase as forecast and that the existing aircraft fleet will be gradually replaced by quieter and more efficient aircraft. As described in Sections 6.1 and 6.3, the noise and air quality characteristics of this alternative would therefore be similar to existing conditions.

6.6.2.2 Proposed Action

The Proposed Action would not acquire any property, result in the relocation of any residences or businesses, or have any impact on local tax bases. In the absence of acquisition of physical development, changes in noise and air emissions have the greatest potential to affect communities in the study area. Implementing the Proposed Action would not significantly increase noise levels at any location and

would not require changes in land use to maintain current patterns of land use compatibility. In general, implementing the Proposed Action would concentrate flight activity at the lower altitudes where noise levels would be greatest in narrower corridors along the extended centerlines of the runways at SEA. Other areas of increased flight concentration would generally fall over water and would not affect populated areas. Implementing the Proposed Action would reduce air emissions, which would slightly improve air quality in the region. The following subsections summarize these results with respect to socioeconomic impacts, environmental justice, and children’s environmental health and safety risk.

Socioeconomic Impacts

The noise analysis presented in Section 6.1 concludes that no area would be exposed to a significant increase in aircraft noise. The compatible land use analysis presented in Section 6.2 concludes that no changes in land use patterns would be required as a result of implementing the Proposed Action. Due to the lack of significant noise or land use impacts, no significant socioeconomic impacts would occur.

Environmental Justice

As discussed above, no significant noise impacts would occur at any point in the study area. As discussed in Section 6.3.2.2, no adverse impacts to air quality would occur as a result of the Proposed Action, and regional air quality would experience a small benefit as a result of the project. Therefore, no significant environmental justice impacts would occur.

Children’s Environmental Health and Safety Risks

Changes in noise levels would not approach the threshold of significance at any location. Seven schools are located in areas exposed to noise levels at or near DNL 65 dB and one, St. Philomena’s, would experience a slight increase in noise levels in 2014 and 2018. The remaining schools would experience no change or a slight reduction in noise levels. The changes would be less than DNL 0.1 dB, which would not be perceptible. These schools are listed in Table 6.6-1, along with the results of the noise analysis at these locations.

As discussed in Section 6.3.2.2, no adverse impacts to air quality would occur as a result of the Proposed Action, and regional air quality would experience a small benefit as a result of the project. Due to the lack of significant noise and air quality impacts, no significant impact on children’s environmental health would occur.

Table 6.6-1. Noise Levels at Potentially Affected Schools

School	2014		2018	
	No Action	Proposed Action	No Action	Proposed Action
Christian Faith School	65.7	65.7	66.2	66.1
St. Philomena Primary School	67.3	67.4	67.7	67.7
Pacific Middle School	64.2	64.2	64.5	64.5
Mt. Rainier High School	66.5	66.5	66.8	66.8
Midway Elementary School	64.5	64.5	64.8	64.8
Hilltop Elementary School	62.8	62.8	63.2	63.2

School	2014		2018	
	No Action	Proposed Action	No Action	Proposed Action
Southern Heights Elementary School	64.5	64.3	64.9	64.8

6.6.3 Determination

No significant impacts from the project were identified, therefore, no mitigation is necessary.

6.7 Secondary/Induced Impacts

This section addresses the potential for secondary or induced impacts of the Proposed Action as compared with No Action. In describing this environmental impact category, Appendix A of FAA Order 1050.1E, Section 15, provides the following guidance:

Major development proposals often involve the potential for induced or secondary impacts on surrounding communities. When such potential exists, the EA shall describe in general terms such factors. Examples include: shifts in patterns of population movement and growth; public service demands; and changes in business and economic activity to the extent influenced by the airport development. Induced impacts will normally not be significant except where there are also significant impacts in other categories, especially noise, land use, or direct social impacts. In such circumstances, an EIS may be needed.

6.7.1 Methodology

The following subsections discuss the regulations addressing secondary impacts, the methodology used to assess socioeconomic impacts, and the thresholds used to assess the significance of secondary impacts. Impacts identified in Section 6.1, Noise, Section 6.2, Compatible Land Use, Section 6.3, Air Quality, and Section 6.6, Socioeconomic, Environmental Justice, and Children’s Health and Safety Risks, were evaluated to determine if there was potential for these impacts to result in secondary impacts.

6.7.2 Results

The following subsections analyze the potential for secondary and induced impacts for No Action and the Proposed Action. As noted above such impacts could be caused by shifts in patterns of population movement and growth, public service demands, or changes in business and economic activity.

6.7.2.1 No Action

Under No Action, there would be no changes to flight procedures; therefore, there is no potential for secondary or induced impacts.

6.7.2.2 Proposed Action

As documented in the preceding sections, given that the Proposed Action is not expected to change the number of people flying in or out of SEA and given the insignificant noise and air quality impacts, the Proposed Action would not cause shifts in patterns of population movement and growth, public service demands, or changes in business and economic activity. In addition, implementing the proposed procedure changes would not cause significant adverse impacts with respect to noise or compatible land

use and would cause no adverse impacts with respect to air quality, socioeconomics, environmental justice, or children's health and safety. No secondary or induced impacts would, therefore, occur.

6.7.3 Determination

No secondary or induced impacts were identified, therefore no mitigation is necessary.

6.8 Historical, Architectural, Archaeological, and Cultural Resources

This section addresses potential for impacts to historical, architectural, archaeological, and cultural resources from the Proposed Action as compared with No Action. Potential impacts to protected resources could be caused by physical development at or near the protected resource but might also arise indirectly from noise or visual impacts that alter the characteristics of a historic property.

6.8.1 Methodology

The Proposed Action Area of Potential Effect (APE) was defined as the area exposed to a DNL of 65 dB or more at SEA. This includes an area of approximately 4,900 acres and is shown in the Cultural Resources Report in Appendix I. For disclosure purposes, also included in Appendix I is a list of all of the NHRP properties located within the Study Area. There are no properties listed on the NHRP and one cultural resource – an unevaluated archaeological site (45K1772) -- identified in the APE.

An action would adversely affect an NRHP property if it introduces “an atmospheric, audible, or visual feature to the area that would diminish the integrity of the property's setting, provided that setting contributes to the property's historical significance.”⁸⁹ If project-related activities occur within the boundaries of an eligible site, then the undertaking will have an effect on historic properties. For an undertaking to have an adverse effect, it must be demonstrated that the undertaking may alter any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

6.8.2 Results

The following subsections provide an analysis of potential impacts on historical, architectural, archaeological, and cultural resources for No Action and the Proposed Action.

6.8.2.1 No Action

Under No Action, no changes to the flight paths would occur and, therefore, no impacts to historical, architectural, archaeological, or cultural resources would occur.

6.8.2.2 Proposed Action

The Proposed Action would not result in any physical development; therefore, there is no potential for direct impacts to historical, architectural, archaeological, or cultural resources. Indirect effects from changes in noise levels or visual changes could occur in some areas.

In most cases, the Proposed Action would increase the concentration of flight activity toward the center of existing flight corridors. In some cases, this concentration could result in increased visibility of aircraft during the day and aircraft lighting during the night. Visual impacts were assessed by comparing the concentration of flight activity over or near historic properties under No Action (as represented by

⁸⁹ FAA Order 1050.1E, Change 1, Appendix A Section 11.2 m(4)

existing flight track data) to that proposed under Greener Skies. As stated in Section 6.1, the change in the noise levels resulting from the Proposed Action are so small, that even if any of the NRPH properties within the APE have quiet as one of their recognized attributes, this characteristic of the NRHP property would not be diminished as a result of the Proposed Action. Figure 6.8-1 shows the radar tracks of existing flights recorded in 2011 in relation to the entire study area. This figure also shows that the Proposed Action would not introduce aircraft activity into areas that do not currently experience routine overflights. Flights currently occur throughout this area and are visible from all NHRP sites in the APE. In most cases, the Proposed Action would tend to concentrate aircraft along the centerlines of the existing approach corridors to SEA, but the number of aircraft visible from any of the NRHP would not change; accordingly, no visual impacts to historic properties would occur.

A letter was sent to the Washington State Historic Preservation Office (SHPO) on July 24, 2012, requesting concurrence with the definition of the APE and briefly describing the Proposed Action. A statement of Finding of No Adverse Effect and a Section 106 Report was sent to the Washington SHPO on July 31, 2012. In a response dated October 13, 2012, the SHPO concurred with the definition of the APE and with the FAA's Finding of No Adverse Effect in a letter dated October 15, 2012.

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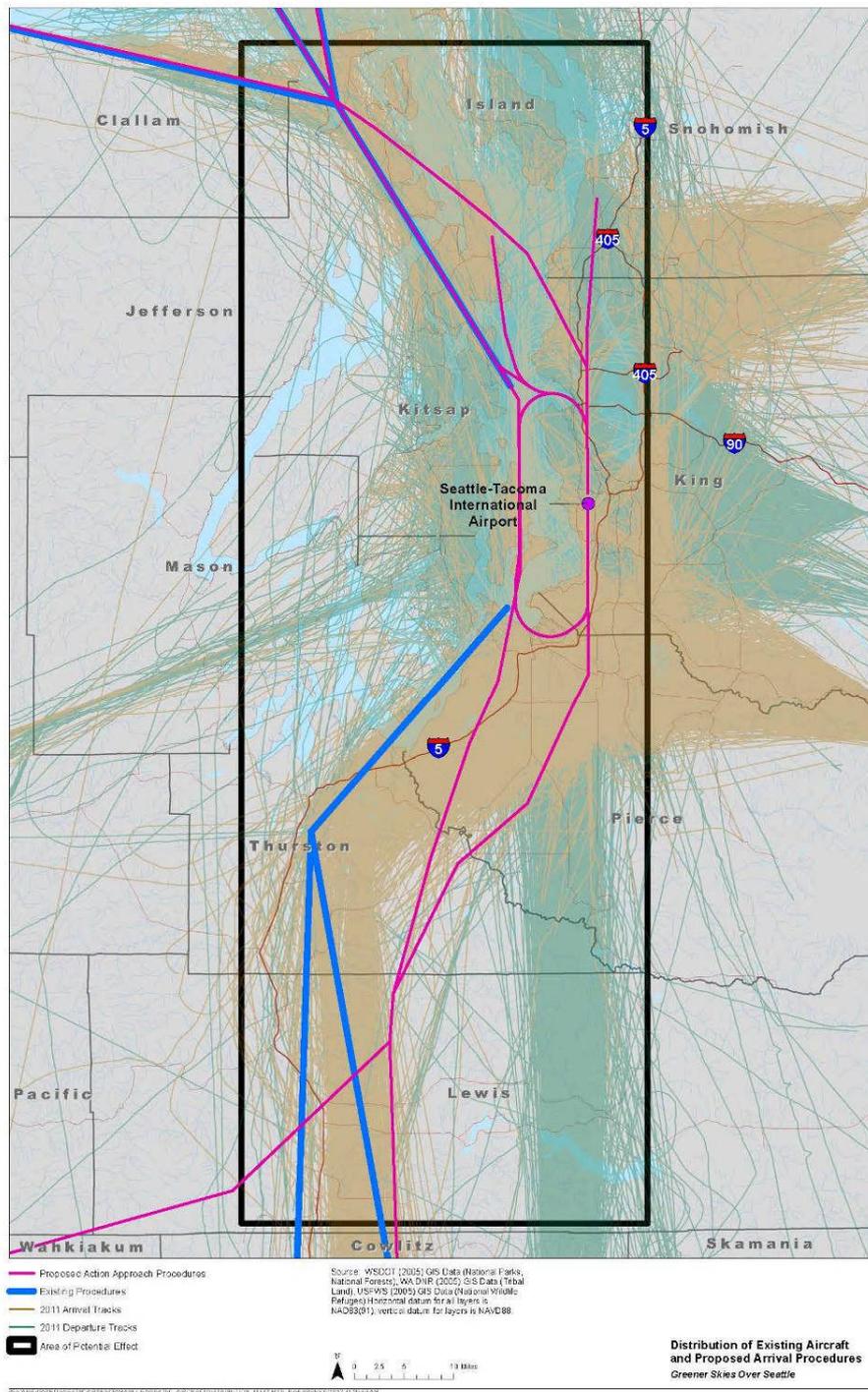


Figure 6.8-1. Distribution of Existing Aircraft and Proposed Arrival Procedures

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6.8.3 Determination

No impacts to historical, architectural, archaeological, or cultural resources would occur, therefore, no mitigation is necessary.

6.9 Department of Transportation Act Section 4(f) and Land and Water Conservation Fund Act Section 6(f)

This section addresses the potential impacts on USDOT Section 4(f) resources from the Proposed Action as compared to No Action. Appendix A of FAA Order 1050.1E, Section 15, defines the requirements of USDOT Section 4(f) as follows:

Section 4(f) of the DOT Act, which is codified and renumbered as section 303(c) of 49 U.S.C., provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance or land from an historic site of national, State, or local significance as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use...

Section 4601, Title 16 USC, The Land and Water Conservation Fund (LWCF) Act, commonly referred to as Section 6(f) states that no public outdoor recreation areas acquired with LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior.

The potential impacts to both Section 4(f) and Section 6(f) were analyzed as described in 6.8.

6.9.1 Methodology

6.9.1.1 Section 4(f): Parks, Wildlife Refuges, Wilderness Areas

The Proposed Action would not require any property acquisition, and there is no potential for direct use; therefore, only the potential for constructive use was evaluated. As noted in Section 5.2.6, constructive, or indirect use would result from noise, air pollution, water quality, or surface transportation effects that substantially diminished the features or attributes of the resource. For instance, an adverse constructive noise impact on a 4(f) resource would occur if the uses within the resource were no longer compatible with noise levels. FAA land use compatibility guidelines identify incompatible noise impacts on most urban recreation resources as noise levels above DNL 75, unless the resource contains a receptor of unusual noise sensitivity, such as a nature exhibit or outdoor amphitheater, which requires a lower level of noise to be compatible.

Existing Section 4(f) resources were identified through review of federal, state, and local parks data and data from the Washington State Department of Archeology and Historic Preservation (DAHP) were reviewed to identify and historic sites. Constructive uses are assessed by comparing the noise analysis results provided in Section 6.1, Noise, with these locations to determine if they would experience a significant noise impact. The analysis also examines the findings of Section 6.2, Compatible Land Use, to determine if the compatibility with of park land use would change at any of these sites. Other potential constructive uses are evaluated based on the impact analysis documented in Section 6.3, Air Quality, and Section 6.8, Historical, Architectural, Archaeological, and Cultural Resources.

6.9.1.2 Section 6(f)

Public outdoor recreation areas with the potential of being section 6(f) resources are identified in Section 5.2.6. The National Park Service (NPS) has determined that conversion of 6(f) parkland occurs under four conditions: 1) property interests are conveyed for non-public outdoor recreation uses; 2) non-recreation uses are made of the project area, or a portion of it; 3) non-eligible indoor facilities are developed within the project area without approval; and 4) public outdoor recreation use of the property is terminated. Because the Proposed Action would not convey 6(f) property and would not include the construction of indoor facilities, there would be a 6(f) impact only if the new procedures included in the Proposed Action would result in the constructive use of a park such that it would cause a permanent and substantial use of the 6(f) property.

6.9.2 Results

The following subsections provide an analysis of potential impacts on Section 4(f) resources for No Action and the Proposed Action. In the absence of direct physical use of any Section 4(f) resource, this analysis examines the potential for the Proposed Action to result in an indirect use of an Section 4(f) property when compared to No Action.

6.9.2.1 No Action

Under No Action, no change to existing flight paths would occur, and no constructive use to USDOT Section 4(f) or 6(f) resources would occur.

6.9.2.2 Proposed Action

Section 4(f): Parks, Wildlife Refuges, Wilderness Areas

As stated in Section 6.1, there would be no significant noise increases over parks, cultural, historic, archaeological sites or other potentially 4(f) properties under the Proposed Action. As discussed in Section 6.3.2.2, there would be no adverse air quality impacts from the project, and there would be a slight benefit in regional air quality. As discussed in Section 6.7.2.2, there would be no adverse effects on historic resources. No constructive use of USDOT Section 4(f) resources would occur.

Section 6(f)

As stated in Section 6.1, there would be no significant noise increases over potential 6(f) properties under the Proposed Action. As discussed in Section 6.3.2.2, there would be no adverse air quality impacts from the project, and there would be a slight benefit in regional air quality. Therefore there would be no effect on 6(f) properties as a result of the Proposed Action.

6.9.3 Determination

No impacts to USDOT Section 4(f) resources were identified, therefore, no mitigation is necessary.

6.10 Fish, Wildlife, and Plants

This section addresses the potential for impacts to fish, wildlife, and plants from the Proposed Action as compared with No Action.

6.10.1 Methodology

Under the Magnuson-Stevens Act, federal agencies must consult with the NMFS with regard to any action authorized, funded, or undertaken that might adversely affect any essential fish habitat identified

under the act. Fish and essential fish habitat would not be impacted by the Proposed Action. Due to the lack of physical development related to the project, there are no potential impacts to fish, plants, and terrestrial wildlife. The impact analysis therefore focuses on birds and specifically migratory birds, threatened and endangered species and bald eagles, protected under the Migratory Bird Treaty Act (MBTA), Endangered Species Act (ESA) and the Bald and Golden Eagle Protection Act, respectively. In particular, according to the USFWS databases, there are two bird species located within the Study Area which are protected under the ESA and one which is proposed to be protected. These species are the Marbled Murrelet, the Bald Eagle and the Streaked-Horned Lark respectively. The Bald Eagle is additionally protected under the Bald and Golden Eagle Protection Act.

The potential for bird strikes is discussed in relation to all species. Information on bird usage in the study area was obtained from the USFWS, and the Washington Department of Fish and Wildlife (WDFW) Marine Bird Density Atlas and Priority Habitat Species databases were also reviewed. Implementing the Proposed Action would alter the vertical and lateral distribution of aircraft using the new procedures. Two sound metrics were used to evaluate potential noise impacts to wildlife refuges due to these changes: the DNL and the maximum sound level (L_{max}). The DNL noise analysis reflects any change in average daily cumulative sound levels due to implementation of the Proposed Action (see Section 6.1). The L_{max} is the maximum instantaneous noise level heard by a receiver during a single aircraft event and reflects any change in maximum sound levels due to the Proposed Action. DNL reflects the total amount of aircraft activity that is close enough to the site to contribute to cumulative noise levels. For this project the type and number of aircraft is the same between No Action and the Proposed Action; therefore, any change in the L_{max} would reflect an increase or a decrease in the distance to the loudest events from the site in question. Both of these metrics are based on the “A-weighted” decibel (dBA), a weighting that most closely approximates the human response to sound. A-weighting also approximates the shapes of hearing threshold curves in birds⁹⁰.

As noted above, the changes in noise levels in the study area are caused by changes in the vertical and lateral distribution of aircraft. These changes are evaluated graphically in areas of high bird concentrations to illustrate the reasons for any changes in noise levels and to assess potential changes in bird-strike risk. In order to understand the current distribution and altitudes of aircraft in north and south flows, a gate-crossing analysis was conducted. Gates, or cross-sections of the airspace, were created to display the vertical and lateral distribution of aircraft flying through the gate using radar data collected in 2011. Gates were drawn across routes where the Proposed Action would present a change over near-shore areas, which included across Elliott Bay between West Seattle and downtown Seattle in the north and across Commencement Bay between Tacoma and Federal Way in the south (See Figure 6.10-1). The resulting plots are shown on Figures 6.10-2 through 6.10-4 in Section 6.10.2.2.

⁹⁰ The costs of chronic noise exposure for terrestrial organisms Jesse R. Barber, Kevin R. Crooks and Kurt M. Fristrup, *Trends in Ecology and Evolution*, Vol. 25, No. 3, p. 180.

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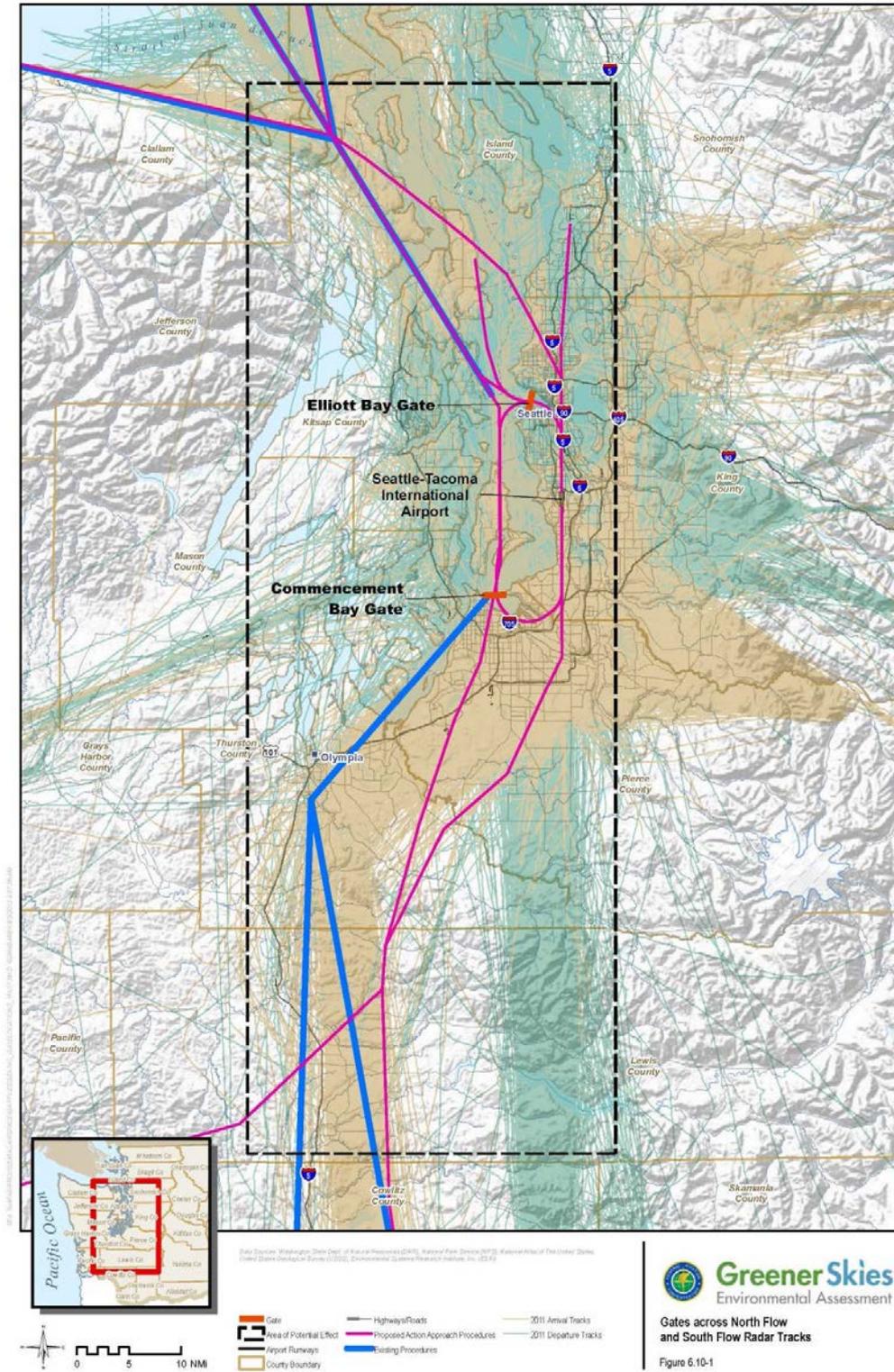


Figure 6.10-1. Gates across North Flow and South Flow Radar Tracks

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6.10.2 Results

Significant impacts would occur if the Proposed Action was likely to jeopardize the existence of a threatened or endangered species, likely to “take” any species protected under the MBTA, or harm Bald or Golden Eagles protected under the Bald and Golden Eagle Protection Act.

6.10.2.1 No Action

The following subsections describe No Action conditions for migratory birds, threatened and endangered species, and Bald and Golden Eagles, in particular looking at bird strike factors.

Migratory Birds

Under No Action, flight paths would remain the same and existing noise levels would not change. Birds that have adapted to existing aircraft flight paths and noise levels in the study area would continue to experience the same levels of urban disturbance.

Threatened and Endangered Birds

Murrelets that have adapted to existing aircraft flight paths and noise levels in the study area would continue to experience the same levels of urban disturbance. Streaked-horned larks are proposed for inclusion as a threatened species under the ESA and would be exposed to a similar potential for bird strike.

Bald and Golden Eagles

Eagles that have adapted to existing aircraft flight paths and noise levels in the study area would continue to experience the same levels of urban disturbance. A similar level of bird strikes would be anticipated for other migratory birds.

6.10.2.2 Proposed Action

The following subsections describe the Proposed Action conditions for migratory birds, threatened and endangered species, and Bald and Golden Eagles, in particular looking at bird strike factors.

Migratory Birds

In general, the Proposed Action would result in a higher concentration of aircraft in the central portion of the Study Area and shift flight paths away from Puget Sound and important bird habitats associated with it. More concentrated flight paths would also benefit birds and wildlife in general because aircraft disturbance would be concentrated over already developed areas where birds and wildlife have adapted to an urban setting. However, proposed flight paths to the northwest of SEA may result in slightly increased noise levels in northern portions of Puget Sound between the Kitsap Peninsula and Everett. DNL noise levels at the three NWRs are shown in Table 6.10-1. L_{max} noise levels at the three NWRs are shown in Table 6.10-2.

The Proposed Action would cause a 0.4 dB increase in DNL over Protection Island NWR. Anticipated noise levels for years 2014 through 2018 range from DNL 30 to 31 dB. As shown in Table 6.10-2, there was no change in the L_{max} sound level between No Action and the Proposed Action at this location. These results indicate implementing the Proposed Action would not adversely affect migratory bird populations.

Table 6.10-1. DNL Noise Analysis for Federal Refuges with Important Bird Habitat

Location	DNL 2014 (dB)		DNL 2018 (dB)	
	No Action	Proposed Action	No Action	Proposed Action
Protection Island NWR	29.9	30.3	30.2	30.6
Dungeness NWR	27.2	26.8	27.5	27.0
Nisqually NWR ¹	35.4	32.6	35.6	32.9

¹ dB for Nisqually NWR is represented by the average DNL for multiple measurements within refuge

Table 6.10-2. L_{max} Noise Analysis for Federal Refuges with Important Bird Habitat

Location	L _{max} 2014 (dB)		L _{max} 2018 (dB)	
	No Action	Proposed Action	No Action	Proposed Action
Protection Island NWR	53.3	53.3	53.3	53.3
Dungeness NWR	56.1	56.1	56.1	56.1
Nisqually NWR ¹	56.1 to 59.6	56.1 to 59.6	56.1 to 59.6	56.1 to 59.6

¹ dB for Nisqually NWR is represented by a range of dB for multiple measurements within refuge

As shown in Table 6.10-1, there would be a 0.5 dB decrease in DNL over Dungeness NWR. Anticipated noise levels for years 2014 through 2018 would be DNL 27 dB. As shown in Table 6.10-2, there was no change in the L_{max} sound level between No Action and the Proposed Action at this location. While the slight decrease is not expected to result in a discernible difference over Dungeness NWR, the decreased air traffic over the area would be an overall benefit. Flight paths over Protection Island and Dungeness NWR would not change; therefore, existing conditions in these areas are not expected to change.

The proposed flight path near Nisqually NWR would change from existing conditions, and the existing STAR that runs between the two portions of the Nisqually NWR would be used less often under the Proposed Action. Instead, flight paths for aircraft arrivals from the north and south would follow a route further east. Therefore, the Proposed Action is expected to result in decreased aircraft noise over Nisqually NWR, thereby benefitting this area. As shown in Table 6.10-1, there would be a 0.2 to 4.3 dB decrease in DNL over Nisqually NWR. Anticipated noise levels for the several grid points modeled in this NWR would average DNL 33 dB for years 2014 through 2018. As shown in Table 6.10-2, there was no change in the L_{max} sound level between No Action and the Proposed Action at this location. While the decrease in noise levels in this NWR is very small, there would be a slight benefit to some areas of Nisqually NWR. In addition, the decreased volume of air traffic over the area would be an overall benefit.

The noise analysis shows increases of less than 1.5 dB in Elliott Bay, with noise levels remaining between 45 and 50 DNL. Other areas of minor increases, also less than 1.5 dB, include the area along the I-5 corridor in Seattle and between SEA and Fife, as well as over downtown Puyallup. Noise levels in these areas would remain between 45 and 55 DNL.

Migratory flight paths are not expected to be significantly impacted by the proposed action. Although the course of aircraft would be pulled tighter together and further to the east away from Puget Sound, aircraft are already utilizing the same airspace. Because the proposed flight paths would be located further inland, it may benefit migratory birds following the shoreline of Puget Sound.

Threatened and Endangered Species: Marbled Murrelet

As previously indicated in Section 5.2.10.2, the areas near the proposed approaches of the Proposed Action do not include suitable marbled murrelet nesting habitat, therefore, the Proposed Action is not expected to result in impacts to nest sites. Rather, the impact discussion focuses on the following two issues: 1) potential noise impacts that might affect near-shore and marine foraging habitat, and 2) direct loss of marbled murrelets through bird strike.

Increased noise levels associated with the proposed flight paths are not anticipated to significantly impact marbled murrelet foraging habitat in Puget Sound. Although the aircraft distribution would change, aircraft are already utilizing the same airspace. The highest concentration of aircraft would generally be over urban areas where there are already known gaps in murrelet distribution. Therefore, near-shore and marine foraging habitat are not expected to be impacted.

Proposed changes to approach procedures are not expected to result in murrelet strikes since seabirds generally fly anywhere between 30 feet and 150 to 200 feet above the water, well below the typical altitude for the area of proposed change.

Threatened and Endangered Species: Streaked-Horned Lark

Some horned larks and streaked-horned larks are known to breed in grassy fields and open areas at airports and are, therefore, accustomed to elevated noise levels. Thus as previously discussed in Chapter 5, bird strike potential is the greater concern for this species. The study area is already used by existing aircraft on approach or departure from SEA and the Proposed Action would not increase the number of aircraft operations at SEA; it would only alter the pattern of the approach from stepped descent to a smooth descent. Therefore, potential for aircraft collision with streaked-horned lark is not expected to change.

Bald and Golden Eagles

Proposed flight paths under the Proposed Action would be more concentrated over urban areas and would be located further inland, away from Puget Sound and associated shorelines. Therefore, the Proposed Action would result in a decreased number of aircraft flying over eagle nesting and foraging habitat within Puget Sound thereby benefitting resident and wintering eagles. As previously stated, bald eagles nesting in Puget Sound have acclimated, to varying degrees, to a semi-urban setting. Therefore, increased noise levels in portions of Puget Sound are not anticipated to adversely affect bald eagles.

Bird Strike Factors

Graphs of “gates” or cross-sections across flight tracks are shown in Figures 6.10-2 through 6.10-4. These figures also show the location of the Proposed Action in relation to the flight tracks. Figure 6.10-2 shows jets heading east through Elliott Bay before turning south to approach SEA from the north. Figure 6.10-3 shows the same jets heading north through Commencement Bay towards Elliott Bay in order to approach SEA from the north. Figure 6.10-4 shows jets heading south through Commencement Bay before turning to head north and approach SEA from the south.

Figure 6.10-2 shows that, over Elliott Bay, arriving jet aircraft typically crossed this gate between 1,500 and 6,000 feet above ground level, with most flying between 3,000 and 5,000 feet. Departing aircraft (not shown) typically cross this gate between 4,000 and 12,000 feet, with most flying between 5,000 and 8,000 feet.

Arriving jet aircraft crossed the Commencement Bay gate in the north flow typically fly between 2,500 and 9,000 feet, with most flying between 5,000 and 7,000 feet (Figure 6.10-3). Arriving jet aircraft crossed the south gate in the south flow typically fly between 10,000 and 13,000 feet. (Figure 6.10-4) Departing aircraft (not shown) crossed this gate typically fly between 9,000 and 17,000 feet, with some flying up to 19,000 feet.

Although the height of migratory flight is highly variable, some shorebirds and raptors, including eagles, fly above 3,000 feet with infrequent altitudes exceeding 5,000 feet, which is within the altitudinal range of most aircraft. However, in general, most migratory birds within the study area likely fly at lower altitudes (under 1,000 feet), and occur below the altitude of most aircraft. Although the pattern of descent would change from a stepped pattern to an optimized profile descent (OPD), flight altitudes would generally not change below 1,000 feet. Therefore, the potential for bird strikes is expected to remain the same as current conditions.

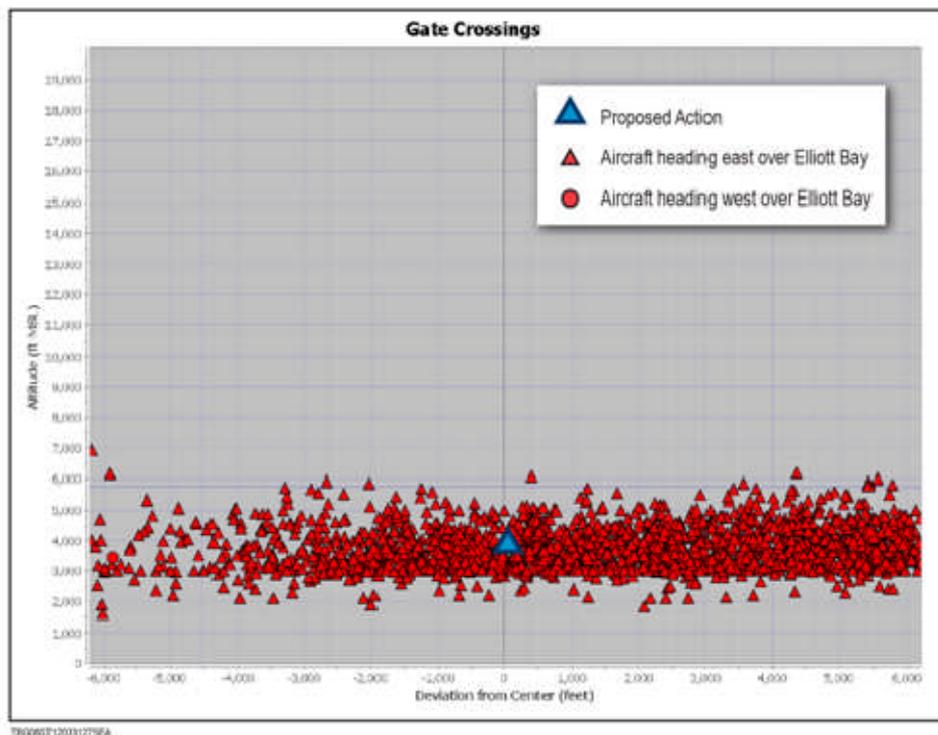


Figure 6.10-2. Elliott Bay Gate: Arrival Jets in South Flow

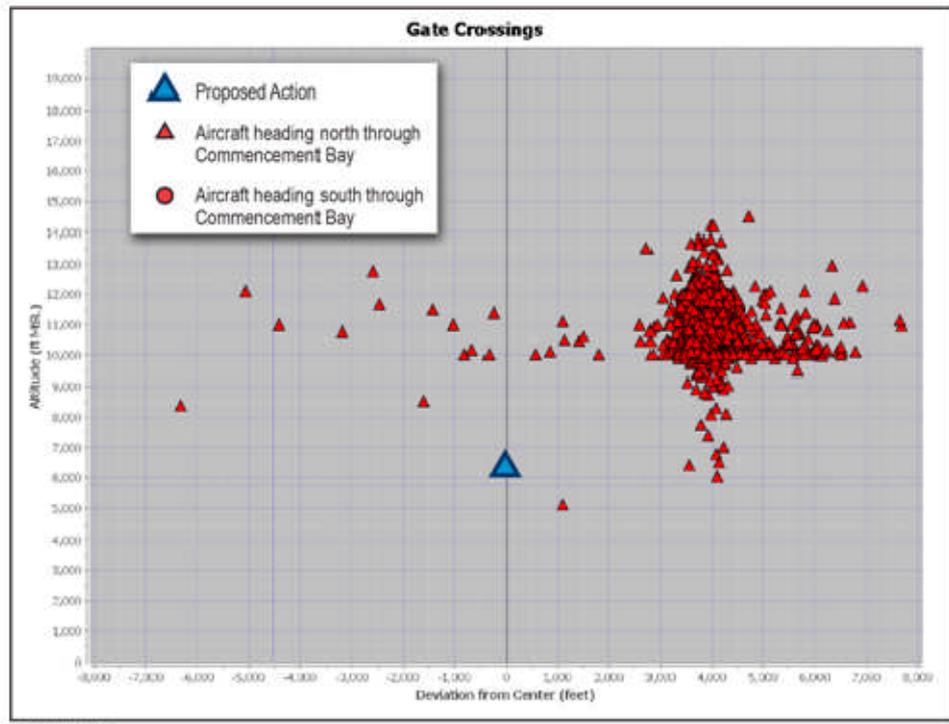


Figure 6.10-3. Commencement Bay Gate-Arrival Jets in South Flow

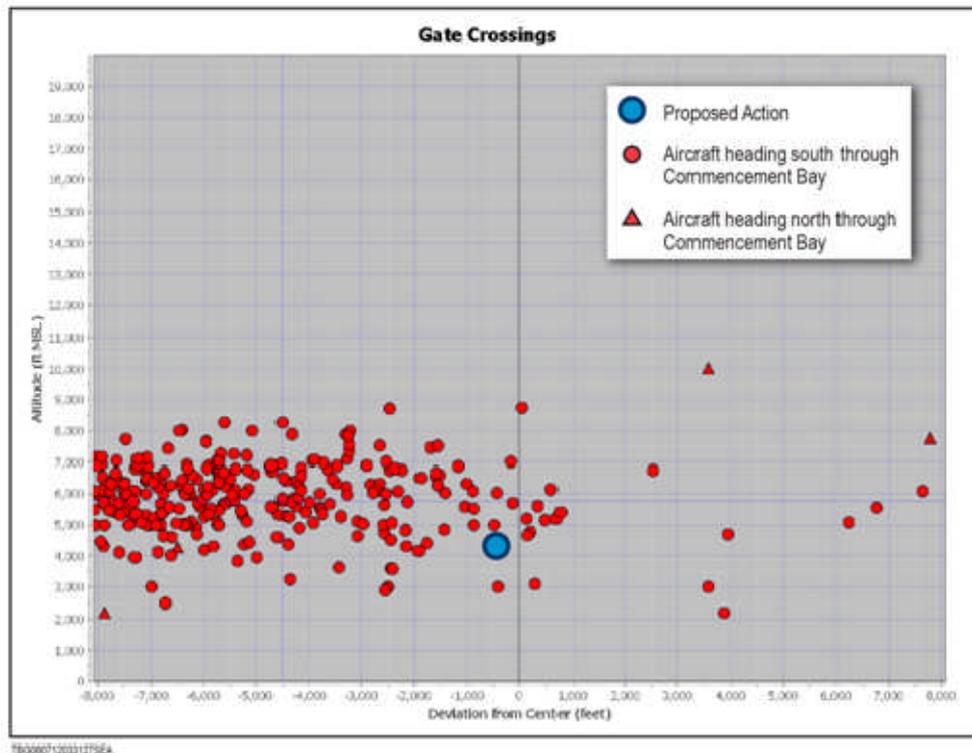


Figure 6.10-4. Commencement Bay Gate: Arrival Jets in North Flow

6.10.3 Determination

No impacts to fish, wildlife, or plants were identified; therefore, no mitigation is necessary.

6.11 Light Emissions and Visual Impacts

This section addresses the potential for changes in light emissions and for visual impacts from the Proposed Action as compared to No Action. Potential impacts to people and properties covered by USDOT Section 4(f) are of primary concern.

6.11.1 Methodology

This section describes the regulatory context, the threshold of significance, and the methodology for the evaluation of project-related changes in light emissions and visual effects.

In most portions of the study area, the Proposed Action would shift some flight activity toward the center of existing flight corridors and, therefore, could result in increased visibility of aircraft during the day and aircraft lighting during the night under these flight paths. Areas with potentially sensitive viewsheds identified in or near the study area include the following:

- Wilderness Areas within Olympic National Park
- Olympic National Park
- Mount Rainier National Park
- Native American reservations (Tulalip, Port Gamble S'Klallam, Suquamish, Muckleshoot, Squaxin Island, Puyallup, and Nisqually)

These sites are shown on Figure 6.11-1, Visually Sensitive Lands. National Parks and National Forest Wilderness Areas are considered sensitive viewsheds because the views in these areas are considered part of the purpose of these designations, and changes in these views could be inconsistent with their designation. Native American reservations were assessed in accordance with FAA Order 1210.20, *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, which require assessment of the “environmental impact of FAA activities on Tribal resources and consider Tribal interests before taking action.”⁹¹

⁹¹ FAA Order 1210.20, American Indian and Alaska Native Tribal Consultation Policy and Procedures; Section 7(b)(5)

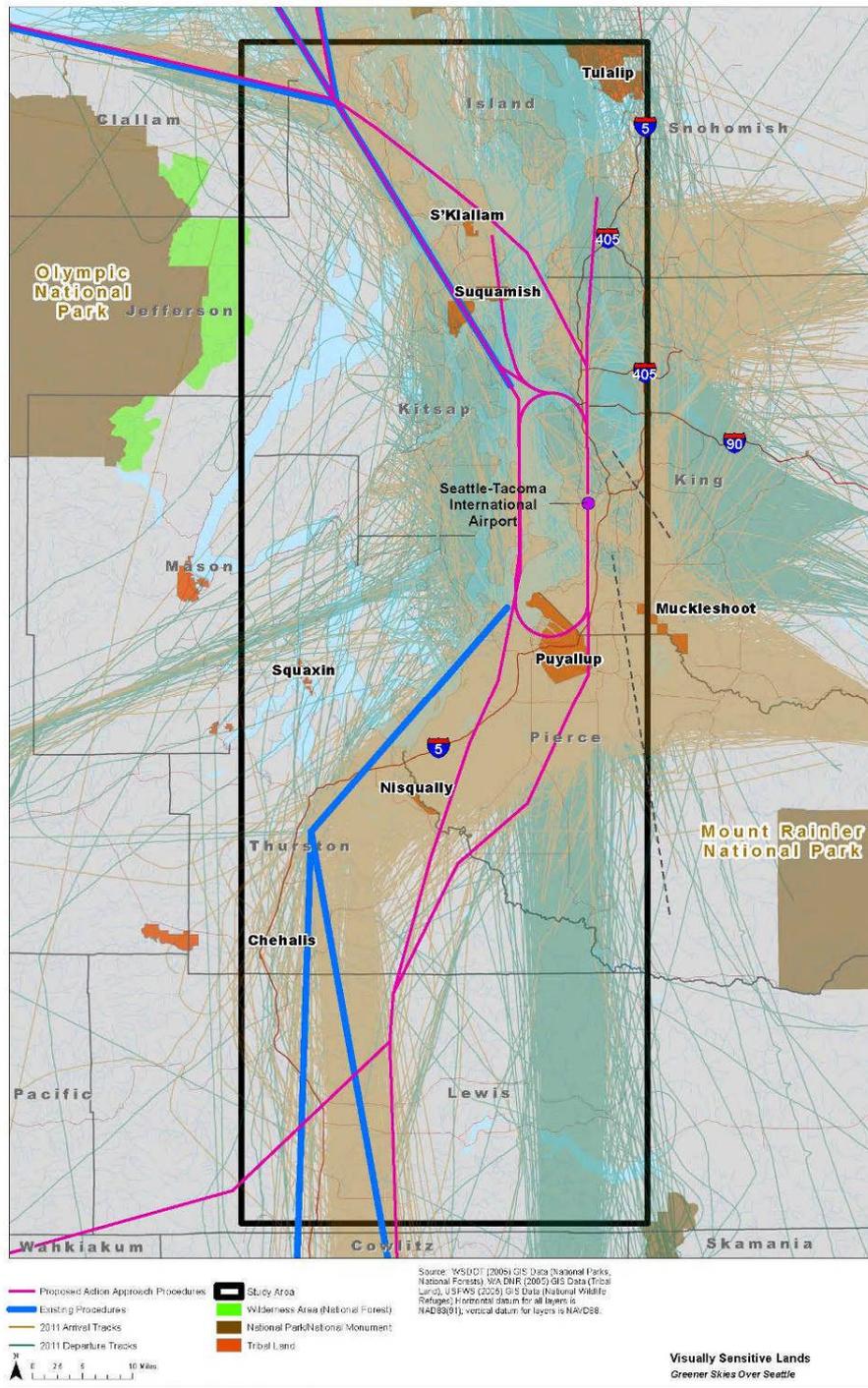


Figure 6.11-1. Visually Sensitive Lands, National Parks and National Forest Wilderness Areas

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Potential impacts were assessed by identifying the changes in the Standard Terminal Arrival Route (STAR) procedures relative to each sensitive location based on the distance measured between the closest point between the site and the existing and proposed STARs. The locations of the Native American reservations, which are closer to or under the existing and proposed STARs, were also overlaid with the existing radar tracks, to show where aircraft currently fly relative to the reservations (Figure 6.11-1). These radar data are based on data collected for one week each month during 2011, to provide a picture of aircraft airspace use throughout the year (see Chapter 2). These data show the divergence of air traffic over the Puget Sound area under current procedures, where they are vectored by air traffic control (ATC). Although some of this traffic would become concentrated on the proposed STAR procedures, other aircraft would continue to be vectored by air traffic control because they would not be equipped to use the STAR procedures.

6.11.2 Results

The following subsections provide an analysis of potential visual and light emission impacts for No Action and the Proposed Action.

6.11.2.1 No Action

Under No Action, no change to existing flight paths would occur and aircraft would continue to be seen on their current flight paths. No impact would occur because there would be no change from the current condition.

6.11.2.2 Proposed Action

No change to lighting is proposed at SEA as part of this project; therefore, the only potential for visual change or light emissions would be relate to the change in aircraft flight paths. Changes in flight paths could affect the visibility of aircraft and their navigation lights. While aircraft navigation lights are not directed toward the ground and are not likely to be intrusive, landing lights used by aircraft on final approach are most likely to be noticeable to people on the ground. The Proposed Action would not materially alter the final approach paths to the runways at SEA because aircraft on final descent are already concentrated on the centerlines of the runways. The proposed action would not, therefore, alter light emissions.

The sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact. Figure 6.11-1 shows that the Proposed Action would not introduce flight activity into any area that does not currently experience routine overflights and would concentrate those aircraft using the new procedures toward the center of existing routes. Flight paths would be the same under all analysis years for the Proposed Action, so this analysis did not consider different analysis years, only one future condition.

Although the proposed arrival procedures (STARs) that are included in the Proposed Action (see Section 3.1) could increase or decrease the number of flights and/or the altitude of flights over the visually sensitive areas identified above in Section 6.10.1.3, these aircraft would continue to operate at distances that are not normally intrusive.

6.11.3 Determination

The Proposed Action would not result in any impacts; therefore, no mitigation is necessary.

6.12 Cumulative Impacts

NEPA requires that cumulative effects be evaluated along with the direct and indirect effects of the proposed actions. CEQ regulations for implementing NEPA define cumulative effects as:

...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR §1508.7). Cumulative impacts can result from actions which are individually minor, but collectively significant over a period of time. The cumulative impact of implementation of either the Proposed Action or the No Action alternative, when added with other known past, present and reasonably foreseeable actions, would be collectively insignificant.

CEQ has provided guidance in considering the cumulative effect of federal actions as follows:

Section 1508.25 (a)(2) requires NEPA documents to address cumulative actions that, when viewed with other proposed actions, have cumulatively significant impacts. Those actions and their impacts, therefore, should be addressed in the same impact statement.

CEQ's handbook entitled "Considering Cumulative Effects Under the National Environmental Policy Act", January 1997, provides guidance specifically addressing cumulative impacts and the requirements of CEQ regulations Section 1508.

CEQ's Guidance on the Consideration of Past Actions in the Cumulative Effects Analysis, June 24, 2005, discusses how to determine the past actions needed for agency decision-making. Among other things, the guidance notes that agencies may focus on the current aggregate effects of past actions. Agencies need not delve into each individual past action's historical details.

CEQ guidance⁹² provides the following guidance in assessing the impacts of cumulative actions:

The significance of effects should be determined based on context and intensity. In its implementing regulations for NEPA, CEQ states that 'the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality (40 CFR1508.27). Significance may vary with the setting of the proposed action. Intensity refers to the severity of the effect (40 CFR 1508.27). Factors that have been used to define intensity of effects include magnitude, geographic extent, duration, and frequency of effects.

The No Action scenario serves as the reference against which cumulative effects are measured. This analysis uses the same thresholds of significance used to assess the environmental impacts of the Proposed Action discussed under each resource. When numerical thresholds were not available or could not be determined, impacts were analyzed in terms of relative magnitude or were assessed qualitatively..

6.12.1 Methodology

6.12.1.1 This analysis addresses the cumulative effects resulting from the impacts of the Proposed Action when combined with the impacts of other past, present, and reasonably foreseeable projects in the region that could affect the same environmental resources. In order to contribute to a cumulative impact, the Proposed Action must first have an impact. Resources where the Proposed Action could contribute to cumulative impacts were identified and compared with past, present, and reasonably foreseeable future projects that

⁹² Council on Environmental Quality. 1997. Considering Cumulative Impacts, page 44.

might also have impacts in these same resource categories. Past, Present, and Reasonably Foreseeable Future Actions

Table 6.12-1 identifies projects within the study area that could contribute to cumulative impacts when combined with the effects of the Proposed Action. Projects listed could also change procedures at larger airports within the study area as well as those that could result in changes to aircraft noise.

Table 6.12-1. Past, Present, and Reasonably Foreseeable Future Projects

Project	Project Description	Schedule
Past		
Runway 16R/34L	This project entailed construction of Runway 16R/34L, the third parallel runway on the western side of SEA.	Opened in 2008.
Present		
Testing of I-2 Measures	This project is collecting data useful for the evaluation and implementation of I-2 Measures policies and air traffic management tools, (see below) for the purposes of evaluating flight data, validating procedures, identifying and implementing changes and/or improvements for pilots and air traffic control, and developing implementation plans for actions derived from the I-2 Measures.	No time line for the completion of the implementation of the I-2 Measures as a whole.
SEA Part 150 Study	The goal of the Part 150 Study is to determine where noise impacts from SEA are experienced the most, as well as the type of noise people experience from various airport sources. The study will also develop and recommend actions that can lessen the effects of aircraft noise.	Draft report for public review by end of 2012.
Future		
I-2 Measures	The I-2 Measures, if feasible, may allow for independent parallel approaches on two runways at SEA or at runways at SEA and BFI.	First full year of implementation expected to be 2018.
Rehabilitation of Runway 16C/34C at SEA	This project will involve rehabilitation of the center runway at SEA and shifting the current operations at 16C/34C to the other two runways	Expected to begin in 2016

BFI Boeing Field
 FAR Federal Aviation Regulations
 PAE Paine Field
 SEA Seattle-Tacoma International Airport

6.12.2 Results

As shown in Sections 6.1 through 6.11, noise is the only environmental resource area where some change would occur and, therefore, the only resource area for which the Proposed Action would have the potential to contribute to cumulative impacts. Significant cumulative impacts depend on the intensity, duration and frequency of effects. These generally include actions at SEA or other area airports that would change the number or type of operations and would change airspace use at these airports. The analysis of potential cumulative impacts focuses on resources identified as having potential for impacts and does not evaluate potential cumulative impacts for resources with no potential for impacts from the Proposed Action.

Of the projects identified in Table 6.12-1, only the construction of Runway 16R/34L, the rehabilitation of Runway 16C/34C, and implementation of the I-2 Measures currently under study have the potential of contributing to the cumulative noise impacts of the Proposed Action. The Port of Seattle is conducting a Part 150 Noise Study for SEA. A draft report is due for public comment by the end of the year. The Part 150 Study process is designed to identify noise incompatibilities due to current and forecast operations,

and to recommend measures to both correct existing incompatibilities and to prevent future incompatibilities. To this end, noise incompatibilities are defined as residences or public use noise-sensitive facilities (libraries, churches, schools, nursing homes, and hospitals) within the 65 DNL noise contour. Given that the Proposed Action does not change the 65 DNL at SEA and a Part 150 study does not increase the 65 DNL and may even mitigate the impact of the existing 65 DNL, there would be no cumulative impact resulting from the Proposed Action and the Part 150 study. Discussion of the only three projects that could create cumulative impacts follows:

- **Construction of Runway 16R/34L:** As noted in the 1997 FAA Record of Decision (ROD) for this project⁹³ the final supplemental environmental impact statement (FSEIS) acknowledged that, "... after the year 2010 there would likely be some level of adverse noise and land use impacts resulting from the approval of the preferred development alternatives, when compared to the no action alternative after that date." The FAA, therefore, required the Port of Seattle to expand its ongoing noise remedy program to include the areas newly exposed to significant (DNL 65 dB or greater) noise levels. The Proposed Action does not alter flight profiles or tracks within the area exposed to noise levels of the DNL 65 dB or above and would have a negligible effect on noise levels this close to the runway ends. The effects of the Proposed Action, when considered in combination with the effects of Runway 16R/34L, would not be significant.
- **Rehabilitation of Runway 16C/34C:** Approximately 45% of current arrivals and 25% of current departures utilize Runway 16C/34C. Once this runway is closed for rehabilitation, these operations will be shifted in the short term to Runways 16 R/L and 34 R/L. While the distribution of operations for this short term change would be unaffected by the implementation of the Proposed Action, since the Runway Rehab is still in the planning stages it is unknown what the short or long term impact would be of the project. Given the minimal level of noise impacts from the Proposed Action, as described in Section 6.1, it is not expected that the cumulative impacts of the Proposed Action combined with the operational shift from the Runway Rehab would result in permanent significant noise impacts. Therefore, the effects of the Proposed Action, when considered in combination with the effects of rehabilitating Runway 16C/34C, would not be significant.
- **Implementation of the I-2 Measures:** The addition of new I-2 policies, procedures and air traffic management tools currently under study is hoped to improve air traffic control efficiency and increase the use of the Proposed Action approach procedures by allowing ATC to apply reduced separation standards to curved RNP and RNP-to-ILS approaches. If feasible and safe, the reduced standards would permit simultaneous independent and dependent parallel approaches without the current minimum 1,000-foot vertical separation from aircraft on approach to an adjacent runway. Referred to as "RNP Established", the reduced separations would be expected to result in shorter downwind legs and greater use of OPDs. Such measures are within potential reach because of the huge improvements in precision routing of aircraft to very tight tolerances, in some cases down to ± 0.03 or even ± 0.01 NM (68 feet), the latter being about half the wingspan of a Boeing 757. Commensurate with the increased use of OPDs and shorter downwind legs are reduced fuel burn and carbon emissions providing further environmental benefit.

The FAA is currently undergoing modeling and simulation analysis of the potential reduced separation standards, with a report due by the end of the calendar year. By the end of 2013, a safety analysis of these reduced separations is intended to be completed, at which point the safety management system

⁹³ U. S. Department Of Transportation, Federal Aviation Administration Northwest Mountain Region Record Of Decision For The Master Plan Update Development Actions at Sea-Tac International Airport July 3, 1997

process will be initiated. All of this needs to be completed prior to the initiation of the policy change process, which would then implement the reduced separation standards. There is no time line for the completion of the implementation of the I-2 Measures as a whole.

In summary, at this point in time, it is not certain that the I-2 Measures will be approved, and in what form. Even though the I-2 Measures may enhance the I-1 procedures, it is not reasonably foreseeable that the implementation of this I-2 Measures would increase operations over those already analyzed for the I-1 procedures at SEA, because there is not enough information available to currently conduct any further analysis on the potential impacts of the I-2 Measures or the cumulative impacts related to I-1 procedures and the I-2 Measures.

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7 AGENCY AND PUBLIC COORDINATION

This chapter presents the approach to agency, tribal, and public coordination, including early public scoping and tribal and agency coordination meetings as well as a discussion of the follow-up tribal and agency meetings and two public workshops that were held following the release of the DEA. Appendix K presents actual documents that were used in the agency and tribal meetings, while Appendix L presents actual documents used in the public meetings.

7.1 Scoping Objectives and Process

Scoping is as an early and open process for determining the scope of issues to be addressed in an environmental review process and to identify the potentially significant and non-significant issues related to a proposed action (40 CFR 1501.7). Scoping as described in 40 CFR 1501.7 is required for an Environmental Impact Statement but optional in the case of an EA. The FAA considers an open public process to be an important component of this project and therefore decided to conduct scoping with the following specific goals in mind:

- Identify significant issues to be analyzed in greater depth;
- Clarify legal responsibilities and areas of environmental analysis requiring special expertise;
- Encourage the public to provide their input and concerns;
- Identify and eliminate from detailed study any issues that are insignificant or which have been covered by prior environmental review;
- Establish the extent of the study area; and Identify available technical information.

The FAA disseminated project information, solicited comments, and conducted public agency scoping meetings in an effort to achieve these goals.

7.1.1 Scoping Notification and Information Provided

Information about the project was distributed via invitations to scoping meetings, emails, advertisements in newspapers and the project website. An agency scoping meeting and a series of two (2) public scoping meetings held in January 2012. In addition to the scoping completed for the DEA, the FAA met with other stakeholders to discuss the project. Throughout the development of the RNAV and RNP procedures, the FAA met frequently with agencies, airport sponsors, cities and counties, as well as interested citizen groups to disseminate information on the procedure development and to better understand potential concerns regarding the proposed procedures.

7.1.1.1 Notification for Agency and Tribal Scoping Meetings

Potentially interested agencies and community organizations listed in Appendix K were invited by letter to attend a scoping meeting on Thursday, January 26, 2012. That letter also invited comment through the scoping period (i.e., through February 29, 2012). A sample scoping meeting invitation letter is included in Appendix K.

Potentially interested tribes listed in Appendix K were invited to attend a tribal consultation meeting on Thursday January 26, 2012. That letter also invited comment through the scoping period (i.e., through February 29, 2012). A sample meeting invitation letter is included in Appendix K.

7.1.1.2 Notification for Public Scoping Meetings

The public scoping meetings were advertised in The Seattle Times on January 5, 2012 and January 12, 2012; the advertisement also ran online on The Seattle Times website for a total of 14 days. In addition, the meetings were advertised in The Highline Times on Friday, January 6, 2012. Copies of the scoping meeting notices and scoping contacts are included in Appendix L.

7.1.2 Scoping Meetings

An Agency Scoping Meeting and two Public Scoping Meetings were held in January 2012 to provide opportunity for interested stakeholders and citizens to learn about the Proposed Action, ask questions, and provide comments and feedback. FAA representatives also provided opportunity for tribal consultation, but no representatives attended.

7.1.2.1 Agency Scoping Meeting

The Agency Scoping Meeting was held on Thursday, January 26, 2012 from 1:30 to 3:00 p.m. at the Rainier Room, 1601 East Valley Highway, Renton, WA. Eight (8) agency attendees were at the meeting. Table 7.1-1 provides a list of agencies and organizations in attendance at the Agency Scoping Meeting.

Table 7.1-1. Agency Scoping Meeting Participants

Agency	Representative
National Marine Fisheries Service	Mike Grady
Puget Sound Regional Council	Stephen Kiehl
City of Tukwila	Stacy MacGregor
WSDOT, Aviation	Carter Timmerman
Port of Seattle	Steve Rybolt
Department of Ecology	Nick Roach
Port of Seattle	Michael Carroll
Port of Seattle	Stan Shepherd

A PowerPoint presentation was provided to the group with project background, the elements of the DEA, the Proposed Action and Purpose Need, and the preliminary study area. Attendees were provided the opportunity to ask the FAA and project team questions during and following the presentation. The project boards displayed at the Public Scoping Meetings were also exhibited at the Agency Scoping Meeting. Copies of the Agency Scoping Meeting presentation and the agency handout are provided in Appendix L.

7.1.3 Public Scoping Meetings

Two public scoping meetings were held. Although the information relayed was identical each night, two different locations to provide access to communities north of SEA (Shoreline) and south of SEA (Federal Way). The meeting locations and schedule are provided in Table 7.1-2.

Table 7.1-2. Scoping Meeting Schedule and Locations

Meeting Type	Date	Location	Time	Number of Attendees
Agency Scoping Meeting	Thursday, January 26, 2012	Rainier Room, 1601 East Valley Highway, Renton, WA	1:30 – 3:00 p.m.	8
Public Scoping Meeting	Wednesday, January 25, 2012	Federal Way 320th Library, 848 S. 320th Street, Federal Way, WA	6:00 – 8:00 p.m.	19
Public Scoping Meeting	Thursday, January 26, 2012	Shoreline Conference Center, 18560 1st Avenue N.E., Shoreline, WA	6:00 – 8:00 p.m.	2

The scoping meetings were held in an “Open House” format and also included a 30-minute PowerPoint presentation by the Project Manager. Six (6) poster-size project boards were displayed at each of the meetings to provide relevant project and process information. Attendees were encouraged to circulate among the display boards where FAA and contractor staff were available to answer questions and discuss the Proposed Action with the public.

Copies of the presentation and of the display boards are provided in Appendix L. Approximately 20 members of the general public attended the scoping meetings on January 25th and 26th. Table 7.1-2 provides a breakdown of scoping meeting attendees by type and date.

7.2 Scoping Comments

Agencies and the public were invited to comment on the Proposed Action using several methods during the scoping process. During the public meetings, self-addressed comment cards were made available for written comments that could be either left at the meeting or sent in via mail. Attendees also had the option to submit scoping comments via email. It was requested that comments be submitted by February 29, 2012, in order to allow the FAA time to identify issues early in the Draft EA process and to maintain the project timeline.

7.2.1 Comment Sources

A total of fifteen (15) written comments were received during the scoping period. The majority of comments were provided via email (11 comments provided by 7 individuals), one public comment form was submitted, and two letters were submitted as attachments to email comments (in addition to the 11 comments identified above). Appendix L contains the scoping comments received.

The majority of comments received were from the public. Other comments were received from local jurisdictions (the City of Tukwila, the City of Federal Way, and the City of Medina), SEA representatives (Port of Seattle), and Agency representatives (State of Washington Department of Ecology).

7.2.2 Primary issues and Concerns

All comment letters and emails were reviewed and entered into a database which was coded according to the issue(s) raised in the letter/email. Many of the comments addressed more than one issue. Table 7.2-1 summarizes the number of comments received on each topic.

Table 7.2-1. Number of Comments Received, by Topic

Topic	Number of Comments Received
Noise	7
NEPA Process	7
Air Quality	5
Fuel burn	2
Safety	1
Wildlife	1

Each of the comment topics is discussed below, followed by discussion of how the FAA addressed the issue in the DEA analysis and documentation. All issues were addressed in compliance with the requirements of NEPA (42 USC 4321), the CEQ Regulations for Implementing NEPA (40 CFR 1500-1508), and FAA Order 1050.1E, Policies and Procedures for Considering Environmental Impacts. The issues were also addressed in compliance with applicable executive orders and other relevant Federal and State requirements.

7.2.2.1 Noise

Seven comments expressed concern about possible noise impacts of the proposed action. Specific concerns included the following:

- Concern for the possible health and environmental impacts caused by a possible “aborted” approach, and discussion of projected health impacts, including increased toxins, blood pressure, etc.
- Possible impacts of proposed action on the “Four Post Plan” and noise impacts of more concentrated flight paths in neighborhoods.
- Possible noise impacts over communities that have not previously been exposed to noise.
- Need for study to include supplemental noise metrics, including lower DNL, single event metrics, grid point analysis, and quantified population exposures under existing and proposed conditions.
- The DEA should include discussion of actual noise impacts resulting from implementation of RNAV and RNP procedures at other airports.

Comment Response:

The major technical emphasis of the DEA was on noise and noise-related impacts. The FAA used the most current version of the Noise Impact Routing System (NIRS) to prepare the analyses. NIRS is the FAA’s approved noise model for environmental analyses of air traffic changes.

Because this is an air traffic airspace action, the noise analysis focused on changes in noise levels at population points, cultural and historic areas, and Department of Transportation (DOT) Section 4(f) resource points throughout the study area, as stated in FAA Order 1050.1E. A significant noise impact would occur if analysis showed that the Proposed Action would cause noise sensitive areas to experience an increase in DNL of 1.5 decibels (dB) or more at or above DNL 65 dB noise exposure when compared to No Action for the same timeframe. DNL is the 24-hour average sound level in decibels (dB). This

average is derived from all aircraft operations during a 24-hour period that represents an airport's average annual operational day. DNL has been widely accepted as the best available method to describe aircraft noise exposure and is the noise descriptor required by the FAA for use in aircraft noise exposure analyses and noise compatibility planning.

Special consideration was given to the evaluation of the significance of noise impacts on noise sensitive areas within national wildlife refuges and historic sites, including traditional cultural properties in coordination with the responsible resource agency.

Noise contours were not prepared for the analysis. Rather, NIRS was used to produce change-of-exposure tables and maps at population centroids using the criteria stated in FAA Order 1050.1E. Graphics were produced illustrating noise levels and noise level changes by color. Additionally, changes in noise exposure at grid points representing noise sensitive locations within the study area were disclosed.

7.2.2.2 NEPA Process

A number of comments were made requesting clarification of the NEPA process or with requests for additional information, including:

- Possible implications of FAA Reauthorization on current project
- Request for presentation to residents of Federal Way, including expected altitudes of aircraft over noise sensitive communities
- Encouragement of additional community outreach, including using resources/experience of the Port of Seattle
- Need for DEA to be on website
- Discussion of how results of research conducted under Initiative 2 will be disseminated to community
- Need to add additional contacts for City of Tukwilla

Comment Response:

The project included a comprehensive outreach plan, including a project website. The FAA has provided project briefings to a number of communities.

7.2.2.3 Air Quality

There were five comments made concerning air quality and aircraft emissions, with focus on understanding how the proposed action might alter concentrations of pollutants or otherwise change air quality in the region.

Comment Response:

The DEA included an air quality analysis that addressed these comments.

7.2.2.4 Fuel burn

One comment was made in support of the project and anticipated reduction in aircraft fuel burn. Another comment emphasized the need to quantify fuel burn benefits.

Comment Response:

The DEA included a quantification of fuel burn benefits.

7.2.2.5 Safety

One commenter was concerned about the potential safety impacts of “aborted RNAV” approaches and how that would be addressed in the DEA. The commenter asked that the study address how many of these occurrences might be expected, and the impact they would have on the community, including children.

7.2.2.6 Wildlife

One commenter expressed concern that changes to existing flight tracks might have impacts on wildlife.

7.3 Follow-up Tribal and Agency Meetings and Public Workshops

Following completion of the resource analyses in the environmental assessment process, the Draft Environmental Assessment was released for public comment on August 7, 2012. That was followed by new Tribal and Agency meetings and by two public workshops, which were held to present the findings of the analyses and give attendees the opportunity to discuss concerns with subject matter experts. The Tribal and Agency meetings were held consecutively on the morning of September 5, 2012 and included a 30-minute presentation and an opportunity for follow-up discussions with FAA and consultant team members at various work stations.

The first public workshop was held later that evening from 6:00 to 7:30 p.m. at the main library in Federal Way. The second workshop was held the following evening September 6, 2012 at the Ballard Branch Library, also from 6:00 to 7:30 p.m. Similar to the scoping meetings, the content of each of these sessions was identical and consisted of an initial 30 minutes for informal question and answers at a series of workstations with boards and members of the FAA and consulting team in attendance. That was followed by a 30-minute presentation explaining the proposed new procedures, the resulting noise, and fuel burn findings. The final 30 to 45 minutes were again open to informal questions and answers at the workstations. A court reporter was in attendance at both workshops to take verbatim transcripts of public comments as one of several means available for submitting formal comments on the draft document.

The concluding Tribal Meeting for the FEA was announced by individual letter to the same set of tribes identified for the Scoping process. A copy of the tribal invitation letter and the list of invitees is again included in Appendix K. The meeting was held as scheduled though there were no attendees representing any of the identified tribes in the study area. A sign-in sheet of FAA and consultant team attendees is included in the appendix nevertheless.

Agency meeting attendees included the individuals noted in Table 7.3-1, representing their respective organizations, many of whom had attended the Scoping meeting as well. A copy of the Power Point presentation made for the Agencies is included in Appendix L and was the same presentation to each of the Public workshops. Agency representatives engaged in the follow-up questions and answer session at the several workstations in the room and later submitted formal comments in writing, responses to which are included with each letter in the Appendix.

The various agencies in attendance, and others who did not attend the meeting, provided their comments on the DEA. Comments ranged from clerical clarifications to requests for elaboration of specific points

in the document. Some of the responses reflected the agency’s support for the proposed changes as well as questions regarding I2. Responses to agency comments are included in Appedix K.

Table 7.3-1. DEA Agency Meeting Participants

Agency	Representative
City of Tukwila	Stacy MacGregor
Puget Sound Regional Council	Stephen Kiehl
Port of Seattle	Steve Rybolt
Port of Seattle	Stan Shepherd
Port of Seattle	Rob Kikilim
Port of Seattle	Russ Simonson
WS DOT	Rob Hodgman

The PowerPoint presentation was provided to the group including a description of the Proposed Action, a brief summary of the elements of the DEA, and general findings regarding noise, the resulting carbon footprint, and fuel burn.

7.3.1 Final Public Workshops

Two public workshops were held midway through the 39-day comment period for the Draft EA. Meeting locations and schedule as well as the number of attendees at each are provided in Table 7.3-2.

Table 7.3-2. Public Workshop Schedule and Locations

Meeting Type	Date	Location	Time	Number of Attendees
Final Public Workshop	Wednesday, September 5, 2012	Federal Way Library, 34200 1 st Way South, Federal Way, WA	6:00 – 7:30 p.m.	32
Final Public Workshop	Thursday, September 6, 2012	Ballard Branch Library, 5614 22 nd Ave., NW, Seattle, WA	6:00 – 7:30 p.m.	54*

* additional attendees were present at this meeting but chose not to sign in. There were approximately 65 people in attendance.

A total of 210 comments were received on the DEA, many of them criticizing the meeting format at the Ballard Branch Library. Others raised questions regarding the magnitude of the expected changes in noise exposure, and still others asked about getting noise monitoring stations in their neighborhoods. Further details on the final set of meetings and workshops is contained in Appendix L. Copies of sign-in sheets for each meeting, the workstation boards, the representative Power Point presentation, and a compilation of every comment received along with the FAA’s response to each comment are included in Appendix L.

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8 LIST OF PREPARERS

This chapter identifies the individuals assisting in the preparation and independent review of the FEA, along with each preparer's responsibilities.

Table 8.1-1 shows FAA staff who are responsible for the preparation of the FEA and/or who were involved in its review. Supporting the FAA in this effort are individuals from Tetra Tech AMT NAVTEC, Harris Miller Miller & Hanson Inc., CH2M HILL, Critgen, and Mosaic ATM, Inc. LLC.

Table 8.1-1. List of Preparers

Preparer	Title	Responsibility
Federal Aviation Administration		
Augustin Moses	Environmental Protection Specialist	Overall Project Management
Janelle Cass	Environmental Protection Specialist	
Marina Landis	Environmental Protection Specialist	
Doug Marek		Airspace Redesign
Nicholas J. Tallman	Required Navigation Performance Technical Lead	
Minh A. Nguyen		
Brian Schimpf	Safety Management System/Safety Risk Management Program	Safety Specialist
Patricia Deem	Attorney, Northwest. Mountain Region	Legal Review
Tetra Tech NMT NAVTAC Contractor		
Bob Graham	RNAV/RNP Specialist	
Harris Miller Miller & Hanson Inc.		
Robert L. Miller	Senior Vice President & Supervisory Consultant	HMMH Project Management, Documentation
Vinayak Khara	Director, DC Office	HMMH Deputy Project Management, Documentation
David Crandall	Senior Consultant	Noise Technical Analysis
Rhea Hanrahan	Consultant	Noise Technical Analysis
Bradley Nicholas	Senior Consultant	Noise Technical Analysis
Philip DeVita	Director, Air Quality	Air Quality Analysis
Mary Ellen Eagan	President	Public Outreach Manager
Laura Taylor	Administrative Assistant	Administrative Officer, Administrative Support, Public Outreach Support
Mike Hamilton	Senior GIS Specialist	GIS Analysis
Wanda Maldonado	Senior Graphic Designer	Graphic Support
CH2M Hill		
Bill Willkie	Senior Technologist	Senior Reviewer
Alisa Swank	Environmental Planner	Affected Environment and Environmental Consequences
Sophie Chiang	Biologist	Affected Environment and Environmental Consequences – Biological Resources
Keith Mendez	Cultural Resource Specialist	Affected Environment and Environmental Consequences – Cultural Resources
Kate Clark	Cultural Resource Specialist	Affected Environment and Environmental Consequences – Cultural Resources
Critgen		
Rob Grabarek	GIS Analyst	GIS Analysis
Mosaic ATM, Inc.		
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