Chapter 6 – Environmental Review

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Introduction

The purpose of this Environmental Review is to identify physical or environmental conditions of record which may affect the recommended improvements at Bremerton National Airport. This environmental review includes the evaluation of airport noise for both existing conditions and future years and an evaluation of other environmental conditions and stormwater management unique to the airport site.

With the exception of the airport noise evaluation, the scope of work for this element is limited to compiling, reviewing and briefly summarizing information of record from applicable local, federal and state source for the airport site and its environs. The airport noise evaluation was conducted based on prescribed Federal Aviation Administration (FAA) guidelines, using the FAA's Integrated Noise Model (INM) computer software with several airport-specific inputs including FAA-approved air traffic forecasts, fleet mix, common aircraft flight tracks, and existing/future runway configurations.

Local Site Conditions

The review of existing airport site conditions and items of interest included water resources (wetlands, streams, stormwater), air quality, species of concern, and wildlife hazards. A planning level analysis of stormwater drainage was conducted to document both existing conditions and potential changes that may be related to future proposed development. The technical memorandums are included in **Appendix E**.

Airport Noise Analysis

AIRPORT NOISE AND NOISE MODELING

It is often noted that noise is the most common negative impact associated with airports. A simple definition of noise is "unwanted sound." However, sound is measurable, whereas noise is subjective. The relationship between measurable sound and human irritation is the key to understanding aircraft noise impact. A rating scale has been devised to relate sound to the sensitivity of the human ear. The A-weighted decibel scale (dBA) is measured on a "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a designated increase of 1 dBA. This system of measurement is used because the human ear functions over such an enormous range of sound energy impacts. At a psychological level, there is a rule of thumb that the human ear often "hears" an increase of 10 decibels as equivalent to a "doubling" of sound.

The challenge to evaluating noise impact lies in determining what amount and what kind of sound constitutes noise. The vast majority of people exposed to aircraft noise are not in danger of direct physical harm. However, much research on the effects of noise has led to several generally accepted conclusions:

- The effects of sound are cumulative; therefore, the duration of exposure must be included in any evaluation of noise.
- Noise can interfere with outdoor activities and other communication.
- Noise can disturb sleep, TV/radio listening, and relaxation.
- When community noise levels have reached sufficient intensity, community wide objection to the noise will likely occur.

Research has also found that individual responses to noise are difficult to predict.[1] Some people are annoyed by perceptible noise events, while others show little concern over the most disruptive events. However, it is possible to predict the responses of large groups of people – i.e. communities. Consequently, community response, not individual response, has emerged as the prime index of aircraft noise measurement.

On the basis of the findings described above, a methodology has been devised to relate measurable sound from a variety of sources to community response. For aviation noise analysis, the FAA has determined that the cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of yearly day/night average sound level (DNL) as FAA's primary metric. The DNL methodology is used in conjunction with the standard A-weighted decibel scale (dBA) which is measured on a "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a

[1] Beranek, Leo, *Noise and Vibration Control*, McGraw-Hill, 1971, pages ix-x.

designated increase of 1 dBA. DNL has been adopted by the U. S. Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), and the Federal Aviation Administration (FAA) for use in evaluating noise impacts. In a general sense, it is the yearly average of aircraft-created noise for a specific location (i.e., runway), but includes a calculation penalty for each night flight.

The FAA has determined that a significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the no action alternative for the same time frame. As an example, an increase from 63.5 dB to 65 dB is considered a significant impact. The DNL methodology also includes a significant calculation penalty for each night flight. DNL levels are normally depicted as contours. These contours are generated from noise measurements processed by a FAA-approved computer noise model. They are superimposed on a map of the airport and its surrounding area. This map of noise contour levels is used to predict community response to the noise generated from aircraft using that airport.

The basic unit in the computation of DNL is the sound exposure level (SEL). An SEL is computed by mathematically summing the dBA level for each second during which a noise event occurs. For example, the noise level of an aircraft might be recorded as it approaches, passes overhead, and then departs. The recorded noise level of each second of the noise event is then added logarithmically to compute the SEL. To provide a penalty for nighttime flights (considered to be between 10 PM and 7 AM), 10 dBA is added to each nighttime dBA measurement, second by second. Due to the mathematics of logarithms, this calculation penalty is equivalent to 10-day flights for each night flight.[2]

A DNL level is approximately equal to the average dBA level during a 24-hour period with a weighting for nighttime noise events. The main advantage of DNL is that it provides a common measure for a variety of different noise environments. The same DNL level can describe an area with very few high noise events as well as an area with many low-level events.

NOISE MODELING AND CONTOUR CRITERIA

DNL levels are typically depicted as contours. Contours are an interpolation of noise levels drawn to connect all points of a constant level, which are derived from information processed by the FAA-approved computer noise model. They appear similar to topographical contours and are superimposed on a map of the airport and its surrounding area. It is this map of noise levels drawn about an airport, which

[2] Where Leq ("Equivalent Sound Level") is the same measure as DNL without the night penalty incorporated, this can be shown through the mathematical relationship of:

$$Leq_d = 10 \log \left(\frac{N_d \times 10^{(SEL/10)}}{86{,}400} \right)$$

If SEL equals the same measured sound exposure level for each computation, and if N_d = 10 daytime flights, and N_n = 1 night-time flight, then use of a calculator shows that for any SEL value inserted, $Leq_d = Leq_n$.

is used to predict community response to the noise from aircraft using that airport. DNL mapping is best used for comparative purposes, rather than for providing absolute values. That is, valid comparisons can be made between scenarios as long as consistent assumptions and basic data are used for all calculations. It should be noted that a line drawn on a map by a computer does not imply that a particular noise condition exists on one side of the line and not on the other. These calculations can only be used for comparing average noise impacts, not precisely defining them relative to a specific location at a specific time.

NOISE AND LAND-USE COMPATIBILITY CRITERIA

Federal regulatory agencies of government have adopted standards and suggested guidelines relating DNL to compatible land uses. Most of the noise and land-use compatibility guidelines strongly support the concept that significant annoyance from aircraft noise levels does not occur outside a 65 DNL noise contour. Federal agencies supporting this concept include the Environmental Protection Agency, Department of Housing and Urban Development, and the Federal Aviation Administration.

Federal Aviation Regulations (FAR) Part 150, Airport Noise Compatibility Planning provides guidance for land-use compatibility around airports. **Table 6-1** summarizes the federal guidelines for compatibility or non-compatibility of various land uses and noise exposure levels. Under federal guidelines, all land uses, including residential, are considered compatible with noise exposure levels of 65DNL and lower. Generally, residential and some public uses are not compatible within the 65-70 DNL, and above. As noted in this table, some degree of noise level reduction (NLR) from outdoor to indoor environments may be required for specific land uses located within higher-level noise contours. Land uses such as commercial, manufacturing, some recreational uses, and agriculture are compatible within 65-70 DNL contours.

Residential development within the 65 DNL contour and above is not recommended and should be discouraged. Care should be taken by local land use authorities to avoid creating potential long-term land use incompatibilities in the vicinity of the airport by permitting new development of incompatible land uses such as residential subdivisions in areas of moderate or higher noise exposure. Washington's airport noise and land use compatibility guidelines discourage residential development starting at the 55 DNL contour, although it is not prohibited.

Bremerton National Airport is located within the South Kitsap Industrial Area (SKIA), a defined subarea within the City of Bremerton. The Airport and the other land in the SKIA subarea have industrial zoning and comprehensive plan land use designations that provide an effective land use buffer between the runway and areas abutting the subarea.

TABLE 6-1: LAND USE COMPATIBILITY WITH DNL

	YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS					
Land Use	<65	65-70	70-75	75-80	80-85	85+
Residential						
Residential, other than mobile homes & transient	Y	N(1)	N(1)	N	N	N
Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and Nursing Homes	Y	25	30	N	N	N
Churches, Auditoriums, and Concert Halls	Y	25	30	N	N	N
Government Services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, Business and Professional	Y	Y	25	30	N	N
Wholesale and Retail-Building Materials,						
Retail Trade-General	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing General	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and Optical	Y	Y	25	30	N	N
Agriculture (except livestock) and Forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock Farming and Breeding	Y	Y(6)	Y(7)	N	N	N
Mining and Fishing, Resource Production and						
Recreational						
Outdoor Sports Arenas, Spectator Sports	Y	Y(5)	Y(5)	N	N	N
Outdoor Music Shells, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits and Zoos	Y	Y	N	N	N	N
Amusement Parks, Resorts and Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables and Water	Y	Y	25	30	N	N

Y (Yes) Land-use and related structures compatible without restrictions.
N (No) Land-use and related structures are not compatible and should be prohibited.
NLR - Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into design and construction of the structure.
25, 30 or 35 - Land uses and structures generally compatible; measure to achieve NLR or 25, 30 or 35 dB must be incorporated into design and construction of the structure.

Table 6-1 Notes:

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Levels Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2. Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
5. Land-use compatible, provided special sound reinforcement systems are installed.
6. Residential buildings require an NLR of 25.
7. Residential buildings require an NLR of 30.
8. Residential buildings not permitted.

SOURCE: Federal Aviation Regulations, Part 150, Airport Noise Compatibility Guidelines

PLANNING PERIOD NOISE CONTOURS

A noise analysis of the effects of existing aircraft operations and proposed projects/activities linked to the updated airport master plan has been performed using the FAA's Integrated Noise Model (INM), version 7.0D. The INM data runs are included in **Appendix D.**

The noise contours and associated information have been developed to assess current and future aircraft noise exposure and support local land use compatibility planning. Data from the updated forecasts of activity levels were assigned to the common arrival, departure and airport traffic pattern flight tracks defined for the runways. The existing and future noise contours were generated based on the FAA-approved master plan aircraft operations forecast for 2012, 2017 and 2032.

No changes to the existing runway configuration are assumed in the twenty year planning period. Runway extensions reserves, depicted on the updated airport layout plan, are not reflected in the future noise contours since the projects are not anticipated to occur in the current twenty year planning period.

The runway use (directional) distributions for the updated noise analysis are consistent with the noise analysis conducted in the previous master plan, with the exception of the previously planned additional of a small parallel runway, which is no longer recommended. The current runway use distribution (60% Runway 20/40% Runway 02) is maintained in the future year noise runs (2017 and 2032).

The airport's existing traffic patterns were maintained for all future years. The fixed wing aircraft traffic patterns for Runway 2/20 are located on the east side of the runway, 1,000 feet above ground level (AGL). A helicopter traffic pattern is located on the west side of the runway, 500 feet AGL.

The current and future noise contours are depicted in **Figure 6-1**. The contours are plotted in 5 DNL increments from 65 DNL to 80 DNL, which is consistent with local noise and land use compatibility planning. As noted earlier in this section, under federal standards, all land uses are considered compatible with noise exposure below 65 DNL and the FAA does not formally recognize noise levels below 65DNL in its land use compatibility planning assessments.

The large land area that comprises Bremerton National Airport creates significant land use compatibility benefits for the surrounding community. Based on the forecast activity levels through 2032, all 65 DNL and higher noise contours (for 2012, 2017 and 2032) are contained entirely within the airport property boundary, or extend only slightly over the Highway 3 right of way.

Table 6-2 summarizes the overall size (measured in square miles) of the 65 to 85 DNL noise contours for the current, 5-year, and 20-year INM runs. The increase in surface area for each noise level is consistent with the forecast increase in air traffic, minor changes in aircraft fleet mix, and no changes to the current runway configuration.

TABLE 6-2: CURRENT AND FUTURE NOISE CONTOUR SIZE

DNL NOISE LEVELS	SIZE OF CONTOURS (IN SQUARE MILES)		
	2012	**2017**	**2032**
65	0.23	0.25	0.31
70	0.08	0.09	0.13
75	0.03	0.03	0.04
80	0.01	0.01	0.01
85	0	0	0

2012 Noise Contours

The 65 DNL noise contour extends along the sides of Runway 2/20 and approximately 100 to 150 feet beyond each end of the runway, largely within the runway's 1000-foot wide primary surface. The 65 DNL contour widens on its west side, near mid-runway due to the flight tracks and west traffic pattern established for helicopter operations. For mapping purposes, a common takeoff and landing point was established adjacent to the parallel taxiway, near mid-runway. This location approximates the common location of operations, hover-taxiing and parking generated by flight training, transient and military helicopters. The helicopter operations create a "bubble" that merges with the noise generated from runway operations to form a continuous area of 65 DNL. The helicopter operations also generate a concentration of noise above 65 DNL (up to 80 DNL), which is contained entirely within the runway-taxiway system.

A characteristic of aircraft noise exposure on a runway is the increase in contour size (width) near the ends of the runway. Like wake turbulence generated from aircraft wings during flight, noise energy is dissipated behind and to the sides of the aircraft. The enlarged contours near the runway ends reflect the increase in noise generated during the initial application of power for takeoff and during the initial slow movement of aircraft at the beginning of the takeoff roll. The low altitude of aircraft during final approach and landing also concentrates noise exposure at the runway ends. Both ends of Runway 2/20 have islands of 70 DNL contours that extend approximately 150 to 200 feet beyond the ends of the runway and 1,400 to 1,600 feet down the runway. Smaller 75 and 80 DNL contours extend approximately 100 feet beyond the runway ends and 800 to 1,000 feet down the runway.

2017 Noise Contours

The 65 DNL noise contour for 2017 has the same overall shape as the 2012 contour, with a slight increase in size. A very small sliver of the 65 DNL contour extends beyond airport property near the north end of the runway, into the Highway 3 right of way. The 70, 75, and 80 DNL contours also increase marginally based on the forecast increase in aircraft operations.

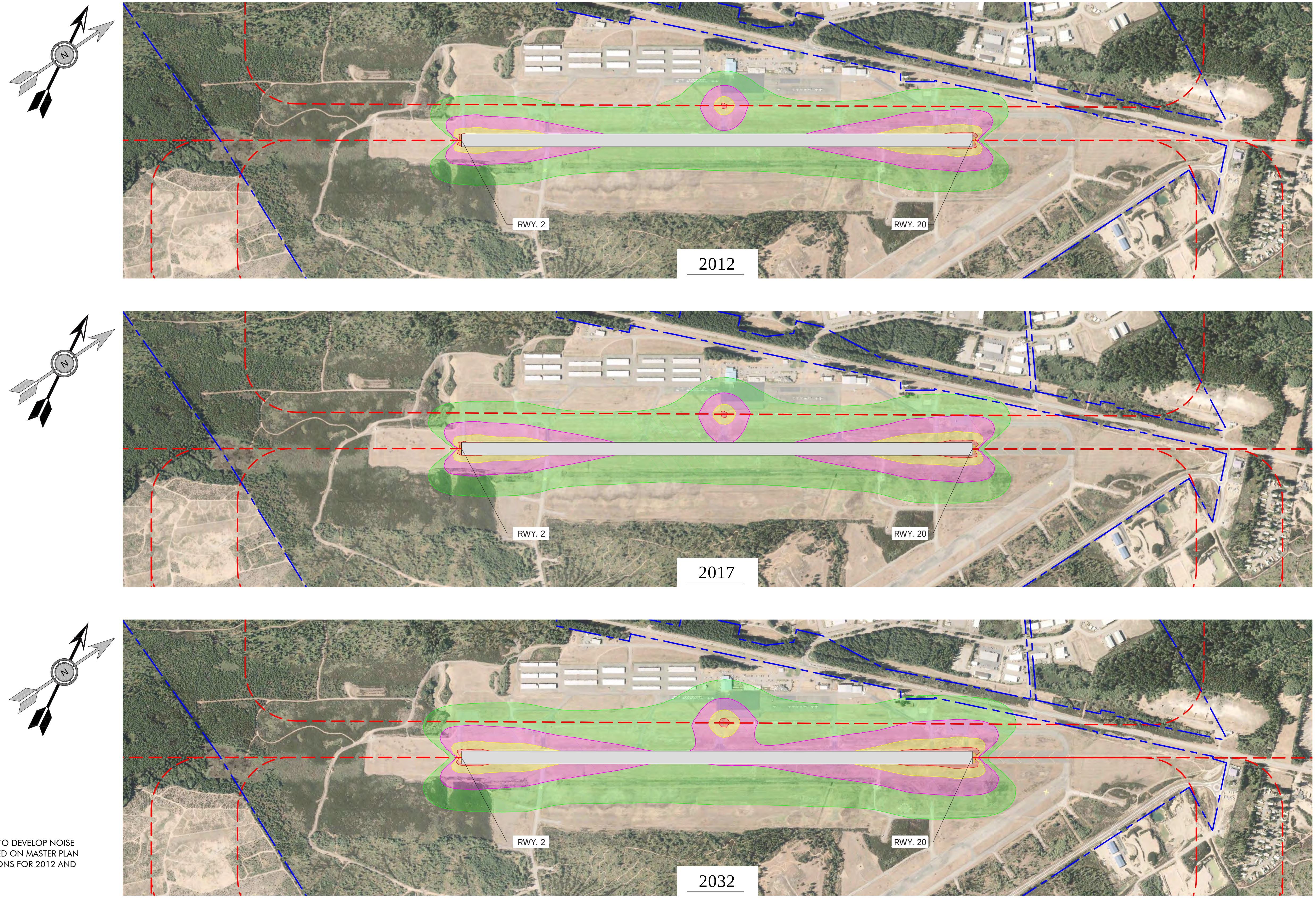
2032 Noise Contours

The 65 DNL noise contour for 2032 has the same overall shape as the 2012 and 2017 contours, with continued growth due to the forecast increase in flight activity. A small portion of the 65 DNL contour extends beyond airport property near the north end of the runway, into the Highway 3 right of way. The 70, 75, and 80 DNL contours also increase in size based on the forecast increase in aircraft operations and the islands of 70 DNL noise contours largely concentrated at the ends of the runway in the 2012 and 2017 contours now merge with the helicopter noise bubble and extend along nearly the entire length of the runway.

LEGEND

- 65 DNL
- 70 DNL
- 75 DNL
- 80 DNL
- 85 DNL
- FLIGHT TRACKS
- PROPERTY LINE

DAY-NIGHT LEVEL (DNL)



NOTE:
1. FAA INM VERSION 7.0C USED TO DEVELOP NOISE CONTOURS. CONTOURS BASED ON MASTER PLAN FORECAST AIRCRAFT OPERATIONS FOR 2012 AND 2032.

BREMERTON NATIONAL AIRPORT | AIRPORT MASTER PLAN

PORT OF Bremerton Washington

2012, 2017, 2032 NOISE CONTOURS | **FIG. 6-1**

CENTURY WEST ENGINEERING CORPORATION