CHAPTER FIVE
ALTERNATIVES

This chapter presents the range of alternatives that were considered in this Part 150 Noise Compatibility Study Update to mitigate noise impacts of aircraft operations at the Seattle-Tacoma International Airport (Sea-Tac Airport). In this chapter, alternatives are divided into the following three primary categories:

- Abatement Alternatives focus on operational procedures that could potentially reduce noise at the source (e.g. flight location, runway use configuration, and flight procedures).
- Mitigation Alternatives focus on actions to remediate existing incompatible land uses or actions to prevent the development of new incompatible land uses in areas that are significantly impacted by aircraft noise.
- Program Management Alternatives address administrative and management actions to enhance the Port of Seattle's (Port) ability to respond to public concerns about aircraft noise and overflights, as well as to work closely with land use planning agencies to maintain compatibility between the airport and development in the airport environs.

Those alternatives that are recommended for inclusion in the updated Noise Compatibility Program (NCP) are included in **Chapter Six, *Noise Compatibility Program***.

5.1 ABATEMENT ALTERNATIVES

This section discusses the consideration and evaluation of potential abatement alternatives for possible inclusion in the updated NCP for Sea-Tac Airport. The concept of noise abatement generally focuses on measures that may be able to affect the source of the noise such that the receivers of noise (residential areas etc.) are exposed to less noise. Thus, abatement measures generally are concerned with actions that would alter the use or configuration of air space, flight tracks, airport facilities, or aircraft operations, so as to reduce or shift the location of noise. The evaluation of a number of these alternatives is required under Title 14 of the Code of Federal Regulations (14 CFR) Part 150, even though they may have little utility for local application. These measures tend to fall into one of the five general categories listed below.

- Runway Use Modifications
- Flight Routing Modifications
- Aircraft Operational Procedure Modifications
- Airport Facility Modifications
- Airport Regulations and Facility Restrictions

The consideration of the various potential abatement techniques must be undertaken in the context of the current NCP at Sea-Tac Airport as well as the policies of the Federal Aviation Administration (FAA) under 14 CFR Part 150. The Sea-Tac Airport NCP is an on-going program with a number of approved abatement measures already implemented. The currently-approved measures are discussed in Section 5.1.1. These measures, in conjunction with the changes in operational levels and fleet mix that have occurred over the past ten years, have resulted in reductions in noise exposure around the airport.

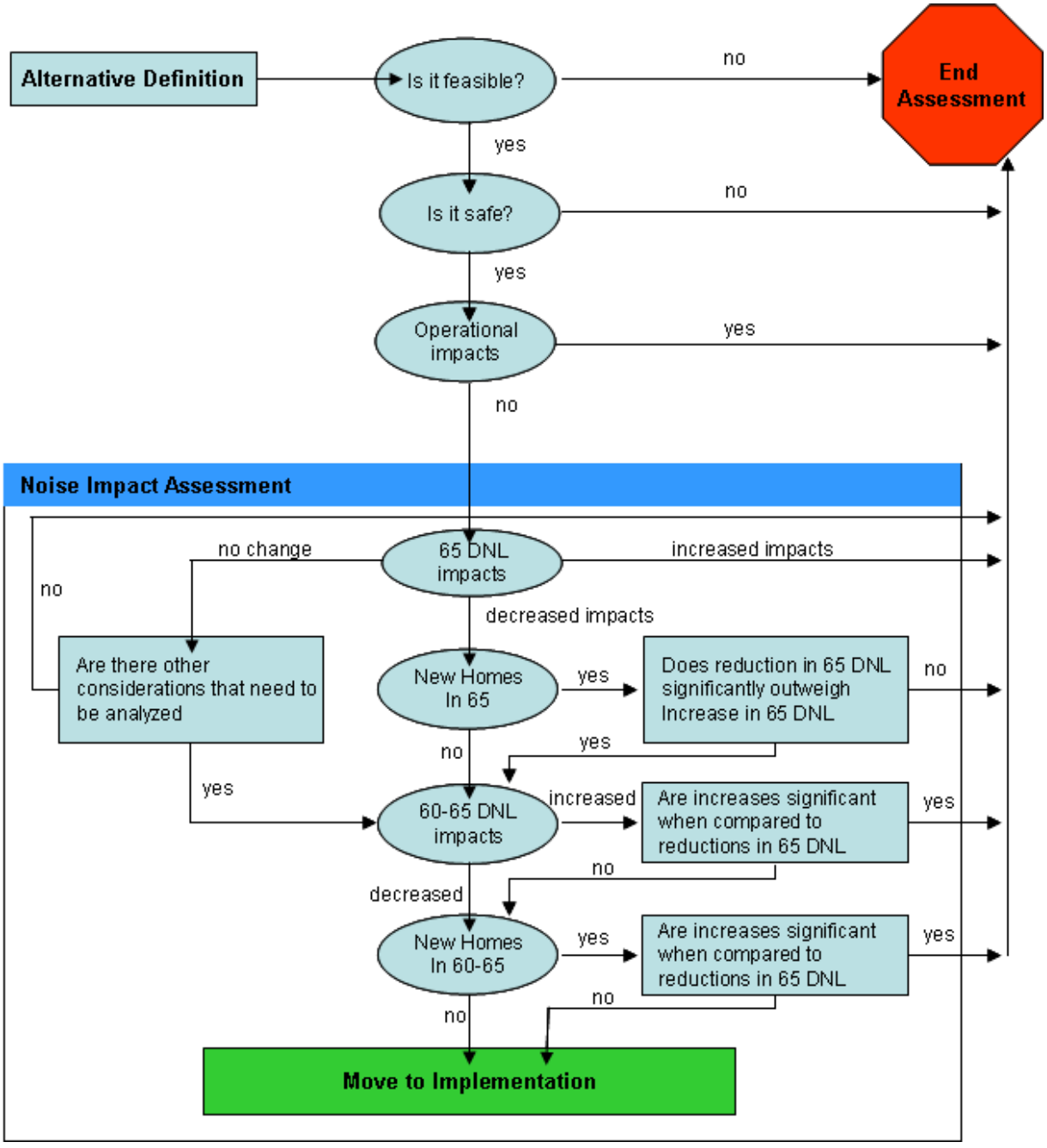
In order to evaluate each alternative, a set of evaluation criteria was established and used to identify the benefits and drawbacks of each alternative. The criteria include feasibility, safety, operational considerations, and noise reduction. After it was determined that an alternative was feasible, safe, and had no major operational drawbacks, an assessment of the benefits in terms of noise and land use compatibility was conducted. Because a decrease in one area may result in an increase in another area, priorities were developed to clarify the evaluation process. The noise impact priorities were as follows:

- Reductions in 65 + Day-Night Average Noise Level (DNL) (most important)
- Sensitivity to shifting noise from one area to another (important)
  - Ensuring that the tradeoffs of increased versus decreased noise are understood before making a decision
  - Recognizing that an alternative may have a net reduction in noise impacts, but may be eliminated because those impacts are a result of decreases in one area with a similar level of increases in another

Exhibit 5-1, *Abatement Alternatives Evaluation Process*, graphically depicts the steps of the evaluation process for abatement alternatives.

Within the aforementioned context, a two-step evaluation method was conducted for potential new abatement alternatives. First, a qualitative screening analysis was conducted on the full range of potential new abatement alternatives for Sea-Tac Airport to determine whether or not they were feasible, and safe, and whether or not they would cause operational impacts. A summary of this screening analysis is provided in Section 5.1.2. Secondly, those alternatives that were determined to be feasible were then subjected to a quantitative analysis, including, where applicable, an analysis of the benefits or drawbacks and potential implementation costs (*see* Section 5.1.3).

Exhibit 5-1
ABATEMENT ALTERNATIVES EVALUATION PROCESS



5.1.1 CURRENTLY APPROVED ABATEMENT MEASURES

This section provides a review of the current abatement measures that were included in the 1985, 1993, and 2002 NCP Updates. Provided for each measure is a description, the current status, and the recommendation for this 2013 NCP Update. Measures are either recommended to be continued, recommended to be continued with modification, recommended to be withdrawn, or are complete.

Measure A-1: Explore Limited Rescheduling of Nighttime Flights

Description: This measure involves the voluntary rescheduling of the flight times (earlier or later) of nighttime short-haul flights by jet aircraft. This measure primarily addresses those short-haul flights that currently are scheduled to operate between 10:00 p.m. and 12:00 a.m. or between 5:00 a.m. and 7:00 a.m. to reduce the number of operations of jet aircraft during periods of low ambient noise.

Status: Airlines operating at Sea-Tac Airport were sent letters requesting that they voluntarily limit nighttime flights. All startup airlines are sent letters requesting that they limit nighttime flights if possible. Also prior to the year 2000, Sea-Tac Airport had restrictions on Stage 2 aircraft over 75,000 lbs during the nighttime hours (prior to the Federally-mandated Stage 2 phase-out).

Recommendation: **CONTINUE** to encourage limited scheduling of nighttime flights.

Measure A-2: Eliminate Training Activity

Description: This measure was intended to limit the use of Sea-Tac Airport for training activities (primarily practice instrument approaches by military aircraft).

Status: This measure is complete. Very few military training operations occur at Sea-Tac Airport.

Recommendation: **COMPLETED** measure.

Measure A-3: Use VOR Radials to Curb Aircraft Drifting from Noise Abatement Track

Description: This measure uses very high frequency (VHF) omnidirectional range (VOR) radials to curb departing aircraft from drifting off the runway heading tracks as specified in the Tower Order.

Status: This measure has been implemented and adherence to this measure is ongoing.

Recommendation: **CONTINUE** measure.

Measure A-4: Expand Noise Monitoring System

Description: This measure expanded the existing noise monitoring system at Sea-Tac Airport by adding two additional permanent noise monitors.

Status: This measure has been implemented. The Port has a noise and operations monitoring system. The Port has periodically expanded and upgraded this system. The system collects and stores flight data from the FAA's automated radar terminal system, which enables staff to regularly monitor noise abatement procedures and investigate citizen inquiries. In addition to this system, the Port also provides WebTrak, which enables the public to investigate flights via the Web. The Port owns and operates 25 permanent noise monitors. The noise monitoring system measures noise levels from individual aircraft and keeps track of operations over time. As data from the monitors is accumulated and analyzed, a history of noise levels is maintained so changes can be noted and trends identified.

Recommendation: **COMPLETED** measure. Evaluate potential improvements to the current system as identified in Alternative P-A.

Measure A-5: Establish Noise Abatement Office

Description: This measure established a noise abatement office to initiate, implement, and monitor the various abatement actions included in the NCP.

Status: This measure has been implemented. The Port established and currently operates the Noise Abatement Office.

Recommendation: **COMPLETED** measure. Continue ongoing operation of the Noise Abatement Office through recommended new Measure P-3.

Measure A-6: Establish Follow-Up Public Committee

Description: This measure recommended the establishment of a committee to monitor programs implemented as a result of the Part 150 Study after its completion; and help develop and evaluate the Fly Quiet Program described in Measure A-12.

Status: This measure was approved by the FAA in the 2002 ROA. This measure is complete. The Follow-Up Committee assisted in the development of the Fly Quiet Program, which is currently in effect at Sea-Tac Airport. Committee disbanded after recommended programs were implemented.

Recommendation: **COMPLETED** measure.

Measure A-7: Establish Noise Barriers/Run-up Enclosure

Description: The 1985 Part 150 Study recommended the use of airport facilities for buffering ground noise. This measure was amended in the 2002 Part 150 Study Update to include the construction of a noise barrier in the North Cargo Area and conduct a siting/feasibility study for a Ground Run-up Enclosure (GRE), commonly referred to as a "hush house".

Status: Not implemented – This measure was approved in part by the FAA in the 2002 ROA. The FAA approved the conduct of a siting/feasibility study, but noted that "…placement of any future GRE will be subject to additional FAA review determined by the results of the study." The Port completed a feasibility study in 2001, but since then a recommended site could not be finalized because of airfield planning issues adjacent to the area that was designated for a future GRE. A GRE should be located in close proximity to the aircraft maintenance facilities of an airport's primary air carriers. The GRE is currently being reviewed again as part of the current Part 150 Study (see Alternative A-A in this chapter).

The construction of a noise barrier in the North Cargo Area was disapproved by the FAA in the 2002 FAA Record of Approval (ROA) because no land use compatibility benefit was shown within the DNL 65 dBA noise exposure contour.

This Part 150 Study Update also considered a noise barrier on the west side of the Sea-Tac Airport to provide a barrier from noise from aircraft operating on the runways and taxiways. A noise barrier is most effective when it is close to the source of the noise and at least 24 feet in elevation above the elevation of the runway. In order to clearly meet Part 77 Surfaces protecting navigable airspace, a noise barrier at 24 feet above the runway elevation at any location to the west of Sea-Tac Airport would need to be constructed at least 668 feet from runway centerline.

Recommendation: **WITHDRAW** measure and replace with Alternative A-A.

Measure A-8: Restrict Taxiing of Aircraft to/from Maintenance Areas during Nighttime Hours

Description: This measure would require that airlines tow aircraft to and from the maintenance area or when repositioning aircraft from one gate to another during nighttime hours to reduce noise from such ground operations.

Status: This measure was not implemented. Current airport rules and regulations do not prohibit taxiing aircraft for maintenance activity because it would reduce operational efficiency below acceptable levels.

Recommendation: **WITHDRAW** measure.

Measure A-9: Encourage Voluntary Phase-out of Stage 2 Jet Aircraft under 75,000 Lbs.

Description: The 1985 Part 150 Study recommended compliance with 14 CFR Part 36 standards related to the phase-out of Stage 2 aircraft weighing over 75,000 lbs. Jet aircraft weighing less than 75,000 lbs. are exempt from the Stage 2 phase-out mandated under the Airport Noise and Capacity Act (ANCA) of 1990. This measure was amended in the 2002 Part 150 Study Update to include a voluntary phase-out of Stage 2 commercial and business jets weighing less than 75,000 lbs.

Status: This measure was disapproved by the FAA in the 2002 ROA pending submission of additional information to document the contribution Stage 2 aircraft had on the overall noise environment at Sea-Tac Airport. However, this measure is complete. Horizon Airlines has phased-out the F-28 commercial jet, which met the Stage 2 criteria but was less than 75,000 lbs.

Recommendation: **COMPLETED** measure.

Measure A-10: Maintenance Run-up Regulations

Description: This measure addresses maintenance run-ups and recommends several limitations on run-up related activities. These include:

- Prohibit run-ups during the overnight hours of 12:00 a.m. to 6:00 a.m.
- Include language that allows run-ups during the shoulder hours of 10:00 p.m. to 12:00 a.m. and 6:00 a.m. to 7:00 a.m. only if it is necessary for a departure within two-and-a-half hours of the scheduled run-up.
- Increase fines for violations to the run-up regulations to $1,000 for the first offense, doubling each time thereafter, within a 12-month timeframe, to a maximum of $8,000 per occurrence.
- Implement new fine structure once new noise monitoring system has been installed and tested for reliability.
- Include run-up monitoring in Fly Quiet Program (See Measure A-12)
- Work with airlines to restrict run-ups on weekend mornings before 9:00 a.m. unless needed for a departure within two-and-a-half hours of the scheduled run-up.

Status: This measure was disapproved by the FAA in the 2002 ROA. This measure has been implemented by the Port independent of the NCP. The Port has established a period that restricts engine run-ups from 10:00 p.m. to 7:00 a.m. If absolutely necessary, run-ups may be conducted during these hours with the airport's permission and may not exceed two minutes in duration. Aircraft operators may conduct longer run-ups from 6:00 a.m. to 7:00 a.m. only if the aircraft is scheduled for a flight that departs between the hours of 7:00 a.m. to 8:30 a.m. and has the airport's permission. Violations to these time restrictions will result in the following tariffs being applied to the aircraft operator:

- First offense – Letter of Admonishment
- Second offense in a calendar year - $1,000
- Third offense within a calendar year from the first offense - $2,000
- Maximum fine within a calendar year from first offense - $8,000

Recommendation: **CONTINUE** measure.

Measure A-11: Preferential Runway Use

Description: This measure implemented a preferential runway system, during the nighttime hours, for operations through the North Flow Nighttime Noise Abatement Corridor. This would be operational when traffic and other conditions permit as determined by the FAA. When conditions permit, during nighttime hours, departures can be shifted from south to north, thus utilizing the established noise abatement corridor.

Status: This measure was approved as voluntary by the FAA in the 2002 ROA. This measure has been implemented.

Recommendation: **CONTINUE** measure.

Measure A-12: Development/Implementation of a Fly Quiet Program

Description: This measure is intended to encourage greater compliance with the abatement procedures, work with operators to reduce single event noise levels, and continue to raise awareness of citizens' noise concerns with the FAA and aircraft operators. The Fly Quiet Program was recommended to:

- Monitor adherence to ideal noise abatement flight tracks
- Evaluate success of airlines, aircraft types, and other variables
- Establish goals and track level of improvement over time
- Offer incentives for improvement

The Fly Quiet Program was recommended to include the following elements:

- Aircraft noise should be related to its effects on people including such factors as annoyance, speech interference and sleep disturbance;
- Comparative fleet quality between airlines should also be included;
- The program should utilize measured data from the Airport's noise monitoring system;
- A method of normalizing data to account for airlines that most efficiently serve the region's air transportation needs should be developed;
- Incentives of sufficient importance that airlines will take notice of the results; and
- Pilots and air traffic controllers should be included, if possible.

Status: This measure was approved as voluntary by the FAA in the 2002 ROA. This measure has been implemented. The Fly Quiet Program was implemented in 2004 and remains in place for the foreseeable future. Airline operations are carefully monitored and airlines compete to be designated as the "quietest" at Sea-Tac Airport. Winning airlines are rewarded with extensive publicity regarding their Fly Quiet efforts. Airlines are evaluated on their performance in complying with flight tracks, as well as their compliance with ground run-up regulations. An advisory committee worked in 2003 to assist the Port in developing the program, and served as the "follow-up committee" per the 2002 recommendation.

Recommendation: **CONTINUE** measure and expand program according to Alternative A-B.

Measure A-13: Evaluate Increased Use of the Duwamish/Elliott Bay Corridor with FMS

Description: Through this measure, the Port encouraged the FAA to pursue options for determining the feasibility of increased use of the Duwamish/Elliott Bay Corridor. Increasing the use of Flight Management Systems (FMS) technology ensures that the rate of adherence to an optimum flight track will increase over time.

Status: This measure was previously disapproved by the FAA in the 2002 ROA. According to the 2002 ROA, implementing this action would greatly impact the efficiency of the air traffic system in the region and degrade safety, which would not be consistent with 14 CFR Part 150, section 150.35(b)(3)(iii).

Recommendation: **WITHDRAW** measure.

Measure A-14: Nighttime Use of Commencement Bay Departure Corridor

Description: This measure recommended that the FAA study the nighttime (12:00 a.m. to 5:00 a.m.) use of the Commencement Bay corridor.

Status: This measure was studied during the 2002 Part 150. Port staff coordinated/consulted with Pierce County officials who firmly objected to the recommendation. Since no agreement could be made between the various jurisdictions involved, no FAA action was taken in the 2002 ROA and the recommendation was not implemented.

Recommendation: **WITHDRAW** measure.

Measure A-15: Use of FMS Procedures

Description: This measure is designed to encourage the use of FMS procedures over non-populated areas, to discourage the development of new FMS procedures over populated areas, and to support development of FMS procedures for all north flow departures turning west to improve compliance with the identified noise

abatement corridor. FMS flight tracks have the potential to become very narrow on straight portions of the flight tracks. When turning, however, the differing operating characteristics of the aircraft will cause dispersion.

Status: This measure was approved by the FAA in the 2002 ROA. This measure has been implemented. Following the 2002 Part 150, FMS departure procedures have been developed by the FAA for use of the Duwamish/Elliott Bay corridor and are routinely assigned to pilots.

Recommendation: **CONTINUE** measure.

Measure A-16: Use of Ground Equipment

Description: This measure recommended the installation of power and conditioned air in existing and newly constructed gates to minimize the use of auxiliary power units/ground power units. Once power and conditioned air are installed at gates, airlines should be required to use these services.

Status: This measure was disapproved by the FAA in the 2002 ROA; however, has been implemented by the Port independently of the NCP. The project is underway – 73 gates are anticipated to be equipped with central pre-conditioned air by April 2013. As of October 2012 there were 30 diesel/electric point of use units being utilized.

Recommendation: **CONTINUE** measure.

Measure A-17: Raise Altitude Where Aircraft Intercept Glide Slope

Description: When aircraft are on arrival to the Airport, they are utilizing the glide slope and the angle of the glide slope to line up on the runway and descend at the proper rate of speed and angle to touch down on the runway. This is usually done under instrument flying conditions, but almost all-commercial service aircraft and cargo aircraft fly the glide slope even during clear weather conditions (VFR). All glide slope angles at the Airport are at three degrees. This is consistent with almost every other airport in the country. Aircraft are designed to operate at an approximate three-degree glide slope for safety, efficiency of aircraft movement, performance of the aircraft, and comfort to the passengers. Increasing the glide slope increases the altitude of aircraft upon approach, thus decreasing noise levels below the approach path.

Status: This measure was previously disapproved by the FAA. As noted in the 2002 ROA, moving aircraft further out on the glide slope would negatively impact airspace capacity and efficiency. The current procedures are needed to maintain operational efficiency at the airport.

Recommendation: **WITHDRAW** measure.

5.1.2 SCREENING OF POTENTIAL ABATEMENT ALTERNATIVES

This section summarizes the qualitative screening analysis of modified or potential new noise abatement measures. **Table 5-1, *Abatement Alternatives Screening Analysis Summary*** presents a summary of the screening of the abatement alternatives. The "Evaluation and Recommendation" column provides a brief synopsis of the issues and findings associated with each alternative and notes whether the alternative was recommended for further analysis. Those alternatives that were determined to warrant further analysis are discussed in greater detail in Section 5.1.3.

5.1.3 ANALYSIS OF POTENTIAL ABATEMENT ALTERNATIVES

The qualitative analysis described in Section 5.1.2 identified two potential new measures that are recommended for continued evaluation. These measures are analyzed in greater detail in the following pages.

The following information is provided for each alternative:

- Title – includes a brief descriptive title of the measure.
- Category – provides the category of each abatement alternative (runway use modification, flight routing modification, airport regulations and facility restrictions, aircraft operational procedure modification, or airport facility modification).
- Background and Intent – includes the intent of the measure as a means to mitigate noise impacts, and the background and setting to which the measure relates where applicable.
- Benefits – includes a statement of how the measure would provide noise mitigation benefits.
- Drawbacks – identifies any potential negative consequences of implementing the measure.
- Cost to Implement – identifies the potential cost to implement each measure.
- Evaluation Method – provides the method by which the measure was evaluated.
- Findings and Recommendations – provides a recommendation as to whether or not to carry forward the alternative for further analysis and consideration. In some cases alternatives had drawbacks that made that alternative unfeasible or they did not provide measureable benefits and therefore no further consideration was warranted. Those alternatives that showed potential benefits were continued for further analysis, including further discussion with parties responsible for implementation (FAA, Port, airport users) and presented to the public for input and comment. Alternatives that are recommended for inclusion in this NCP update are included in Chapter Six.

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Table 5-1
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
FLIGHT TRACK MODIFICATIONS			
Modify departure flight tracks to reduce noise within the DNL 65 dBA (e.g., immediate turns, hold runway heading longer, International Blvd. departure).	Could reduce noise levels for the areas experiencing the most overflights.	Due to the lack of naturally occurring compatible corridors within the DNL 65 dBA, modifying flight tracks close in to the runways would result in shifting noise from one area to another.	Due to the inability to identify flight track procedures that would not result in simply shifting noise from one area to another, this alternative is **NOT RECOMMENDED** for further analysis.
Modify arrival flight tracks to reduce noise within the DNL 65 dBA (e.g., follow interstates, visual approaches).	Could reduce noise levels for the areas experiencing the most overflights.	Due to the lack of naturally occurring compatible corridors within the DNL 65 dBA, modifying flight tracks close in to the runways would result in shifting noise from one area to another.	Due to the inability to identify flight track procedures that would not result in simply shifting noise from one area to another, this alternative is **NOT RECOMMENDED** for further analysis.
Modify departure flight tracks to reduce noise outside the DNL 65 dBA (e.g., use water corridors, utilize RNAV/RNP to improve track adherence).	n/a	n/a	Part 150 guidelines require that any approved air traffic measure must show benefits for non-compatible uses within the DNL 65 dBA. By definition, this effort would not meet that requirement. Furthermore, because the evaluation of flight tracks within the DNL 65 dBA found no options, this effort cannot be combined with other measures to result in a positive impact. Therefore, this alternative is **NOT RECOMMENDED** for further analysis.

Table 5-1, *Continued*
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
FLIGHT TRACK MODIFICATIONS (CONTINUED FROM PREVIOUS PAGE)			
Modify arrival flight tracks to reduce noise outside the DNL 65 dBA (e.g., visual approach procedures, RNAV/RNP to improve flight track adherence).	n/a	n/a	Part 150 guidelines require that any approved air traffic measure must show benefits for non-compatible uses within the DNL 65 dBA. By definition, this effort would not meet that requirement. Furthermore, because the evaluation of flight tracks within the DNL 65 dBA found no options, this effort cannot be combined with other measures to result in a positive impact. It should be noted that the Port was a participant in the Greener Skies Initiative that looked at modifying procedures farther out from the Airport. Changes in the noise exposure from these arrival procedures are all outside of the DNL 65 dBA contour and as such the Greener Skies Initiative is independent of this Part 150 Study. Therefore, this alternative is **NOT RECOMMENDED** for further analysis.
RUNWAY USE MODIFICATIONS			
Voluntary restrictions on one or more of the runways to only arrival operations.	Would reduce noise from departures for areas immediately north/south of the runway not being used for departures.	• Would result in departures being shifted from one area to another. • Reduces operational flexibility of FAA Air Traffic, potentially increasing delays.	Due to the outcome being a shifting of noise from one area to another and potential operational impacts, this alternative is **NOT RECOMMENDED** for further analysis.
Voluntary restrictions on one or more of the runways to daytime only flights.	Would result in localized noise reduction at night for areas immediately north/south of the runway not being used.	• Would result in nighttime flights being shifted from one area to another. • Reduces operational flexibility of FAA Air Traffic, potentially increasing delays.	Due to the outcome being a shifting of noise from one area to another and potential operational impacts, this alternative is **NOT RECOMMENDED** for further analysis.

Table 5-1, *Continued*
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
AIRCRAFT OPERATIONAL PROCEDURE MODIFICATIONS			
Optimized Profile Descent Approach procedure	Optimized Profile Descent (OPD) procedures (previously known as continuous descent approach [CDA]) have been used at some airports to reduce approach noise at a distance from the airport. Generally, their most notable effect relates to reduced fuel burn and corresponding air emissions.	Potential noise reduction benefits would be limited to areas outside DNL 65 dBA.	Because no benefits are likely to occur within the DNL 65 dBA, this measure is **NOT RECOMMENDED** for inclusion in the NCP; although it should be noted that OPDs were included in the Greener Skies Initiative.
Implement Distant Noise Abatement Departure Profiles (NADP)	Implementing Distant NADPs can potentially reduce noise for areas further away from the runway end (greater than three miles).	Distant NADPs can potentially increase noise for areas closer to the runway end.	Due to the land use patterns around Sea-Tac Airport, this alternative is **NOT RECOMMENDED** for further analysis.
Implement Close-in Noise Abatement Departure Profiles (NADP)	Implementing Close-in NADPs can potentially reduce noise for areas in close proximity to the runway end (less than three miles).	Close-in NADPs can potentially increase noise for areas farther away from the runway end.	Due to the land use patterns around Sea-Tac Airport, this alternative is **NOT RECOMMENDED** for further analysis.

Table 5-1, *Continued*
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
AIRPORT FACILITY MODIFICATIONS			
Construct a hush house on the airport to minimize run-up noise.	Could reduce run-up noise by up to 20 dB. Standardizes procedures for run-ups.	Expensive facility ($4-$6 million) and potentially high cost for site preparation. Requires a large land envelope, which is in demand at Sea-Tac Airport. Increases time needed for run-up due to aircraft positioning.	Due to the benefits, **CONTINUE TO EXPLORE** the feasibility and specific plans for a hush house on the airport (see Alternative A-A).
Construct noise berms/walls to minimize ground noise.	Could reduce noise from taxiing, engine run-ups, reverse thrust, and engine idling.	• The placement of a noise berm/wall at Sea-Tac Airport would need to be on the west side of the airport to be effective. • The terrain on that side of the airport and the FAA height restrictions make it impossible to site a berm/wall that would effectively reduce noise.	Due to the inability to site a berm/wall that would be effective, this alternative is **NOT RECOMMENDED** for further analysis.
Apply sound-absorbing materials to airport buildings	The use of sound absorbing materials could reduce noise from aircraft taxiing on the airfield	Noise reduction would occur within a few hundred feet of the building. Beyond that, the noise reduction would be imperceptible because noise from taxiing aircraft becomes indistinguishable from roadway and aircraft flight noise. As a result, this option would have little effect on residential uses due to the location of the airport buildings in relationship to nearby residential uses.	Due to the limited effectiveness of such a measure, this alternative is **NOT RECOMMENDED** for further analysis.

Table 5-1, *Continued*
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
AIRPORT FACILITY MODIFICATIONS (CONTINUED FROM PREVIOUS PAGE)			
Runway Extension	A runway extension can potentially reduce departure noise for noise-sensitive areas under the departure path by allowing aircraft to begin their take-off roll further away from the noise-sensitive areas, thus allowing them to reach a greater altitude before overflying that area.	A runway extension has the potential to increase arrival noise as aircraft will touch-down at a point closer to off-airport land uses under the arrival path, and thus be at lower altitude over these areas. High construction cost.	Sea-Tac Airport recently opened a new air carrier runway and the current land use patterns around the airfield are not conducive for alternative runway alignments that would benefit noise compatibility. Therefore, this alternative is **NOT RECOMMENDED** for further analysis.
Displaced or Relocated Thresholds	A displaced or relocated threshold has the potential to reduce arrival noise by moving the touchdown point farther away from noise-sensitive land uses under the approach path, thus increasing the altitude of arriving aircraft over these areas.	Reduces the operational effectiveness of a runway and reduces the margin of safety for arriving aircraft, increasing the potential for missed approaches and overruns.	This alternative was assessed in the 2002 Part 150 Study, which determined that to achieve a perceptible sound reduction, a runway displacement of 3,000 ft. or more is required, which would adversely affect the operational efficiency of Sea-Tac Airport. Therefore, this alternative is **NOT RECOMMENDED** for further analysis.

Table 5-1, *Continued*
ABATEMENT ALTERNATIVES SCREENING ANALYSIS SUMMARY
Seattle-Tacoma International Airport

DESCRIPTION	BENEFITS	DRAWBACKS	EVALUATION AND RECOMMENDATION
AIRPORT REGULATIONS AND FACILITY RESTRICTIONS			
Implement Airport Operational Restrictions (Part 161 Restrictions) such as: noise-/time-based landing fees, airport capacity restrictions based on relative "noisiness", aircraft type restrictions based on "noisiness"	Can resolve noise annoyance issues with certain loud aircraft events or aircraft types operating at Sea-Tac Airport.	Such restrictions would be subject to the costly and time-consuming analytical requirements under FAR Part 161 (Part 161). The FAA has never officially approved such measures, and due to the current noise mitigation situation at Sea-Tac Airport, would be unlikely to approve such measures for noise mitigation purposes.	Restrictions on access to an airport are measures of last resort for use in the most extreme cases of noise impact. This alternative is **NOT RECOMMENDED** for further analysis.
Modify/Expand the Fly Quiet Program	Can improve the effectiveness of the existing Fly Quiet Program at Sea-Tac Airport.	Program is voluntary and could encounter resistance from airlines and aircraft operators.	Due to the benefits, **CONTINUE TO EXPLORE** the feasibility and potential methods for expanding the Fly Quiet Program.
Modify restrictions on engine run-ups	Can reduce noise annoyance issues associated with engine run-ups	• Does not reduce the size of the DNL 65 dBA noise contour over noise-sensitive land uses. • Imposes additional restrictions on aircraft operators.	Sea-Tac Airport currently has run-up procedures in place that have been developed through a collaborative effort between the Port, airlines, and community members. This alternative is **NOT RECOMMENDED** for further analysis with the exception of potentially adjusting the location in accordance with Alternative A-A.

Source: Landrum & Brown analysis, 2013.

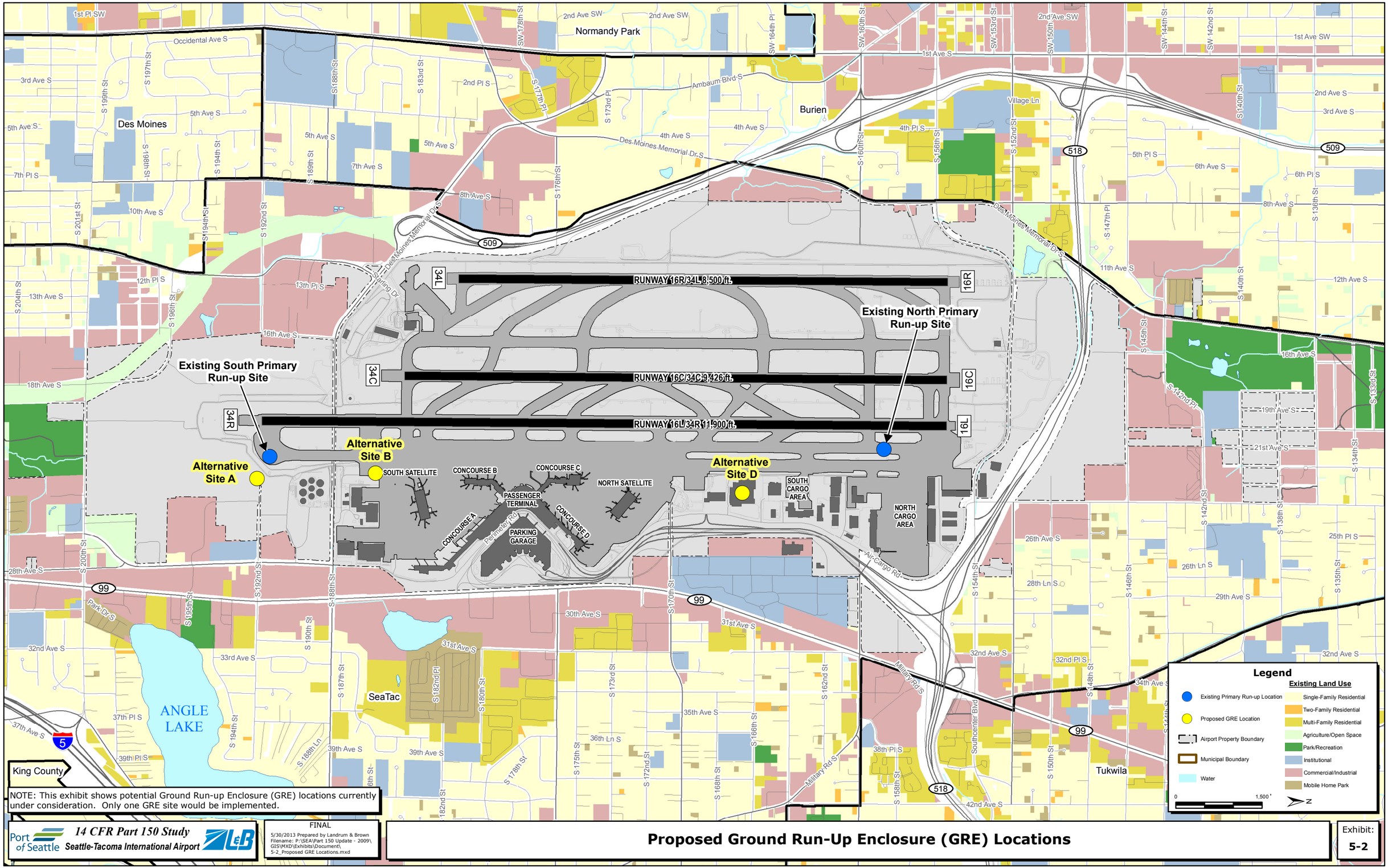
NOISE COMPATIBILITY PROGRAM ALTERNATIVE A-A

TITLE:	Construct a Ground Run-Up Enclosure (GRE, a.k.a. hush house) on the airport to minimize run-up noise.
CATEGORY:	Airport Facility Modifications
BACKGROUND AND INTENT:	The 1985 Part 150 recommended the use of airport facilities for buffering ground noise. The 2002 Part 150 Study Update recommended the construction of a noise barrier in the North Cargo Area and a siting/feasibility study for a Ground Run-up Enclosure (GRE), commonly referred to as a "hush house". The Port completed a feasibility study in 2001, but since then a recommended site could not be finalized because of some serious airfield planning issues adjacent to the area that was designated for a future GRE. Currently engine run-ups are conducted in two locations on the airfield, on Taxiway B between Taxiways D and E, and on the hold pad east of the end of Runway 34R. Neither of these locations provide for any significant buffering of engine noise. Concurrent to this Part 150 Study an updated Hush House Siting Study has been undertaken. This study assessed multiple Hush House alternatives, including several locations on the airfield. This measure recommends construction of a Hush House based on the recommendation of the GRE Siting Study. See Appendix K for more information on the GRE Siting Study. **Exhibit 5-2** shows the potential GRE sites under consideration. Only one GRE site will be selected following the outcome of the GRE siting study.
BENEFITS:	Would reduce engine noise from ground run-ups. Depending on which potential site and orientation is chosen, construction and use of a hush house could result in a reduction in single event noise by up to 20 dB.
DRAWBACKS:	Would not reduce the number of incompatible uses within the DNL 65 dBA. Depending upon the type of facility and orientation, a GRE would have a limited effect on noise reduction in the direction of the open end of a three-sided structure. Some locations may experience an increase in single event noise if the location of the GRE is closer than the existing primary run-up locations and if those areas are aligned with the open end of the GRE. Expensive facility and site preparation costs. Requires a large land envelope, which is in demand at Sea-Tac Airport. Increases time needed for run-up due to aircraft positioning.
COST TO IMPLEMENT:	Construction of a Hush House is estimated to range from $6,000,000 to $17,000,000, depending on site preparation costs.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE A-A, *Continued*

EVALUATION METHOD:	Qualitative and quantitative – **Table 5-2** shows a comparison of the noise level created by a run-up event with and without a Hush House using the Maximum Noise Level (Lmax) noise metric to show the maximum noise energy generated by a typical single run-up event. However, 14 CFR Part 150 guidelines do not consider the Lmax metric when evaluating an alternative. Therefore the results of this analysis are provided for information purposes only.

FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP, if implemented, it is recommended that the current run-up regulations at Sea-Tac Airport be modified to reflect the location of the GRE.



NOTE: This exhibit shows potential Ground Run-up Enclosure (GRE) locations currently under consideration. Only one GRE site would be implemented.

Port of Seattle — *14 CFR Part 150 Study* — *Seattle-Tacoma International Airport* — LeB

FINAL

5/30/2013 Prepared by Landrum & Brown
Filename: P:\SEA\Part 150 Update - 2009\GIS\MXD\Exhibits\Document\5-2_Proposed GRE Locations.mxd

Proposed Ground Run-Up Enclosure (GRE) Locations

Exhibit: **5-2**

Table 5-2
SINGLE EVENT GROUND RUN-UP NOISE ANALYSIS GRID POINT RESULTS
Seattle-Tacoma International Airport

GRID ID	South Primary	North Primary	Site A (West Orientation)			Site B1 (South Orientation)			Site B2 (West Orientation)			Site D9 (West Orientation)			Site D10 (South Orientation)		
	Lmax	Lmax	Lmax	Difference from South Primary	Difference from North Primary	Lmax	Difference from South Primary	Difference from North Primary	Lmax	Difference from South Primary	Difference from North Primary	Lmax	Difference from South Primary	Difference from North Primary	Lmax	Difference from South Primary	Difference from North Primary
NE1	62.5	63.7	49.6	-12.9	-14.1	47.9	-14.6	-15.8	52.5	-10.0	-11.2	59.9	-2.6	-3.8	62.6	0.1	-1.1
NE2	60.6	70.6	47.8	-12.8	-22.8	46.1	-14.5	-24.5	50.3	-10.3	-20.3	48.2	-12.4	-22.4	63.3	2.7	-7.3
NE3	58.4	71.8	45.7	-12.7	-26.1	44.3	-14.1	-27.5	47.8	-10.6	-24.0	54.1	-4.3	-17.7	61.0	2.6	-10.8
NE4	55.6	73.4	42.8	-12.8	-30.6	41.7	-13.9	-31.7	44.7	-10.9	-28.7	58.2	2.6	-15.2	54.5	-1.1	-18.9
NE5	59.4	67.4	46.8	-12.6	-20.6	47.2	-12.2	-20.2	48.9	-10.5	-18.5	48.0	-11.4	-19.4	56.8	-2.6	-10.6
NW1	52.6	69.1	42.3	-10.3	-26.8	44.9	-7.7	-24.2	44.2	-8.4	-24.9	65.9	13.3	-3.2	54.0	1.4	-15.1
NW2	53.2	69.0	43.3	-9.9	-25.7	46.1	-7.1	-22.9	45.3	-7.9	-23.7	66.5	13.3	-2.5	54.5	1.3	-14.5
NW3	54.9	66.8	45.4	-9.5	-21.4	48.4	-6.5	-18.4	53.6	-1.4	-13.3	66.3	11.4	-0.5	53.7	-1.2	-13.1
NW4	53.3	57.8	53.5	0.2	-4.3	42.0	-11.3	-15.8	54.5	1.2	-3.3	57.1	3.8	-0.7	44.5	-8.8	-13.3
SE1	71.9	52.1	62.2	-9.7	10.1	67.7	-4.2	15.6	56.9	-15.0	4.8	44.1	-27.8	-8.0	56.8	-15.1	4.7
SE2	78.8	53.8	55.4	-23.4	1.6	74.1	-4.7	20.3	65.4	-13.4	11.6	47.6	-31.2	-6.2	60.0	-18.8	6.2
SE3	73.0	54.3	54.4	-18.6	0.1	61.7	-11.3	7.4	49.1	-23.9	-5.2	49.1	-23.9	-5.2	61.4	-11.6	7.1
SE4	67.9	57.3	55.8	-12.1	-1.5	59.6	-8.3	2.3	58.6	-9.3	1.3	54.4	-13.5	-2.9	66.2	-1.7	8.9
SE5	68.4	53.1	48.1	-20.3	-5.0	55.5	-12.9	2.4	49.6	-18.8	-3.5	46.9	-21.5	-6.2	59.0	-9.4	5.9
SW1	69.4	59.3	67.4	-2.0	8.1	56.2	-13.2	-3.1	68.6	-0.8	9.3	55.1	-14.3	-4.2	61.4	-8.0	2.1
SW2	70.7	55.0	70.2	-0.5	15.2	67.1	-3.6	12.1	61.6	-9.1	6.6	44.3	-26.4	-10.7	57.0	-13.7	2.0
SW3	65.4	55.1	64.7	-0.7	9.6	57.1	-8.3	2.0	63.8	-1.6	8.7	43.6	-21.8	-11.5	56.4	-9.0	1.3
SW4	61.9	55.6	60.8	-1.1	5.2	48.3	-13.6	-7.3	60.9	-1.0	5.3	56.5	-5.4	0.9	50.2	-11.8	-5.5
SW5	63.6	59.1	62.2	-1.4	3.1	51.0	-12.6	-8.1	63.5	-0.1	4.4	60.3	-3.3	1.2	54.1	-9.6	-5.1
High	78.8	73.4	70.2	0.2	15.2	74.1	-3.6	20.3	68.6	1.2	11.6	66.5	13.3	1.2	66.2	2.7	8.9
Low	52.6	52.1	42.3	-23.4	-30.6	41.7	-14.5	-31.7	44.2	-23.9	-28.7	43.6	-31.2	-22.4	44.5	-18.8	-18.9
Average	63.2	61.3	53.6	-9.6	-7.7	53.0	-10.2	-8.3	54.7	-8.5	-6.6	54.0	-9.2	-7.3	57.2	-6.0	-4.1

Source: Landrum & Brown, 2013.

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NOISE COMPATIBILITY PROGRAM ALTERNATIVE A-B

TITLE:	Expand the Fly Quiet Program.
BACKGROUND AND INTENT:	The Port established a Fly Quiet program following the recommendation from the 2002 Part 150 Study Update (see Measure A-12). This measure would identify opportunities to expand the program with new elements, including: • Use of Airport Traffic Control Tower (ATCT) reporting of operational modes for comparison to runway use goals. • Include provisions for the use of the hush house recommended in Alternative A-A. • Evaluate the possibility of adding different categories of airline operations.
BENEFITS:	This measure can improve the effectiveness of the existing Fly Quiet Program at Sea-Tac Airport.
DRAWBACKS:	Program is voluntary and could encounter resistance from airlines and aircraft operators.
COST TO IMPLEMENT:	Minimal administrative cost to the Port. Additional costs to airport users to comply with expanded program on a voluntary basis.
EVALUATION METHOD:	Qualitative – No specific noise reduction benefits can be quantified because program elements are voluntary on the part of aircraft operators.
FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

5.2 MITIGATION ALTERNATIVES

This section provides a summary of the analysis of the currently-approved mitigation measures and potential new mitigation alternatives.

5.2.1 CURRENTLY APPROVED MITIGATION MEASURES

This section provides a review of the currently-approved mitigation measures that were included in the 2002 NCP Update. Provided for each measure is a description, the current status, and the recommendation for this 2013 NCP Update. Measures are either recommended to be continued, to be continued with modification, or to be withdrawn.

Measure M-1: Outright Acquisition

Description: Single-Family homes located within high noise exposure areas were recommended for outright acquisition.

Status: This measure is complete. Approximately 1,400 single-family residences were acquired and residents were relocated, including 388 units that were acquired for construction of the new third parallel runway.

Recommendation: **COMPLETED** measure.

Measure M-2: Sound Insulation

Description: Install sound insulation in single-family residential units within the Noise Remedy Boundary established in the 1985 Part 150 Study. This measure was amended in the 1993 NCP Update by Measures M-2a, M-2b, M-2c, and M-2d described below.

Measure M-2a: Standard Insulation

Description: Continuation of original Measure M-2 for sound insulation of eligible single-family residences. This measure was again amended in the 2002 NCP Update to focus efforts on more highly impacted residential uses; although, the overall Remedy Program Boundary set in 1985 was not changed. Completion of the single family sound insulation program was also an element of the July 3, 1997 Record of Decision for the Master Plan Update for the inclusion of the new third runway.[1]

Status: This measure was approved by the FAA in the 2002 ROA and is ongoing. As of August 2012, over 9,300 single-family homes have been sound insulated.

[1] United States Department of Transportation, Federal Aviation Administration, Record of Decision for the Master Plan Update Development Actions Sea-Tac International Airport, Seattle, Washington, July 3, 1997.

Recommendation: **CONTINUE** measure within modified Noise Remedy Boundary (see Chapter Six, Section 6.1.1).

Measure M-2b: Insulation of Schools

Description: This measure includes a sound insulation program for eligible schools. A pilot program was initiated according to the original measure from the 1993 NCP Update to determine the feasibility, procedural requirements, and costs, for sound insulating four public buildings based on the Building Committee recommendations. Following the pilot program, several private schools and classrooms at Highline Community College were insulated within the DNL 65 dBA noise contour. This measure was amended in the 2002 NCP Update to develop a program to insulate schools within the Highline School District that fall within the DNL 65 dBA.

Status: This measure was approved by the FAA in the 2002 ROA and is ongoing. As of August 2012, sound insulation has been installed in seven schools within the Highline School District, with eight schools remaining. Fourteen of the eligible 22 buildings on the Highline Community College Campus have been sound insulated.

Recommendation: **CONTINUE** measure.

Measure M-2c: Multi-Family Developments

Description: This measure includes a sound insulation program for eligible multi-family residences. The 1993 NCP Update recommended a pilot project to sound insulate one multi-family unit similar to the criteria outlined in measure M-2. That pilot project was implemented and the measure was amended in the 2002 NCP Update to include sound insulation for approximately 300 owner-occupied multi-family units within the 70+ DNL of the 1998 noise contour. Owner-occupied units (e.g. condominiums) were considered differently than tenant-occupied units (e.g. apartments) for two major reasons: 1) apartments are considered a business because the units are rented for a profit and 2) they are typically not a permanent residence and the residents are generally more mobile, and the owner-occupied multi-family residents typically have more monetary investment in their residence. Structures must meet the same eligibility requirements as single-family homes within the Noise Remedy Boundary.

Status: This measure was approved by the FAA in the 2002 ROA. This measure is ongoing. As of October 2012, approximately 236 units within six condominium complexes have been sound insulated.

Recommendation: **WITHDRAW** measure and replace with alternatives M-C and M-D.

Measure M-2d: Mobile Homes

Description: The 1993 NCP Update recommended that the Port offer financial assistance for the removal of mobile homes for residents within a manufactured/mobile home park (MMHP) which the owner has decided to close. In exchange for this assistance, the MMHP owner would sign an avigation easement to ensure that a noise compatible use would be developed to replace the MMHP. This measure was amended in the 2002 NCP Update in two ways: 1) the Port will purchase MMHPs within the 70+ DNL of the 1998 noise contour and provide relocation assistance to the residents in accordance with the Uniform Relocation and Property Acquisition Policies Act, as amended; and 2) the Port will continue to offer financial assistance for the removal of mobile homes for residents residing in parks, where the park owner has decided to close the park, located in the 65 to 70 DNL of the 1998 noise contour.

Status: This measure was approved by the FAA in the 2002 ROA. This measure is complete. The Port acquired five mobile home parks with a total of 359 mobile home units. Owners of those homes were relocated with financial and advisory assistance from the Port (see also Alternative M-E).
Recommendation: **COMPLETED** measure.

Measure M-3: Transaction Assistance

Description: Formerly referred to as "purchase assurance" this measure is now termed transaction assistance in keeping with its primary function. The intent of the measure is to provide financial and technical assistance to owner-occupants of single-family residences who desire to sell and move away from areas of relatively high noise exposure. If the various forms of assistance to be made available do not result in an acceptable sales transaction, the Port could acquire the property at fair market value as a "buyer of last resort." Following necessary improvements (which could include sound insulation); the Port would resell the property to a willing buyer with an avigation easement attached to the deed.

Status: This measure is ongoing. It was approved in the 1985 NCP and amended in the 1993 NCP (see Measures M-3a and M-3b).

Measure M-3a: Special Purchase Option

Description: This measure modified the Transaction Assistance program to include a Special Purchase Option (SPO) for residents who have owned their home for more than five years, and are adjacent to Port property, to have the option to sell their property to the Port based on fair market value. The Port will then insulate the residence and offer it for resale. This SPO can occur only once per property.

Status: Due to the lack of community response for this program it was discontinued.

Measure M-3b: Insulation Requirement

Description: This measure modified the Transaction Assistance program to require that to be eligible for the program, a homeowner must first have the property sound insulated. If, after sound insulation is completed, the homeowner still wishes to relocate, they will be eligible for transaction assistance.

Status: Due to the lack of community response for this program it was discontinued.

Recommendation: **WITHDRAW** measures M-3, M-3a, and M-3b.

Measure M-4: Easement Acquisition

Description: This measure recommended that the Port obtain avigation easements in return for sound insulation or transaction assistance, as well as for situations of specialized nature. For some residences, the Port could purchase an avigation easement from an eligible owner of an owner-occupied residence who desires to continue living in the same location, even though the home cannot be satisfactorily sound insulated. Other situations in which avigation easements may be appropriate include churches. The easement fee paid by the Port could be used to provide some measure of sound insulation of noise-sensitive areas of church structures.

Status: This measure is ongoing, but has been modified from the original description. The Port does not purchase avigation easements for owner-occupied homes that cannot be effectively sound insulated.[2]

Recommendation: **WITHDRAW** measure.

Measure M-5: Property Advisory Service

Description: This measure provides residents and property owners within the Airport Environs with access to timely and factual information concerning 1) what noise remedies they may be eligible for, 2) assistance with making decisions when they are eligible for multiple options, 3) information regarding rumors about the mitigation program (either good or bad), and 4) assurances that the various programs are indeed aimed at improving the living, working and leisure-time environment. This two-way communication can also provide the Port with information about the concerns of residents/property owners and can provide a means by which the success or failure of programs can be monitored.

Status: This measure is ongoing.

Recommendation: **CONTINUE** measure.

[2] Note that this provision differs from completed Measure M-2d in which the Port would offer an avigation easement to owners of mobile home lots in return for removing the mobile home.

Measure M-6: Local Government Remedy Support

Description: By insulating homes and assisting with real estate transactions, the Port can participate in making the Airport and surrounding residents better neighbors. However, the Port alone cannot accomplish all program goals. Local governments, with land use jurisdiction must also participate if the program is to be a success, especially in the long term. Under this measure, the Port will encourage local jurisdictions to undertake projects, provide services, and adopt laws that reinforce neighborhoods and make them compatible with the Airport. The Port will also work with jurisdictions in coordinating activities and exchanging information.

Status: This measure is ongoing.

Recommendation: **CONTINUE** measure.

Measure M-7: Funding for Land Use / Noise Compatibility Planning

Description: This measure enables public agencies (defined as a state, municipality or other political subdivision, or Native American Tribe) having planning authority within the DNL 65 dBA noise contour to be able to apply for reimbursable funding of specific off-airport land use/noise compatibility planning efforts which are consistent with the principles and guidelines of 14 CFR Part 150 and the Port noise compatibility goals.

Status: This measure is ongoing.

Recommendation: **CONTINUE** measure.

Measure M-8 was previously considered but not recommended for inclusion in the NCP.

Measure M-9: Community Planners Forum

Description: The Port will initiate the formation of a committee to allow planning representatives from all jurisdictions within the DNL 65 dBA noise contour, or other invited jurisdictions with interest, to meet on a regular basis to share information pertaining to comprehensive planning, community and airport planning, land use issues, and noise mitigation efforts.

Status: The Planning Committee was formed and met for several years but has since disbanded.

Recommendation: **WITHDRAW** measure. The Port participates in the Highline Forum, which continues the intent of this measure.

Measure M-10: Operations Review and NEM Updates

Description: The Part 150 Study is a five-year program recommended to be reevaluated at the end of the five-year period. In addition, if there is a significant change in either aircraft types or numbers of operations, or significant new facilities, then it is recommended that the Study will be reevaluated prior to the end of the five-year time frame.

Status: This measure was approved by the FAA in the 2002 ROA. This measure is ongoing. This Part 150 Study Update represents the continuation of this measure, which is occurring at this time due to the recent opening of the third parallel runway.

Recommendation: **WITHDRAW** measure and replace with Measure P-2.

Measure M-11: Approach Transition Zone Acquisition

Description: This measure recommended that the Port purchase residential properties experiencing noise levels of DNL 65 dBA or greater, and located within the Approach Transition Zones (ATZ) of Runway 16R/34L.

Status: This measure was approved by the FAA in the 2002 ROA "…with respect to those areas located within the most recent official Part 150 NEMs." This measure is ongoing. A total of 69 residential parcels and 2 mobile home parks within the North ATZ have been purchased and residents relocated and the program is complete in this area. A reevaluation of the Runway 16R/34L South ATZ was conducted as part of this Part 150 Update. There are 16 single-family residences and 6 apartment buildings remaining in the south ATZ.

Recommendation: **CONTINUE** measure as a voluntary acquisition program for the South Approach Transition Zone.

Measure M-12: Prepare Cooperative Development Agreements

Description: The Port and the surrounding jurisdictions should work towards development of cooperative development agreements concerning land use, redevelopment, and infrastructure of the ATZs, as well other redevelopment areas as necessary.

Status: This measure was approved by the FAA in the 2002 ROA and is ongoing. As of March 2011, the Port has worked with Burien on the North East Redevelopment Area north of Runway 16R/34L and has signed a Development Agreement with the City of Des Moines on the Des Moines Creek Business Park.

Recommendation: **CONTINUE** measure. The process should continue to address development potentials for other areas included within the modified Noise Remedy Boundary (see Chapter Six, Section 6.1.1).

Measure M-13: Amend Community Plans and Zoning Ordinances

Description: The Port will work with the jurisdictions to amend zoning maps, as necessary to reflect ATZ and mobile/manufactured home park recommendations that may not be consistent with existing maps and to take into consideration 14 CFR Part 77 height requirements. Such changes shall work towards discouraging the location of additional mobile/manufactured homes that cannot be insulated within the DNL 65 dBA contour.

Status: This measure was approved by the FAA in the 2002 ROA. This measure is complete. All of the residential parcels purchased by the Port have been re-zoned as "airport noise compatible," which means that if and when they are redeveloped they can only be used for industrial/commercial purposes, not residential. The Port also evaluated residential building code requirements for all jurisdictions within the 1998 DNL contour and found that they either met or exceeded the FAA's noise reduction standards.

Recommendation: **COMPLETED** measure.

5.2.2 ANALYSIS OF POTENTIAL MITIGATION ALTERNATIVES

This section summarizes the analysis of potential new mitigation alternatives. The following information is provided for each alternative:

- Title – includes a brief descriptive title of the measure.
- Background and Intent – includes the intent of the measure as a means to mitigate noise impacts, and the background and setting to which the measure relates where applicable.
- Benefits – includes a statment of how the measure would provide land use compatibility benefits
- Drawbacks – identifies any potential negative consequences of implementing the measure
- Cost to Implement – identifies the potential cost to implement each measure
- Findings and Recommendations – provides a recommendation as to whether or not to carry forward the alternative for further analysis and consideration. In some cases alternatives had drawbacks that made that alternative unfeasible. Those alternatives that showed potential benefits were continued for further analysis. Alternatives that are recommended for inclusion in this NCP update are included in Chapter Six.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-A

TITLE:	Retrofit Positive Ventilation for Previously Attenuated Single Family Residences.
BACKGROUND AND INTENT:	The Port has been providing sound attenuation to single family residences within the Noise Remedy Boundary established in 1985. When the sound insulation program was first established at Sea-Tac Airport, air conditioning units were not deemed to be eligible for inclusion. Air conditioning is now an allowable element in sound insulation programs at some other airports around the country. This measure considered providing positive ventilation (typically air conditioning) to those residences that are not so equipped and remain within modified Noise Remedy Boundary resulting from this Part 150 Study (see Chapter Six, Section 6.1.1). The study considered a pilot program to identify the criteria and eligibility for participation. Further steps would depend upon the outcome of that program, but could include retrofitting eligible homes, if any.
BENEFITS:	Could limit extent to which homes without positive ventilation open their windows during the limited period of high temperature in the Seattle area, allowing the installed sound attenuation measures to work as installed.
DRAWBACKS:	The residences that might be included in this program are already considered to be compatible with aircraft noise by virtue of their inclusion in the sound attenuation program in past years. Homeowners would not be providing any consideration for the cost of installing new equipment.
COST TO IMPLEMENT:	The estimated cost of the pilot program is $100,000. Cost of installing positive ventilation would vary from residence to residence depending upon numerous factors including the age, condition and construction of the residence. Total cost of this measure would depend upon the number of residences that were ultimately deemed eligible.
FINDINGS AND RECOMMENDATIONS:	Houses potentially affected by this measure are already deemed compatible uses because they have been previously sound insulated and thus have achieved the intended interior noise level reduction. Furthermore, Washington State law prevents additional treatment. Therefore, this alternative is **NOT RECOMMENDED** for inclusion in the NCP.[3]

[3] Note that Measure M-2a is recommended to be modified to consider, on a case-by-case basis, the applicability of including installation of central air conditioning for sound insulation of eligible homes that have not previously been sound insulated.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-B

TITLE:	Replace Certain Windows Previously Installed In Homes Participating In Noise Remedy Program

BACKGROUND AND INTENT:	The Port has provided sound attenuation measures (windows, doors, insulation, etc.) to over 9,300 single family residences within the current Noise Remedy Boundary. There have been limited anecdotal reports from some homes where windows were installed early during the program, that the windows or other measures have lost some of their noise reduction characteristics. The study considered whether to first investigate whether that condition exists among program participants, and, if so, to assess potential responses. In July 2011, the Airports Cooperative Research Program (ACRP) began a project to evaluate the extent of decreased effectiveness of sound attenuation elements in remedy programs throughout the United States. This project (ACRP 02-31, Assessment of Sound Insulation Treatments) is underway and several test airports are currently included in the project. to be completed before the end of 2012. This Part 150 study considered whether the Port should volunteer for participation in the ACRP project. The study also considered the Port conducting a pilot program to investigate the anecdotal reports and whether there was any decreased sound attenuation among the housing units within the program area. That program could include conducting exterior to interior acoustic testing among a sampling of dwellings treated at different periods during the program, and comparing the results of those tests with measured pre- and post-insulation data acquired at the time the attenuation was done.

BENEFITS:	Residences that might be affected by this measure are already considered to be compatible with aircraft noise by virtue of their inclusion in the sound attenuation program in past years. With time, such systems are expected to lose a degree of their insulation through loss of seals, shrinkage, and wear. The completion of a pilot program to evaluate the extent of decreased attenuation, if any, from windows or other measures could identify the extent of the issue and assist in assessing possible remedies.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-B, *Continued*

DRAWBACKS:	FAA policy currently does not consider window replacement to be eligible for grant funding; possible funding options would have to be addressed in the pilot study. In addition, the agreements entered into by noise remedy program participants plainly establish that maintenance, replacement and warranty issues regarding installed windows are issues to be addressed solely among the homeowner, installing contractor and window manufacturer and that the Port has no obligation – contractual or otherwise – to the homeowners in connection with such issues.

COST TO IMPLEMENT:	The estimated cost of the pilot program is $100,000, but might be reduced if done at the same time as the pilot study considered under M-A. The cost of remedying any decrease in attenuation effectiveness at a particular residence would vary drastically from residence to residence depending on age, condition and construction of the residence and the extent of lost attenuation. Total cost would depend upon all of these factors plus the number of total residences that might participate in the measure.

FINDINGS AND RECOMMENDATIONS:	The FAA does not currently fund window replacement and there is no basis for imposing the cost of this measure on the Port. Furthermore, Washington State law limits such benefits to one time.[4] Therefore, this alternative is **NOT RECOMMENDED**

[4] RCW 53.54.030(5)

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-C

TITLE:	Sound insulate eligible owner-occupied multi-family units (condominiums) within the modified Noise Remedy Boundary.
BACKGROUND AND INTENT:	Measure M-2c offered sound insulation to owner-occupied multi-family units within the 70 DNL of the 1998 Noise Exposure Contour. This measure would expand the program to eligible units within the modified Noise Remedy Boundary that were not previously mitigated (see Chapter Six, Section 6.1.1). Sound insulation consists of increasing the exterior-to-interior sound attenuation characteristics of a structure, i.e., reducing the level of noise intrusion from aircraft overflights and ground operations. There are several basic ways in which this can be accomplished (e.g. acoustical windows, acoustical doors, ventilation systems, additional roof/wall insulation, etc.), and variations of each would occur on a structure-to-structure basis.
BENEFITS:	This measure has the potential to convert owner-occupied multi-family housing units into to compatible uses.
DRAWBACKS:	Funding may not be available from the FAA or the Port to implement the sound insulation. Total costs are uncertain pending completion of the feasibility study.
COST TO IMPLEMENT:	There are approximately 320 condominiums that have not been sound insulated located within the proposed noise remedy boundary.[5] Noise attenuation costs for a particular unit may vary extensively depending upon the age, condition and construction of the overall building and each individual unit. No work has been done at this point to assess these factors or develop actual costs. Total cost would depend upon all of these factors and the number of units that choose to participate.
FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

[5] Note that this figure differs from the count of impacted housing units located within the 65 DNL of the Future (2018) noise exposure contour reported in Chapter Four*, Land Use Analysis* of this document. The estimated 320 units are those eligible units located within the proposed noise remedy boundary for this NCP Update.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-D

TITLE:	Sound insulate eligible tenant-occupied multi-family units (apartments) within the modified Noise Remedy Boundary.
BACKGROUND AND INTENT:	Measure M-2c offered sound insulation to owner-occupied multi-family units within the 70 DNL of the 1998 Noise Exposure Contour. This measure would also include eligible tenant-occupied units within the revised Noise Remedy Boundary (see Measure M-C). The Port should consider a pilot project to determine feasibility, costs, and procedures for sound insulating tenant-occupied buildings. Sound insulation consists of increasing the exterior-to-interior sound attenuation characteristics of a structure, i.e., reducing the level of noise intrusion from aircraft overflights and ground operations. There are several basic ways in which this can be accomplished (e.g. acoustical windows, acoustical doors, ventilation systems, additional roof/wall insulation, etc.), and variations of each would occur on a structure-to-structure basis.
BENEFITS:	This measure has the potential to convert tenant-occupied multi-family housing units into to compatible uses.
DRAWBACKS:	This alternative could be expensive to implement. Funding may not be available from the FAA or the Port to conduct the pilot program or to implement the sound insulation.
COST TO IMPLEMENT:	A feasibility study is estimated to cost $30,000 to $40,000. There are approximately 897 apartments that have not been sound insulated located within the proposed Noise Remedy Boundary.[6] Sound attenuation costs for each unit may vary extensively depending upon the age, condition and construction of the overall building and each individual unit. The feasibility study would review these factors and assist in developing actual cost figures. Total cost would also depend upon all of these factors and the number of units that choose to participate.
FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

[6] Note that this figure differs from the count of impacted housing units located within the 65 DNL of the Future (2018) noise exposure contour reported in Chapter Four of this document. The estimated 897 units are those eligible units located within the proposed noise remedy boundary for this NCP Update. This number also does not include units within the South ATZ that would be acquired per ongoing Measure M-11.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-E

TITLE:	Offer avigation easements to owners of individual lots on which mobile homes are located within the modified Noise Remedy Boundary
BACKGROUND AND INTENT:	Measure M-2d offered sales and relocation assistance to residents of mobile home parks that were acquired by the Port in an effort to remove incompatible structures within mobile home parks. Most mobile homes cannot be effectively sound insulated. This measure would compensate owners of individual lots in return for removing the mobile home from the lot and/or providing easements for air rights ("avigation easements"). There are approximately 88 mobile homes located on individual lots within the proposed noise remedy boundary.[7]
BENEFITS:	This measure would acquire an avigation easement for the Port and has the potential to remove mobile homes that are incompatible with aircraft noise levels and cannot be effectively sound insulated
DRAWBACKS:	This alternative could be expensive to implement and would be voluntary in nature. Property owners may not be willing to remove the mobile homes due to potential lost rent on the property.
COST TO IMPLEMENT:	There are approximately 88 mobile homes located on individual lots within the proposed Noise Remedy Boundary. Total cost will depend upon how many lots participate in the program and the purchase price of the easements.
FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

[7] Note that this figure differs from the count of impacted housing units located within the 65 DNL of the Future (2018) noise exposure contour reported in Chapter Four of this document. The estimated 88 units are those eligible units located within the proposed noise remedy boundary for this NCP Update. This number also does not include units within the South ATZ that would be acquired per ongoing Measure M-11.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-F

TITLE:	Initiate a formal study to evaluate the noise levels at various churches/places of worship located within the recommended Noise Remedy Boundary for eligibility for sound insulation (eligibility based on FAA funding criteria).

BACKGROUND AND INTENT:	This measure is intended to address potential noise impacts resulting from the daytime (in particular Sunday morning) aircraft operations. There are twelve churches located within the recommended Noise Remedy Boundary. A formal study would be conducted to evaluate noise levels at these churches to determine eligibility and feasibility of providing sound insulation. In order to more accurately assess the impact of aircraft noise on churches, this study would focus on the aircraft events occurring during typical church service hours. The results of the analysis *could* lead to a recommendation for the sound insulation the church structure. The Airport Improvement Program (AIP) Handbook (FAA Order 5100.38c, Chapter 812(d)) states that churches, when recommended for sound insulation by an airport sponsor in an FAA-approved NCP are eligible for sound insulation. The AIP Handbook further states that the sound insulation of churches should be evaluated on a case-by-case basis involving consultation with the FAA Airports Financial Assistance Division (APP-520) and the FAA Community and Environmental Needs Division (APP-600). This consultation process and evaluation will take place prior to implementing sound insulation at a church/place of worship. Sound insulation consists of increasing the exterior-to-interior sound attenuation characteristics of a structure, i.e., reducing the level of noise intrusion from aircraft overflights and ground operations. There are several basic ways in which this can be accomplished (e.g. acoustical windows, acoustical doors, ventilation systems, additional roof/wall insulation, etc.), and variations of each would be based on the outcome of the study.

BENEFITS:	This alternative has the potential to convert eligible churches from an incompatible to a compatible use.

DRAWBACKS:	The study may determine that the structure cannot be effectively sound insulated. If the structure can be effectively sound insulated, the project could be expensive to implement. It could encounter resistance from church members. Funding may not be available from the FAA or the Port to conduct the feasibility study or to implement the sound insulation.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE M-F, *Continued*

COST TO IMPLEMENT:	The cost for the proposed study, which will be funded by the Port, would be approximately $40,000 to $50,000. Cost to sound insulate eligible church structures, if feasible, would be determined by the study.

FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP. Following the findings of the feasibility study, sound insulation of the eligible church could be implemented.

5.3 PROGRAM MANAGEMENT ALTERNATIVES

This section describes the program management alternatives that were considered for this NCP update. In past Part 150 studies conducted for Sea-Tac Airport, Program Management measures were included in the list of Abatement measures described above in Section 5.1.1, and include completed measures A-4, A-5, and A-6. However, for this Part 150 Study update, Program Management measures are listed separately since, unlike abatement measures, they do not directly reduce noise at the source.

Program Management measures are designed to provide administrative and management actions to enhance the ability of airport administrators, in this case the Port, to respond to public concerns about aircraft noise and overflights. Such alternatives are also intended to enhance the ability of the Port to work closely with local land use planners and agencies to maintain land use compatibility between the airport and development within the airport environs.

The following section provides a comprehensive list of all potential program management alternatives that were considered by this Part 150 Noise Compatibility Study Update. The following information is provided for each alternative:

- Title – includes a brief descriptive title of the alternative.
- Background and Intent – includes the intent of the measure and the background and setting within which the alternative relates, where applicable.
- Benefits – includes a statment of how the measure would provide a benefit in terms of program management.
- Drawbacks – identifies any potential negative consequences of implementing the alternative.
- Findings and Recommendations – provides a recommendation as to whether or not to carry forward the alternative for further analysis and consideration. Alternatives that are recommended for inclusion in this NCP update are included in Chapter Six.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE P-A

TITLE:	Evaluate and Expand Noise Monitoring and Flight Tracking System
BACKGROUND AND INTENT:	The Port has installed a noise and operations monitoring system that collects and stores flight data from the FAA's automated radar terminal system, which enables staff to regularly monitor abatement procedures and investigate citizen inquiries. In addition to this system, the Port also provides WebTrak, which allows the public to investigate flights via the Web. The system includes 25 existing permanent noise monitors. This alternative includes evaluating these permanent noise monitors and the central system hardware/software for potential replacement with newer equipment.
BENEFITS:	This alternative would enhance the features of the existing noise monitoring system, make system maintenance easier and more cost-effective, and improve the ability of the Port to provide information regarding noise and aircraft operations to the public.
DRAWBACKS:	Cost to purchase new monitors and upgrade the system.
COST TO IMPLEMENT:	Cost to upgrade the central system hardware/software and replace 25 permanent noise monitors at their existing sites is approximately $1.5 to $2 million. If additional monitors are added or new sites are selected, the cost will be higher.
FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

NOISE COMPATIBILITY PROGRAM ALTERNATIVE P-B

TITLE:	Periodically review and, if necessary, update the Noise Exposure Maps (NEMs) and the Noise Compatibility Program (NCP).

BACKGROUND AND INTENT:	Over time, the NEMs are likely to become outdated and will need to be periodically updated. The NEMs should be updated every five years or when there are significant changes in operating levels and patterns in accordance with the FAA's guidelines for determining what constitutes a potentially significant increase in operations (17 percent increase in the area impacted by 65+ DNL). The NCP should be updated every five years, or as necessary, to reflect any broader changes in the nature of aircraft noise surrounding the Airport. Should any on-airport development, such as runway extensions or significant modifications to ground facilities, enlarge the area exposed to aircraft noise above 65 Day-Night Average Sound Level (DNL), the NCP should be updated prior to the implementation of those improvements. A full update may not be required, but rather, a targeted assessment of the changes occasioned by specific development projects may suffice to bring the NCP to conformity and to qualify additional areas for NCP programs, if appropriate.

BENEFITS:	Ensures the NEMs remain up-to-date and the NCP continues to mitigate aircraft noise to the fullest extent possible. Provides continued opportunity for public outreach and public involvement in planning for noise compatibility.

DRAWBACKS:	Cost of NEM or NEM/NCP update

COST TO IMPLEMENT:	It is estimated that the NEM update could be accomplished for approximately $400,000 to $500,000. An NEM/NCP could be updated at an estimated cost of $1,000,000 (assuming only a minimal review of existing abatement measures is necessary). Both updates are eligible for funding through FAA AIP grant monies at 80 percent FAA participation.

FINDINGS AND RECOMMENDATIONS:	This alternative is **RECOMMENDED** for inclusion in the NCP.

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