Appendix G NOISE MODELING TECHNICAL REPORT

G.1 Noise Modeling Methodology and Data Inputs

FAA Order 1015.1E specifies that one of three noise models -- FAA's Integrated Noise Model (INM), its Heliport Noise Model (HNM), or its Noise Integrated Routing System (NIRS) -- should be used for an Environmental Assessment[1]. However, paragraph 14.5e further specifies that for air traffic airspace actions over large study areas or at altitudes above 3,000 feet above ground level (AGL), noise modeling "will be conducted using NIRS." A beneficial newly-approved feature of the model is that, in addition to its noise modeling capabilities, NIRS now also incorporates a fuel burn and aircraft emissions database developed by EUROCONTROL – an intergovernmental group of 39 member states headquartered in Brussels. Known as the Base of Aircraft Data (BADA), the database is part of an aircraft performance model developed in cooperation with aircraft manufacturers and airlines designed to support the evaluation of new air traffic management concepts and to be used in environmental studies of aircraft emissions[2]. NIRS, Version 7.0b.2[3] was used for all evaluations of noise, emissions and fuel burn in the Greener Skies EA.

FAA Order 1050.1E specifies that analysis for the EA should be done with the yearly Day-Night Average Sound Level (YDNL or DNL) noise metric. In accordance with Order 1050.1E, this analysis considers the noise exposure for the following seven scenarios:

- Existing Conditions (2012)
- First year of proposed implementation (2014) – No-action
- Future year of proposed implementation (2018) – No-action
- Future year of proposed implementation (2023) – No-action
- First full year of proposed I-1 implementation (2014) – Proposed Action
- Future year of proposed I-1 implementation (2018) – Proposed Action
- Future year of proposed I-1 implementation (2023) – Proposed Action

The 2012 operational scenario is used to represent the current noise environment. The 2014 Proposed Action noise results will be compared to the 2014 No-action Alternative to determine if there are any increases in noise levels that will meet or exceed FAA's criteria. The 2018 and 2023 Proposed Action results also will be compared to the 2018 No-action alternative and will be compared to FAA's criteria.[4] Fuel burn and Green House Gas (GHG) emission comparisons are also reported for the future scenarios.

The NIRS requires inputs in a number of categories, including:

- Routes and events for each scenario

[1] Other methodology and computer models can be used with prior written approval from FAA's Office of Environment and Energy (AEE.) (FAA order 1050.1E Change 1, Appendix A, Section 14.2b).
[2] http://www.eurocontrol.int/products/bada
[3] FAA released NIRS Version 7.0b.2 on March 2, 2012 (website). This was the most current version of NIRS at the time of the noise analysis.
[4] FAA's criteria for airspace related EAs are defined in FAA order 1050.1E, Change 1, specifically Appendix A, Section 14.3, 14.4, and 14.5e.

- Airport and runway locations
- Annualization weights for each traffic component of each scenario
- Additional population locations for calculation of DNL
- Additional grids for calculation of DNL and other metrics
- Geographic areas
- Terrain files

Data for this project came from various sources and were used for many of the input categories discussed above. Several of the primary sources of data are listed below, while additional sources are later discussed as appropriate.

- Radar Data. The FAA provided HMMH with 12 one-week samples of PDARS data in IFF format 2.6 with no modifications.
    - Dates: the dates are based on local time. The date ranges are meant to be inclusive
        - 01/09/2011 to 01/15/2011
        - 02/13/2011 to 02/19/2011
        - 03/06/2011 to 03/12/2011
        - 04/17/2011 to 04/23/2011
        - 05/08/2011 to 05/14/2011
        - 06/12/2011 to 06/18/2011
        - 07/10/2011 to 07/16/2011
        - 08/14/2011 to 08/20/2011
        - 09/11/2011 to 09/17/2011
        - 10/09/2011 to 10/15/2011
        - 11/07/2011 to 11/13/2011
        - 12/04/2011 to 12/10/2011
- Landrum & Brown's Port of Seattle Part 150 study. This included an INM study representing 2009 and 2016 conditions, flight tracks, associated noise location modeling grid points, associated terrain data, high level operation summary that is consistent with the 2009 and 20016 publicly available FAA approved forecast.[5]
- Interviews. HMMH had discussions with personnel at the airport, particularly flight tower operators regarding activity and traffic flow at the airport.

[5] http://www.airportsites.net/SEA-Part150/documents/SEA%20Part%20150%20Forecast%2020100819.pdf

HMMH's assumptions and data collection processes for each of these items are discussed below.

G.2 Airport Layout

The layout of an airfield is an important modeling input. Accurate runway information places modeled flights in the correct locations. Elevation data allow the NIRS to calculate runway gradients, which influence modeled take-off roll and landing distance.

The runway information for SEA, including runway end locations, elevations, width, and length and the locations and elevation of the airport reference point were taken from FAA data and cross checked with the recent/ongoing Part 150. Runway information for SEA is presented in Table G.2-1. Figure G-1 shows the FAA airport Diagram for SEA.

Table G.2-1. Seattle-Tacoma International Airport Runway Information

Runway End	Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (ft, MSL)	Width (ft)	Length (ft)
16L	47.463792	-122.307753	433	150	11901
16R	47.463835	-122.317856	415	150	8500
16C	47.463806	-122.310988	430	150	9426
16Q	47.463792	-122.307753	433	150	9387.8
34L	47.440531	-122.318061	356	150	8500
34R	47.431172	-122.308041	347	150	11901
34C	47.437968	-122.311213	363	150	9426
34Q	47.438056	-122.307982	363	150	9387.8

Notes: Latitude/Longitude coordinates referenced to North American Datum 1983 (NAD 83)

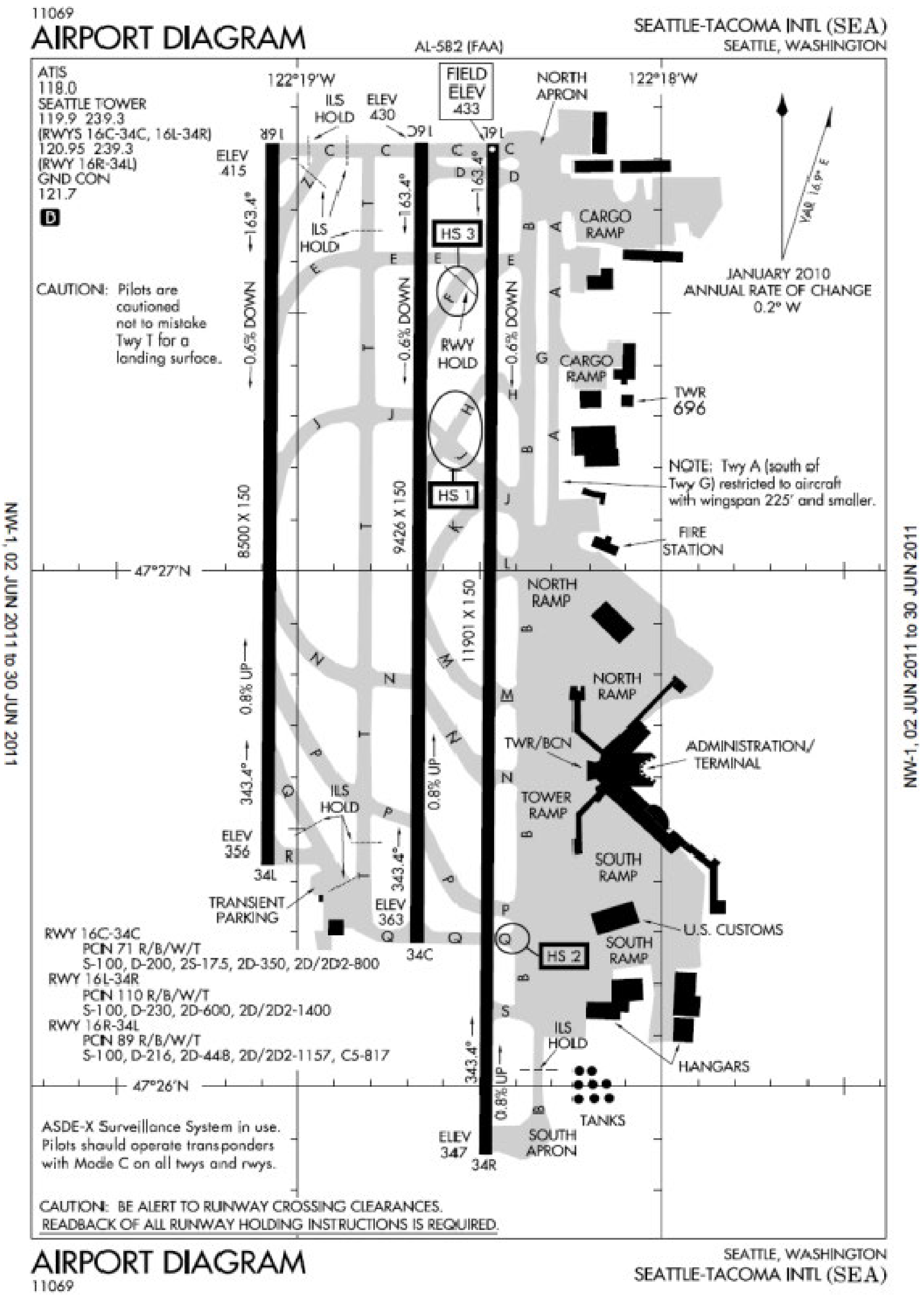

Figure G-1. Seattle-Tacoma International Airport Diagram

G.3 Aircraft Operations

Operations data for each of the four study years were developed from the on-going Part 150 Study. Table G.3-1 lists the different forecast aircraft type for four operations categories:

- Jet w/RNAV
- Jet
- Dash 8
- Prop

Table G.3-1. Forecast Aircraft Type by Category

Category:	Jet w/RNAV			Jet	Dash 8	Prop
FAA Approved Forecast Aircraft Type	747-400	B737-800	CRJ-900	B727	DHC8-100	ANTONOV 12
	A300-600F	B737-900	E190	B727-200	DHC8-200	ATR-42
	A310F	B747-400	MD-10F	B727F	DHC8-300	ATR-72
	A318	B757	MD-11F	B737	DHC8-400	BEECH 18
	A319	B757-200	MD80	B737F		Cessna (light aircraft)
	A320	B757-200F	MD-80F	B747		Cessna (single turboprop)
	A321	B757-300	MD90	B747F		CESSNA 208
	A330	B767		B777-200		EMB-120
	A330-200	B767-200		B777-300ER		F-27
	A330-300	B767-300		DC10		ANTONOV 12
	A340-300	B767-400		DC-8F		ATR-42
	B717	B777		DC-9F		
	B737-300	B777F		F28		
	B737-400	B787		L100-30F		
	B737-500	CRJ-200		MD83		
	B737-700	CRJ-700				
Source: http://www.airportsites.net/SEA-Part150/documents/SEA%20Part%20150%20Forecast%2020100819.pdf						

Table G.3-2 presents the annual forecast aircraft operations split by category and study year. Operations for 2012, 2014, 2018 and 2023 were interpolated from the publicly available FAA approved forecast years. Operations remain the same for the No-action and Proposed Action forecast years.

Table G.3-2. Summary of Operations Forecasts

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	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 NIRS requires that the user assign a specific aircraft type from the NIRS's standard database to each operation. In addition, the day-night split of aircraft operations is important with the DNL metric. A nighttime operation, defined in the DNL metric as an operation between 10 PM and 7 AM, is penalized 10 dB, mathematically equivalent to an operation being counted as if it occurred ten times.

Table G.3-3 provides the daily operations for the existing (2012) conditions. Table G.3-4, Table G.3-5 and Table G.3-6 present the operations for the 2014, 2018, and 2023 No-action Alternative and Proposed Action, respectively.

G.3.1 Aircraft Noise Performance

Specific noise and performance data must be entered into the NIRS for each aircraft type operating at the airport. Noise data are included in the form of sound exposure levels (SELs) at a range of distances from a particular aircraft with engines at a specific thrust level. Performance data include thrust, speed and altitude profiles for takeoff and landing operations. The NIRS database contains standard noise and performance data for over one hundred different fixed wing aircraft types, most of which are civilian aircraft. The NIRS automatically accesses the noise and performance data for takeoff and landing operations by those aircraft.

In some cases however, the actual aircraft types operating at SEA did not always match the types or the performance characteristics in the NIRS database. While many aircraft could be modeled by direct assignments from the standard NIRS database, several were not listed as having procedure steps in the NIRS database – a format needed to properly model level-off segments as aircraft climb or descend within the study area. Other aircraft types do not exist in the database at all. For those aircraft, FAA-approved substitutions must be used. The details of these changes, the submission to FAA's Office of Environment and Energy (AEE-100), and FAA's associated approval are provided in Appendix E. FAA approved substitutions came from the NIRS User's Guide Version 7.0b.2[6].

Table G.3-3. Existing 2012 Operations

NIRS Type	*Arrival*		*Departure*		*Total*
	Day	Night	Day	Night	
717200	0.4	0.1	0.4	0.1	1
727D15/MD11PW	0.4	0.4	0.4	0.4	1.6
737300	9.7	1.8	9.7	1.8	22.9
737400	22.1	4.1	22.1	4.1	52.3
737500	2	0.4	2	0.4	4.6
737700	43.4	8	43.4	8	102.6
737700/737800	95	17.2	95	17.2	224.5
737QN	0.3	0.3	0.3	0.3	1.1
747200	0.3	0	0.3	0	0.6
747400	3.1	2.5	3.1	2.5	11.2
757PW	6.6	1.2	6.6	1.2	15.6
757RR/757300	7.5	1.4	7.5	1.4	17.7
757RR	6.3	1.1	6.3	1.1	14.7
767300	4	0.7	4	0.7	9.3
A300B4-203	0.4	0.4	0.4	0.4	1.6
A310-304/777200	2.9	0.2	2.9	0.2	6.2
A310-304/777300	0.4	0	0.4	0	0.9
A319-131	10.6	1.9	10.6	1.9	25
A320-211	14.5	2.7	14.5	2.7	34.4
A320-232	14.5	2.7	14.5	2.7	34.4
A321-232	2.7	0.5	2.7	0.5	6.4
A330-301	1.5	0.1	1.5	0.1	3.1
A330-343	2.9	0.2	2.9	0.2	6.1
A340-211	0.3	0	0.3	0	0.6
BEC58P	0.1	0	0.1	0	0.4
CIT3	0.1	0	0.1	0	0.2

[6] March 2, 2012 FAA release; NIRS Version 7.0b.2 Appendix E, Supported Aircraft Substitutions

CL600	0.4	0.1	0.4	0.1	1
CL601	2.5	0.2	2.5	0.2	5.4
CNA172	1.2	0.2	1.2	0.2	2.7
CNA208	2.7	2.1	2.7	2.1	9.6
CNA441	4.7	1.4	4.7	1.4	12.3
CNA500	0.1	0	0.1	0	0.1
CNA750	0.1	0	0.1	0	0.3
CRJ9-ER	20.3	2.1	20.3	2.1	44.8
DC1010	1.2	1.4	1.2	1.4	5.2
DHC8	0.1	0.1	0.1	0.1	0.5
DHC830	93.9	9.1	93.9	9.1	205.9
EMB120	5.4	0.6	5.4	0.6	12.1
GIV	0.1	0	0.1	0	0.2
GV	3.9	0.7	3.9	0.7	9.2
HS748A	0.1	0.1	0.1	0.1	0.3
IA1125	0.1	0	0.1	0	0.4
LEAR35	0.3	0.1	0.3	0.1	0.7
MD9025/MD83	5.3	1	5.3	1	12.6
MD9028	0.6	0.1	0.6	0.1	1.5
MU3001	0.4	0.1	0.4	0.1	1
Total	395.4	67.3	395.4	67.3	924.8

Note: Totals and subtotals may not match exactly due to rounding

Table G.3-4. Forecast Operations 2014 No-action and Proposed Action

NIRS Type	*Arrival*		*Departure*		*Total*
	Day	Night	Day	Night	
717200	0.2	0	0.2	0	0.5
727D15/MD11PW	0.4	0.4	0.4	0.4	1.6
737300	8	1.5	8	1.5	18.9
737400	18.9	3.4	18.9	3.4	44.7
737500	1.6	0.3	1.6	0.3	3.9
737700	47.2	8.6	47.2	8.6	111.5
737700/737800	107	19.3	107	19.3	252.6
737QN	0.1	0.1	0.1	0.1	0.4
747200	0.3	0	0.3	0	0.6
747400	3.4	2.7	3.4	2.7	12.2
757PW	3.8	0.7	3.8	0.7	8.9
757RR/757300	7.7	1.4	7.7	1.4	18.2
757RR	2.8	0.5	2.8	0.5	6.6
767300	4.4	0.7	4.4	0.7	10.3
A300B4-203	0.4	0.4	0.4	0.4	1.7
A310-304/777200	3	0.2	3	0.2	6.5
A310-304/777300	0.4	0	0.4	0	0.9
A319-131	11.2	2	11.2	2	26.4
A320-211	18.4	3.4	18.4	3.4	43.6
A320-232	18.4	3.4	18.4	3.4	43.6
A321-232	2.9	0.5	2.9	0.5	6.8
A330-301	1.3	0.1	1.3	0.1	2.8
A330-343	3.3	0.2	3.3	0.2	7.1
A340-211	0.2	0	0.2	0	0.5
BEC58P	0.1	0	0.1	0	0.4
CIT3	0.1	0	0.1	0	0.2
CL600	0.4	0.1	0.4	0.1	1.1
CL601	2.7	0.2	2.7	0.2	5.7
CNA172	0.7	0.1	0.7	0.1	1.7
CNA208	2.4	2.1	2.4	2.1	9

CNA441	4.5	1.4	4.5	1.4	11.7
CNA500	0.1	0	0.1	0	0.2
CNA750	0.1	0	0.1	0	0.3
CRJ9-ER	20.3	2.1	20.3	2.1	44.7
DC1010	1.3	1.4	1.3	1.4	5.4
DHC8	0.1	0.1	0.1	0.1	0.5
DHC830	100.5	9.6	100.5	9.6	220.3
EMB120	2.7	0.3	2.7	0.3	6
GIV	0.1	0	0.1	0	0.2
GV	4.5	0.8	4.5	0.8	10.6
HS748A	0.1	0.1	0.1	0.1	0.3
IA1125	0.2	0	0.2	0	0.4
LEAR35	0.3	0.1	0.3	0.1	0.7
MD9025/MD83	2.7	0.5	2.7	0.5	6.3
MD9028	0.3	0.1	0.3	0.1	0.8
MU3001	0.4	0.1	0.4	0.1	1.1
Total	409.9	68.9	409.9	68.9	958.4

Note: Totals and subtotals may not match exactly due to rounding

Table G.3-5. Forecast Operations 2018 No-action and Proposed Action

NIRS Type	*Arrival*		*Departure*		*Total*
	Day	Night	Day	Night	
717200	0	0	0	0	0
727D15/MD11PW	0.4	0.5	0.4	0.5	1.8
737300	3.8	0.7	3.8	0.7	8.9
737400	8.8	1.6	8.8	1.6	20.9
737500	0.7	0.1	0.7	0.1	1.6
737700	56.8	10.3	56.8	10.3	134
737700/737800	135.7	24.3	135.7	24.3	320
737QN	0.1	0.1	0.1	0.1	0.2
747200	0.3	0	0.3	0	0.7
747400	3.8	3	3.8	3	13.7
757PW	0.5	0.1	0.5	0.1	1.1
757RR/757300	8.5	1.5	8.5	1.5	20
757RR	0.3	0	0.3	0	0.7
767300	3.6	0.5	3.6	0.5	8.3
A300B4-203	0.4	0.5	0.4	0.5	1.8
A310-304/777200	3.3	0.2	3.3	0.2	7.1
A310-304/777300	0.5	0	0.5	0	1.1
A319-131	12.6	2.3	12.6	2.3	29.8
A320-211	23.8	4.3	23.8	4.3	56.4
A320-232	23.8	4.3	23.8	4.3	56.4
A321-232	3.2	0.6	3.2	0.6	7.7
A330-301	1.2	0.1	1.2	0.1	2.6
A330-343	5.4	0.5	5.4	0.5	11.9
A340-211	0.3	0	0.3	0	0.6
BEC58P	0.1	0	0.1	0	0.4
CIT3	0.1	0	0.1	0	0.2
CL600	0.5	0.1	0.5	0.1	1.2
CL601	2.9	0.2	2.9	0.2	6.2
CNA172	0.3	0.1	0.3	0.1	0.7
CNA208	2.1	2.3	2.1	2.3	8.7
CNA441	4.3	1.3	4.3	1.3	11.3
CNA500	0.1	0	0.1	0	0.2
CNA750	0.1	0	0.1	0	0.4
CRJ9-ER	21.6	2.2	21.6	2.2	47.5

DC1010	1.4	1.6	1.4	1.6	5.9
DHC8	0.1	0.1	0.1	0.1	0.6
DHC830	113.8	10.5	113.8	10.5	248.7
EMB120	0	0	0	0	0
GIV	0.1	0	0.1	0	0.2
GV	5.5	0.9	5.5	0.9	13
HS748A	0.1	0.1	0.1	0.1	0.3
IA1125	0.2	0	0.2	0	0.5
LEAR35	0.3	0.1	0.3	0.1	0.8
MD9025/MD83	0	0	0	0	0
MD9028	0	0	0	0	0
MU3001	0.5	0.1	0.5	0.1	1.3
Total	451.9	75.1	451.9	75.1	1055.4

Note: Totals and subtotals may not match exactly due to rounding

Table G.3-6. Forecast Operations 2023 No-action and Proposed Action

NRIS Type	*Arrival*		*Departure*		*Total*
	Day	Night	Day	Night	
717200	0	0	0	0	0
727D15/MD11PW	0.5	0.5	0.5	0.5	1.9
737300	0	0	0	0	0
737400	0	0	0	0	0
737500	0	0	0	0	0
737700	69.5	12.6	69.5	12.6	164.2
737700/737800	172.9	31.1	172.9	31.1	407.9
737QN	0.1	0.1	0.1	0.1	0.2
747200	0.3	0	0.3	0	0.7
747400	4	3.1	4	3.1	14.3
757PW	0	0	0	0	0
757RR/757300	9.6	1.7	9.6	1.7	22.7
757RR	0.3	0	0.3	0	0.8
767300	1.6	0.1	1.6	0.1	3.5
A300B4-203	0.5	0.5	0.5	0.5	2
A310-304/777200	3.6	0.3	3.6	0.3	7.6
A310-304/777300	0.5	0	0.5	0	1.2
A319-131	14.3	2.6	14.3	2.6	33.7
A320-211	27	4.9	27	4.9	63.8
A320-232	27	4.9	27	4.9	63.8
A321-232	3.7	0.7	3.7	0.7	8.7
A330-301	1.1	0.1	1.1	0.1	2.3
A330-343	9.3	1.3	9.3	1.3	21.2
A340-211	0.5	0	0.5	0	1.2
BEC58P	0.1	0	0.1	0	0.3
CIT3	0.1	0	0.1	0	0.3
CL600	0.6	0.1	0.6	0.1	1.5
CL601	3	0.2	3	0.2	6.4
CNA172	0.3	0.1	0.3	0.1	0.7
CNA208	2.3	2.5	2.3	2.5	9.4
CNA441	4.6	1.3	4.6	1.3	12
CNA500	0.1	0	0.1	0	0.2
CNA750	0.2	0	0.2	0	0.4
CRJ9-ER	24.5	2.4	24.5	2.4	53.6
DC1010	1.5	1.7	1.5	1.7	6.3
DHC8	0.1	0.2	0.1	0.2	0.6
DHC830	127.3	11.5	127.3	11.5	277.6

EMB120	0	0	0	0	0
GIV	0.1	0	0.1	0	0.2
GV	6.3	1.1	6.3	1.1	14.7
HS748A	0.1	0.1	0.1	0.1	0.3
IA1125	0.2	0.1	0.2	0.1	0.6
LEAR35	0.4	0.1	0.4	0.1	1
MD9025/MD83	0	0	0	0	0
MD9028	0	0	0	0	0
MU3001	0.6	0.1	0.6	0.1	1.5
Total	518.7	86	518.7	86	1209.3

Note: Totals and subtotals may not match exactly due to rounding

G.4 Runway Utilization

Runway use describes the percent use of each of the runways and is affected by many factors including weather, runway length requirements, instrumentation available on each runway, and, if applicable, traffic flow at nearby airports.

HMMH identified runway use information presented in the Port of Seattle's Part 150 Study. The Proposed Action is not expected to change runway use.

Table G.4-1 provides the runway use for the existing conditions and all future No-action and Proposed Action Alternatives.

Table G.4-1. Runway Utilization

	Runway	Jet	Dash 8	Turbo Prop	Prop
Arrivals	**16R**	20%	23%	15%	12%
	16C	26%	28%	32%	27%
	16L	18%	16%	16%	19%
	34R	13%	10%	9%	9%
	34C	13%	13%	17%	18%
	34L	10%	11%	11%	15%
Total		100%	100%	100%	100%
Departures	**16R**	0%	1%	0%	0%
	16C	18%	18%	17%	19%
	16L	48%	46%	35%	38%
	34R	18%	15%	28%	28%
	34C	16%	17%	19%	16%
	34L	0%	2%	1%	0%
Total		100%	100%	100%	100%

Approximately 12% of aircraft that depart off of 34R do not go all the way to the runway end but make intersection takeoffs at the start of Taxiway Q (see airport diagram in Figure G-1 above). These smaller types are noted by asterisk in the tables that follow. Heavy aircraft, however, utilize the full length of the runway.

G.5 Flight Tracks and Flight Track Utilization

HMMH identified track use information presented in the Port of Seattle's Part 150 Study. Table G.5-1 and Table G.5-2 provide a list of the arrival and departure flight track names, with accompanying figures, Figure G-2 and Figure G-3, respectively. Each track name represents the combination of a single backbone track and the addition of up to 8 individual dispersed tracks. Dispersed tracks represent an aircraft's displacement or angular deviation from a backbone track. The Proposed Action tracks assume reduced deviation due to the precision of the equipment and procedures. This is modeled by reducing the number of dispersed tracks needed. Table G.5-3 provides the No Action arrival track utilization, Table G.5-4 provides the No Action and Proposed Action departure track utilization, and finally, Table G.5-5 provides the Proposed Action arrival track utilization. Copies of the NIRS input files can be made available through the FAA upon request.

Table G.5-1. List of Modeled Arrival Track Names

Runway 16C Tracks	Runway 16L Tracks	Runway 16R Tracks	Runway 34C Tracks	Runway 34L Tracks	Runway 34R Tracks	Proposed Action Tracks
Arrivals						
16CA2AO	16LA2AO	16RA2AO	34CA2A	34LA2A	34RA2A	BTG
16CA2AP	16LA2AP	16RA2AP	34CA2B	34LA2B	34RA2B	BTG_E
16CA2AT	16LA2AT	16RA2AT	34CA2C	34LA2C	34RA2C	BTG_HED
16CA2BO	16LA2BO	16RA2BO	34CA2D	34LA2D	34RA2D	BTG_SON
16CA2BP	16LA2BP	16RA2BP	34CA3AH	34LA3AH	34RA3AH	BTG_W
16CA2BT	16LA2BT	16RA2BT	34CA3AL	34LA3AL	34RA3AL	LAT_HED
16CA2CO	16LA2CO	16RA2CO	34CA3AO	34LA3AO	34RA3AO	LAT_SON
16CA2CP	16LA2CP	16RA2CP	34CA3BH	34LA3BH	34RA3BH	LATAY
16CA2CT	16LA2CT	16RA2CT	34CA3BL	34LA3BL	34RA3BL	LATAY_E
16CA3A	16LA3A	16RA3A	34CA3BO	34LA3BO	34RA3BO	LATAY_W
16CA3B	16LA3B	16RA3B	34CA3CH	34LA3CH	34RA3CH	ORC_DLT
16CA3C	16LA3C	16RA3C	34CA3CL	34LA3CL	34RA3CL	ORC_GRI
16CA4AH	16LA4AH	16RA4AH	34CA3CO	34LA3CO	34RA3CO	ORC_MOO
16CA4AL	16LA4AL	16RA4AL	34CA4A	34LA4A	34RA4A	ORC_SHI
16CA4AO	16LA4AO	16RA4AO	34CA5AO	34LA5AO	34RA5AO	ORCUS
16CA4B	16LA4B	16RA4B	34CA5AP	34LA5AP	34RA5AP	TOU
16CA5A	16LA5A	16RA5A	34CA5AT	34LA5AT	34RA5AT	TOU_DLT
16CA5B	16LA5B	16RA5B	34CA5B	34LA5B	34RA5B	TOU_GRI
			34CA5C	34LA5C	34RA5C	TOU_MOO
						TOU_SHI
						YVR
						YVR_DLT
						YVR_GRI
						YVR_MOO
						YVR_SHI
Notes:						

Table G.5-2. List of Modeled Departure Tracks

Runway 16C Tracks	Runway 16L Tracks	Runway 16R Tracks	Runway 34C Tracks	Runway 34L Tracks	Runway 34Q* Tracks	Runway 34R Tracks
Departures						
16CD1A	16LD1A	16RD1A	34CD1	34LD1	34QD1	34RD1
16CD1B	16LD1B	16RD1B	34CD2A	34LD2A	34QD2A	34RD2A
16CD1C	16LD1C	16RD1C	34CD2B	34LD2B	34QD2B	34RD2B
16CD1D	16LD1D	16RD1D	34CD2C	34LD2C	34QD2C	34RD2C
16CD2A	16LD2A	16RD2A	34CD2D	34LD2D	34QD2D	34RD2D
16CD2B	16LD2B	16RD2B	34CD3A	34LD3A	34QD3A	34RD3A
16CD3A	16LD3A	16RD3A	34CD3B	34LD3B	34QD3B	34RD3B
16CD3B	16LD3B	16RD3B	34CD3C	34LD3C	34QD3C	34RD3C
16CD4A	16LD4A	16RD4A	34CD3D	34LD3D	34QD3D	34RD3D
16CD4B	16LD4B	16RD4B	34CD3E	34LD3E	34QD3E	34RD3E
16CD4C	16LD4C	16RD4C	34CD3F	34LD3F	34QD3F	34RD3F
16CD5A	16LD5A	16RD5A	34CD4A	34LD4A	34QD4A	34RD4A
16CD5B	16LD5B	16RD5B	34CD4B	34LD4B	34QD4B	34RD4B
16CD5C	16LD5C	16RD5C	34CD4C	34LD4C	34QD4C	34RD4C
			34CD5A	34LD5A	34QD5A	34RD5A
			34CD5B	34LD5B	34QD5B	34RD5B

Notes:
*Tracks for aircraft that do not use full length of Runway 34R and instead depart from taxiway Q

Table G.5-3. No Action Arrival Track Utilization

Runway											
16C		16L		16R		34C		34L		34R	
16CA2AO	6%	16LA2AO	6%	16RA2AO	6%	34CA2A	8%	34LA2A	8%	34RA2A	8%
16CA2AP	3%	16LA2AP	2%	16RA2AP	3%	34CA2B	7%	34LA2B	7%	34RA2B	7%
16CA2AT	1%	16LA2AT	1%	16RA2AT	1%	34CA2C	2%	34LA2C	2%	34RA2C	2%
16CA2BO	1%	16LA2BO	1%	16RA2BO	1%	34CA2D	7%	34LA2D	7%	34RA2D	7%
16CA2BP	1%	16LA2BP	0%	16RA2BP	1%	34CA3AH	1%	34LA3AH	1%	34RA3AH	1%
16CA2BT	0%	16LA2BT	0%	16RA2BT	0%	34CA3AL	3%	34LA3AL	3%	34RA3AL	3%
16CA2CO	1%	16LA2CO	1%	16RA2CO	1%	34CA3AO	14%	34LA3AO	14%	34RA3AO	14%
16CA2CP	0%	16LA2CP	0%	16RA2CP	0%	34CA3BH	1%	34LA3BH	1%	34RA3BH	1%
16CA2CT	0%	16LA2CT	0%	16RA2CT	0%	34CA3BL	3%	34LA3BL	3%	34RA3BL	3%
16CA3A	15%	16LA3A	15%	16RA3A	15%	34CA3BO	13%	34LA3BO	13%	34RA3BO	13%
16CA3B	12%	16LA3B	12%	16RA3B	12%	34CA3CH	0%	34LA3CH	0%	34RA3CH	0%
16CA3C	3%	16LA3C	3%	16RA3C	3%	34CA3CL	0%	34LA3CL	0%	34RA3CL	0%
16CA4AH	1%	16LA4AH	1%	16RA4AH	1%	34CA3CO	2%	34LA3CO	2%	34RA3CO	2%
16CA4AL	6%	16LA4AL	6%	16RA4AL	6%	34CA4A	23%	34LA4A	23%	34RA4A	23%
16CA4AO	23%	16LA4AO	23%	16RA4AO	23%	34CA5AO	10%	34LA5AO	10%	34RA5AO	11%
16CA4B	1%	16LA4B	1%	16RA4B	1%	34CA5AP	4%	34LA5AP	4%	34RA5AP	3%
16CA5A	25%	16LA5A	25%	16RA5A	25%	34CA5AT	1%	34LA5AT	1%	34RA5AT	1%
16CA5B	1%	16LA5B	1%	16RA5B	1%	34CA5B	0%	34LA5B	0%	34RA5B	0%
						34CA5C	1%	34LA5C	1%	34RA5C	1%
Total:	**100%**		**100%**		**100%**		**100%**		**100%**		**100%**
Notes:											

Table G.5-4. No Action and Proposed Action Departure Track Utilization

Runway													
16C		16L		16R		34C		34L		34Q		34R	
16CD1A	23%	16LD1A	24%	16RD1A	18%	34CD1	14%	34LD1	3%	34QD1	15%	34RD1	15%
16CD1B	9%	16LD1B	8%	16RD1B	9%	34CD2A	7%	34LD2A	1%	34QD2A	7%	34RD2A	8%
16CD1C	1%	16LD1C	1%	16RD1C	2%	34CD2B	4%	34LD2B	1%	34QD2B	4%	34RD2B	5%
16CD1D	1%	16LD1D	1%	16RD1D	1%	34CD2C	4%	34LD2C	1%	34QD2C	4%	34RD2C	5%
16CD2A	4%	16LD2A	4%	16RD2A	3%	34CD2D	6%	34LD2D	1%	34QD2D	6%	34RD2D	6%
16CD2B	23%	16LD2B	24%	16RD2B	18%	34CD3A	14%	34LD3A	3%	34QD3A	15%	34RD3A	15%
16CD3A	11%	16LD3A	11%	16RD3A	8%	34CD3B	9%	34LD3B	2%	34QD3B	9%	34RD3B	9%
16CD3B	4%	16LD3B	5%	16RD3B	3%	34CD3C	4%	34LD3C	1%	34QD3C	4%	34RD3C	5%
16CD4A	7%	16LD4A	6%	16RD4A	11%	34CD3D	4%	34LD3D	1%	34QD3D	4%	34RD3D	4%
16CD4B	7%	16LD4B	6%	16RD4B	11%	34CD3E	4%	34LD3E	1%	34QD3E	4%	34RD3E	4%
16CD4C	1%	16LD4C	1%	16RD4C	2%	34CD3F	1%	34LD3F	0%	34QD3F	1%	34RD3F	2%
16CD5A	3%	16LD5A	2%	16RD5A	4%	34CD4A	6%	34LD4A	18%	34QD4A	5%	34RD4A	5%
16CD5B	3%	16LD5B	2%	16RD5B	4%	34CD4B	4%	34LD4B	13%	34QD4B	4%	34RD4B	4%
16CD5C	3%	16LD5C	2%	16RD5C	4%	34CD4C	1%	34LD4C	4%	34QD4C	1%	34RD4C	1%
						34CD5A	10%	34LD5A	31%	34QD5A	9%	34RD5A	8%
						34CD5B	7%	34LD5B	22%	34QD5B	7%	34RD5B	6%
Total:	**100%**		**100%**		**100%**		**100%**		**100%**		**100%**		**100%**
Notes:													

Table G.5-5. Proposed Action Arrival Track Utilization

Runway											
16C		**16L**		**16R**		**34C**		**34L**		**34R**	
16CA2AO	0%	16LA2AO	0%	16RA2AO	0%	34CA2A	8%	34LA2A	8%	34RA2A	8%
16CA2AP	2%	16LA2AP	2%	16RA2AP	2%	34CA2B	7%	34LA2B	7%	34RA2B	7%
16CA2AT	0%	16LA2AT	0%	16RA2AT	0%	34CA2C	2%	34LA2C	2%	34RA2C	2%
16CA2BO	0%	16LA2BO	0%	16RA2BO	0%	34CA2D	7%	34LA2D	7%	34RA2D	7%
16CA2BP	1%	16LA2BP	0%	16RA2BP	1%	34CA3AH	0%	34LA3AH	0%	34RA3AH	0%
16CA2BT	0%	16LA2BT	0%	16RA2BT	0%	34CA3AL	1%	34LA3AL	1%	34RA3AL	1%
16CA2CO	0%	16LA2CO	0%	16RA2CO	0%	34CA3AO	4%	34LA3AO	4%	34RA3AO	4%
16CA2CP	0%	16LA2CP	0%	16RA2CP	0%	34CA3BH	0%	34LA3BH	0%	34RA3BH	0%
16CA2CT	0%	16LA2CT	0%	16RA2CT	0%	34CA3BL	1%	34LA3BL	1%	34RA3BL	1%
16CA3A	15%	16LA3A	15%	16RA3A	15%	34CA3BO	4%	34LA3BO	4%	34RA3BO	3%
16CA3B	12%	16LA3B	12%	16RA3B	12%	34CA3CH	0%	34LA3CH	0%	34RA3CH	0%
16CA3C	3%	16LA3C	3%	16RA3C	3%	34CA3CL	0%	34LA3CL	0%	34RA3CL	0%
16CA4AH	0%	16LA4AH	0%	16RA4AH	0%	34CA3CO	0%	34LA3CO	0%	34RA3CO	0%
16CA4AL	3%	16LA4AL	2%	16RA4AL	3%	34CA4A	23%	34LA4A	23%	34RA4A	23%
16CA4AO	6%	16LA4AO	5%	16RA4AO	6%	34CA5AO	1%	34LA5AO	0%	34RA5AO	1%
16CA4B	1%	16LA4B	1%	16RA4B	1%	34CA5AP	4%	34LA5AP	4%	34RA5AP	3%
16CA5A	25%	16LA5A	25%	16RA5A	25%	34CA5AT	0%	34LA5AT	0%	34RA5AT	0%
16CA5B	0%	16LA5B	0%	16RA5B	0%	34CA5B	0%	34LA5B	0%	34RA5B	0%
BTG	18%	BTG	19%	BTG	19%	34CA5C	1%	34LA5C	1%	34RA5C	1%
BTG_HED	2%	BTG_HED	2%	BTG_HED	2%	BTG_E	2%	BTG_E	2%	BTG_E	3%
LAT_HED	0%	LAT_HED	0%	LAT_HED	0%	BTG_SON	19%	BTG_SON	19%	BTG_SON	21%
LATAY	1%	LATAY	1%	LATAY	1%	BTG_W	2%	BTG_W	2%	BTG_W	3%

Runway											
16C		16L		16R		34C		34L		34R	
ORC_DLT	0%	ORC_DLT	0%	ORC_DLT	0%	LAT_SON	2%	LAT_SON	2%	LAT_SON	2%
ORC_GRI	6%	ORC_GRI	7%	ORC_GRI	7%	LATAY_E	0%	LATAY_E	0%	LATAY_E	0%
ORCUS	1%	ORCUS	1%	ORCUS	1%	LATAY_W	0%	LATAY_W	0%	LATAY_W	0%
TOU	0%	TOU	0%	TOU	0%	ORC_SHI	1%	ORC_SHI	1%	ORC_SHI	1%
TOU_DLT	0%	TOU_DLT	0%	TOU_DLT	0%	ORCUS	8%	ORCUS	8%	ORCUS	8%
TOU_GRI	1%	TOU_GRI	1%	TOU_GRI	1%	TOU	1%	TOU	1%	TOU	1%
YVR_MOO	0%	YVR_MOO	0%	YVR_MOO	0%	TOU_SHI	0%	TOU_SHI	0%	TOU_SHI	0%
Total:	100%		100%		100%		100%		100%		100%
Notes:											

G.6 Meteorological Conditions

The NIRS has several settings that affect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average annual temperature, barometric pressure, and relative humidity at the airport. Weather data acquired by the Port of Seattle for 2009 from the National Climatic Data Center (NCDC) 29 for SEA (WBAN #24233) were collected and reviewed. Based on analysis of the NCDC data, the average annual conditions for SEA include a temperature of 52.8 °F, sea level pressure of 29.92 inches of Hg, and a relative humidity of 70 percent.

G.7 Modeling Locations

While the previous sections have discussed parameters that affect the noise source considered in this study, i.e. aircraft operations, this section will discuss the various modeling locations, or noise receivers, for which aircraft noise exposure levels were computed using the NIRS. These locations represent noise sensitive land use, or other locations of interest. For this study, several different types of locations were identifies in the study area and these locations are represented by a total of 55,786 individual modeled points. Noise results at these points are mentioned in Appendix H as available on CD, though a copy of NIRS is needed to view the results.

All modeled points were adjusted for terrain elevation so that aircraft altitudes over the ground would be more accurately represented in the noise calculations. Elevation data were downloaded from the United States Geographic Survey (USGS). Terrain files imported into NIRS for noise computations must be in the USGS 1:250,000 scale DEM format – 1 degree square with 3 by 3 arc-second data spacing.

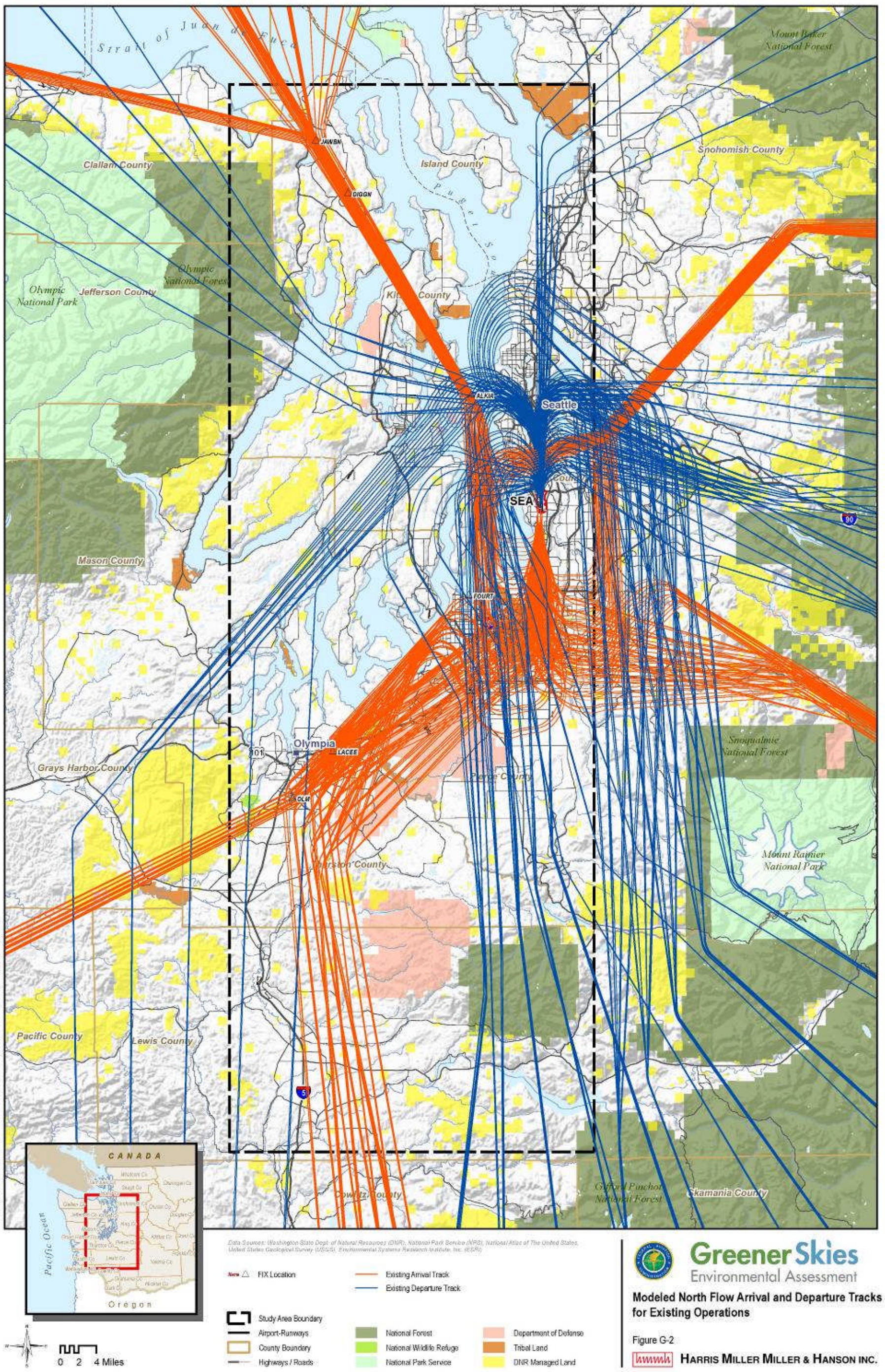

Figure G-2. Modeled North Flow Arrival and Departure Tracks for Existing Operations

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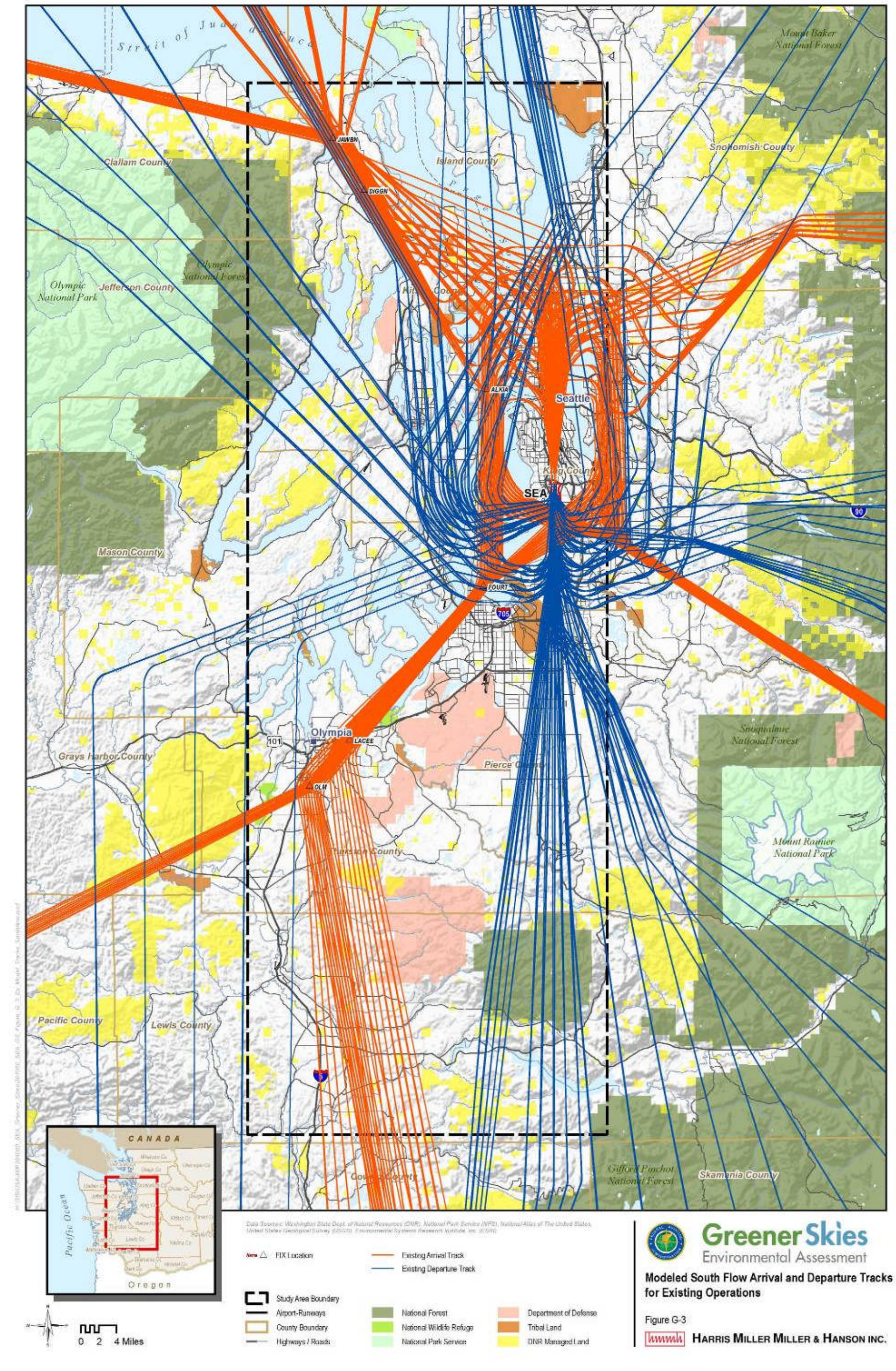

Figure G-3. Modeled South Flow Arrival and Departure Tracks for Existing Operations

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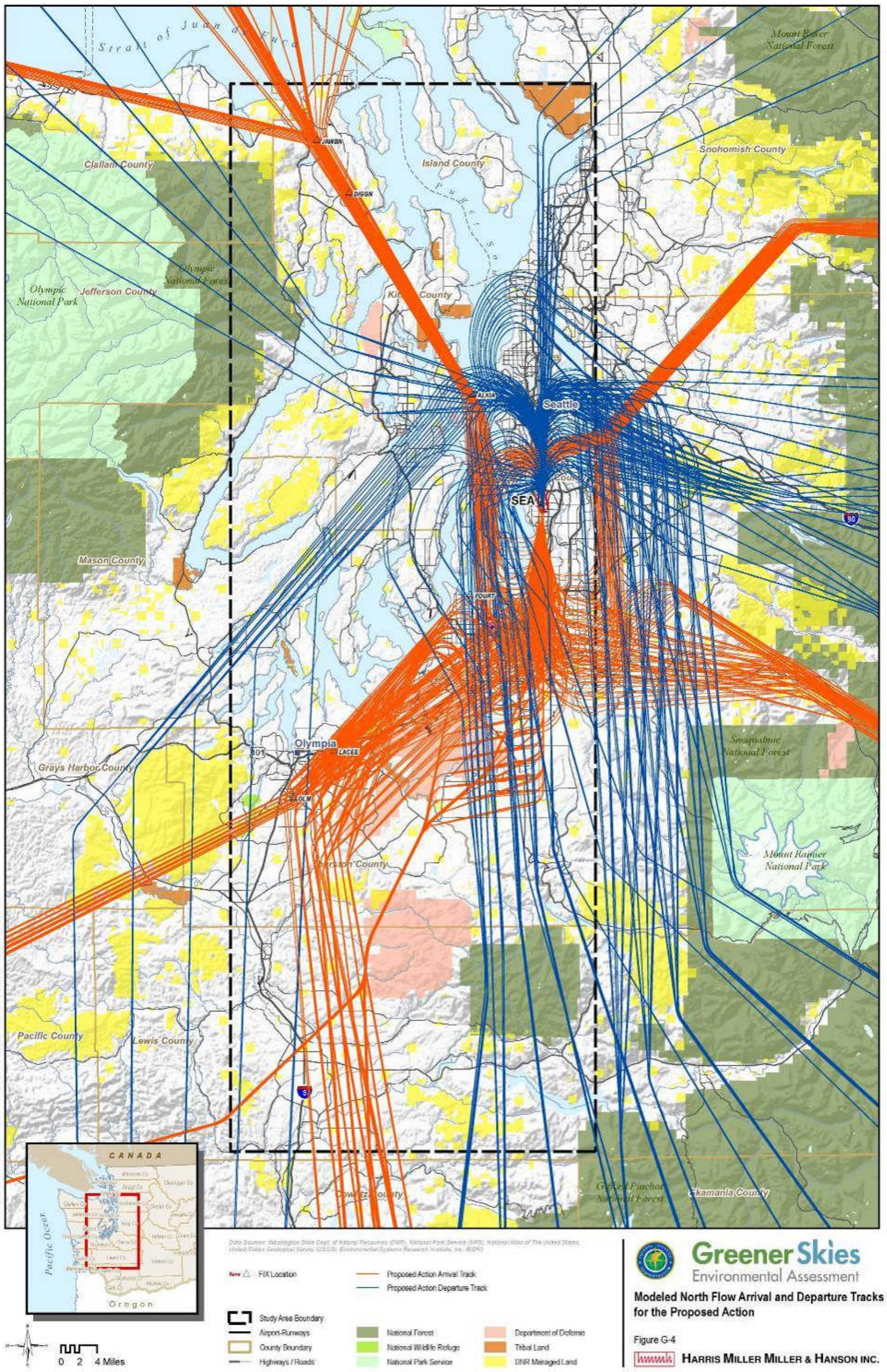

Figure G-4. Modeled North Flow Arrival and Departure Tracks for the Proposed Action

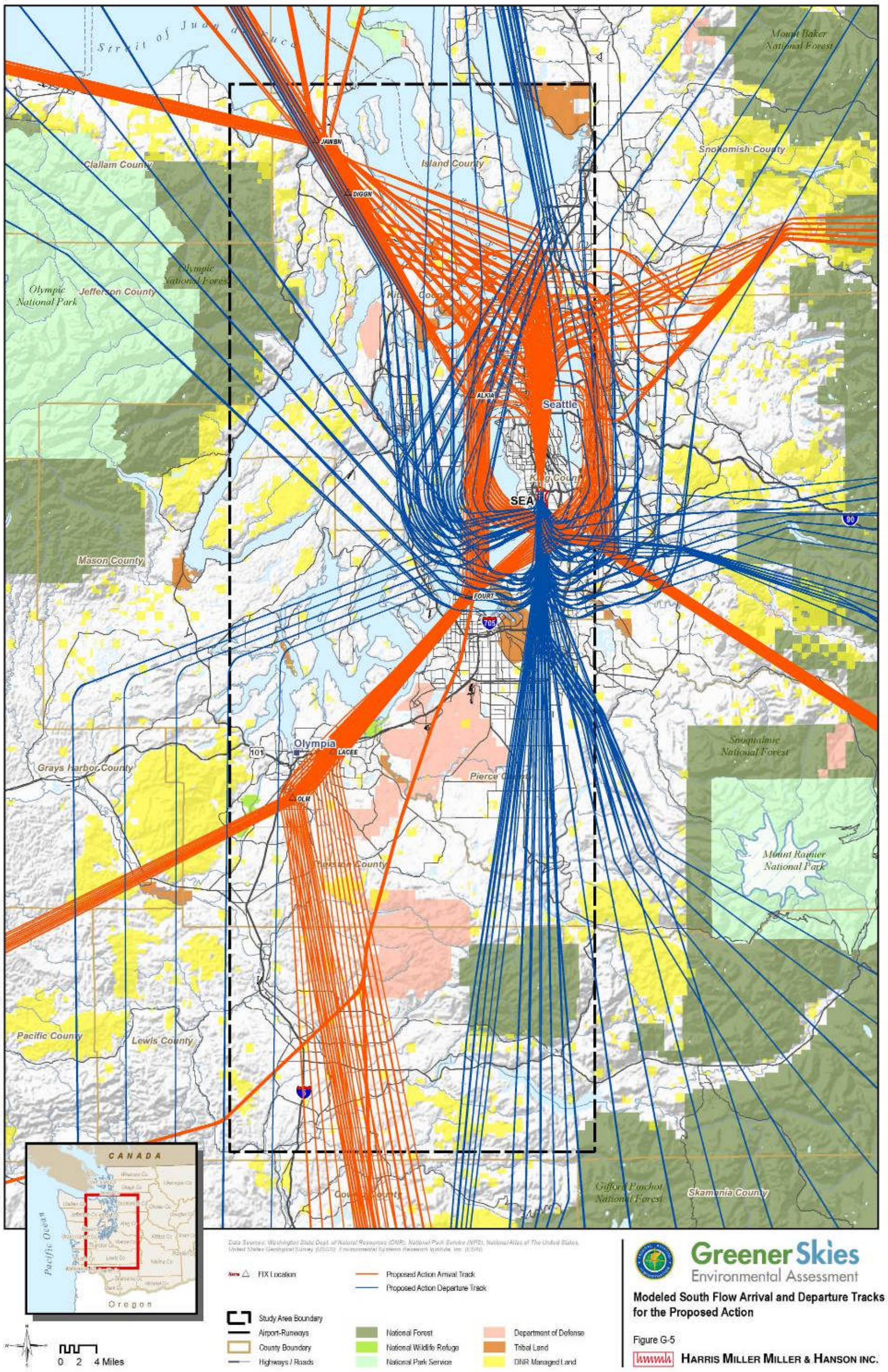

Figure G-5. Modeled South Flow Arrival and Departure Tracks for the Proposed Action