AIR INSTALLATION COMPATIBLE USE ZONE REPORT

Selfridge Air National Guard Base
Michigan Air National Guard
Mount Clemens, Michigan

October 2009

ACRONYMS AND ABBREVIATIONS

ABD	Average Busy Day
AFB	Air Force Base
AFI	Air Force Instruction
AGL	Above Ground Level
AICUZ	Air Installation Compatible Use Zone
ANG	Air National Guard
ANGB	Air National Guard Base
APZ	Accident Potential Zone
BASH	Bird/Wildlife Aircraft Strike Hazard
cps	Cycles Per Second
CZ	Clear Zone
dB	Decibel
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DTW	Detroit Metropolitan-Wayne County Airport
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
Hz	Hertz
IFR	Instrument Flight Rule
INM	Integrated Noise Model
MSL	Mean Sea Level
NZ	Noise Zone
SEL	Sound Exposure Level
SLUCM	Standard Land Use Coding Manual
U.S.	United States
UFC	Unified Facilities Criteria
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VFR	Visual Flight Rule

TO: Area Governments

SUBJECT: Air Installation Compatible Use Zone (AICUZ) Study

This Air Installation Compatible Use Zone (AICUZ) Study for Selfridge ANGB (ANGB) is an update to the AICUZ study dated May 1999. The update was initiated because of changes in the number of aircraft operations and aircraft fleet mix. It is a reevaluation of aircraft noise and accident potential related to Air Force flying operations. It is designed to aid in the development of local planning mechanisms which will protect public safety and health, as well as preserve the operational capabilities of Selfridge ANGB.

The enclosed report contains a summary description of the affected area around the base. The report outlines the location of runway clear zones, aircraft accident potential zones and noise contours and airfield imaginary surfaces (e.g., structure height restrictions). Based on these factors, it recommends compatible land use for areas in the vicinity of the base. It is our hope that this information will be incorporated into your community plans, zoning ordinances, subdivision regulations, building codes, and other related documents.

The basic objective of the AICUZ program is to achieve compatible uses of public and private lands in the vicinity of military airfields by controlling incompatible development through local actions. This update provides noise contours based upon the Day-Night Average A-Weighted Sound Level (DNL) metric used by the Air Force. This report provides the information necessary to maximize beneficial use of the land surrounding Selfridge ANGB while minimizing the potential for degradation of the health and safety of the affected public.

We greatly value the positive relationship Selfridge ANGB has experienced with its neighbors over the years. As a partner in the process, we have attempted to reduce noise disturbances through such actions as minimizing night flying and avoiding flights over heavily populated areas. We solicit your cooperation in implementing the recommendations and guidelines presented in this AICUZ Study.

Michael L Peplinski

MICHAEL L. PEPLINSKI, Brig. Gen., MI ANG
Selfridge ANG Base Commander

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SECTION 1 PURPOSE AND NEED

1.1 INTRODUCTION

Selfridge ANGB

This study is an update of the 1999 Selfridge Air National Guard Base (ANGB), Michigan, Air Installation Compatible Use Zone (AICUZ) Study. The update presents and documents the changes to the AICUZ for the period 1999-2009 and is based on the February 2009 aircraft operational conditions, as modified to reflect operations once all units currently beddown at the installation are at full strength. This AICUZ Study reaffirms United States Air Force (USAF) policy of assisting local, regional, state, and federal officials in the areas neighboring Selfridge ANGB by promoting compatible development within the AICUZ area of influence and protecting USAF operational capability from the effects of land use that are incompatible with aircraft operations. Specifically, this report documents changes in aircraft operations since the last study and provides noise contours and compatible use guidelines for land areas neighboring the installation based on updated aircraft operations. This information is provided to assist local communities and to serve as a tool for future planning and zoning activities. Changes that occurred since the 1999 Selfridge ANGB AICUZ Study include:

- Beddown of A-10 aircraft (assigned to Air National Guard [ANG]);
- Beddown of CH-47 aircraft (assigned to Army National Guard);
- Beddown of Cessna 210, Cessna 550, Beechcraft 300, EC-120, H-60, and AS-350 aircraft (assigned to Department of Homeland Security);
- Beddown of KC-135E aircraft followed by replacement of KC-135E aircraft with KC-135R/T aircraft (currently assigned to ANG but originally assigned to Air Force Reserves);
- Reassignment of C-130 and F-16 aircraft to other installations;
- Relocation of the TF-34 Engine Intermediate Maintenance;
- Replacement of the engines in the Coast Guard HH-65 helicopters (Turbomeca Arriel 2C2 CG turboshaft for Avco Lycoming LTS101-650C3);

- Addition, elimination, and modification of aircraft flight tracks to correspond to flight operational changes; and

- Technical improvements to the NOISEMAP noise-modeling computer program, from Version 6.5 to Version 7.3.

1.2 PURPOSE AND NEED

The purpose of the AICUZ program is to promote compatible land development in areas subject to aircraft noise and accident potential. The USAF provides the AICUZ Study to all local communities to assist them in preparing local land use plans. Construction of noise-sensitive land uses near areas of elevated noise, land uses in the Clear Zones (CZs) and Accident Potential Zones (APZs) that unduly increase risk associated with aircraft mishaps, and obstruction to flight in the airspace are of great concern to Selfridge ANGB. The USAF is very interested in minimizing such incompatible land uses because of the potential for this type of development to result in restrictions being placed on flying operations. As Macomb County and the townships of Harrison and Chesterfield prepare and modify land use development plans, recommendations from this updated AICUZ Study should be included in the planning process to prevent incompatible land use development. Appropriate land use controls help to ensure that Selfridge ANGB will continue to be able to fulfill its mission.

USAF AICUZ guidelines reflect land use recommendations for the CZs, APZs I and II, and the four noise zones exposed to noise levels at or above 65 decibels (dB) Day-Night Average Sound Level (DNL). These guidelines were established on the basis of studies prepared and sponsored by several federal agencies, including the United States Department of Housing and Urban Development, United States Environmental Protection Agency (USEPA), USAF, and state and local agencies. The guidelines recommend land uses that are compatible with airfield operations while allowing maximum beneficial use of adjacent properties. The USAF has no desire to recommend land use regulations that render property economically useless. It does however, have an obligation to the inhabitants of the Selfridge ANGB area of influence and the citizens of the United States (U.S.) to point out ways to protect the public investment in the installation and the people living in areas adjacent to the installation. The AICUZ area of influence includes the area within the DNL 65 dB and greater noise exposure area, and the area within the CZs and APZs.

Selfridge ANGB has undergone several mission changes since the previous AICUZ report was published in 1999. Because these mission changes have led to substantial changes in noise exposure near the base, Selfridge ANGB identified a need for a new AICUZ report to be completed after all new units had been beddown. As of the date when operational data for this

report was gathered, certain units were not yet at full-strength. In these cases, the frequency of aircraft operations was estimated based on the expected number of flying hours for which the unit is expected to be funded or other similar factors. Noise contours published in this report reflect noise conditions in the vicinity of Selfridge ANGB for the foreseeable future or until another major mission change takes place.

1.3 PROCESS, PROCEDURE, AND NOISE METRICS

Preparation and presentation of this update to Selfridge ANGB's AICUZ Study is part of the continuing USAF participation in the local planning process. Guidance for the USAF AICUZ program is contained in Air Force Instruction (AFI) 32-7063, *Air Installation Compatible Use Zone Program*, which implements Department of Defense (DoD) Instruction 4165.57, *Air Installations Compatible Use Zones*. This AICUZ Study is accompanied by a Citizen's Brochure, which summarizes the study.

As local communities prepare land use plans and zoning ordinances, the USAF recognizes it has the responsibility to provide input on its activities relating to the community. This study is presented in the spirit of mutual cooperation and assistance by Selfridge ANGB to aid in the land use planning process around the base (Appendix A).

The AICUZ program uses the latest technology to define noise levels in areas near USAF installations with a flying mission. Data collection for this effort was conducted at Selfridge ANGB in February 2009. Information collected included flight track information (where we fly), flight profile information (how we fly), ground engine runup information, and information on the frequency of each type of event. The USAF reviewed and validated the data through a communicative process that was finalized in June 2009. After verification for accuracy, the data were input into the NOISEMAP (Version 7.32) computer program to produce DNL noise contours. The noise contours for Selfridge ANGB were plotted on an area map and overlaid with the CZ and APZ areas for the airfield. Background maps, as well as data on land use and zoning, were provided by the Macomb County Planning and Economic Development Department.

Data on local weather conditions was also collected, because temperature, relative humidity, and other atmospheric factors influence how quickly sound is absorbed by the atmosphere as it travels outwards from its source. Using the methodology published in Air Force Handbook 32-7084, *AICUZ Program Manager's Guide*, the "standard day" weather conditions at Selfridge ANGB were determined. The "standard day" conditions are 62.8 degrees Fahrenheit with a relative humidity of 72 percent.

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SECTION 2 INSTALLATION DESCRIPTION

2.1 DESCRIPTION OF SELFRIDGE AIR NATIONAL GUARD BASE

Selfridge ANGB is located in Macomb County, Michigan, on the western shore of Lake Saint Clair. The installation lies immediately to the east of the City of Mount Clemens, and to the north of the City of Detroit (see Figure 2.1-1). As of the 2000 Census, Macomb County was home to 788,149 persons and was the third most populous county in the state of Michigan. Interstate 94 runs north-south near the western boundary of the base. The primary access to the base is via County Route 59, which runs along the northern boundary of the base.

Selfridge ANGB includes approximately 680 buildings, a 9,000 foot active runway, over a million square yards of taxiway and paved aircraft parking ramps, thirty-nine miles of paved roads, and seven miles of railroad track. The active runway (Runway 01/19) can accommodate all U.S. military aircraft and has both precision and non-precision published navigational approaches. Closed runways on the installation are used for rotary-wing aircraft training operations. Selfridge ANGB is the only stand-alone military air base currently open in Michigan. Land uses on the 3,600-acre Selfridge ANGB include administrative, aircraft operations and maintenance, airfield, industrial, open space, outdoor recreation, and water. The majority of the land area on the base is dedicated to airfield operations (i.e., active runway, inactive runway, parking apron, taxiways).

2.2 HISTORY

Selfridge ANGB is named after Lieutenant Thomas E. Selfridge who was killed September 17, 1908, in an aircraft crash while flying with Orville Wright at Fort Meyer, Virginia. Lieutenant Selfridge was the first military officer to pilot an engine-driven aircraft and the first to meet his death in powered flight. On July 1, 1917, Selfridge Field was opened when the U.S. Army leased 640 acres of land from Henry B. Joy. On July 16, 1917, two months after the start of World War I, actual pilot training began at the airfield. Many world-renowned pilots trained or were stationed at Selfridge Field, among them Eddie Rickenbacker, Curtis LeMay, Earl E. Patridge, Carl “Tooey” Spaatz, Joseph Cannon, Emmett “Rosie” O’Donnell, and James Doolittle. After World War II, Selfridge Field expanded to its present size of 3,600 acres. In 1947, Selfridge Field became Selfridge Air Force Base (AFB). On July 1, 1971, Selfridge AFB was transferred to the Michigan Air National Guard.

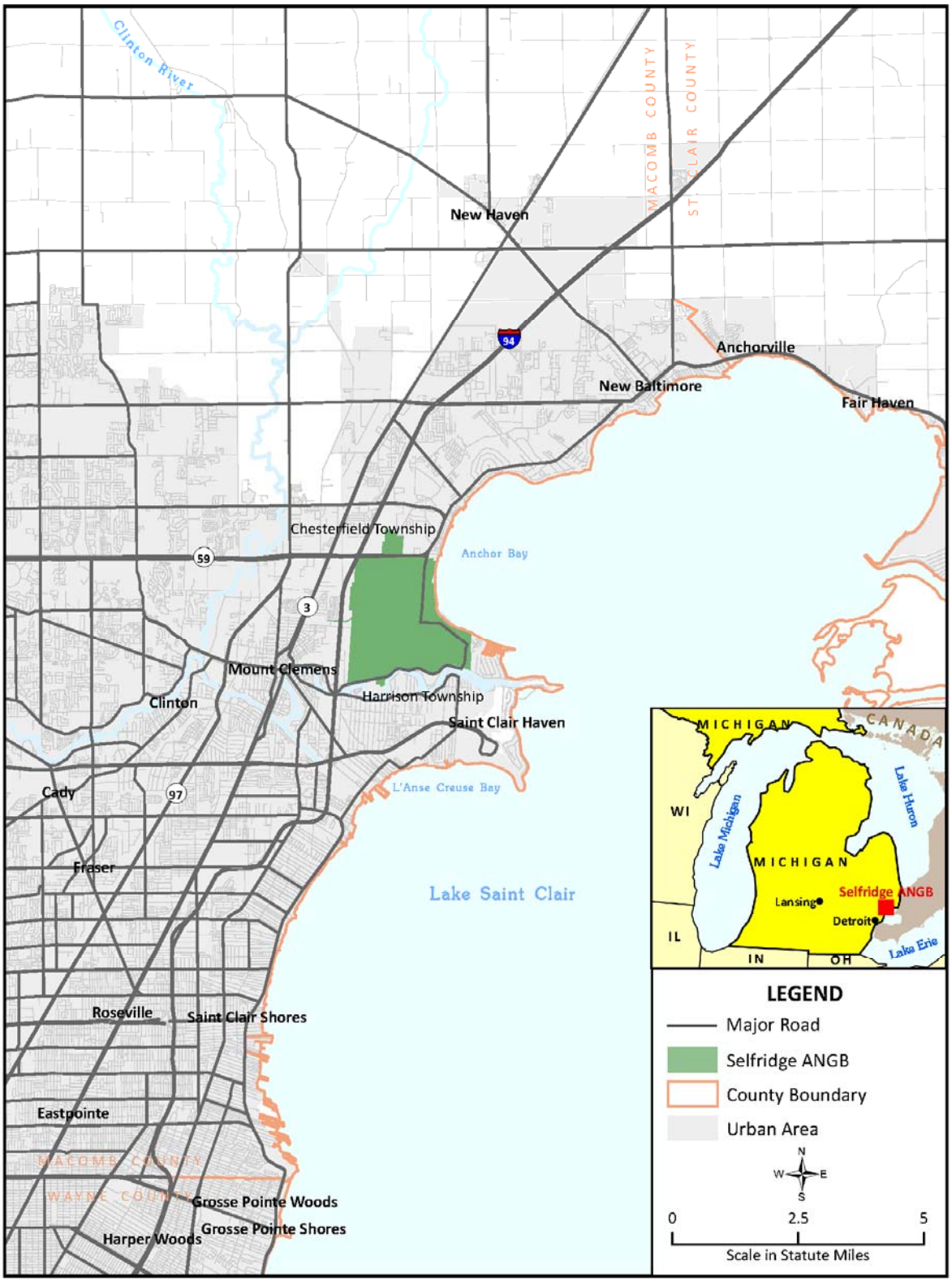

Figure 2.1-1. Selfridge ANGB Location Map

2.3 CURRENT MISSION

A-10 aircraft

KC-135R/T aircraft

The 127th Wing, Michigan ANG, is the host unit at Selfridge ANGB. It supports three separate Major Commands (Air Combat Command, Air Mobility Command, and Air Force Special Operations Command), and flies two distinctly different missions in the KC-135R/T and the A-10. The KC-135R/T aircraft are assigned to the 171st Air Refueling Squadron. These aircraft provide aerial refueling support to USAF, Navy, Marine Corps, and allied nation aircraft. The A-10 aircraft are assigned to the 107th Fighter Squadron. The primary mission of the A-10 is to provide close air support to ground forces by attacking tanks, armored vehicles, and other ground targets.

The Michigan National Guard has three distinct missions:

- *Federal* - to assist the federal government in defending the sovereign interests of the U.S. when they are threatened or violated;
- *State* - to protect the lives and property of Michigan citizens during times of natural disaster and to preserve peace, order, and public safety at the direction of the Governor; and,
- *Local* - to contribute to communities in which its units are based and provide resources and equipment, as applicable regulations allow, to the communities.

The installation supports several tenant units representing all branches of the military as well as the Coast Guard and U.S. Customs and Border Protection. Tenant units with flying missions include Coast Guard Air Station Detroit, Army Aviation Support Facility #2, and the U.S. Customs and Border Protection Northern Air Wing. Coast Guard Air Station Detroit flies the H-65 "Dolphin" helicopter in support of their mission to protect the public, the environment, and U.S. economic and security interests in any maritime region. The Army Aviation Support Facility #2 supports Detachment 1 B Co 3-328th Aviation, which flies CH-47 "Chinook" helicopters. The primary function of the CH-47 is tactical and logistical air support. The U.S. Customs and Border Protection Northern Air Wing flies several aircraft types including both

fixed- and rotary-wing aircraft. Customs and Border Protection provides security and access control at America's borders with the priority mission being preventing terrorists and terrorists' weapons from entering the U.S. Tenant organizations that do not have flying missions, but that contribute to the function of the installation, include the following:

- Navy Operations Support Center
- Marine Wing Support Group-47
- Marine Wing Support Squadron 471-Det B
- Defense Reutilization and Marketing Office
- J-RISE, EUCOM (Reserve Intel Command)
- Naval Mobile Construction Battalion 26
- Co. F, 425th Infantry Regiment
- 1st Battalion, 24th Marine Regiment
- Joint Combat Support Systems
- Michigan Air Guard Historical Association Air Museum
- Army and Air Force Exchange Service
- Defense Commissary Agency
- Central Macomb Community Credit Union

2.4 ECONOMIC IMPACT

For nine decades, Selfridge ANGB has filled key defense and security needs for the nation and the state of Michigan while providing important social and economic support to the southeast Michigan region. This section describes jobs and expenditures associated with operations at the installation.

2.4.1 LOCAL ECONOMIC CHARACTERISTICS

Selfridge ANGB is located within Macomb County and borders on Harrison Township and Chesterfield Township. Chesterfield Township is located to the north of the installation and

Harrison Township is located to the south. As shown in Table 2.4-1, the population of Macomb County was estimated to be 831,077 in 2007 and is estimated to have grown by approximately 5 percent between 2000 and 2007 (U.S. Census Bureau 2009). The population of Chesterfield Township is estimated to have grown by 18 percent between 2000 and 2007 and the population of Harrison Township is estimated to have grown by 7 percent during the same time period.

Table 2.4-1. Historic and Projected Population in Harrison Township, Chesterfield Township, and Macomb County, MI

Area	*2000 Census*	*2007 Estimate*	*Percent Growth*
Chesterfield Township	37,829	44,566	18%
Harrison Township	24,475	26,091	7%
Macomb County	788,149	831,077	5%

Notes: Population estimates are for July 1, 2000 and July 1, 2007
Source: U.S. Census Bureau 2009

2.4.2 BASE IMPACT

Selfridge ANGB directly employs over 6,220 personnel. The exact number of persons working on the installation at any given time varies due to unit deployments, Reserve and National Guard training events, and individual unit manning adjustments. However, the installation typically employs greater than 500 active duty personnel, 1,720 civilians, and 4,000 Reservists and Guardsmen (Table 2.4-2). It should be noted that many of the personnel assigned to Reserve and National Guard units do not work at Selfridge ANGB full-time.

Table 2.4-2. Personnel by Classification

Classification	*Personnel (Approximate)*
Military - Active Duty	500
Military - Reserve and Guard	4,000
Total Military	**4,500**
Total Civilian	**1,720**
Grand Total	**6,220**

Source: Selfridge ANGB 2008

In 2008, 127th Wing payroll exceeded 88 million dollars and non-payroll expenditures exceeded 43 million dollars (Table 2.4-3). The input of the installation to the local economy is particularly valuable because it is less strongly affected by economic trends than other industries in the region.

Table 2.4-3. Annual Economic Impact

Category	*Annual Dollars ($)*
Payroll	
Military – Active Duty	12,031,363
Military – Traditional Guard	22,697,612
Civilian – Federal	52,392,718
Civilian – State	1,548,429
Total	**88,670,122**
Expenditures	
Fly Program	11,651,597
Military Personnel Expenditures	2,178,480
Real Property Maintenance	6,233,137
Other Operations and Maintenance Spending	23,366,100
Total	**43,429,314**
Grand Total	**132,099,436**

Source: Selfridge ANGB 2008

SECTION 3 AIRCRAFT OPERATIONS

3.1 INTRODUCTION

To describe the relationship between aircraft operations and land use at and around the airfield, it is necessary to fully evaluate the exact nature of flying activities. The February 2009 aircraft operations data collection at Selfridge ANGB included where aircraft fly, how high they fly, how many times they fly over a given area, and the time of day they operate. Interviews were held with representatives from each flying unit, as well as Air Traffic Control and Transient Alert to gather this information. Section 3.2 discusses the number of airfield operations flown at Selfridge ANGB per Average Busy Day (ABD). Section 3.3 discusses runway and flight track utilization for all operations by aircraft type. Section 3.4 describes aircraft maintenance activity and Section 3.5 discusses aircraft flight profiles.

3.2 AIRCRAFT OPERATIONS

Based on data collected in February 2009, approximately 108 airfield operations per ABD will be flown at Selfridge ANGB once all flying units are at full-strength (Table 3.1-1). An airfield operation is defined as one takeoff/departure, one approach/landing, or half a closed pattern. A *closed pattern* consists of two portions, a takeoff/departure and an approach/landing, i.e., two operations. A *sortie* is a single military aircraft flight from the initial takeoff through the termination landing. The minimum number of airfield operations for one sortie is two operations, one takeoff (departure) and one landing (approach).

Some of the flying units currently based at Selfridge ANGB have recently beddown at the installation and have not yet received their full aircraft inventory. Aircraft operations flown by these units will increase over time until the full complement of aircraft are on-station. This should occur for all units by about 2011. Because the AICUZ program is intended to facilitate prudent long-term land use planning, end-state operational data was used to generate noise contours for this report.

Although the number of military and civil aircraft operations at an installation usually varies from day to day, NOISEMAP requires input of the specific numbers of daily flight and aircraft maintenance engine runup operations. The USAF does not follow the FAA's use of the "average annual day" in which annual operations are averaged over an entire 365-day year. Neither does the USAF use the "worst-case day" since it typically does not represent the typical noise exposure. Instead, the USAF uses the ABD concept in which annual operations for an aircraft type are averaged over the number of flying days per year by that aircraft type. Days in which flying operations are limited or non-existent (e.g., holidays and weekends) are not used in computing the ABD operations. Flying by Selfridge ANGB flying units ranges from 240 to 365

days per year. Transient Alert operations are based on 355 days per year reflecting the number of days on which that organization is normally open for business.

Table 3.1-1. Average Busy-Day Airfield Operations for Full-Strength Operations

Aircraft Type	*Arrivals*		*Departures*		*Closed Pattern Airfield Operations*	
	*7 a.m. – 10 p.m.**	*10 p.m. – 7 a.m.*	*7 a.m. – 10 p.m. **	*10 p.m. – 7 a.m.*	*7 a.m. – 10 p.m. **	*10 p.m. – 7 a.m.*
KC-135R/T	2.2	0.0	1.9	0.3	29.0	4.0
A-10	12.0	0.0	12.0	0.0	8.2	0.0
HH-65	4.5	0.5	4.5	0.5	2.4	0.0
CH-47	1.0	0.0	0.9	0.1	6.8	0.0
Cessna 210	1.0	0.5	1.0	0.5	0.0	0.0
Cessna 550	0.8	0.4	0.8	0.4	0.0	0.0
Beechcraft 300	0.8	0.4	0.8	0.4	0.0	0.0
EC-120	0.8	0.4	0.8	0.4	0.0	0.0
H-60	0.6	0.3	0.6	0.3	0.0	0.0
AS-350	0.8	0.4	0.8	0.4	0.0	0.0
Transient Aircraft	1.5	0.0	1.5	0.0	0.0	0.0
Total	26	2.9	25.6	3.3	46.4	4.0

Note: A "sortie" is a single military aircraft flight from the initial takeoff through the termination landing and includes at least one takeoff/departure and one landing/arrival airfield operation. Two closed pattern operations make up a single closed pattern event.

Table 3.1-1 summarizes the projected ABD aircraft operations for the Selfridge ANGB airfield based on information provided by base staff, flying units, and Air Traffic Control personnel. Flying units at Selfridge ANGB operate 10 different aircraft types. The 127th Wing KC-135R/T and A-10 aircraft make up the majority of the operations (64 percent). HH-65 aircraft (Coast Guard) and CH-47 aircraft (Army Reserve) fly 11 percent and 8 percent of operations, respectively. In total, U.S. Customs and Border Protection aircraft (Cessna 210, Cessna 550, Beechcraft 300, EC-120, H-60, and AS-350) fly approximately 13 percent of all airfield operations flown each ABD. In addition, several types of transient aircraft visited Selfridge ANGB during Fiscal Year 2008, flying approximately 4 percent of total operations on an ABD.

Approximately 8 percent of the operations occur during the "night" period between 10 p.m. to 7 a.m. Night sorties (10 p.m. to 7 a.m.) are minimized to the extent practicable. However, the mission sometimes requires flying during this time period. U.S. Customs and Border Protection aircraft, in particular, fly frequently during this time (33 percent of total airfield operations). KC-135R/T, CH-47, H-65, and A-10 aircraft fly less than 10 percent of their total airfield operations during this time period.

3.3 RUNWAY AND FLIGHT TRACK UTILIZATION

Runway 01/19 is 9,000 feet long and 150 feet wide and is the only active runway on Selfridge ANGB. When deciding which runway threshold to use for a particular aircraft operation (arrival, departure, or closed pattern), the primary consideration is often the direction and intensity of wind. Both fixed-wing and rotary-wing aircraft typically take off and land into a headwind whenever possible for safety reasons. At Selfridge ANGB, when winds do not dictate otherwise, arrivals are typically made from the north (to Runway 19) and departures are made to the north (Runway 01). This is because airspace to the south of the installation is relatively congested due to aircraft operations at nearby Detroit Metropolitan-Wayne County Airport (DTW). DTW is the 12th busiest airport in the U.S. and is located approximately 40 miles southwest of Selfridge ANGB (Figure 3.3-1). Aircraft arriving to and departing from DTW traverse areas to the south and west of Selfridge ANGB. As a result, Radar Approach Control often directs Selfridge ANGB air traffic maneuvering in the DTW departure corridor to remain below altitudes used by DTW aircraft until there is no potential for conflict.

Selfridge ANGB Class D airspace extends approximately seven nautical miles to the north, east, and south and approximately five nautical miles to the west. This configuration reflects the preference for using the areas to the east of the installation as opposed to areas to the west of the installation. Prior to entering Class D airspace, pilots are required to establish radio contact with the air traffic control tower and radio contact must be maintained until the aircraft has exited the airspace. In certain circumstances, the tower will direct pilots maneuvering in Class D airspace such that mid-air collisions are avoided. Air traffic to the east of the base flies over Lake Saint Clair and relatively sparsely developed areas, while areas to the west are densely developed and contain several airports. Preferentially routing air traffic to the east of the installation reduces noise impacts and potential air traffic conflicts. Additional discussion on airspace classifications can be found in Appendix B. Furthermore, several particularly noise-sensitive locations, including the town of Mount Clemens and two elementary schools, have been designated as overflight avoidance areas.

Other airports within the area of influence for aircraft arrival and departure flight tracks at Selfridge ANGB include the Detroit City Airport, Windsor International Airport (Canadian), Oakland County International Airport, and several smaller airfields without air traffic control facilities. Additionally, the Canadian border runs from the southwest to the northeast approximately 10 miles south of Selfridge ANGB. Aircraft require clearance to enter Canadian airspace.

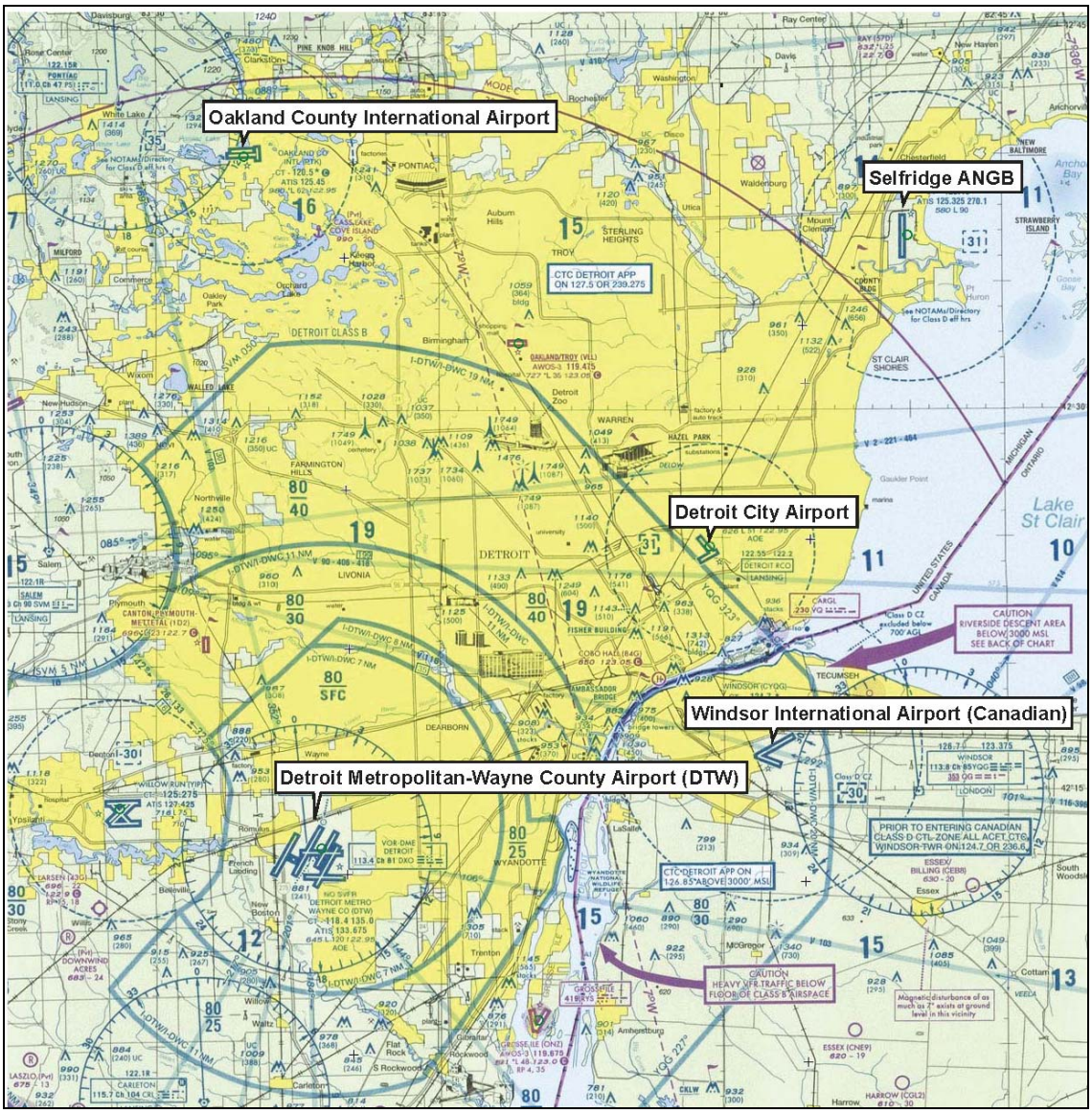

Figure 3.3-1. Selfridge ANGB, DTW, and Other Nearby Airports

Considering the above limitations, Selfridge ANGB aircraft use the following basic flight patterns:

- departures;
- straight-in approaches;
- overhead landing patterns;
- Instrument Flight Rule (IFR) or radar closed patterns;
- Visual Flight Rule (VFR) or closed patterns; and
- re-entry VFR patterns.

Flight patterns specific to Selfridge ANGB result from several considerations, including:

- takeoff patterns routed to avoid noise sensitive areas as much as possible;
- USAF criteria governing the speed, rate of climb, and turning radius for each type of aircraft;
- efforts to control and schedule missions to keep noise levels low, especially at night; and,
- coordination with the FAA to minimize conflict with civilian aircraft operations.

Planning for areas surrounding an airfield considers three primary aircraft operational/land use determinants: (1) aircraft accident potential to land users; (2) aircraft noise; and (3) hazards to operations from land uses (e.g., height of structures). Each of these concerns is addressed in conjunction with mission requirements and safe aircraft operations to determine the optimum flight track for each aircraft type. The flight tracks depicted in Figures 3.3-2 through 3.3-4 are the result of such planning and depict the representative flight tracks used for noise modeling. The flight track locations represent the various types of arrivals, departures, and closed patterns accomplished at Selfridge ANGB. The location for each track is representative for the specific track and may vary due to air traffic control, weather, and other reasons (e.g., one pilot may fly the track on one side of the depicted track, while another pilot may fly the track slightly to the other side).

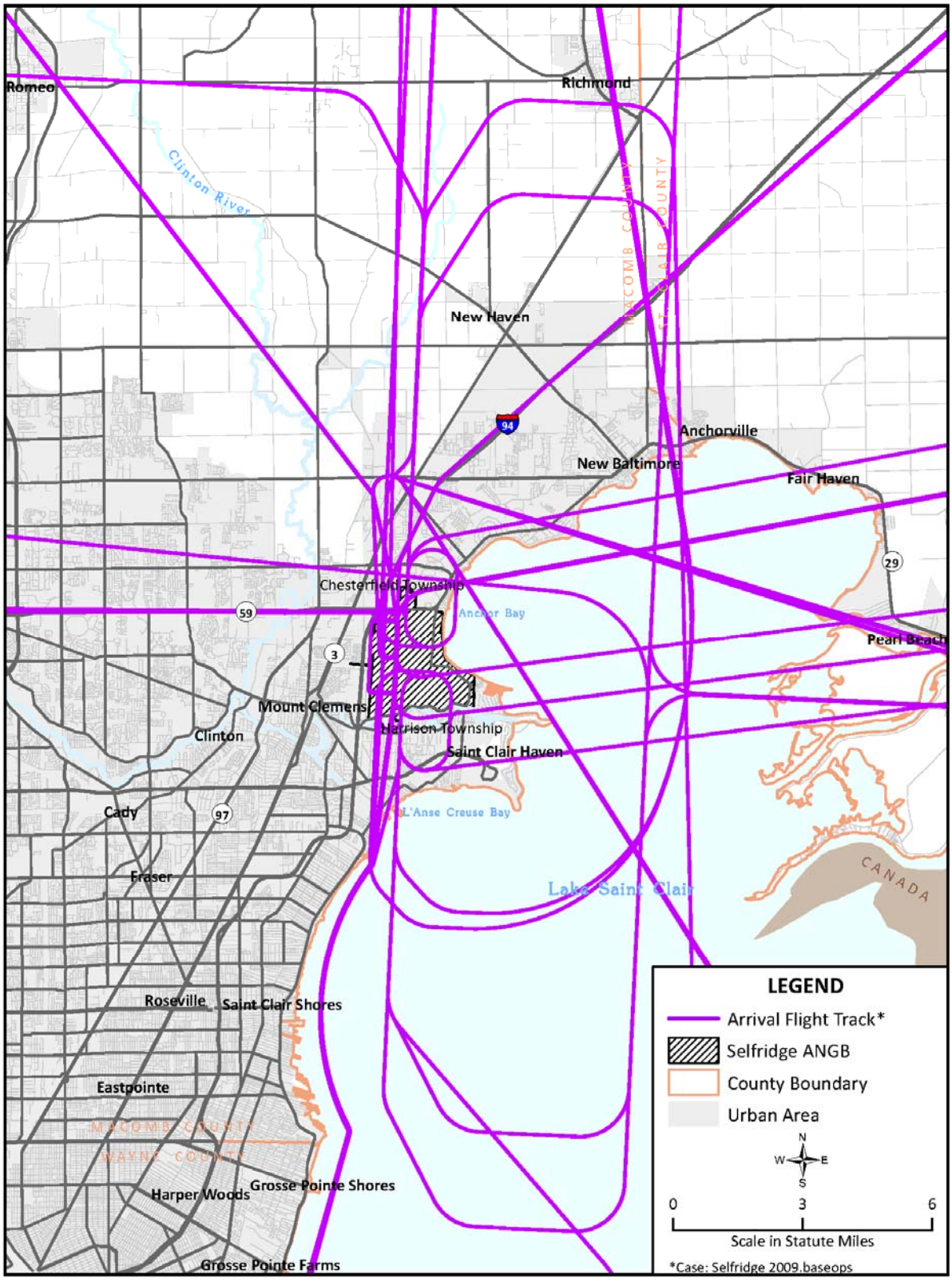

Figure 3.3-2. Arrival Flight Tracks

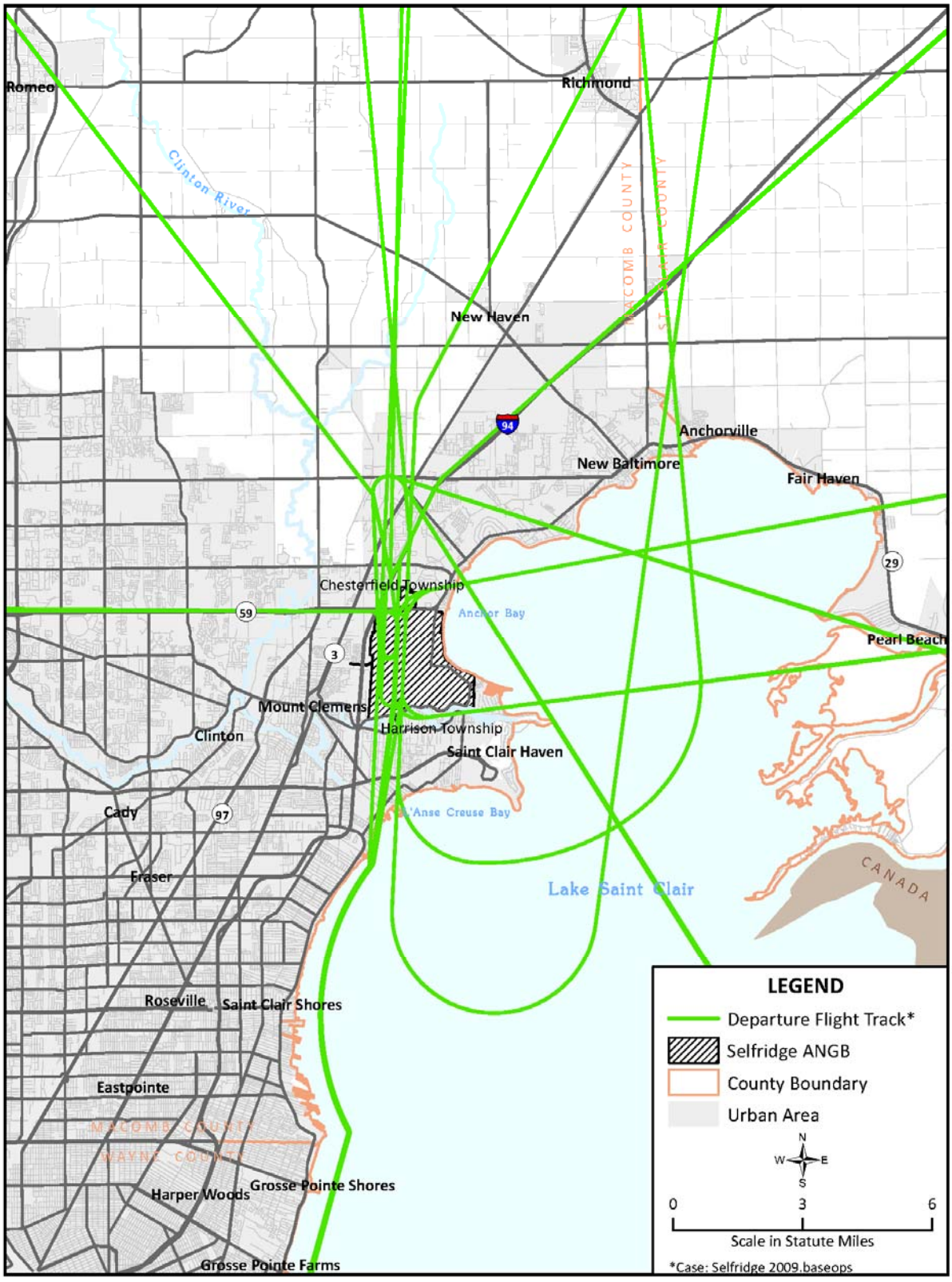

Figure 3.3-3. Departure Flight Tracks

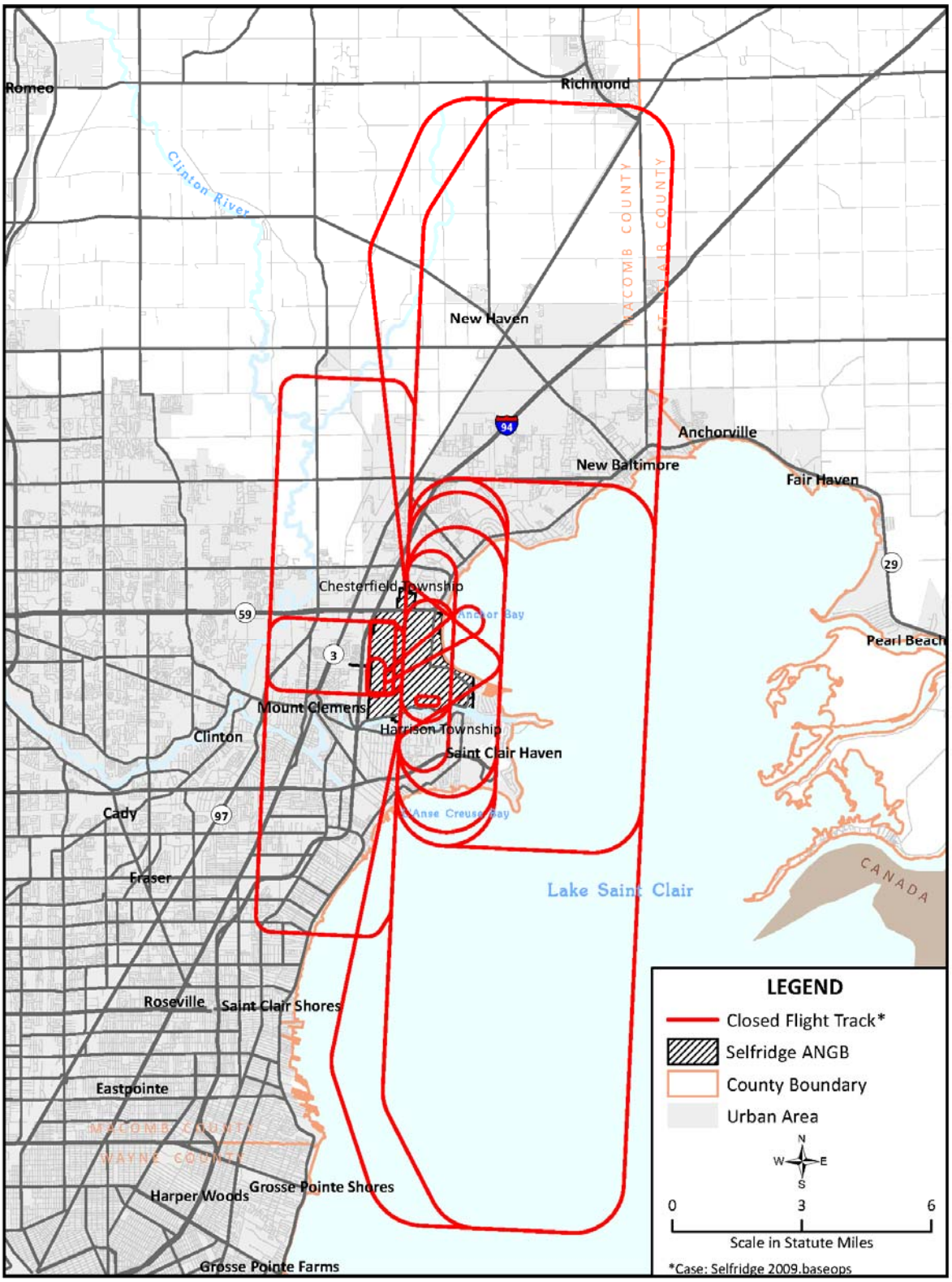

Figure 3.3-4. Closed Pattern Flight Tracks

3.4 AIRCRAFT MAINTENANCE RUNUP OPERATIONS

To the maximum extent possible, aircraft maintenance static engine runup locations have been established in areas to minimize noise for people on base, as well as for those in surrounding communities (Figure 3.4-5). Aircraft engine static runup operations are accomplished by based flying units and their associated maintenance functions.

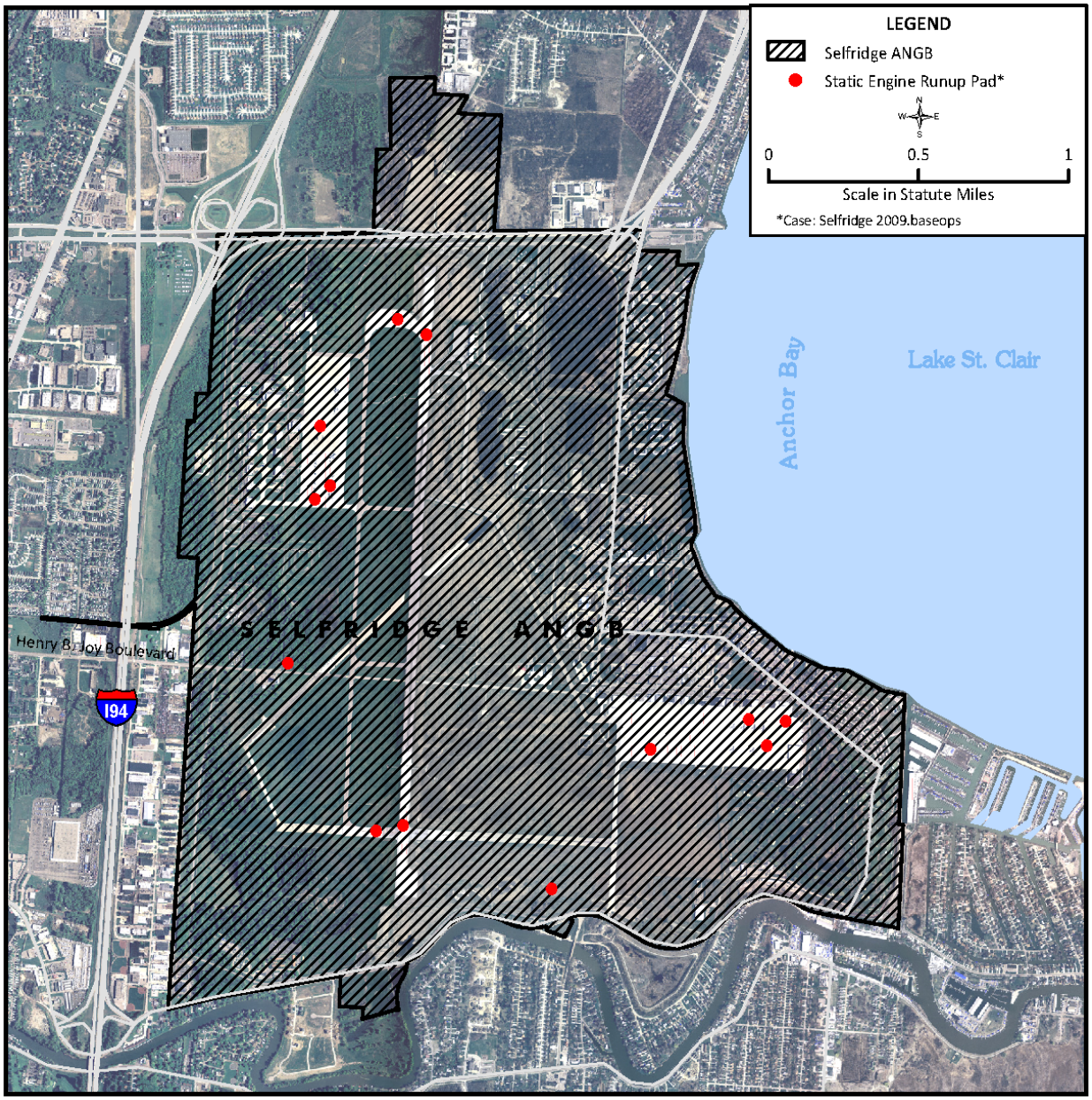

Figure 3.4-5. Aircraft Maintenance Engine Static Runup Locations

ABD aircraft maintenance runup operations were calculated similarly to flight operations described in Section 3.1. Weekly, monthly, or annual estimates of runups provided by Selfridge ANGB aircraft maintenance personnel were divided by the typical number of days that runups are performed over the respective period. Maintenance operations during the "night" period (10 p.m. to 7 a.m.) are extremely rare, occurring approximately once per month.

3.5 AIRCRAFT FLIGHT PROFILES

For purposes of this AICUZ Study, aircraft "flight profiles" denote the aircraft power settings, altitudes above runway level, and airspeeds along each flight track. Aircraft flight profiles were obtained from Selfridge ANGB personnel for all based aircraft types. Generic flight profiles from the BASEOPS database were used to model operations for transient aircraft types.

Noise data from the NOISEFILE database were used to model operations for all aircraft types. In cases where NOISEFILE did not contain entries for a particular aircraft type, a similar aircraft was selected as a surrogate. All surrogate aircraft used were the same as had been used in previous environmental analysis documentation.

SECTION 4 LAND USE COMPATIBILITY CRITERIA

4.1 INTRODUCTION

The DoD developed the AICUZ program for military airfields in 1972. Using this program at its installations, the DoD works to protect aircraft operational capabilities and to assist local government officials in protecting and promoting the public's health, safety, and quality of life. The goal is to promote compatible land use development around military airfields by providing information on aircraft noise exposure and accident potential.

AICUZ reports describe three basic types of constraints that affect, or result from, flight operations. The first constraint involves noise zones based on the DNL metric and the DoD NOISEMAP method. Using the NOISEMAP program, which is similar to FAA's Integrated Noise Model (INM), the USAF produces noise contours showing the noise levels generated by aircraft operations. The AICUZ report contains noise contours plotted in 5 dB increments, ranging from DNL 65 dB to 80+ dB (see Section 4.2). The second constraint involves CZs and APZs based on statistical analysis of past DoD aircraft accidents. DoD analysis has determined that areas immediately beyond the ends of runways and along the approach and departure flight paths have elevated potential for aircraft accidents (see Section 4.4). The third constraint involves areas that the FAA and the DoD identified for height limitations (see Section 4.5).

Other land use considerations discussed in this report include factors that could pose a direct threat to aircraft during flight (see Section 4.6). Land uses that could obstruct pilot vision through generation of dust, smoke, or steam or that could prevent pilot communications (e.g., high-intensity electrical emissions) should be sited properly to avoid potential safety issues. In addition, land uses that would attract birds could increase the level of Bird/Wildlife Aircraft Strike Hazard (BASH). Land uses that are attractive to birds include, but are not limited to, sanitary landfills, dredging operations, wetland areas, or the growing of certain vegetation.

4.2 NOISE EXPOSURE

NOISEMAP Version 7.3 was used to calculate and plot the DNL noise contours based on the average busy-day aircraft operations data collected in 2009 and described in Sections 3.1 through 3.5. Figure 4.2-1 shows the DNL noise contours plotted in 5 dB increments, ranging from DNL 65 dB to DNL at or above 80 dB.

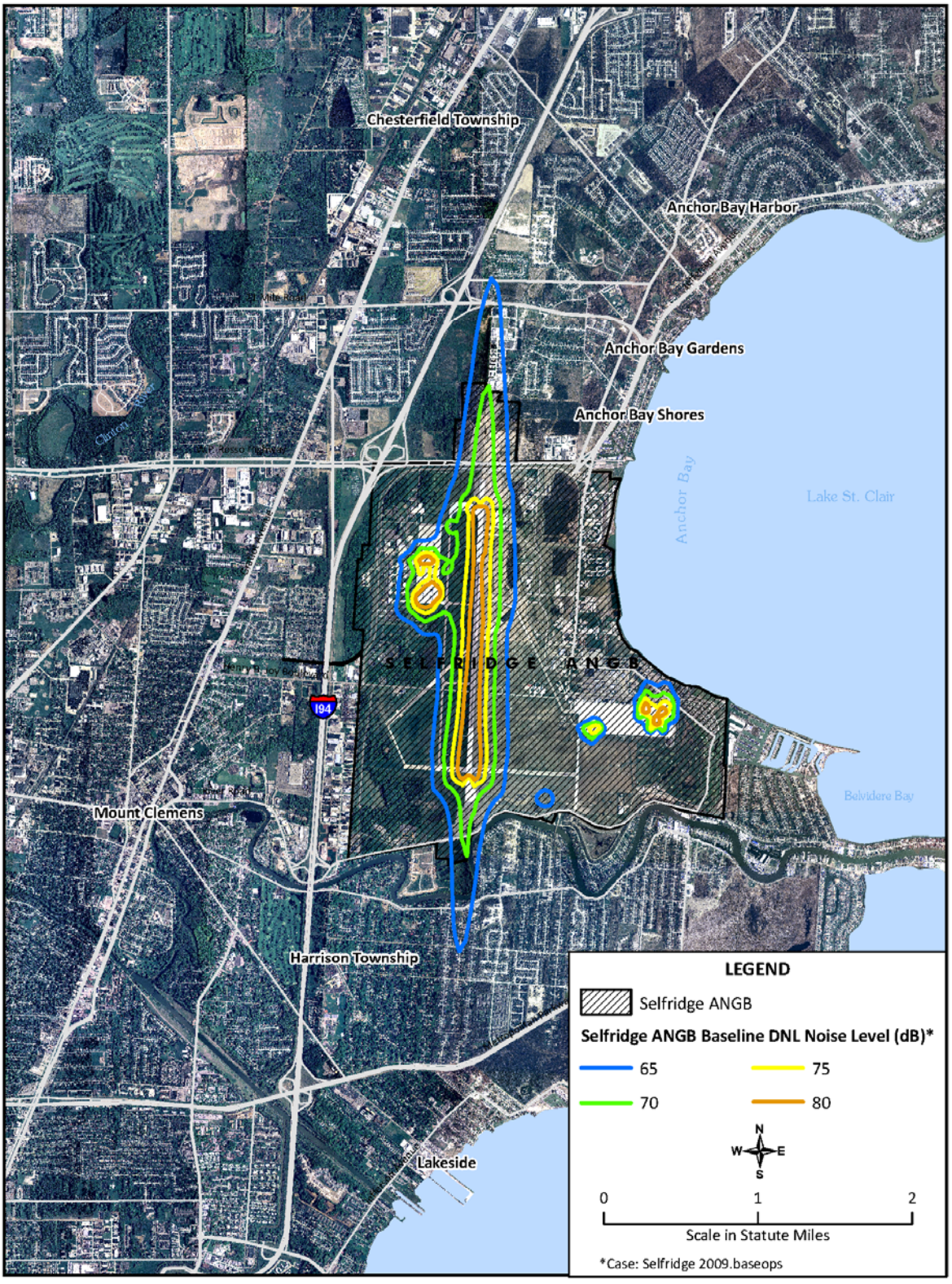

Figure 4.2-1. Average Busy Day Noise Contours for 2009

Different sounds have different frequency content. When describing sound and its effect on a human population, A-weighted dB sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the sound signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute. The A-weighted noise level has been found to correlate well with people's judgments of the noisiness of different sounds and has been in use for many years as a measure of community noise.

Table 4.2-1 shows the off-DoD property noise exposure within the DNL 65 dB and greater noise exposure area for aircraft operations at Selfridge ANGB in terms of acreage.

Table 4.2-1. Area Within Noise Contours (off-DoD Property)

DNL Noise Zone	*Acres*
65–69	121.2
70–74	0.7
75–79	0
80+	0
Total	**121.9**

4.3 PAST, PRESENT, AND POTENTIAL FUTURE AIRCRAFT NOISE LEVELS

AICUZ noise contours describe the noise characteristics of specific operational environments, and as such, change over time as operational changes occur. Should significant mission changes occur at Selfridge ANGB, the AICUZ could be amended and noise contours could exceed those published in this report.

Selfridge ANGB has recently undergone major mission changes including drawdown of the F-16 units and beddown of an A-10 unit. As a result of these mission changes, noise levels have decreased as compared to those experienced in 1999. While there are currently no known plans to change units or operational characteristics at Selfridge ANGB, such changes could occur at some point in the future. The DoD periodically reviews unit basing and force structure, making changes to better reflect strategic objectives and to maximize taxpayer return on investment.

With these thoughts in mind, Selfridge ANGB has updated the 1999 AICUZ report, providing flight track, aircraft operational tempo, and noise contour information reflecting full-strength operations of units currently beddown at the installation. We would, however, like to point out that continuing to use the larger 1999 noise contours for land use planning would help to protect

the Selfridge ANGB mission and allow for future aircraft changes and or added mission activity with fewer land use impacts. This buffer zone would increase operational flexibility at the base.

4.4 CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

Areas around airports are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, past history makes it clear that accidents may occur.

The risk of people on the ground being killed or injured by aircraft accidents is small. However, an aircraft accident is a high-consequence event and when a crash does occur the result is often catastrophic. Because of this, the USAF does not attempt to base its safety standards on accident probabilities. Instead, it approaches this safety issue from a land use-planning perspective. Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public's exposure to safety hazards.

The AICUZ program includes three safety zones: the CZ, APZ I, and APZ II. These zones were developed from analysis of over 800 major USAF accidents that occurred within 10 miles of a USAF installation between 1968 and 1995. Figure C.3 in Appendix C summarizes the location of these accidents. Figure 4.4-1 depicts the CZs and APZs for Runways 01/19 at Selfridge ANGB.

At either end of the runway is a 3,000-foot by 3,000-foot CZ. The CZ has the highest accident potential of the three zones, with 27 percent of accidents studied occurring in this area. Accident potential within the CZ is so high that the necessary land use restrictions would prohibit reasonable economic use of land. It is USAF policy to request that Congress authorize and appropriate funds to purchase the real property interests in this area to prevent incompatible land uses.

Selfridge ANGB has taken several proactive steps to limit incompatible development in its northern and southern CZs. Selfridge ANGB owns the majority of the land in the northern CZ and has purchased easements in the remainder of the land that prevent incompatible development. In the southern CZ, the majority of the area south of the Clinton River has been developed as single-family residential for several decades. After discussions with Congressional delegates, this area has been exempted from the USAF policy to purchase all CZ lands (USAF 1979). At the southwest corner of the southern CZ, in the housing development "Brigantine Estates," there is another privately held area. The USAF purchased a restrictive easement disallowing the development of any incompatible land uses in the portion of Brigantine Estates located within the CZ.

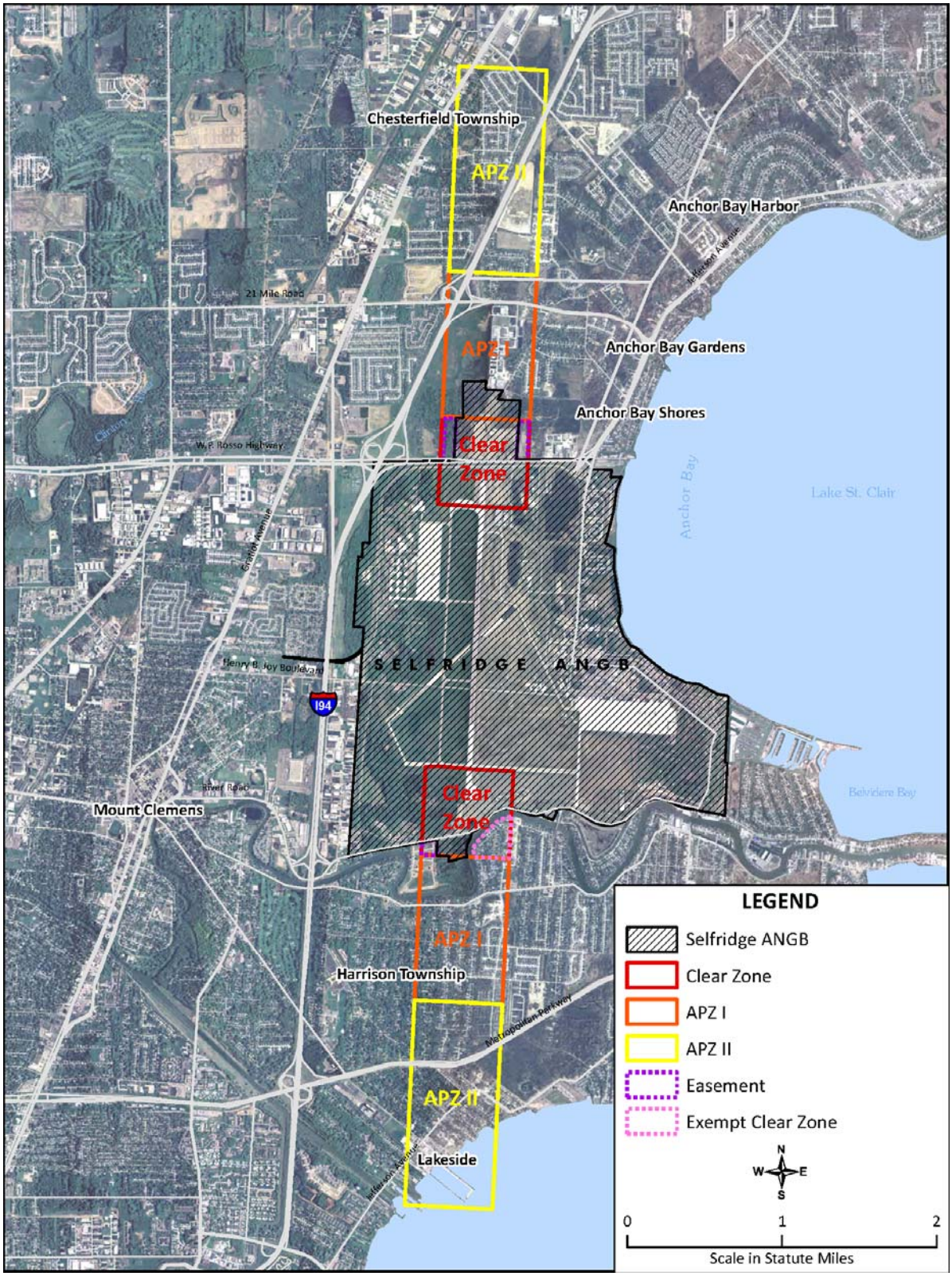

Figure 4.4-1. Clear Zones and Accident Potential Zones

APZ I is a 3,000-foot by 5,000-foot area that lies along the extended runway centerline, just beyond the end of the CZ. APZ I possesses somewhat less accident potential than the CZ, containing 10 percent of the accidents studied. Land use compatibility guidelines in APZ I allow reasonable economic uses of the land, such as industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agriculture. However, uses that concentrate people in small areas are not acceptable.

APZ II is a 3,000-foot by 7,000-foot area lying beyond the APZ I, extending to 15,000 feet from the runway threshold. APZ II has less accident potential than APZ I, with 6 percent of the accidents studied occurring in this zone. Accident potential in APZ II is less critical than APZ I, but still possesses potential for accidents. Acceptable land uses include those of APZ I, as well as low-density single-family residential and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High-density functions such as multi-story buildings, places of assembly (e.g., theaters, churches, schools, restaurants, etc.), and high-density office uses are not considered appropriate. High people densities should be limited to the maximum extent possible in APZ II. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in APZ II is one-to-two dwelling units per acre.

4.5 SAFETY OF FLIGHT

4.5.1 RUNWAY AIRSPACE IMAGINARY SURFACES

Runway airspace imaginary surfaces define volumes of airspace that must remain free of obstructions to air navigation in order to maintain safety of flight in the airfield airspace. Any object that passes through the surface is termed an obstruction to air navigation. Obstructions may include:

- natural objects or man-made structures that protrude above the planes or imaginary surfaces; and/or
- man-made objects that extend more than 500 feet above ground level (AGL) at the site of the structure.

Runway imaginary surfaces are standard for all Class B runways, as defined in Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*. Figure 4.5-1 depicts the runway airspace imaginary surfaces for a Class B runway, such as Runway 01/19 at Selfridge ANGB. USAF obstruction criteria in UFC 3-260-01 are based on those contained in Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*, Subpart C. FAR Part 77 provides guidance on submittal of FAA Form 7460-1, *Notice of Proposed Construction or*

Alteration. The form notifies the FAA of construction or alteration of structures proximate to imaginary surfaces around airfields.

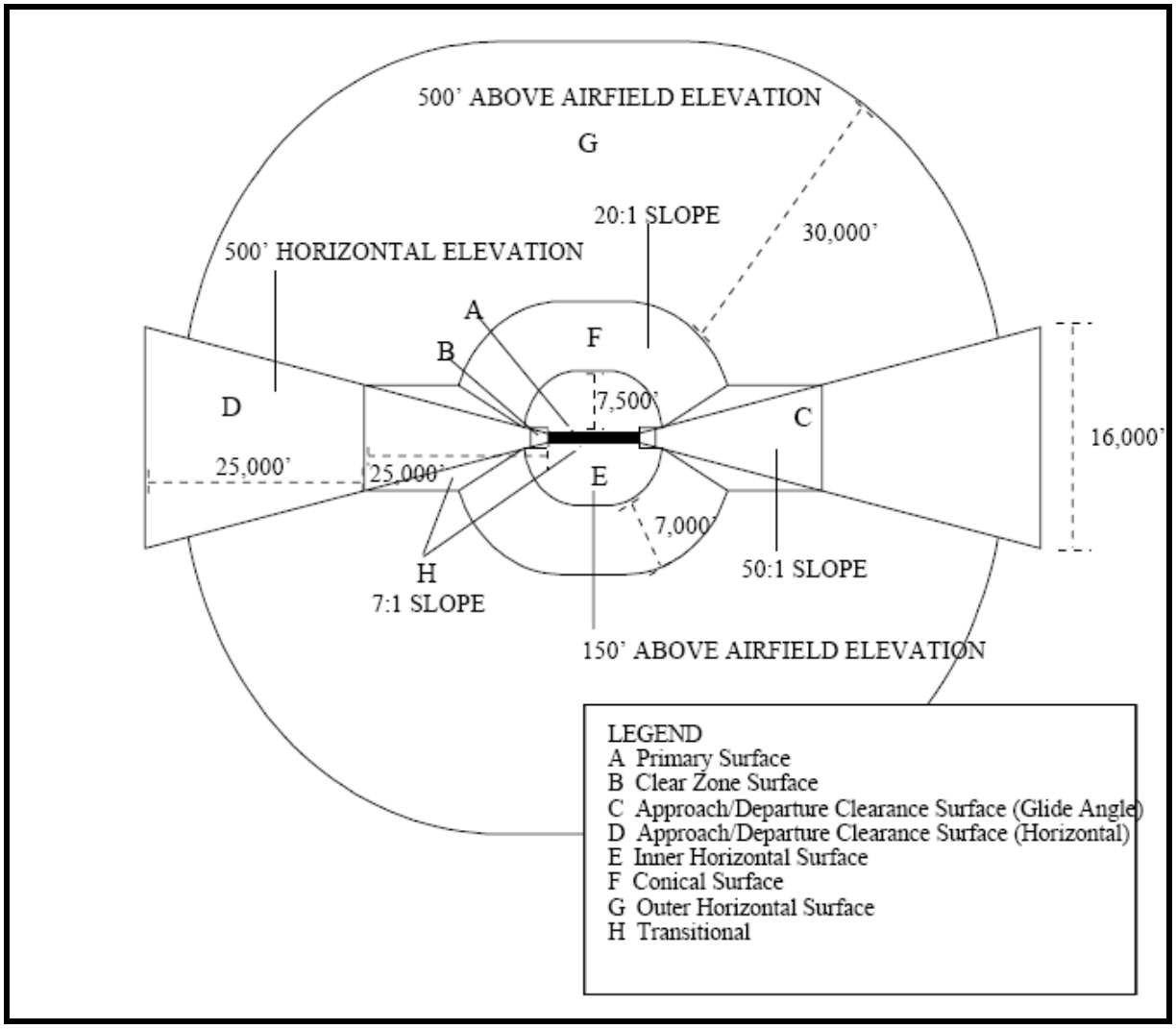

Figure 4.5-1. Class B Air Force Runway Airspace Imaginary Surfaces

The following paragraphs contain definitions of the runway airspace imaginary surfaces for USAF Class B runways. All surfaces are defined from 580 feet above mean sea level (MSL), the established airfield elevation at Selfridge ANGB.

- Primary Surface (labeled as A in Figure 4.5-1) - This surface immediately surrounds the runway, and must be kept free of all obstructions not directly required for airfield operations.

- CZ Surface (labeled as B in Figure 4.5-1) – CZs are 3,000-foot by 3,000-foot areas defined relative to the runway ends. With few exceptions, these areas must be kept free of all obstructions not directly required for airfield operations.

- Approach-Departure Clearance Surface (labeled as C and D in Figure 4.5-1) - This imaginary surface is symmetrically centered on the extended runway centerline, beginning as an inclined plane (glide angle) 200 feet beyond each end of the primary surface, and extending for 50,000 feet. The slope of the approach-departure clearance surface is 50:1 until it reaches an elevation of 500 feet above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 feet from the starting point. The width of this surface at the runway end is 2,000 feet, flaring uniformly to a width of 16,000 feet at the end point.

- Inner Horizontal Surface (labeled as E in Figure 4.5-1) - This imaginary surface is an oval plane at a height of 150 feet above the established airfield elevation. The inner boundary intersects with the approach-departure clearance surface and the transitional surface. The outer boundary is formed by scribing arcs with a radius 7,500 feet from the centerline of each runway end and interconnecting these arcs with tangents.

- Conical Surface (labeled as F in Figure 4.5-1) - This is an inclined imaginary surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation. The slope of the conical surface is 20:1. The conical surface connects the inner and outer horizontal surfaces.

- Outer Horizontal Surface (labeled as G in Figure 4.5-1) - This imaginary surface is located 500 feet above the established airfield elevation and extends outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.

- Transitional Surface (labeled as H in Figure 4.5-1) - This imaginary surface extends outward and upward at right angles to the runway centerline and extended runway centerline at a slope of 7:1. The transitional surface connects the primary and the approach-departure clearance surfaces to the inner horizontal, the conical, and the outer horizontal surfaces.

4.5.2 RESTRICTED AND/OR PROHIBITED LAND USES

The land areas outlined by these criteria should be regulated to prevent uses that might otherwise be hazardous to aircraft operations. The following uses should be restricted and/or prohibited.

- Releases into the air of any substance that would impair visibility or otherwise interfere with the operation of aircraft (e.g., steam, dust, or smoke).

- Light emissions, either direct or indirect (reflective), that would interfere with pilot vision.

- Electrical emissions that would interfere with aircraft communications systems or navigational equipment.

- Uses that would attract birds or waterfowl including, but not limited to, operation of sanitary landfills, waste transfer facilities, maintenance of feeding stations, sand and gravel dredging operations, stormwater retention ponds, created wetland areas, or the growing of certain vegetation (127th Wing BASH Plan [91-212] and Related FAA Circulars [AC150/5200-33B])(Appendix D).

- Structures within 10 feet of aircraft approach-departure and/or transitional surfaces.

4.6 LAND USE COMPATIBILITY GUIDELINES

Each AICUZ Study contains land use guidelines. Table 4.6-1 identifies land uses and possible noise exposure and accident potential combinations for Selfridge ANGB. These noise guidelines are essentially the same as those published by the Federal Interagency Committee on Urban Noise in the June 1980 publication, *Guidelines for Considering Noise in Land Use Planning and Control.* The U.S. Department of Transportation publication, *Standard Land Use Coding Manual (SLUCM),* has been used to identify and code land use activities. The designations are a combination of criteria listed in the Legend and Notes at the end of the table. For example, Y^1 means land use and related structures are compatible without restriction at a suggested maximum density of 1-2 dwelling units per acre, possibly increased under a Planned Unit Development where lot coverage is less than 20 percent.

Table 4.6-1. Land Use Compatibility Guidelines
(Page 1 of 3)

LAND USE		APZs			NOISE ZONES (DNL)			
SLUCM No.	*Name*	*CZ*	*APZ I*	*APZ II*	*65-69*	*70-74*	*75-79*	*80+*
10	**Residential**							
11	Household units							
11.11	Single units; detached	N	N	Y[1]	A[11]	B[11]	N	N
11.12	Single units; semidetached	N	N	N	A[11]	B[11]	N	N
11.13	Single units; attached row	N	N	N	A[11]	B[11]	N	N
11.21	Two units; side-by-side	N	N	N	A[11]	B[11]	N	N
11.22	Two units; one above the other	N	N	N	A[11]	B[11]	N	N
11.31	Apartments; walk up	N	N	N	A[11]	B[11]	N	N
11.32	Apartments; elevator	N	N	N	A[11]	B[11]	N	N
12	Group quarters	N	N	N	A[11]	B[11]	N	N
13	Residential hotels	N	N	N	A[11]	B[11]	N	N
14	Mobile home parks or courts	N	N	N	N	N	N	N
15	Transient lodgings	N	N	N	A[11]	B[11]	C[11]	N
16	Other residential	N	N	N[1]	A[11]	B[11]	N	N
20	**Manufacturing**							
21	Food & kindred products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
22	Textile mill products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
23	Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing	N	N	N[2]	Y	Y[12]	Y[13]	Y[14]
24	Lumber and wood products (except furniture); manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
25	Furniture and fixtures; manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
26	Paper & allied products; manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
27	Printing, publishing, and allied industries	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
28	Chemicals and allied products; manufacturing	N	N	N[2]	Y	Y[12]	Y[13]	Y[14]
29	Petroleum refining and related industries	N	N	Y	Y	Y[12]	Y[13]	Y[14]
30	**Manufacturing**							
31	Rubber and misc. plastic products, manufacturing	N	N[2]	N[2]	Y	Y[12]	Y[13]	Y[14]
32	Stone, clay and glass products manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
33	Primary metal industries	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
34	Fabricated metal products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]

Table 4.6-1. Land Use Compatibility Guidelines
(Page 2 of 3)

LAND USE		APZs			NOISE ZONES IN DNL dB			
SLUCM No.	*Name*	*CZ*	*APZ I*	*APZ II*	*65-69*	*70-74*	*75-79*	*80+*
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks manufacturing	N	N	N[2]	Y	A	B	N
39	Miscellaneous manufacturing	N	Y[2]	Y[2]	Y	Y[12]	Y[13]	Y[14]
40	**Transportation, Communications and Utilities**							
41	Railroad, rapid rail transit and street railroad transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
42	Motor vehicle transportation	N[3]	Y	Y	Y	Y[12]	Y[13]	Y[14]
43	Aircraft transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
44	Marine craft transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
45	Highway & street right-of-way	N[3]	Y	Y	Y	Y[12]	Y[13]	Y[14]
46	Automobile parking	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
47	Communications	N[3]	Y[4]	Y	Y	A[15]	B[15]	N
48	Utilities	N[3]	Y[4]	Y	Y	Y	Y[12]	Y[13]
49	Other transportation communications and utilities	N[3]	Y[4]	Y	Y	A[15]	B[15]	N
50	**Trade**							
51	Wholesale trade	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
52	Retail trade-building materials, hardware and farm equipment	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
53	Retail trade-general merchandise	N	N[2]	Y[2]	Y	A	B	N
54	Retail trade-food	N	N[2]	Y[2]	Y	A	B	N
55	Retail trade-automotive, marine craft, aircraft and accessories	N	Y[2]	Y[2]	Y	A	B	N
56	Retail trade-apparel and accessories	N	N[2]	Y[2]	Y	A	B	N
57	Retail trade-furniture, home furnishings and equipment	N	N[2]	Y[2]	Y	A	B	N
58	Retail trade-eating and drinking establishments	N	N	N[2]	Y	A	B	N
59	Other retail trade	N	N[2]	Y[2]	Y	A	B	N
60	**Services**							
61	Finance, insurance and real estate services	N	N	Y[6]	Y	A	B	N
62	Personal services	N	N	Y[6]	Y	A	B	N
62.4	Cemeteries	N	Y[7]	Y[7]	Y	Y[12]	Y[13]	Y[14,21]
63	Business services	N	Y[8]	Y[8]	Y	A	B	N

Table 4.6-1. Land Use Compatibility Guidelines
(Page 3 of 3)

LAND USE		APZs			NOISE ZONES IN DNL dB			
SLUCM No.	*Name*	*CZ*	*APZ I*	*APZ II*	*65-69*	*70-74*	*75-79*	*80+*
64	Repair services	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
65	Professional services	N	N	Y[6]	Y	A	B	N
65.1	Hospitals, nursing homes	N	N	N	A*	B*	N	N
65.1	Other medical facilities	N	N	N	Y	A	B	N
66	Contract construction services	N	Y[6]	Y	Y	A	B	N
67	Governmental services	N	N	Y[6]	Y*	A*	B*	N
68	Educational services	N	N	N	A*	B*	N	N
69	Miscellaneous services	N	N[2]	Y[2]	Y	A	B	N
70	**Cultural, Entertainment and Recreational**							
71	Cultural activities (including churches)	N	N	N[2]	A*	B*	N	N
71.2	Nature exhibits	N	Y[2]	Y	Y*	N	N	N
72	Public assembly	N	N	N	Y	N	N	N
72.1	Auditoriums, concert halls	N	N	N	A	B	N	N
72.11	Outdoor music shell, amphitheaters	N	N	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	N	N	N	Y[17]	Y[17]	N	N
73	Amusements	N	N	Y[8]	Y	Y	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	N	Y[8,9,10]	Y	Y*	A*	B*	N
75	Resorts and group camps	N	N	N	Y*	Y*	N	N
76	Parks	N	Y[8]	Y[8]	Y*	Y*	N	N
79	Other cultural, entertainment and recreation	N	Y[9]	Y[9]	Y*	Y*	N	N
80	**Resources Production and Extraction**							
81	Agriculture (except livestock)	Y[16]	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
81.5 to 81.7	Livestock farming and animal breeding	N	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
82	Agricultural related activities	N	Y[5]	Y	Y[18]	Y[19]	N	N
83	Forestry activities and related services	N[5]	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
84	Fishing activities and related services	N[5]	Y[5]	Y	Y	Y	Y	Y
85	Mining activities and related services	N	Y[5]	Y	Y	Y	Y	Y
89	Other resources production and extraction	N	Y[5]	Y	Y	Y	Y	Y

LEGEND

SLUCM - Standard Land Use Coding Manual, U.S. Department of Transportation.
Y - (Yes) - Land use and related structures are compatible without restriction.
N - (No) - Land use and related structures are not compatible and should be prohibited.
Y^x - (yes with restrictions) - Land use and related structures generally compatible; see notes 1-21.
N^x - (no with exceptions) - See notes 1-21.
NLR - (Noise Level Reduction) - NLR (outdoor to indoor) to be achieved through incorporation of noise attenuation measures into the design and construction of the structures (see Appendix E, Section E.4).
A, B, or C - Land use and related structures generally compatible; measures to achieve NLR of A (DNL 25 dB), B (DNL 30 dB), or C (DNL 35 dB) need to be incorporated into the design and construction of structures.
A^*, B^*, and C^* - Land use generally compatible with NLR. However, measures to achieve an overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted. See appropriate footnotes.
***** - The designation of these uses as "compatible" in this zone reflects individual federal agency and program consideration of general cost and feasibility factors, as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

NOTES

1. Suggested maximum density of 1-2 dwelling units per acre possibly increased under a Planned Unit Development where maximum lot coverage is less than 20 percent.
2. Within each land use category, uses exist where further definition may be needed due to the variation of densities in people and structures. Shopping malls and shopping centers are considered incompatible in any accident potential zone (CZ, APZ I, or APZ II).
3. The placing of structures, buildings, or aboveground utility lines in the CZ is subject to severe restrictions. In a majority of the CZs, these items are prohibited. See AFI 32-7063 and UFC 3-260-01 for specific guidance.
4. No passenger terminals and no major aboveground transmission lines in APZ I.
5. Factors to be considered: labor intensity, structural coverage, explosive characteristics, and air pollution.
6. Low-intensity office uses only. Meeting places, auditoriums, etc., are not recommended.
7. Excludes chapels.
8. Facilities must be low intensity.
9. Clubhouse not recommended.
10. Areas for gatherings of people are not recommended.

11A. Although local conditions may require residential use, it is discouraged in DNL 65-69 dB and strongly discouraged in DNL 70-74 dB. An evaluation should be conducted prior to approvals, indicating a demonstrated community need for residential use would not be met if development were prohibited in these zones, and there are no viable alternative locations.

11B. Where the community determines the residential uses must be allowed, measures to achieve outdoor to indoor NLR for DNL 65-69 dB and DNL 70-74 dB should be incorporated into building codes and considered in individual approvals.

11C. NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, and design and use of berms and barriers can help mitigate outdoor exposure, particularly from near ground level sources. Measures that reduce outdoor noise should be used whenever practical in preference to measures that only protect interior spaces.

12. Measures to achieve the same NLR as required for facilities in the DNL 65-69 dB range 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.
13. Measures to achieve the same NLR as required for facilities in the DNL 70-74 dB range 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.
14. Measures to achieve the same NLR as required for facilities in the DNL 75-79 dB range 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.
15. If noise sensitive, use indicated NLR; if not, the use is compatible.
16. No buildings.
17. Land use is compatible provided special sound reinforcement systems are installed.
18. Residential buildings require the same NLR required for facilities in the DNL 65-69 dB range.
19. Residential buildings require the same NLR required for facilities in the DNL 70-74 dB range.
20. Residential buildings are not permitted.
21. Land use is not recommended. If the community decides the use is necessary, personnel should wear hearing protection devices.

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SECTION 5 LAND USE ANALYSIS

5.1 INTRODUCTION

Land use planning and control is a dynamic, rather than a static process. The specific characteristics of land use determinants will always reflect, to some degree, the changing conditions of the economic, social, and physical environment of a community, as well as changing public concern. The planning process accommodates this fluidity in which decisions are normally not based on boundary lines, but rather on more generalized area designations. Computer technology has enabled Selfridge ANGB to more precisely display its flight tracks, airspace control surfaces, noise contours, and accident potential areas for land use planning purposes.

In 1917, Selfridge ANGB (then known as Selfridge Field) was established in a relatively undeveloped area in Macomb County. Between 1920 and 1930, the county doubled in population, spurred in part by the establishment of the base and in part by development of suburbs outside of nearby Detroit. Population growth and associated development have continued steadily in Macomb County from 1940 to the present. Recently growth in the region has slowed somewhat, due to deflation in the housing market and contraction in the manufacturing sector.

Geographic Information Systems (GIS) technology has enabled Selfridge ANGB to more precisely display its flight tracks and noise contours for land use planning purposes. Digital representations of noise contours, CZs, and APZs have been used to exactly delineate areas that are not in compliance with USAF AICUZ recommendations. For the purpose of this Study, existing land uses on the figures in this section are generalized into one of the following 10 categories:

- Single-Family Residential: This category includes all types of single-family residential land uses except manufactured homes.
- Multi-Family Residential: This category includes multi-family residential land uses.
- Mixed Use: The Macomb County "Mixed-Use" generalized land use classification describes areas in which facilities of several types are located together (e.g., residential, offices, and commercial spaces located in one structure).
- Manufactured Home Park: This category includes manufactured homes. This type of residential development is treated separately from other residential land uses

because of its properties with regards to outdoor-to-indoor noise attenuation and potential for high numbers of dwellings per acre.

- Commercial: This category includes retail, restaurants, and other types of commercial establishments.

- Industrial: This category includes manufacturing, warehousing, and other similar uses.

- Institutional: This category includes publicly owned lands and/or land to which the public has access, including military reservations and training grounds, public buildings, schools, churches, cemeteries, and hospitals. Selfridge ANGB itself is not included in this land use analysis.

- Agriculture: This category includes agricultural areas and grazing lands.

- Open Space/Water: This category includes undeveloped land areas. Bodies of water may be used for several purposes including recreation (e.g., recreational fishing, swimming), commercial purposes (e.g., commercial fishing), transportation/utility (e.g., ferries), or even residential (e.g., house boats). Typically, such uses are low-intensity and, as such, water is "lumped" together with open space for the purpose of quantitative analysis. For clarity, maps in this report will use different symbols for water and open land.

- Transportation/Utility: This category includes roads, railroads and other transportation-related land uses, as well as land uses related to utilities.

The 10 generalized land use classifications were compared against land use data provided by Macomb County to identify land uses that are compatible, conditionally compatible, and incompatible. Compatibility was determined using a simplified land use compatibility matrix. Each Macomb County generalized land use classification was assigned an equivalent Air Force SLUCM code (see Table 4.6-1). Zones that are unconditionally compatible are colored green, zones that are conditionally compatible are colored yellow, and zones that are unconditionally incompatible are colored red (see Table 5.2-1).

The same compatibility designation process that was conducted for land use was also carried out for zoning. Macomb County generalized zoning categories are not the same categories that the county uses for describing generalized land use. For example, no separate generalized zoning designation exists for agriculture, open space, or recreation whereas these categories are used to

describe land use. At the same time, the county has designated an "Office" generalized zoning classification, which has no direct equivalent generalized land use classification.

Land use and zoning compatibility analysis was not carried out for Selfridge ANGB itself. All construction projects on the installation must undergo an internal USAF planning process, which includes AICUZ considerations. Development on the installation is subject to operational requirements that do not apply to civilian development outside the installation's boundaries.

5.2 EXISTING LAND USE

As previously described, Selfridge ANGB is located to the east of the Town of Mount Clemens in Macomb County. The portion of Macomb County in which the installation is located has become fairly heavily developed. However, some land areas remain as open space. The following analysis quantifies, by total acreage, existing land use types in each of the Selfridge ANGB compatible use zones.

Figure 5.2-1 is an overlay of the 2009 noise contours, CZs, and APZs on an aerial photograph of the vicinity of Selfridge ANGB. Generalized land uses have been overlaid on the map, in areas affected by noise contours greater than DNL 65 dB and APZs. An analysis was performed on the property lying inside the noise zones or accident potential zones but outside the Selfridge ANGB boundaries. The acreage of each generalized existing land use type was calculated within each of the noise zones (Table 5.2-1) and the CZs and APZs (Table 5.2-2). Table 5.2-3 shows the estimated number of persons residing within the noise zones, CZs, and APZs.

In addition to the analysis of generalized land use, a detailed noise level analysis was run for specific points that are particularly noise sensitive or that have the potential to become noise sensitive if proposed development is carried out. These points include two schools (Emma V Lobbestael Elementary and South River Elementary), the Town of Mount Clemens, the Brigantine Estates subdivision, and the undeveloped area immediately north of the base that is zoned for light industrial land use. Time-average noise levels (DNL) and the highest single-event noise levels (Sound Exposure Level) expected to occur on an ABD at these locations are listed in Table 5.2-4. The Sound Exposure Level noise metric reflects total noise energy of a single aircraft overflight event normalized to one second. Land uses at all five locations analyzed are considered to be compatible with the DNL noise level. Displaying the SEL metric shows that, despite overall noise levels being considered acceptable at these locations, individual overflight events can be quite loud.

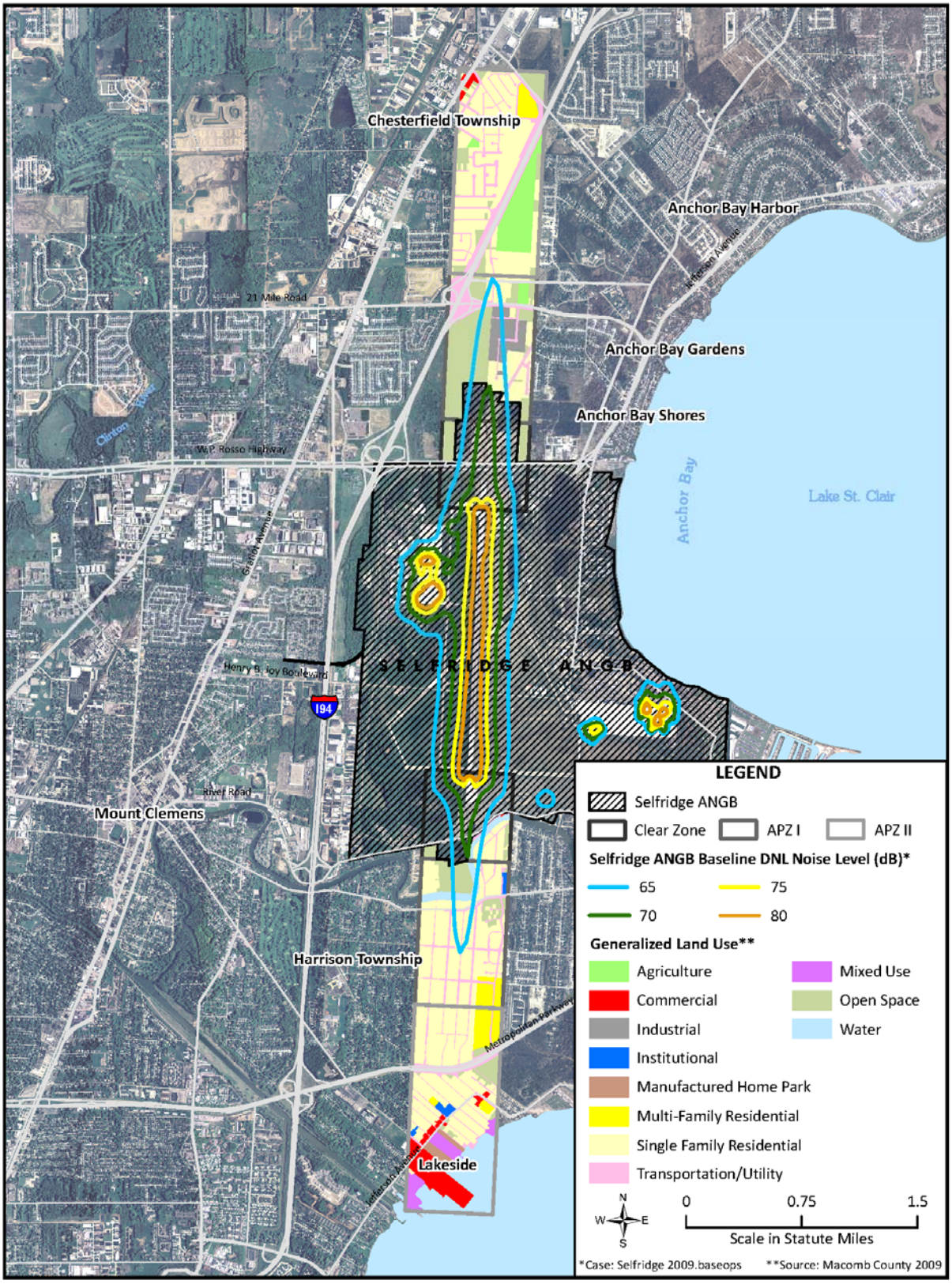

Figure 5.2-1. Generalized Existing Land Use

Table 5.2-1. Generalized Existing Land Use within DNL 65 dB and Greater Noise Exposure Area (outside of Selfridge ANGB)

Macomb County Generalized Land Use Classifications	*USAF SLUCM Equivalent (see Table 4.6-1)*	NOISE CONTOURS (DNL)			
		80+	*75–79*	*70–74*	*65–69*
Residential Districts					
Single-Family Residential	11.11 (single units; detached)	0.0	0.0	0.3	36.9
Multi-Family Residential	11.31 (Apartments; walk up)	0.0	0.0	0.0	0.0
Mixed-Use	11.31 (Apartments; walk up)	0.0	0.0	0.0	0.0
Manufactured Home Park	14 (Mobile home parks or courts)	0.0	0.0	0.0	0.0
Non-Residential Districts					
Agriculture	81.5 to 81.7 (livestock farming and animal breeding)	0.0	0.0	0.0	0.0
Industrial	39 (Misc. manufacturing)	0.0	0.0	0.0	17.1
Recreation	72.2 (outdoor sports arenas, spectator sports)	0.0	0.0	0.0	0.0
Commercial	53 (retail trade, general merchandise)	0.0	0.0	0.0	0.0
Institutional	68 (educational services)	0.0	0.0	0.0	0.0
Transportation / Utility	48 (motor vehicle)	0.0	0.0	0.0	11.5
Other Districts/Overlays					
Open Space/Water	n/a	0.0	0.0	0.4	55.8

Note: Cells colored red indicate land uses that are not compatible in the given noise zone/CZ/APZ. Yellow cells and green cells indicate land uses that are conditionally compatible and compatible, respectively.

Table 5.2-2. Generalized Existing Land Use within CZs and APZs (outside of Selfridge ANGB)

Macomb County Generalized Land Use Classifications	*USAF SLUCM Equivalent (see Table 4.6-1)*	ACCIDENT POTENTIAL		
		CZ	*APZ I*	*APZ II*
Residential Districts				
Single-Family Residential	11.11 (single units; detached)	21.3	289.3	425.4
Multi-Family Residential	11.31 (Apartments; walk up)	0.0	19.3	44.3
Mixed-Use	11.31 (Apartments; walk up)	0.0	0.0	28.6
Manufactured Home Park	14 (Mobile home parks or courts)	0.0	0.0	11.9
Non-Residential Districts				
Agriculture	81.5 to 81.7 (livestock farming and animal breeding)	0.0	5.9	71.6
Industrial	39 (Misc. manufacturing)	0.0	38.5	2.0
Recreation	72.2 (outdoor sports arenas, spectator sports)	0.0	0.0	0.0
Commercial	53 (retail trade, general merchandise)	0.1	0.0	58.4
Institutional	68 (educational services)	0.0	3.5	5.2
Transportation / Utility	48 (motor vehicle)	8.7	97.1	165.8
Other Districts/Overlays				
Open Space	n/a	47.9	189.6	151.0

Note: Cells colored red indicate land uses that are not compatible in the given noise zone/CZ/APZ. Yellow cells and green cells indicate land uses that are conditionally compatible and compatible, respectively.

Table 5.2-3. Off-Base Population Within the Noise Zones, CZs, and APZs

Zone	*Number of People*[1]
65-69 dB DNL	175
70-74 dB DNL	1
75-79 dB DNL	0
Clear Zones	162
Accident Potential Zone I	1,854
Accident Potential Zone II	4,399

Note: 1. Estimated number of people within each zone estimated based on U.S. Census Bureau data for the year 2000. Where census blocks were partially included, assumed population included was proportional to percentage of the census block included.

Table 5.2-4. Noise Levels at Specific Points

Specific Point	*Time-averaged Noise Level (dB DNL)*	*Highest Single-Event Noise Level (dB SEL)*
Lobbestael Elementary	44.7	91.8
South River Elementary	57.7	106.3
Town of Mount Clemens (center of town)	38.1	86.6
Brigantine Estates Subdivision (point nearest runway)	61.8	110.8
Undeveloped Area North of the Base (point nearest runway)	66.1	111.7

5.3 LAND USE COMPATIBILITY DISCUSSION

Privately owned areas affected by Selfridge ANGB compatibility zones lie to the north and south of the installation. Land use and zoning compatibility with AICUZ recommendations are discussed first for the area south of the installation and then for the area to the north of the runway. For each compatible use zone (e.g., CZ, APZ I, APZ II, noise zones), current land use compatibility is discussed. The land use compatibility discussion is followed by a discussion of zoning compatibility.

Noise contours at Selfridge ANGB affect a total of approximately 122 acres not including Selfridge ANGB acreage (Table 5.2-1). Of this acreage, 37.2 acres are developed in a manner that is conditionally compatible (31 percent) and 84.7 acres are compatible (69 percent) with current noise levels. All conditionally compatible land areas are single-family residential.

CZs and APZs affect approximately 1,687 acres, not including the area on Selfridge ANGB (Table 5.2-2). Of this total acreage affected, 432.3 acres (26 percent) are incompatibly developed, 631.7 acres are conditionally compatibly developed (37 percent), and 626.5 acres (37

percent) are compatibly developed. Incompatible areas are single-family residential, multi-family residential, mixed use, manufactured homes, commercial, institutional, and transportation/utility. Conditionally compatible areas are single-family residential, industrial, commercial, and transportation/utility.

5.4 FUTURE LAND USE AND ZONING

In order to make a complete assessment of the encroachment situation at Selfridge ANGB, one must consider not only current conditions, but also expected future conditions. Zoning is an important predictor of future land use and will be discussed in this section relative to future development near the base. Figure 5.4-1 shows zoning within the current AICUZ area of influence. Because Michigan is a "Home Rule" state, each township establishes its own zoning code, with support from the county as needed.

Most of the land within the Selfridge ANGB area of influence has been developed (see Figure 5.2-1) and major changes in land use patterns in these developed areas are considered unlikely. More likely would be incremental increases in population density in previously developed areas associated with projects that would replace or expand existing facilities. An example would be a project to re-develop a single-family residential area as multi-family residential. In many cases, such re-development would require a modification to or variance from existing zoning regulations. Selfridge ANGB encourages county, city, and township planners to coordinate with the base regarding any zoning change requests that may ultimately affect the base.

The largest contiguous area of open land in the vicinity of Selfridge ANGB lies to the north of the installation immediately to the east of Interstate 94. This area has been zoned for industrial use and is expected to be developed as a mixture of industrial and commercial land uses in the near future. The majority of the industrial and commercial land use sub-categories are conditionally compatible with the APZ I and 65-69 dB DNL zones that cover a portion of the area. Development proposals reviewed by Selfridge ANGB staff to date have been found to be compatible. The staff at Selfridge looks forward to continuing to coordinate on proposed development plans for this area as the plan evolve. The area to the north of Selfridge ANGB is particularly important to the continued viability and mission flexibility of the installation as the majority of aircraft operations at the installation depart to the north and arrive from the north.

All development projects near the base should be assessed for compatibility using the land use compatibility matrix at Table 4.6-1 and for potential effects on safety of flight, as described in Section 4.5.

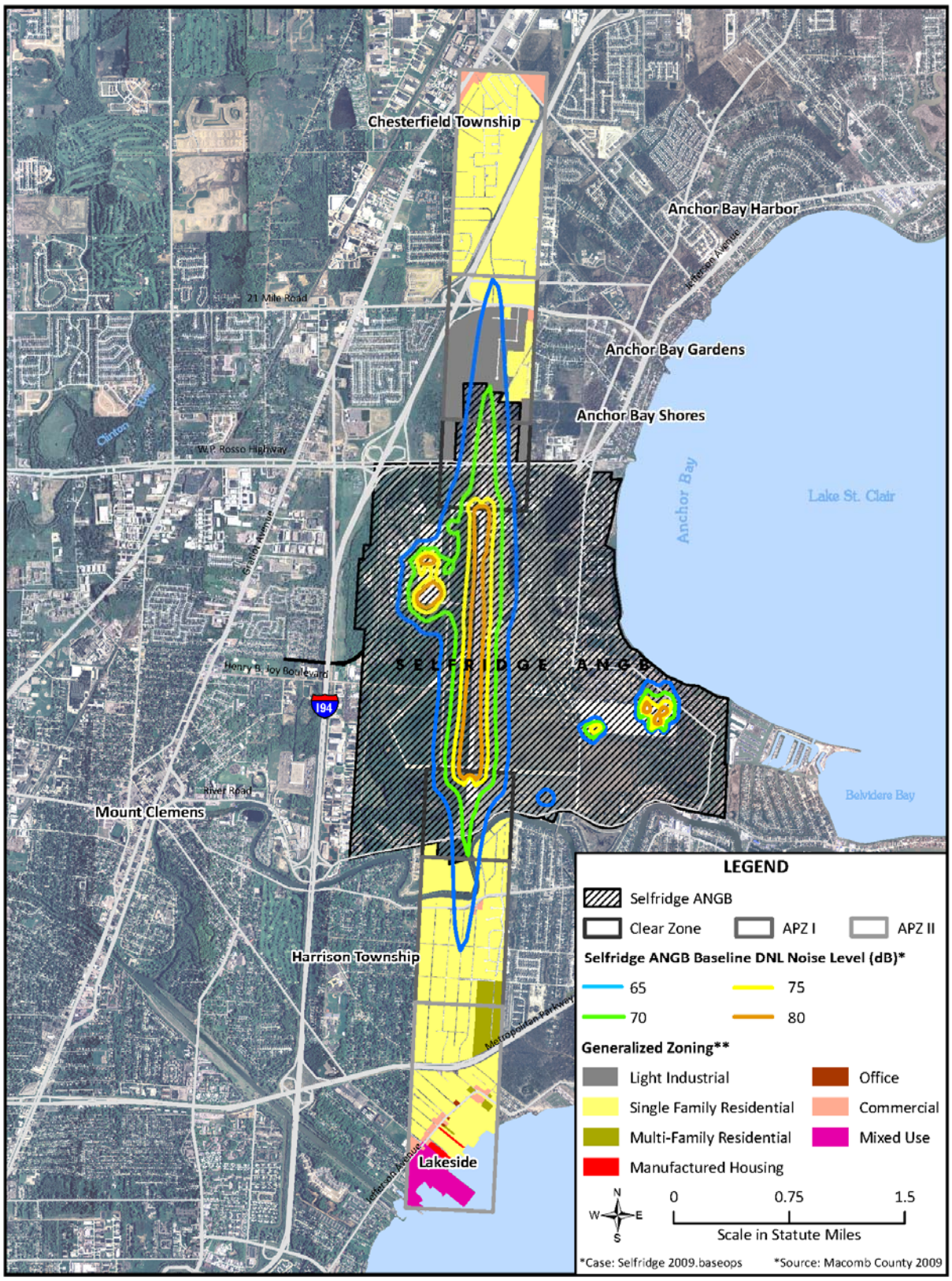

Figure 5.4-1. Generalized Zoning

For the purposes of quantitative future encroachment analysis, it was assumed that land areas will develop according to current zoning unless prevented from doing so by restrictive easement or some other factor. For example, it was assumed that the open area north of the installation will be developed for industrial land use because it is zoned for that type of development. Exceptions to this methodology include instances where an easement is held by the USAF that prevents further incompatible development (i.e., two areas in the northern CZ and one area in the southern CZ) or where an agreement has been reached that recognizes the permanence of the existing land use (i.e., the "exempt CZ" in the southern CZ). The total number of acres of each generalized zoning classification was calculated within each of the sets of noise contours (Table 5.4-1) and within the CZs and APZs (Table 5.4-2).

Zoning mirrors existing land use throughout much of the AICUZ area of influence. Zoning is compatible in 84.0 (69 percent) of the 122 acres affected by noise levels at greater than 65 DNL dB. The remaining 38.1 acres (31 percent) are zoned for usage considered to be conditionally compatible. The conditionally compatible land areas are single-family residential.

Zoning of the off-base acreage within the CZs and APZs is such that 28 percent of the zoned land usage is incompatible (469.8 acres), 46 percent is conditionally compatible (779.4 acres), and only 26 percent is compatible (436.0 acres). Incompatibly zoned lands in the CZ and APZs are low-density residential, medium-density residential, mixed use, manufactured homes, commercial, transportation, and industrial. Areas that are zoned conditionally compatibly include low-density residential, commercial, office, industrial, and transportation.

More land is *zoned* incompatibly/conditionally compatibly than is currently *used* incompatibly/conditionally compatibly. Incompatible development can be expected to increase in future years, as land continues to be developed in accordance with current zoning. Development projects of concern include any projects that would result in higher population densities in APZs than are recommended, development of noise-sensitive land uses in areas of elevated aircraft noise, or projects that would pose a risk to safety of flight (e.g., through increasing BASH hazard, impairing pilot vision).

At Selfridge ANGB, the majority of aircraft operations depart to the north and arrive from the north, resulting in the northern approach to the runway being overflown much more frequently than the southern approach. As a result, maintaining operational flexibility in this area is extremely important to the long-term viability of the base. Chesterfield Township has provided plans for proposed development of a portion of the area north of the base that is currently open space. Selfridge ANGB staff reviewed these plans and found them to be compatible with the installation mission. The staff at Selfridge ANGB look forward to continuing to coordinate with Chesterfield Township as proposed development plans evolve or as new projects are proposed.

Table 5.4-1. Generalized Zoning within DNL 65 dB and Greater Noise Exposure Area (outside of Selfridge ANGB)

Macomb County Generalized Zoning Classifications	USAF SLUCM Equivalent (see Table 4.6-1)	Noise Contours (DNL)			
		80+	75–79	70–74	65–69
Residential Districts					
Low-Density Residential (0-6 Units/Acre)	11.11 (single units; detached)	0.0	0.0	0.2	39.7[1]
Medium-Density Residential (>7 Units/Acre)	11.31 (Apartments; walk up)	0.0	0.0	0.0	0.0
Mixed-Use	11.31 (Apartments; walk up)	0.0	0.0	0.0	0.0
Manufactured Housing	14 (Mobile home parks or courts	0.0	0.0	0.0	0.0
Non-Residential Districts					
Light Industrial	39 (Misc. manufacturing)	0.0	0.0	0.3	56.9
Commercial	53 (retail trade, general merchandise)	0.0	0.0	0.0	0.0
Office	65 (professional services)	0.0	0.0	0.0	0.0
Transportation / Utility	48 (motor vehicle)	0.0	0.0	0.0	9.4
Other Districts/Overlays					
Natural Features	n/a	0.0	0.0	0.1	15.2

Note: Cells colored red indicate land uses that are not compatible in the given noise zone/CZ/APZ. Yellow cells and green cells indicate land uses that are conditionally compatible and compatible, respectively.
1. Of these acres, 2.2 are included in an easement preventing further incompatible development.

Table 5.4-2. Generalized Zoning within CZs and APZs (outside of Selfridge ANGB)

Macomb County Generalized Zoning Classifications	USAF SLUCM Equivalent (see Table 4.6-1)	Accident Potential		
		CZ	APZ I	APZ II
Residential Districts				
Low-Density Residential (0-6 Units/Acre)	11.11 (single units; detached)	31.0[1]	346.6	575.6
Medium-Density Residential (>7 Units/Acre)	11.31 (Apartments; walk up)	0.0	16.3	33.8
Mixed-Use	11.31 (Apartments; walk up)	0.0	0.0	58.6
Manufactured Housing	14 (Mobile home parks or courts	0.0	0.0	8.0
Non-Residential Districts				
Light Industrial	39 (Misc. manufacturing)	28.2[2]	161.9	0.0
Commercial	53 (retail trade, general merchandise)	0.0	4.4	40.5
Office	65 (professional services)	0.0	0.0	1.3
Transportation	48 (motor vehicle)	14.3[3]	95.8	160.8
Other Districts/Overlays				
Water	n/a	4.3	18.2	85.4

Note: Cells colored red indicate land uses that are not compatible in the given noise zone/CZ/APZ. Yellow cells and green cells indicate land uses that are conditionally compatible and compatible, respectively.
1. Of these acres, 29 are covered by an easement that prohibits incompatible development or are within the residential area south of the Clinton River exempted from AF CZ purchase policy (Meis 1979)
2. All 28.2 acres are covered by an easement preventing incompatible development.
3. Of these acres, 6.0 are covered by an easement preventing incompatible development

SECTION 6 IMPLEMENTATION

6.1 INTRODUCTION

Implementation of the AICUZ Study must be a joint effort between the USAF and adjacent communities. The role of the USAF is to minimize impact on the local communities by Selfridge ANGB aircraft operations. The role of the communities is to ensure that development in the surrounding area is compatible with accepted planning, zoning, and development principles and practices.

6.2 AIR FORCE RESPONSIBILITIES

In general, the USAF perceives its AICUZ responsibilities as encompassing the areas of flying safety, noise abatement, and participation in the land use planning process.

Well-maintained aircraft and well-trained aircrews do a great deal to ensure that aircraft accidents are avoided. Despite the best aircrew training and aircraft maintenance intentions, however, history clearly shows that accidents do occur. It is imperative flights be routed over sparsely populated areas as regularly as possible to reduce the exposure of lives and property to a potential accident.

A-10 aircraft refueling from KC-135R/T aircraft

Commanders are required by USAF policy to periodically review existing traffic patterns, instrument approaches, weather minima, and operating practices, and evaluate these factors in relationship to populated areas and other local situations. This requirement is a direct result and expression of USAF policy that all AICUZ plans must include an analysis of flying and flying-related activities designed to reduce and control the effects of such operations on surrounding land areas. Noise is generated from aircraft both in the air and on the ground. In an effort to reduce the noise effects of Selfridge ANGB operations on surrounding communities, the installation routes aircraft flight operations to avoid populated areas.

Preparation and presentation of this Selfridge ANGB AICUZ Study is one phase of continuing USAF participation in the local planning process. It is recognized that as the local community updates its land use plans, the USAF must be ready to provide additional input when needed.

It is also recognized that the AICUZ program is an ongoing activity even after compatible development plans are adopted and implemented. Selfridge ANGB personnel are prepared to participate in the continuing discussion of zoning and other land use matters as they may affect, or may be affected by the base. Base personnel also are available to provide information, criteria, and guidelines to state, regional, and local planning bodies, civic associations, and similar groups.

Participation in land use planning can take many forms. The simplest of these forms is straightforward, consistent two-way discussion and information sharing with neighboring land owners. Copies of the AICUZ Study, including maps, will be provided to local communities and counties and regional planning departments and zoning administrators. Through this communication process, the base reviews applications for development or changed use of properties within the noise impact and safety areas, as well as other nearby parcels. The base coordinates closely with surrounding communities on zoning and land use issues.

6.3 LOCAL COMMUNITY RESPONSIBILITIES

Residents in the area neighboring Selfridge ANGB and base personnel have a long history of working together for mutual benefit of the area around the airfields and installation. For example, local jurisdictions have considered Selfridge ANGB flying operations during development of comprehensive plans. Adoption of the following recommendations will strengthen this relationship, increase the health and safety of the public, and help protect the integrity of the installation's flying mission:

- Incorporate AICUZ policies and guidelines into the comprehensive plans for Macomb County, Harrison Township, and Chesterfield Township. Use overlay maps of the AICUZ noise contours and USAF Land Use Compatibility Guidelines to evaluate existing and future land use proposals. Continue to inform Selfridge ANGB of planning and zoning actions that have the potential of affecting base operations.

- Modify existing zoning ordinances and subdivision regulations to support the compatible land uses outlined in this study through implementation of a zoning overlay district based on noise contours and accident potential zones.

- Adopt fair disclosure ordinances requiring realtors to notify potential buyers of real property of the location of the property relative to CZ/APZs and noise contours

SECTION 7 REFERENCES

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APPENDIX A
THE AICUZ CONCEPT, PROGRAM, METHOD, AND POLICIES

APPENDIX A
THE AICUZ CONCEPT, PROGRAM, METHOD, AND POLICIES

A.1 CONCEPT

Federal legislation, national sentiment, and other external forces, which directly affect the United States Air Force (USAF) mission, serve greatly to increase the role of the USAF in environmental and planning issues. Problems of airfield encroachment from incompatible land uses surrounding installations, as well as air and water pollution and socioeconomic impact, require continued and intensified USAF involvement. The nature of these problems dictates direct USAF participation in comprehensive community and land use planning. Effective, coordinated planning that bridges the gap between the federal government and the community requires establishment of good working relationships with local citizens, local planning officials, and state and federal officials. This depends on creating an atmosphere of mutual trust and helpfulness. The Air Installation Compatible Use Zone (AICUZ) concept has been developed in an effort to:

- protect local citizens from noise exposure and accident potential associated with flying activities; and

- prevent degradation of the capability of the USAF to achieve its mission by promoting compatible land use planning.

The land use guidelines developed herein are a composite of a number of other land use compatibility studies that have been refined to fit the Selfridge Air National Guard Base (ANGB) aviation environment.

A.2 PROGRAM

Installation commanders establish and maintain active programs to promote the maximum feasible land use compatibility between air installations and neighboring communities. The program requires that all appropriate government bodies and citizens be fully informed whenever AICUZ or other planning matters affecting the installation are under consideration. This includes positive and continuous programs designed to:

- provide information, criteria, and guidelines to federal, state, regional, and local planning bodies, civic associations, and similar groups;

- inform such groups of the requirements of the flying activity, noise exposure, aircraft accident potential, and AICUZ plans;

- describe the noise reduction measures that are being used; and

- ensure that all reasonable, economical, and practical measures are taken to reduce or control the impact of noise-producing activities. These measures include such considerations as proper location of engine test facilities, provision of sound suppressors where necessary, and adjustment of flight patterns and/or techniques to minimize the noise impact on populated areas. This must be done without jeopardizing safety or operational effectiveness.

A.3 METHOD

The AICUZ consists of land areas upon which certain land uses may obstruct the airspace or otherwise be hazardous to aircraft operations, and land areas that are exposed to the health, safety, or welfare hazards of aircraft operations. The AICUZ includes:

- Accident Potential Zones (APZs) and Clear Zones (CZs) based on past USAF aircraft accidents and installation operational data (see Appendix C);

- Noise zones (NZ) produced by the computerized Day-Night Average A-weighted Sound Level (DNL) modeling of the noise created by aircraft flight and maintenance operations (see Section 4 of the Study); and

- The area designated by the FAA and the USAF for purposes of height limitations in the approach and departure zones of the base (see Section 4 of the Study).

- Areas near the base where attraction of additional birds would increase Bird/Wildlife-Aircraft Strike Hazard (BASH) hazard (see Appendix D)

The APZ, CZ, and NZ are the basic building blocks for land use planning with AICUZ data. Compatible land uses are specified for these zones, and recommendations on building materials and standards to reduce interior noise levels inside structures are provided in Section 4.

As part of the AICUZ Program, the only real property acquisition for which the USAF has requested and received Congressional authorization, and for which the installation and major commands request appropriation, are the areas designated as the CZ. Compatible land use controls for the remaining airfield area of influence should be accomplished through the community land use planning processes.

A.4 AICUZ LAND USE DEVELOPMENT POLICIES

The basis for any effective land use control system is the development of, and subsequent adherence to, policies that serve as the standard by which all land use planning and control actions are evaluated. Selfridge ANGB recommends the following policies be considered for incorporation into the comprehensive plans of agencies in the vicinity of the base's area of influence:

A.4.1 POLICY 1

To promote the public health, safety, peace, comfort, convenience, and general welfare of the inhabitants in the airfield area of influence, it is necessary to:

- guide, control, and regulate future growth and development;
- promote orderly and appropriate use of land;
- protect the character and stability of existing land uses;
- prevent destruction or impairment of the airfield and the public investment therein;
- enhance the quality of living in the areas affected; and
- protect the general economic welfare by restricting incompatible land use.

A.4.2 POLICY 2

In furtherance of Policy 1, it is appropriate to:

- establish guidelines of land use compatibility;
- restrict or prohibit incompatible land use;
- prevent establishment of any land use which would unreasonably endanger aircraft operations and the continued use of the airfield;
- incorporate the AICUZ concept into community land use plans, modifying them when necessary; and
- adopt appropriate ordinances to implement airfield area of influence land use plans.

A.4.3 POLICY 3

Within the boundaries of the CZ, certain land uses are inherently incompatible. The following land uses are not in the public interest and must be restricted or prohibited:

- uses that release into the air any substance, such as steam, dust, or smoke which would impair visibility or otherwise interfere with the operation of aircraft;
- uses that produce light emissions, either direct or indirect (reflective), which would interfere with pilot vision;
- uses that produce electrical emissions which would interfere with aircraft communication systems or navigation equipment;
- uses that attract birds or waterfowl, such as operation of sanitary landfills, maintenance or feeding stations, or growth of certain vegetation; and
- uses that provide for structures within 10 feet of aircraft approach-departure and/or transitional surfaces.

A.4.4 POLICY 4

Certain noise levels of varying duration and frequency create hazards to both physical and mental health. A limited, though definite, danger to life exists in certain areas adjacent to airfields. Where these conditions are sufficiently severe, it is not consistent with public health, safety, and welfare to allow the following land uses:

- residential;
- retail business;
- office buildings;
- public buildings (schools, churches, etc.); and
- recreation buildings and structures.

A.4.5 POLICY 5

Land areas below takeoff and final approach flight paths are exposed to elevated danger of aircraft accidents. The density of development and intensity of use must be limited in such areas.

A.4.6 POLICY 6

Different land uses have different sensitivities to noise. Standards of land use acceptability should be adopted, based on these noise sensitivities. In addition, a system of Noise Level Reduction guidelines (Appendix F) for new construction should be implemented to permit certain uses where they would otherwise be prohibited.

A.4.7 POLICY 7

Land use planning and zoning in the airfield area of influence cannot be based solely on aircraft-generated effects. Allocation of land used within the AICUZ should be further refined by consideration of:

- physiographic factors;
- climate and hydrology;
- vegetation;
- surface geology;
- soil characteristics;
- intrinsic land use capabilities and constraints;
- existing land use;
- land ownership patterns and values;
- economic and social demands;
- cost and availability of public utilities, transportation, and community facilities; and
- other noise sources.

A.5 BASIC LAND USE COMPATIBILITY

Research on aircraft accident potential, noise, and land use compatibility is ongoing at a number of federal and other agencies. These and all other compatibility guidelines must not be considered inflexible standards. They are the framework within which land use compatibility questions can be addressed and resolved. In each case, full consideration must be given to local conditions such as:

- previous community experience with aircraft accidents and noise;
- local building construction and development practices;
- existing noise environment due to other urban or transportation noise sources;
- time periods of aircraft operations and land use activities;
- specific site analysis; and
- noise buffers, including topography.

These basic guidelines cannot resolve all land use compatibility questions, but they do offer a reasonable framework within which to work.

A.6 ACCIDENT POTENTIAL

Each end of Runway 01/19 at Selfridge ANGB has a 3,000-foot by 3,000-foot CZ and two APZs (APZ I and APZ II). Accident potential on or adjacent to the runway or within a CZ is so high that the necessary land use restrictions would prohibit reasonable economic use of land. As stated previously, it is USAF policy to request Congress to authorize and appropriate funds for the necessary real property interests in this area to prevent incompatible land uses.

APZ I is less critical than the CZ, but still possesses a elevated risk factor. This 3,000-foot by 5,000-foot area has land use compatibility guidelines sufficiently flexible to allow reasonable economic use of the land, such as industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agriculture. However, uses that concentrate people are not acceptable.

APZ II is less critical than APZ I, but still possesses potential for accidents. APZ II, also 3,000 feet wide, is 7,000 feet long extending to 15,000 feet from the runway threshold. Acceptable uses include those of APZ I, as well as low-density single-family residential and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High-density functions such as multi-story buildings, places of assembly (theaters, churches, schools, restaurants, etc.), and high-density office uses are not considered appropriate.

High-density populations should be limited to the maximum extent possible. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in APZ II is one dwelling per acre. For most nonresidential usage, buildings should be limited to one story, and the lot coverage should not exceed 20 percent.

Land use guidelines for the two APZs are based on a hazard index system that compares the relationship of accident occurrence for five areas:

- on or adjacent to the runway;
- within the CZ;
- in APZ I;
- in APZ II; and
- in all other areas within a 10 nautical mile radius of the runway.

Accident potential on or adjacent to the runway or within the CZ is so high that few uses are acceptable. The risk outside APZ I and APZ II, but within the 10 nautical mile radius area, is worthy of consideration, but is acceptable if sound engineering and planning practices are followed.

Land use guidelines for APZs I and II have been developed. The main objective has been to restrict all people-intensive uses because there is greater risk in these areas. The basic guidelines aim at prevention of uses that:

- have high residential density characteristics;
- have high labor intensity;
- involve above-ground explosives, fire, toxic, corrosive, or other hazardous characteristics;
- promote population concentrations;
- involve utilities and services required for area-wide population, where disruption would have an adverse impact (telephone, gas, etc.);
- concentrate people who are unable to respond to emergency situations, such as children, elderly, handicapped, etc.; and
- pose hazards to aircraft operations.

There is no question that these guidelines are relative. Ideally, there should be no people-intensive uses in either of these APZs. The free market and private property systems prevent this where there is a demand for land development. To go beyond these guidelines, however,

substantially increases risk by placing more people in areas where there may ultimately be an aircraft accident.

A.7 NOISE

Nearly all studies analyzing aircraft noise and residential compatibility recommend no residential uses in noise zones above DNL 75 decibels (dB). Usually, no restrictions are recommended below noise zone DNL 65 dB. There is currently no consensus between DNL 65-74 dB. These areas may not qualify for federal mortgage insurance in residential categories according to United States Department of Housing and Urban Development Regulation 24 CFR 51B. In many cases, United States Department of Housing and Urban Development approval requires noise attenuation measures, the Regional Administrator's concurrence, and an Environmental Impact Statement. The United States Department of Veterans Affairs also has airfield noise and accident restrictions that apply to its home loan guarantee program. Whenever possible, residential land use should be located below DNL 65 dB according to USAF land use recommendations. Residential buildings within the DNL 65-75 dB noise contours should contain noise level reduction in accordance with the USAF land use compatibility guidelines in the AICUZ Study, Table 4.6-1.

Most industrial/manufacturing uses are compatible in the airfield area of influence. Exceptions are uses such as research or scientific activities that require lower noise levels. Noise attenuation measures are recommended for portions of buildings devoted to office use, receiving the public, or where the normal background noise level is low.

The transportation, communications, and utilities categories have a high noise level compatibility because they generally are not people-intensive. When people use land for these purposes, the use is generally very short in duration. Where buildings are required for these uses, additional evaluation is warranted.

The commercial/retail trade and personal and business services categories are compatible without restriction up to DNL 70 dB; however, they are generally incompatible above DNL 80 dB. Between DNL 70-79 dB, noise level reduction measures should be included in the design and construction of buildings.

The nature of most uses in the public and quasi-public services category requires a quieter environment, and attempts should be made to locate these uses below DNL 65 dB (a USAF land use recommendation), or else provide adequate noise level reduction.

Although recreational use has often been recommended as compatible with high noise levels, recent research has resulted in a more conservative view. Above DNL 75 dB, noise becomes a

factor that limits the ability to enjoy such uses. Where the requirement to hear is a function of the use (e.g., music shell, etc.), compatibility is limited. Buildings associated with golf courses and similar uses should be noise attenuated.

With the exception of forestry activities and livestock farming, uses in the resources production, extraction, and open space category are compatible almost without restrictions.

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APPENDIX B
AIRSPACE

APPENDIX B
AIRSPACE

Most procedures governing aircraft operations and airspace use distinguish between two types of flight rules - visual and instrument, which dictate how and where a pilot can operate. Pilot qualifications/certifications and the type of flight aviation generally dictate which rules must be used. For instance, general aviation pilots who possess only a private license and fly light aircraft normally operate under Visual Flight Rules (VFR).

VFRs do not require air traffic control (ATC) clearances and generally allow pilots to fly unrestricted under 18,000 feet above MSL using visual references such as towns, highways, and railroads as a means of navigation. VFR rely on "see-and-avoid" flight, which requires pilots to be visually alert for and to maintain safe distances from other obstacles (e.g., populated areas, clouds). Most other air traffic, including air passenger carriers, business aircraft, and military aircraft, operate under Instrument Flight Rules (IFR), which require pilots to be trained and certified in instrument navigational procedures and ATC clearance requirements that provide separation between all aircraft operating under IFR. The respective procedures established under VFR and IFR for flight operations and airspace use help segregate aircraft operating under each set of rules.

Class A Airspace. Class A airspace includes operating altitudes above 18,000 feet above MSL. Formerly referred to as Positive Control Areas, Class A airspace is dominated by commercial and military aircraft utilizing jet routes between 18,000 and 45,000 feet MSL.

Class B Airspace. Class B airspace comprises contiguous cylinders of controlled airspace, which can extend from ground level up to 14,500 feet above MSL. The radii of the cylinders increase incrementally with the shortest radius located closest to the airfield complex and the longest radius located up to 30 NM from the airfield at altitudes between 8,000 and 14,500 feet MSL. This increasing radius with increasing altitude gives the airspace structure the shape of an upside down wedding cake. This shape roughly corresponds to the paths of aircraft approaching and departing from the airport. Prior to operating in Class B airspace, pilots must contact controlling authorities and receive clearance to enter the airspace. Aircraft operating within Class B airspace must be equipped with specialized electronics that allow air traffic controllers to accurately track aircraft speed, altitude, and position. Class B airspace is typically associated with major airports.

Class C Airspace. Class C airspace is controlled airspace that starts at the surface and extends to 4,000 feet AGL. Within Class C airspace, aircraft are required to maintain two-way radio communication with local ATC entities. Class C airspace areas were designed and implemented

to provide additional ATC into and out of primary airports where aircraft operations are periodically at high-density levels.

Class D Airspace. Class D airspace is generally that airspace from the surface to 2,500 feet above the airport elevation. Class D airspace only surrounds airports that have an operational control tower. Class D airspace is also tailored to meet the needs of the airport. Pilots are required to establish and maintain two-way radio communications with the ATC facility providing air traffic control services prior to entering the airspace.

Class E Airspace. Class E airspace can be described as general controlled airspace and includes designated federal airways, portions of the jet route system, and area low routes. Federal airways have a width of 4 statute miles on either side of the airway centerline and occur between 700 feet AGL and 18,000 feet MSL but may have a floor located at ground level at non-towered airfields. These airways frequently intersect approach and departure paths of both military and civilian airfields.

APPENDIX C
CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

APPENDIX C
CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

C.1 GUIDELINES FOR ACCIDENT POTENTIAL

Areas around airports are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, history makes it clear that accidents do happen.

When the AICUZ Program began, there were no current comprehensive studies on accident potential. To support the program, the USAF completed a study of USAF aircraft accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 percent of aircraft accidents occurred on or adjacent to the runway (1,000 feet to each side of the runway centerline) and in a corridor 3,000 feet (1,500 feet either side of the runway centerline) wide, extending from the runway threshold along the extended runway centerline for a distance of 15,000 feet. The USAF updated these studies and this information is presented later in this section.

The CZ, APZ I, and APZ II were established based on crash patterns. The CZ starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The USAF adopted a policy of acquiring property rights to areas designated as CZs because of the high accident potential. APZ I extends from the CZ an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet in an area of further reduced accident potential.

Research in accident potential conducted by the USAF was the first significant effort in this subject area since 1952 when the President's Airport Commission published "The Airport and Its Neighbors," better known as the "Doolittle Report." The recommendations of this earlier report were influential in the formulation of the APZ concept.

The risk to people on the ground being killed or injured by aircraft accidents is small. However, an aircraft accident is a high consequence event, and when a crash does occur, the result is often catastrophic. Because of this, the USAF does not attempt to base its safety standards on accident probabilities. Instead, the USAF approaches this safety issue from a land use planning perspective.

C.2 GUIDELINES FOR ACCIDENT POTENTIAL

Military aircraft accidents differ from commercial air carrier and general aviation accidents because of the variety of aircraft used, the type of missions, and the number of training flights. In 1973, the USAF performed a service-wide aircraft accident hazard study to identify land near airfields with elevated accident potential. Accidents studied occurred within 10 nautical miles of airfields.

The study reviewed 369 major USAF accidents during 1968-1972, and found that 61 percent of those accidents were related to landing operations, and 39 percent were takeoff related. It also found that 70 percent occurred in daylight, and that fighter and training aircraft accounted for 80 percent of the accidents.

Because the purpose of the study was to identify accident hazards, the study plotted each of the 369 accidents in relation to the airfield. This plotting found that the accidents clustered along the runway and its extended centerline. To further refine this clustering, a tabulation was prepared that described the cumulative frequency of accidents as a function of distance from the runway centerline along the extended centerline. This analysis was done for widths of 2,000, 3,000, and 4,000 total feet. Table C.1 reflects the location analysis.

Table C.1. Location Analysis

	WIDTH OF RUNWAY EXTENSION (FEET)		
Length From Both Ends of Runway (feet)	***2,000***	***3,000***	***4,000***
Percent of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	35	39	39
3,000 to 8,000	8	8	8
8,000 to 15,000	5	5	7
Cumulative Percent of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	58	62	62
3,000 to 8,000	66	70	70
8,000 to 15,000	71	75	77

Figure C.1 indicates that the cumulative number of accidents rises rapidly from the end of the runway to 3,000 feet, rises more gradually to 8,000 feet, then continues at about the same rate of increase to 15,000 feet, where it levels off rapidly. The location analysis also indicates 3,000 feet as the optimum runway extension width and the width that includes the maximum percentage of accidents in the smallest area.

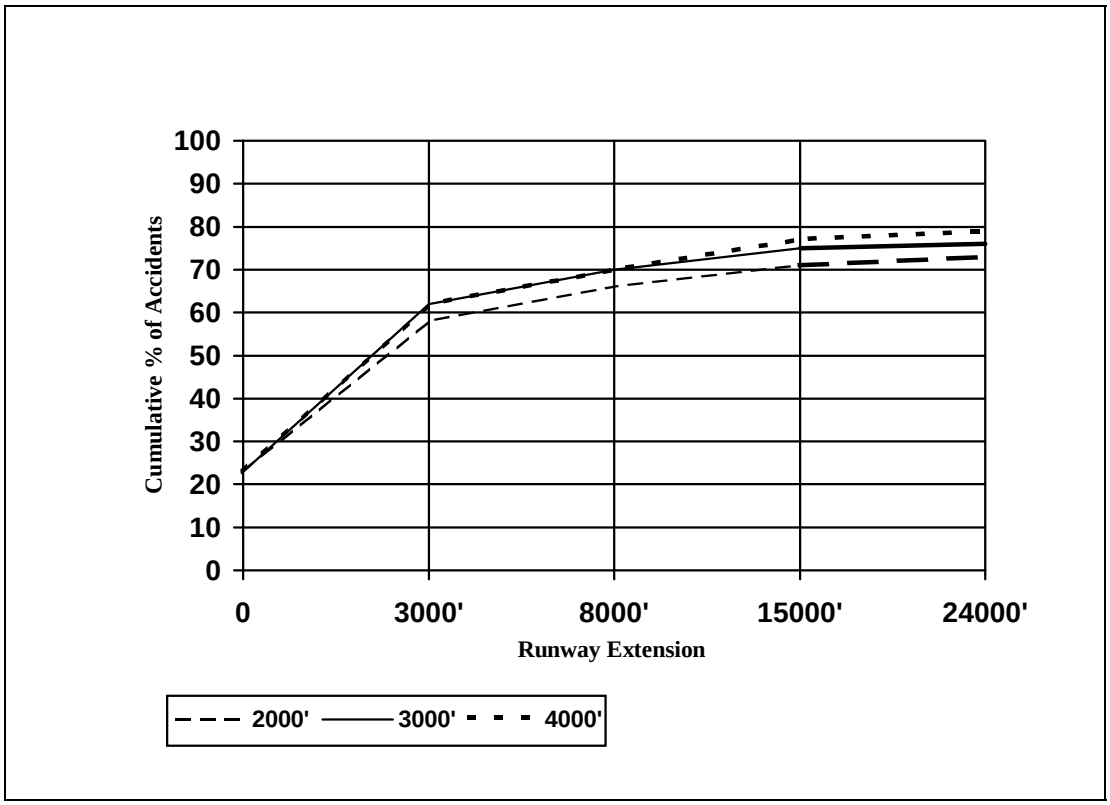


Figure C.1. Distribution of Air Force Aircraft Accidents (369 Accidents - 1968 - 1972)

Using the optimum runway extension width, 3,000 feet, and the cumulative distribution of accidents from the end of the runway, zones were established that minimized the land area included and maximized the percentage of accidents included. The zone dimensions and accident statistics for the 1968-1972 study are shown in Figure C.2.

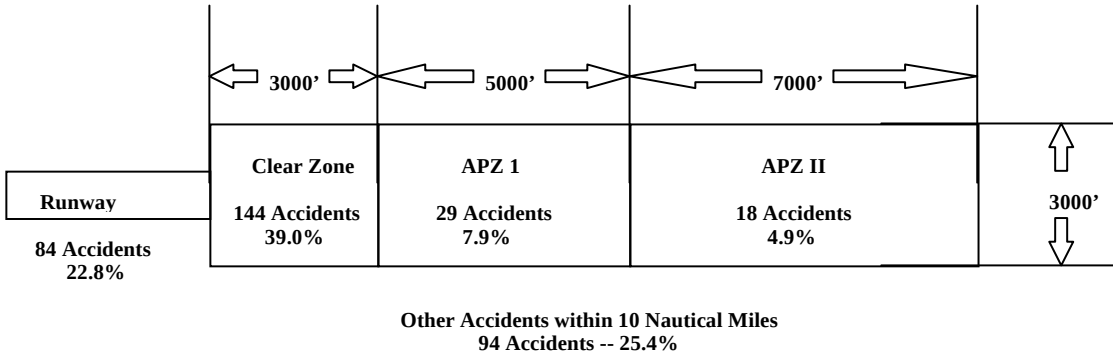


Figure C.2. Air Force Aircraft Accident Data (369 Accidents - 1968 - 1972)

The original study was updated to include accidents through September 1995. This updated study includes 838 accidents during the 1968-1995 period. Using the optimum runway extension width of 3,000 feet, the accident statistics of the updated study are shown in Figure C.3.

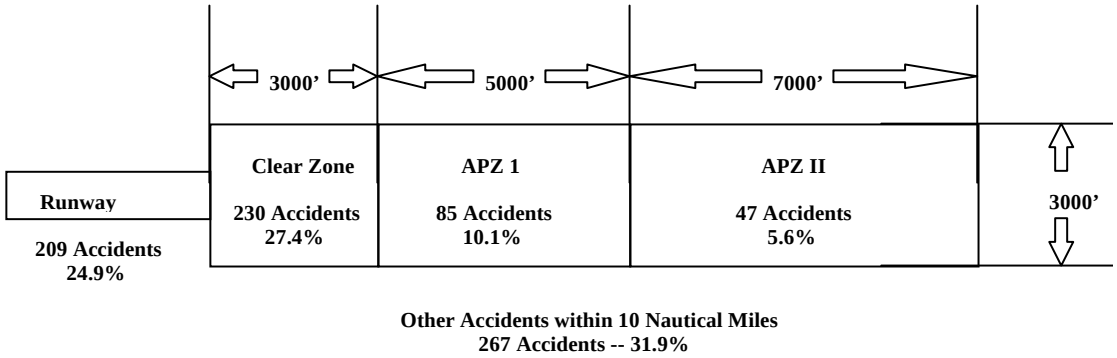


Figure C.3. Air Force Aircraft Accident Data
(838 Accidents - 1968 - 1995)

Using the designated zones and accident data, it is possible to calculate a ratio of percentage of accidents to percentage of area size. These ratios indicate the CZ, with the smallest area size and the highest number of accidents, has the highest ratio, followed by the runway and adjacent area, APZ I, and then APZ II. Table C.2 reflects this data.

Table C.2. Accident to Area Ratio
Ratio of Percentage of Accidents to Percentage of Area
(Air Force Accident Data 1968 - 1995)

	Area[1] (Acres)	*Number[2] Accident*	*Accident Per Acre*	*Percent of Total Area*	*Percent of Total Accidents*	*Ratio:[3] % Accidents to % Area*
Runway Area	487	209	1 Per 2.3 acres	0.183	24.9	136
Clear Zone	413	230	1 Per 1.8 acres	0.155	27.4	177
APZ I	689	85	1 Per 8.1 acres	0.258	10.1	39
APZ II	964	47	1 Per 20.5 acres	0.362	5.6	16
Other Area	264,053	267	1 Per 989 acres	99.042	31.9	0.3

Notes: 1 Area includes land within 10 nautical miles of runway.
2 Total number of accidents is 838 (through 1995).
3 Percent total accidents divided by percent total area.

Additional accident data for 1986 through July 1995 has been analyzed. Specific location data for some of the 1986-1995 accidents were not available and these were not included in the analysis. Table C.3 compares the 1968-1985 data with the data through July 1995:

Table C.3. Additional Accident Data

Zone	1968-1985		1968-1995	
	Accidents	*% of Total*	*Accidents*	*% of Total*
On-Runway	197	27.1	209	24.9
Clear Zone	210	28.8	230	27.4
APZ I	57	7.8	85	10.1
APZ II	36	5.0	47	5.7
Other (Within 10 nautical miles)	228	31.3	267	31.9
Total	728	100.0	838	100.0

Analysis shows that the cumulative changes evident in accident location through July 1995 reconfirm the dimensions of the CZs and APZs.

C.3 DEFINABLE DEBRIS IMPACT AREAS

The USAF also determined which accidents had definable debris impact areas, and in what phase of flight the accident occurred. Overall, 75 percent of the accidents had definable debris impact areas, although they varied in size by type of accident. The USAF used weighted averages of impact areas, for accidents occurring only in the approach and departure phase, to determine the following average impact areas:

Average Impact Areas for Approach and Departure Accidents

Overall Average Impact Area	5.06 acres
Fighter, Trainer, and Misc. Aircraft	2.73 acres
Heavy Bomber and Tanker Aircraft	8.73 acres

C.4 FINDINGS

Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public's exposure to safety hazards.

USAF accident studies have found that aircraft accidents near USAF installations occurred in the following patterns:

- 61 percent were related to landing operations.
- 39 percent were related to takeoff operations.
- 70 percent occurred in daylight.

- 80 percent were related to fighter and training aircraft operations.
- 25 percent occurred on the runway or within an area extending 1,000 feet out from each side of the runway.
- 27 percent occurred in an area extending from the end of the runway to 3,000 feet along the extended centerline and 3,000 feet wide, centered on the extended centerline.
- 15 percent occurred in an area between 3,000 and 15,000 feet along the extended runway centerline and 3,000 feet wide, centered on the extended centerline.

USAF aircraft accident statistics found 75 percent of aircraft accidents resulted in definable impact areas. The size of the impact areas were:

- 5.06 acres overall average.
- 2.73 acres for fighters and trainers.
- 8.73 acres for heavy bombers and tankers.

APPENDIX D
127TH WING BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH) PLAN (91-212) AND RELATED FAA CIRCULAR (AC 150/5200-33B)

APPENDIX D
MICHIGAN AIR NATIONAL GUARD, SELFRIDGE AIR NATIONAL GUARD BASE, 127TH WING BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH) PLAN 91-212

127 WG (MI ANG)
Selfridge ANGB, MI 48045
May 2008

127 WG BASH Plan 91-212

BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH) PLAN

BASIC PLAN

1. References: AFI 91-202/MAJCOM Supplements
AFI 91-204/MAJCOM Supplements
AFPAM 91-212
FAR Part 139.337
FAA AC 150/5200.33
FAA Handbook 7110.65

2. Introduction. A bird/wildlife aircraft strike hazard exists at the Selfridge Air National Guard Base (MI ANG) and its vicinity, due to resident and migratory bird species and other wildlife. Daily and seasonal bird movements create various hazardous conditions. This plan establishes procedures to minimize the hazard to Michigan Air National Guard aircraft at the installation and in their operating areas. This plan updates existing documents and is based on historical bird/wildlife strike records from the 127 WG and its operating areas, the October 2007 Selfridge ANGB BASH Plan, and the spring 2008 visit by NGB. As part of that visit, a review of historical records, documentation, and updated hazard assessment are included in APPENDIX 1, attached to the updated Bird/Wildlife Aircraft Strike Hazard Plan. Detailed observations, and the biological and operational basis for resulting recommendations are included in the appendix for implementing the 127 WG BASH Plan. Birds observed in the vicinity are listed in APPENDIX 2. Additional BASH references are attached in APPENDIX 3. No single solution exists to this BASH problem, and a variety of techniques and organizations are involved in the control program. This plan is designed to:

a. Establish a Bird Hazard Working Group (BHWG) and designate responsibilities to its members.

b. Establish procedures to identify high hazard situations and to aid supervisors and aircrews in altering or discontinuing flying operations when required.

c. Establish aircraft and airfield operating procedures to avoid high-hazard situations.

d. Provide for disseminating information to all assigned and transient aircrews on bird hazards and procedures for bird avoidance.

e. Establish guidelines to decrease airfield attractiveness to birds.

f. Provide guidelines for dispersing birds when they are present on the airfield.

g. Provide guidelines for avoiding birds in operating areas away from the airfield.

h. Identify organizations/OPRs with authority to upgrade, initiate, or downgrade Bird Watch Conditions.

i. Provide guidelines to maintain the working relationship between ANG and tenant units on the Selfridge ANG Base.

3. Summary of Recommendations:

a. Designate ANG personnel or contractors to conduct the wildlife control program.

b. Maintain current depredation permits for all agencies and personnel to control birds, mammals, and other wildlife that may pose potential aviation hazards.

c. Maintain turf over the entire AOA with a dense, uniform monoculture of grass maintained between 7 and 14 inches (AF Mandate).

d. Remove all old operating surfaces, broken tarmac, bare areas, etc. from the AOA.

e. Continue to eliminate wetland habitat within the AOA and ensure any mitigation efforts are conducted off-site. See MOA with US Army Corps of Engineers Memo.

f. Remove all trees and brush within the AOA and ensure all landscaping vegetation in proximity to the field is selected such that it does not attract birds and other wildlife.

g. Construct or replace any new sections of fencing to recommended standards. Monitor the security fences and gates for wildlife breeches and treat sections where breeches routinely occur.

h. Conduct dispersal operations using standard frightening techniques such as bioacoustics, pyrotechnics, gas cannons, or others. ANG and tenant agencies must have this equipment at their disposal to supplement airport personnel as needed.

i. Remove or configure with anti-perching devices, any known bird perches or nest sites in the AOA.

j. Conduct harassment or depredation activities on birds nesting and roosting in hangars and other airfield structures.

k. Disperse roosting birds from local area sites through active harassment or depredation.

l. Conduct training for all aircrews and use the Bird Avoidance Model and Avian Hazard Advisory System for flight planning when away from the home airfield.

m. Prohibit all personnel from feeding or otherwise attracting birds or other wildlife on base property.

4. BASH Plan Execution:

a. Concept of Operations:

(1) Phases. Designate Phase I and Phase II periods of bird activity based on historical information. Phase II represents heavy bird activity, normally associated with migratory seasons. Records indicate migratory seasons (April – June and September – November) as most likely periods of significantly increased local bird activity. Publish Phase I and II designations in the Flight Information Publication and post in Base Operations/Flight Planning room, as appropriate.

(2) Coordination. Reducing the bird strike hazard at the 127 WG requires a cooperative effort between several MI ANG organizations, tenant units, and the surrounding community. The OPR for coordinating this plan is the 127 WG Safety Office.

(3) Bird Hazard Working Group (BHWG):

(a) Function. Collects, compiles, and reviews data on bird strikes. Identifies and recommends actions to reduce hazards. Recommends changes in operational procedures. Prepares informational programs for aircrews. Assists the installation commander by acting as a point of contact for off-installation BASH issues.

(b) Authority. The BHWG submits all recommendations to the installation commander for approval. Implementation is through the normal chain of command.

(c) Composition. The chairperson will be the Vice Wing Commander or designee. As a minimum, the group will consist of a representative from flight safety, aircraft maintenance, civil engineering (pest management, natural resources, grounds maintenance, etc.), airfield management, environmental management, ATC, and representatives from other tasked organizations (ANNEX A) as required. Meeting minutes will be maintained and appropriate distribution made.

(d) Meeting Schedule. As requested by the chairman of the BHWG, but at least semi-annually in accordance with AFI 91-202.

b. **Tasks:** ANNEX C outlines the general and continuing tasks and responsibilities for each organization and gives specific hazard reduction measures for varying bird hazard conditions.

ANNEXES:

A — Tasked Organizations
C — Operations
M — Mapping, Charting and Geodesy
S — Bird Hazard Warning System: Operation Bird Watch

Y — Reports and Forms
Z — Distribution

127 WG (MI ANG)
Selfridge ANGB, MI 48045
30 June 2008

ANNEX A TO 127 WG BASH Plan 91-212

TASKED ORGANIZATIONS:

MICHIGAN AIR NATIONAL GUARD:

127 WG/CC
127 WG/CV
127 WG/SE
127 WG/PA
127 WG/CP
127 WG/BCE
127 OG/CC
127 ARG/CC
127 OG/AT
127 WG/OTM
127 MXG/CC
127 MSG/CC
127 SFS/CC
127 WG/CEV
127 MDS/SGPB
127 MDS/SGPM
191 MXS/CC
171 ARS/CC

NOTE: This list is representative only; other interested or required agencies may be tasked as needed.

U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS	**Date:** 8/28/2007	**AC No:** 150/5200-33B
	Initiated by: AAS-300	**Change:**

1. PURPOSE. This Advisory Circular (AC) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. APPLICABILITY. The Federal Aviation Administration (FAA) recommends that public-use airport operators implement the standards and practices contained in this AC. The holders of Airport Operating Certificates issued under Title 14, Code of Federal Regulations (CFR), Part 139, Certification of Airports, Subpart D (Part 139), may use the standards, practices, and recommendations contained in this AC to comply with the wildlife hazard management requirements of Part 139. Airports that have received Federal grant-in-aid assistance must use these standards. The FAA also recommends the guidance in this AC for land-use planners, operators of non-certificated airports, and developers of projects, facilities, and activities on or near airports.

3. CANCELLATION. This AC cancels AC 150/5200-33A, *Hazardous Wildlife Attractants on or near Airports*, dated July 27, 2004.

4. PRINCIPAL CHANGES. This AC contains the following major changes, which are marked with vertical bars in the margin:

a. Technical changes to paragraph references.

b. Wording on storm water detention ponds.

c. Deleted paragraph 4-3.b, *Additional Coordination*.

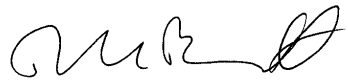
5. BACKGROUND. Information about the risks posed to aircraft by certain wildlife species has increased a great deal in recent years. Improved reporting, studies, documentation, and statistics clearly show that aircraft collisions with birds and other wildlife are a serious economic and public safety problem. While many species of wildlife can pose a threat to aircraft safety, they are not equally hazardous. Table 1

ranks the wildlife groups commonly involved in damaging strikes in the United States according to their relative hazard to aircraft. The ranking is based on the 47,212 records in the FAA National Wildlife Strike Database for the years 1990 through 2003. These hazard rankings, in conjunction with site-specific Wildlife Hazards Assessments (WHA), will help airport operators determine the relative abundance and use patterns of wildlife species and help focus hazardous wildlife management efforts on those species most likely to cause problems at an airport.

Most public-use airports have large tracts of open, undeveloped land that provide added margins of safety and noise mitigation. These areas can also present potential hazards to aviation if they encourage wildlife to enter an airport's approach or departure airspace or air operations area (AOA). Constructed or natural areas—such as poorly drained locations, detention/retention ponds, roosting habitats on buildings, landscaping, odor-causing rotting organic matter (putrescible waste) disposal operations, wastewater treatment plants, agricultural or aquaculture activities, surface mining, or wetlands—can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape. Even small facilities, such as fast food restaurants, taxicab staging areas, rental car facilities, aircraft viewing areas, and public parks, can produce substantial attractions for hazardous wildlife.

During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives worldwide, as well as billions of dollars in aircraft damage. Hazardous wildlife attractants on and near airports can jeopardize future airport expansion, making proper community land-use planning essential. This AC provides airport operators and those parties with whom they cooperate with the guidance they need to assess and address potentially hazardous wildlife attractants when locating new facilities and implementing certain land-use practices on or near public-use airports.

6. MEMORANDUM OF AGREEMENT BETWEEN FEDERAL RESOURCE AGENCIES. The FAA, the U.S. Air Force, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture - Wildlife Services signed a Memorandum of Agreement (MOA) in July 2003 to acknowledge their respective missions in protecting aviation from wildlife hazards. Through the MOA, the agencies established procedures necessary to coordinate their missions to address more effectively existing and future environmental conditions contributing to collisions between wildlife and aircraft (wildlife strikes) throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety while protecting the Nation's valuable environmental resources.



DAVID L. BENNETT
Director, Office of Airport Safety
and Standards

Table 1. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003.[1]

Species group	Ranking by criteria			Composite ranking[2]	Relative hazard score[3]
	Damage[4]	Major damage[5]	Effect on flight[6]		
Deer	1	1	1	1	100
Vultures	2	2	2	2	64
Geese	3	3	6	3	55
Cormorants/pelicans	4	5	3	4	54
Cranes	7	6	4	5	47
Eagles	6	9	7	6	41
Ducks	5	8	10	7	39
Osprey	8	4	8	8	39
Turkey/pheasants	9	7	11	9	33
Herons	11	14	9	10	27
Hawks (buteos)	10	12	12	11	25
Gulls	12	11	13	12	24
Rock pigeon	13	10	14	13	23
Owls	14	13	20	14	23
H. lark/s. bunting	18	15	15	15	17
Crows/ravens	15	16	16	16	16
Coyote	16	19	5	17	14
Mourning dove	17	17	17	18	14
Shorebirds	19	21	18	19	10
Blackbirds/starling	20	22	19	20	10
American kestrel	21	18	21	21	9
Meadowlarks	22	20	22	22	7
Swallows	24	23	24	23	4
Sparrows	25	24	23	24	4
Nighthawks	23	25	25	25	1

[1] Excerpted from the *Special Report for the FAA, "Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003"*. Refer to this report for additional explanations of criteria and method of ranking.
[2] Relative rank of each species group was compared with every other group for the three variables, placing the species group with the greatest hazard rank for $\geq$ 2 of the 3 variables above the next highest ranked group, then proceeding down the list.
[3] Percentage values, from Tables 3 and 4 in Footnote 1 of the *Special Report*, for the three criteria were summed and scaled down from 100, with 100 as the score for the species group with the maximum summed values and the greatest potential hazard to aircraft.
[4] Aircraft incurred at least some damage (destroyed, substantial, minor, or unknown) from strike.
[5] Aircraft incurred damage or structural failure, which adversely affected the structure strength, performance, or flight characteristics, and which would normally require major repair or replacement of the affected component, or the damage sustained makes it inadvisable to restore aircraft to airworthy condition.
[6] Aborted takeoff, engine shutdown, precautionary landing, or other.

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SECTION 1.

GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. INTRODUCTION. When considering proposed land uses, airport operators, local planners, and developers must take into account whether the proposed land uses, including new development projects, will increase wildlife hazards. Land-use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife strikes.

The FAA recommends the minimum separation criteria outlined below for land-use practices that attract hazardous wildlife to the vicinity of airports. Please note that FAA criteria include land uses that cause movement of hazardous wildlife onto, into, or across the airport's approach or departure airspace or air operations area (AOA). (See the discussion of the synergistic effects of surrounding land uses in Section 2-8 of this AC.)

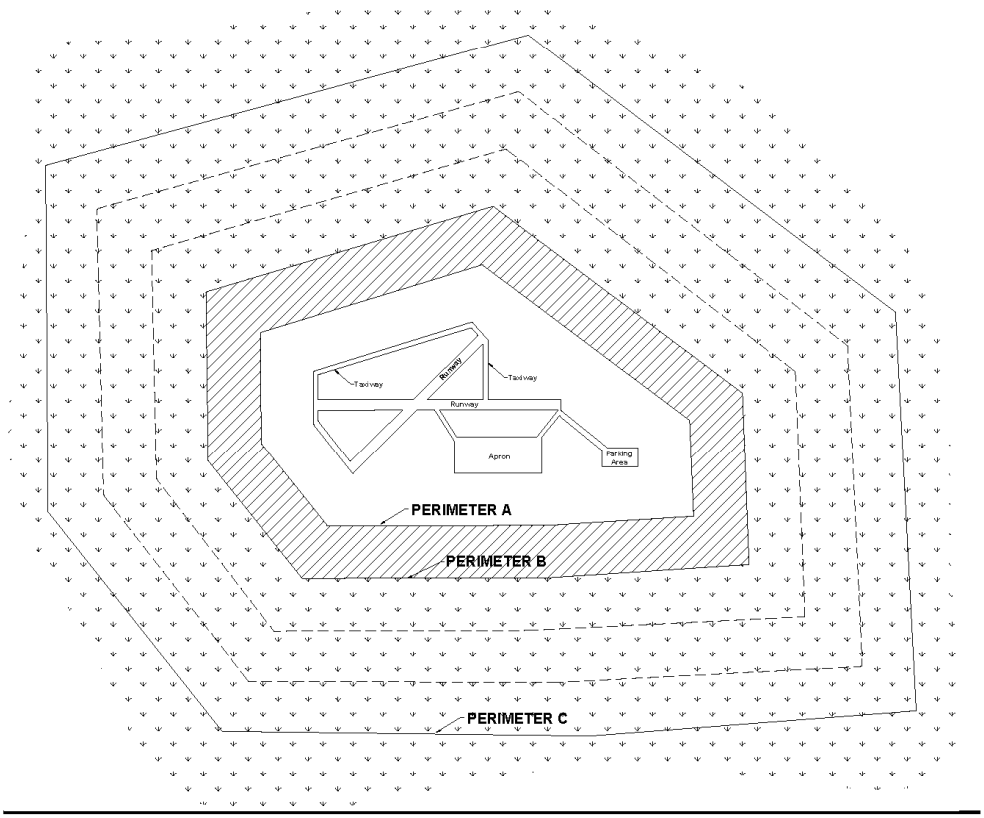
The basis for the separation criteria contained in this section can be found in existing FAA regulations. The separation distances are based on (1) flight patterns of piston-powered aircraft and turbine-powered aircraft, (2) the altitude at which most strikes happen (78 percent occur under 1,000 feet and 90 percent occur under 3,000 feet above ground level), and (3) National Transportation Safety Board (NTSB) recommendations.

1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT. Airports that do not sell Jet-A fuel normally serve piston-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 5,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance measured from the nearest aircraft operations areas.

1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT. Airports selling Jet-A fuel normally serve turbine-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 10,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance from the nearest aircraft movement areas.

1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE. For all airports, the FAA recommends a distance of 5 statute miles between the farthest edge of the airport's AOA and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

Figure 1. Separation distances within which hazardous wildlife attractants should be avoided, eliminated, or mitigated.



PERIMETER A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area.

PERIMETER B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area.

PERIMETER C: 5-mile range to protect approach, departure and circling airspace.

SECTION 2.

LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment vary considerably, depending on several factors, including land-use practices on or near the airport. This section discusses land-use practices having the potential to attract hazardous wildlife and threaten aviation safety. In addition to the specific considerations outlined below, airport operators should refer to *Wildlife Hazard Management at Airports*, prepared by FAA and U.S. Department of Agriculture (USDA) staff. (This manual is available in English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov.). And, *Prevention and Control of Wildlife Damage*, compiled by the University of Nebraska Cooperative Extension Division. (This manual is available online in a periodically updated version at: ianrwww.unl.edu/wildlife/solutions/handbook/.)

2-2. WASTE DISPOSAL OPERATIONS. Municipal solid waste landfills (MSWLF) are known to attract large numbers of hazardous wildlife, particularly birds. Because of this, these operations, when located within the separations identified in the siting criteria in Sections 1-2 through 1-4, are considered incompatible with safe airport operations.

a. Siting for new municipal solid waste landfills subject to AIR 21. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) (AIR 21) prohibits the construction or establishment of a new MSWLF within 6 statute miles of certain public-use airports. Before these prohibitions apply, both the airport and the landfill must meet the very specific conditions described below. These restrictions do not apply to airports or landfills located within the state of Alaska.

The airport must (1) have received a Federal grant(s) under 49 U.S.C. § 47101, et. seq.; (2) be under control of a public agency; (3) serve some scheduled air carrier operations conducted in aircraft with less than 60 seats; and (4) have total annual enplanements consisting of at least 51 percent of scheduled air carrier enplanements conducted in aircraft with less than 60 passenger seats.

The proposed MSWLF must (1) be within 6 miles of the airport, as measured from airport property line to MSWLF property line, and (2) have started construction or establishment on or after April 5, 2001. Public Law 106-181 only limits the construction or establishment of some new MSWLF. It does not limit the expansion, either vertical or horizontal, of existing landfills.

NOTE: Consult the most recent version of AC 150/5200-34, *Construction or Establishment of Landfills Near Public Airports*, for a more detailed discussion of these restrictions.

b. **Siting for new MSWLF not subject to AIR 21.** If an airport and MSWLF do not meet the restrictions of Public Law 106-181, the FAA recommends against locating MSWLF within the separation distances identified in Sections 1-2 through 1-4. The separation distances should be measured from the closest point of the airport's AOA to the closest planned MSWLF cell.

c. **Considerations for existing waste disposal facilities within the limits of separation criteria.** The FAA recommends against airport development projects that would increase the number of aircraft operations or accommodate larger or faster aircraft near MSWLF operations located within the separations identified in Sections 1-2 through 1-4. In addition, in accordance with 40 CFR 258.10, owners or operators of existing MSWLF units that are located within the separations listed in Sections 1-2 through 1-4 must demonstrate that the unit is designed and operated so it does not pose a bird hazard to aircraft. (See Section 4-2(b) of this AC for a discussion of this demonstration requirement.)

d. **Enclosed trash transfer stations.** Enclosed waste-handling facilities that receive garbage behind closed doors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles generally are compatible with safe airport operations, provided they are not located on airport property or within the Runway Protection Zone (RPZ). These facilities should not handle or store putrescible waste outside or in a partially enclosed structure accessible to hazardous wildlife. Trash transfer facilities that are open on one or more sides; that store uncovered quantities of municipal solid waste outside, even if only for a short time; that use semi-trailers that leak or have trash clinging to the outside; or that do not control odors by ventilation and filtration systems (odor masking is not acceptable) do not meet the FAA's definition of fully enclosed trash transfer stations. The FAA considers these facilities incompatible with safe airport operations if they are located closer than the separation distances specified in Sections 1-2 through 1-4.

e. **Composting operations on or near airport property.** Composting operations that accept only yard waste (e.g., leaves, lawn clippings, or branches) generally do not attract hazardous wildlife. Sewage sludge, woodchips, and similar material are not municipal solid wastes and may be used as compost bulking agents. The compost, however, must never include food or other municipal solid waste. Composting operations should not be located on airport property. Off-airport property composting operations should be located no closer than the greater of the following distances: 1,200 feet from any AOA or the distance called for by airport design requirements (see AC 150/5300-13, *Airport Design*). This spacing should prevent material, personnel, or equipment from penetrating any Object Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway. Airport operators should monitor composting operations located in proximity to the airport to ensure that steam or thermal rise does not adversely affect air traffic. On-airport disposal of compost by-products should not be conducted for the reasons stated in 2-3f.

f. **Underwater waste discharges.** The FAA recommends against the underwater discharge of any food waste (e.g., fish processing offal) within the separations identified in Sections 1-2 through 1-4 because it could attract scavenging hazardous wildlife.

g. **Recycling centers.** Recycling centers that accept previously sorted non-food items, such as glass, newspaper, cardboard, or aluminum, are, in most cases, not attractive to hazardous wildlife and are acceptable.

h. **Construction and demolition (C&D) debris facilities.** C&D landfills do not generally attract hazardous wildlife and are acceptable if maintained in an orderly manner, admit no putrescible waste, and are not co-located with other waste disposal operations. However, C&D landfills have similar visual and operational characteristics to putrescible waste disposal sites. When co-located with putrescible waste disposal operations, C&D landfills are more likely to attract hazardous wildlife because of the similarities between these disposal facilities. Therefore, a C&D landfill co-located with another waste disposal operation should be located outside of the separations identified in Sections 1-2 through 1-4.

i. **Fly ash disposal.** The incinerated residue from resource recovery power/heat-generating facilities that are fired by municipal solid waste, coal, or wood is generally not a wildlife attractant because it no longer contains putrescible matter. Landfills accepting only fly ash are generally not considered to be wildlife attractants and are acceptable as long as they are maintained in an orderly manner, admit no putrescible waste of any kind, and are not co-located with other disposal operations that attract hazardous wildlife.

   Since varying degrees of waste consumption are associated with general incineration (not resource recovery power/heat-generating facilities), the FAA considers the ash from general incinerators a regular waste disposal by-product and, therefore, a hazardous wildlife attractant if disposed of within the separation criteria outlined in Sections 1-2 through 1-4.

2-3. WATER MANAGEMENT FACILITIES. Drinking water intake and treatment facilities, storm water and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of storm water management facilities on or near all public-use airports to ensure a safe airport environment.

a. **Existing storm water management facilities.** On-airport storm water management facilities allow the quick removal of surface water, including discharges related to aircraft deicing, from impervious surfaces, such as pavement and terminal/hangar building roofs. Existing on-airport detention ponds collect storm water, protect water quality, and control runoff. Because they slowly release water

after storms, they create standing bodies of water that can attract hazardous wildlife. Where the airport has developed a Wildlife Hazard Management Plan (WHMP) in accordance with Part 139, the FAA requires immediate correction of any wildlife hazards arising from existing storm water facilities located on or near airports, using appropriate wildlife hazard mitigation techniques. Airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

Where possible, airport operators should modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. The FAA recommends that airport operators avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Detention basins should remain totally dry between rainfalls. Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom may remain wet, the detention facility should include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that may provide nesting habitat.

When it is not possible to drain a large detention pond completely, airport operators may use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office.

The FAA recommends that airport operators encourage off-airport storm water treatment facility operators to incorporate appropriate wildlife hazard mitigation techniques into storm water treatment facility operating practices when their facility is located within the separation criteria specified in Sections 1-2 through 1-4.

b. New storm water management facilities. The FAA strongly recommends that off-airport storm water management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. Stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48–hour detention period after the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, rip-rap lined, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages

the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

c. **Existing wastewater treatment facilities.** The FAA strongly recommends that airport operators immediately correct any wildlife hazards arising from existing wastewater treatment facilities located on or near the airport. Where required, a WHMP developed in accordance with Part 139 will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should encourage wastewater treatment facility operators to incorporate measures, developed in consultation with a wildlife damage management biologist, to minimize hazardous wildlife attractants. Airport operators should also encourage those wastewater treatment facility operators to incorporate these mitigation techniques into their standard operating practices. In addition, airport operators should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

d. **New wastewater treatment facilities.** The FAA strongly recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in Sections 1-2 through 1-4. Appendix 1 defines wastewater treatment facility as "any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes." The definition includes any pretreatment involving the reduction of the amount of pollutants or the elimination of pollutants prior to introducing such pollutants into a publicly owned treatment works (wastewater treatment facility). During the site-location analysis for wastewater treatment facilities, developers should consider the potential to attract hazardous wildlife if an airport is in the vicinity of the proposed site, and airport operators should voice their opposition to such facilities if they are in proximity to the airport.

e. **Artificial marshes.** In warmer climates, wastewater treatment facilities sometimes employ artificial marshes and use submergent and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. The FAA strongly recommends against establishing artificial marshes within the separations identified in Sections 1-2 through 1-4.

f. **Wastewater discharge and sludge disposal.** The FAA recommends against the discharge of wastewater or sludge on airport property because it may improve soil moisture and quality on unpaved areas and lead to improved turf growth that can be an attractive food source for many species of animals. Also, the turf requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw, both of which can attract hazardous wildlife. In addition, the improved turf may attract grazing wildlife, such as deer and geese. Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

2-4. WETLANDS. Wetlands provide a variety of functions and can be regulated by local, state, and Federal laws. Normally, wetlands are attractive to many types of wildlife, including many which rank high on the list of hazardous wildlife species (Table 1).

NOTE: If questions exist as to whether an area qualifies as a wetland, contact the local division of the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, or a wetland consultant qualified to delineate wetlands.

a. **Existing wetlands on or near airport property.** If wetlands are located on or near airport property, airport operators should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations. At public-use airports, the FAA recommends immediately correcting, in cooperation with local, state, and Federal regulatory agencies, any wildlife hazards arising from existing wetlands located on or near airports. Where required, a WHMP will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

b. **New airport development.** Whenever possible, the FAA recommends locating new airports using the separations from wetlands identified in Sections 1-2 through 1-4. Where alternative sites are not practicable, or when airport operators are expanding an existing airport into or near wetlands, a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and the state wildlife management agency should evaluate the wildlife hazards and prepare a WHMP that indicates methods of minimizing the hazards.

c. **Mitigation for wetland impacts from airport projects.** Wetland mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects or projects required to correct wildlife hazards from wetlands. Wetland mitigation must be designed so it does not create a wildlife hazard. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4.

   (1) Onsite mitigation of wetland functions. The FAA may consider exceptions to locating mitigation activities outside the separations identified in Sections 1-2 through 1-4 if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge, which cannot be replicated when moved to a different location. Using existing airport property is sometimes the only feasible way to achieve the mitigation ratios mandated in regulatory orders and/or settlement agreements with the resource agencies. Conservation easements are an additional means of providing mitigation for project impacts. Typically the airport operator continues to own the property, and an easement is created stipulating that the property will be maintained as habitat for state or Federally listed species.

Mitigation must not inhibit the airport operator's ability to effectively control hazardous wildlife on or near the mitigation site or effectively maintain other aspects of safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife must be avoided. The FAA will review any onsite mitigation proposals to determine compatibility with safe airport operations. A wildlife damage management biologist should evaluate any wetland mitigation projects that are needed to protect unique wetland functions and that must be located in the separation criteria in Sections 1-2 through 1-4 before the mitigation is implemented. A WHMP should be developed to reduce the wildlife hazards.

(2) Offsite mitigation of wetland functions. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4 unless they provide unique functions that must remain onsite (see 2-4c(1)). Agencies that regulate impacts to or around wetlands recognize that it may be necessary to split wetland functions in mitigation schemes. Therefore, regulatory agencies may, under certain circumstances, allow portions of mitigation to take place in different locations.

(3) Mitigation banking. Wetland mitigation banking is the creation or restoration of wetlands in order to provide mitigation credits that can be used to offset permitted wetland losses. Mitigation banking benefits wetland resources by providing advance replacement for permitted wetland losses; consolidating small projects into larger, better-designed and managed units; and encouraging integration of wetland mitigation projects with watershed planning. This last benefit is most helpful for airport projects, as wetland impacts mitigated outside of the separations identified in Sections 1-2 through 1-4 can still be located within the same watershed. Wetland mitigation banks meeting the separation criteria offer an ecologically sound approach to mitigation in these situations. Airport operators should work with local watershed management agencies or organizations to develop mitigation banking for wetland impacts on airport property.

2-5. DREDGE SPOIL CONTAINMENT AREAS. The FAA recommends against locating dredge spoil containment areas (also known as Confined Disposal Facilities) within the separations identified in Sections 1-2 through 1-4 if the containment area or the spoils contain material that would attract hazardous wildlife.

2-6. AGRICULTURAL ACTIVITIES. Because most, if not all, agricultural crops can attract hazardous wildlife during some phase of production, the FAA recommends against the used of airport property for agricultural production, including hay crops, within the separations identified in Sections 1-2 through 1-4. . If the airport has no financial alternative to agricultural crops to produce income necessary to maintain the viability of the airport, then the airport shall follow the crop distance guidelines listed in the table titled "Minimum Distances between Certain Airport Features and Any On-Airport Agricultural Crops" found in AC 150/5300-13, *Airport Design*, Appendix 17. The cost of wildlife control and potential accidents should be weighed against the income produced by the on-airport crops when deciding whether to allow crops on the airport.

a. **Livestock production.** Confined livestock operations (i.e., feedlots, dairy operations, hog or chicken production facilities, or egg laying operations) often attract flocking birds, such as starlings, that pose a hazard to aviation. Therefore, The FAA recommends against such facilities within the separations identified in Sections 1-2 through 1-4. Any livestock operation within these separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety. Free-ranging livestock must not be grazed on airport property because the animals may wander onto the AOA. Furthermore, livestock feed, water, and manure may attract birds.

b. **Aquaculture.** Aquaculture activities (i.e. catfish or trout production) conducted outside of fully enclosed buildings are inherently attractive to a wide variety of birds. Existing aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4 must have a program developed to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should also oppose the establishment of new aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4.

c. **Alternative uses of agricultural land.** Some airports are surrounded by vast areas of farmed land within the distances specified in Sections 1-2 through 1-4. Seasonal uses of agricultural land for activities such as hunting can create a hazardous wildlife situation. In some areas, farmers will rent their land for hunting purposes. Rice farmers, for example, flood their land during waterfowl hunting season and obtain additional revenue by renting out duck blinds. The duck hunters then use decoys and call in hundreds, if not thousands, of birds, creating a tremendous threat to aircraft safety. A wildlife damage management biologist should review, in coordination with local farmers and producers, these types of seasonal land uses and incorporate them into the WHMP.

2-7. GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS.

a. **Golf courses.** The large grassy areas and open water found on most golf courses are attractive to hazardous wildlife, particularly Canada geese and some species of gulls. These species can pose a threat to aviation safety. The FAA recommends against construction of new golf courses within the separations identified in Sections 1-2 through 1-4. Existing golf courses located within these separations must develop a program to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should ensure these golf courses are monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be immediately implemented.

b. **Landscaping and landscape maintenance.** Depending on its geographic location, landscaping can attract hazardous wildlife. The FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. A wildlife damage management biologist should review all landscaping plans. Airport operators should also monitor all landscaped areas on a continuing basis for the presence of hazardous wildlife. If

hazardous wildlife is detected, corrective actions should be immediately implemented.

Turf grass areas can be highly attractive to a variety of hazardous wildlife species. Research conducted by the USDA Wildlife Services' National Wildlife Research Center has shown that no one grass management regime will deter all species of hazardous wildlife in all situations. In cooperation with wildlife damage management biologist, airport operators should develop airport turf grass management plans on a prescription basis, depending on the airport's geographic locations and the type of hazardous wildlife likely to frequent the airport

Airport operators should ensure that plant varieties attractive to hazardous wildlife are not used on the airport. Disturbed areas or areas in need of re-vegetating should not be planted with seed mixtures containing millet or any other large-seed producing grass. For airport property already planted with seed mixtures containing millet, rye grass, or other large-seed producing grasses, the FAA recommends disking, plowing, or another suitable agricultural practice to prevent plant maturation and seed head production. Plantings should follow the specific recommendations for grass management and seed and plant selection made by the State University Cooperative Extension Service, the local office of Wildlife Services, or a qualified wildlife damage management biologist. Airport operators should also consider developing and implementing a preferred/prohibited plant species list, reviewed by a wildlife damage management biologist, which has been designed for the geographic location to reduce the attractiveness to hazardous wildlife for landscaping airport property.

c. **Airports surrounded by wildlife habitat.** The FAA recommends that operators of airports surrounded by woodlands, water, or wetlands refer to Section 2.4 of this AC. Operators of such airports should provide for a Wildlife Hazard Assessment (WHA) conducted by a wildlife damage management biologist. This WHA is the first step in preparing a WHMP, where required.

d. **Other hazardous wildlife attractants.** Other specific land uses or activities (e.g., sport or commercial fishing, shellfish harvesting, etc.), perhaps unique to certain regions of the country, have the potential to attract hazardous wildlife. Regardless of the source of the attraction, when hazardous wildlife is noted on a public-use airport, airport operators must take prompt remedial action(s) to protect aviation safety.

2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES. There may be circumstances where two (or more) different land uses that would not, by themselves, be considered hazardous wildlife attractants or that are located outside of the separations identified in Sections 1-2 through 1-4 that are in such an alignment with the airport as to create a wildlife corridor directly through the airport and/or surrounding airspace. An example of this situation may involve a lake located outside of the separation criteria on the east side of an airport and a large hayfield on the west side of an airport, land uses that together could create a flyway for Canada geese directly across the airspace of the airport. There are numerous examples of such situations;

therefore, airport operators and the wildlife damage management biologist must consider the entire surrounding landscape and community when developing the WHMP.

SECTION 3.

PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS.

3.1. INTRODUCTION. In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, the FAA may require the development of a Wildlife Hazard Management Plan (WHMP) when specific triggering events occur on or near the airport. Part 139.337 discusses the specific events that trigger a Wildlife Hazard Assessment (WHA) and the specific issues that a WHMP must address for FAA approval and inclusion in an Airport Certification Manual.

3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS. The FAA will use the Wildlife Hazard Assessment (WHA) conducted in accordance with Part 139 to determine if the airport needs a WHMP. Therefore, persons having the education, training, and expertise necessary to assess wildlife hazards must conduct the WHA. The airport operator may look to Wildlife Services or to qualified private consultants to conduct the WHA. When the services of a wildlife damage management biologist are required, the FAA recommends that land-use developers or airport operators contact a consultant specializing in wildlife damage management or the appropriate state director of Wildlife Services.

NOTE: Telephone numbers for the respective USDA Wildlife Services state offices can be obtained by contacting USDA Wildlife Services Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD, 20737-1234, Telephone (301) 734-7921, Fax (301) 734-5157 *(http://www.aphis.usda.gov/ws/)*.

3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL. This manual, prepared by FAA and USDA Wildlife Services staff, contains a compilation of information to assist airport personnel in the development, implementation, and evaluation of WHMPs at airports. The manual includes specific information on the nature of wildlife strikes, legal authority, regulations, wildlife management techniques, WHAs, WHMPs, and sources of help and information. The manual is available in three languages: English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov/. This manual only provides a starting point for addressing wildlife hazard issues at airports. Hazardous wildlife management is a complex discipline and conditions vary widely across the United States. Therefore, qualified wildlife damage management biologists must direct the development of a WHMP and the implementation of management actions by airport personnel.

There are many other resources complementary to this manual for use in developing and implementing WHMPs. Several are listed in the manual's bibliography.

3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139. Part 139.337(b) requires airport operators to conduct a Wildlife Hazard Assessment (WHA) when certain events occur on or near the airport.

Part 139.337 (c) provides specific guidance as to what facts must be addressed in a WHA.

3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP). The FAA will consider the results of the WHA, along with the aeronautical activity at the airport and the views of the airport operator and airport users, in determining whether a formal WHMP is needed, in accordance with Part 139.337. If the FAA determines that a WHMP is needed, the airport operator must formulate and implement a WHMP, using the WHA as the basis for the plan.

The goal of an airport's Wildlife Hazard Management Plan is to minimize the risk to aviation safety, airport structures or equipment, or human health posed by populations of hazardous wildlife on and around the airport.

The WHMP must identify hazardous wildlife attractants on or near the airport and the appropriate wildlife damage management techniques to minimize the wildlife hazard. It must also prioritize the management measures.

3-6. LOCAL COORDINATION. The establishment of a Wildlife Hazards Working Group (WHWG) will facilitate the communication, cooperation, and coordination of the airport and its surrounding community necessary to ensure the effectiveness of the WHMP. The cooperation of the airport community is also necessary when new projects are considered. Whether on or off the airport, the input from all involved parties must be considered when a potentially hazardous wildlife attractant is being proposed. Airport operators should also incorporate public education activities with the local coordination efforts because some activities in the vicinity of your airport, while harmless under normal leisure conditions, can attract wildlife and present a danger to aircraft. For example, if public trails are planned near wetlands or in parks adjoining airport property, the public should know that feeding birds and other wildlife in the area may pose a risk to aircraft.

Airport operators should work with local and regional planning and zoning boards so as to be aware of proposed land-use changes, or modification of existing land uses, that could create hazardous wildlife attractants within the separations identified in Sections 1-2 through 1-4. Pay particular attention to proposed land uses involving creation or expansion of waste water treatment facilities, development of wetland mitigation sites, or development or expansion of dredge spoil containment areas. At the very least, airport operators must ensure they are on the notification list of the local planning board or equivalent review entity for all communities located within 5 miles of the airport, so they will receive notification of any proposed project and have the opportunity to review it for attractiveness to hazardous wildlife.

3-7 COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS. If an existing land-use practice creates a wildlife hazard and the land-use practice or wildlife hazard cannot be immediately eliminated, airport operators must issue a Notice to Airmen (NOTAM) and encourage the land–owner or manager to take steps to control the wildlife hazard and minimize further attraction.

SECTION 4.

FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS

4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS.

a. The FAA discourages the development of waste disposal and other facilities, discussed in Section 2, located within the 5,000/10,000-foot criteria specified in Sections 1-2 through 1-4.

b. For projects that are located outside the 5,000/10,000-foot criteria but within 5 statute miles of the airport's AOA, the FAA may review development plans, proposed land-use changes, operational changes, or wetland mitigation plans to determine if such changes present potential wildlife hazards to aircraft operations. The FAA considers sensitive airport areas as those that lie under or next to approach or departure airspace. This brief examination should indicate if further investigation is warranted.

c. Where a wildlife damage management biologist has conducted a further study to evaluate a site's compatibility with airport operations, the FAA may use the study results to make a determination.

4-2. WASTE MANAGEMENT FACILITIES.

a. Notification of new/expanded project proposal. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) limits the construction or establishment of new MSWLF within 6 statute miles of certain public-use airports, when both the airport and the landfill meet very specific conditions. See Section 2-2 of this AC and AC 150/5200-34 for a more detailed discussion of these restrictions.

The Environmental Protection Agency (EPA) requires any MSWLF operator proposing a new or expanded waste disposal operation within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal (40 CFR 258, *Criteria for Municipal Solid Waste Landfills*, Section 258.10, *Airport Safety*). The EPA also requires owners or operators of new MSWLF units, or lateral expansions of existing MSWLF units, that are located within 10,000 feet of any airport runway end used by turbojet aircraft, or within 5,000 feet of any airport runway end used only by piston-type aircraft, to demonstrate successfully that such units are not hazards to aircraft. (See 4-2.b below.)

When new or expanded MSWLF are being proposed near airports, MSWLF operators must notify the airport operator and the FAA of the proposal as early as possible pursuant to 40 CFR 258.

b. Waste handling facilities within separations identified in Sections 1-2 through 1-4. To claim successfully that a waste-handling facility sited within the separations identified in Sections 1-2 through 1-4 does not attract hazardous wildlife and does not threaten aviation, the developer must establish convincingly that the facility will not handle putrescible material other than that as outlined in 2-2.d. The FAA strongly recommends against any facility other than that as outlined in 2-2.d (enclosed transfer stations). The FAA will use this information to determine if the facility will be a hazard to aviation.

c. Putrescible-Waste Facilities. In their effort to satisfy the EPA requirement, some putrescible-waste facility proponents may offer to undertake experimental measures to demonstrate that their proposed facility will not be a hazard to aircraft. To date, no such facility has been able to demonstrate an ability to reduce and sustain hazardous wildlife to levels that existed before the putrescible-waste landfill began operating. For this reason, demonstrations of experimental wildlife control measures may not be conducted within the separation identified in Sections 1-2 through 1-4.

4-3. OTHER LAND-USE PRACTICE CHANGES. As a matter of policy, the FAA encourages operators of public-use airports who become aware of proposed land use practice changes that may attract hazardous wildlife within 5 statute miles of their airports to promptly notify the FAA. The FAA also encourages proponents of such land use changes to notify the FAA as early in the planning process as possible. Advanced notice affords the FAA an opportunity (1) to evaluate the effect of a particular land-use change on aviation safety and (2) to support efforts by the airport sponsor to restrict the use of land next to or near the airport to uses that are compatible with the airport.

The airport operator, project proponent, or land-use operator may use FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, or other suitable documents similar to FAA Form 7460-1 to notify the appropriate FAA Regional Airports Division Office. Project proponents can contact the appropriate FAA Regional Airports Division Office for assistance with the notification process.

It is helpful if the notification includes a 15-minute quadrangle map of the area identifying the location of the proposed activity. The land-use operator or project proponent should also forward specific details of the proposed land-use change or operational change or expansion. In the case of solid waste landfills, the information should include the type of waste to be handled, how the waste will be processed, and final disposal methods.

a. Airports that have received Federal grant-in-aid assistance. Airports that have received Federal grant-in-aid assistance are required by their grant assurances to take appropriate actions to restrict the use of land next to or near the airport to uses that are compatible with normal airport operations. The FAA recommends that airport operators to the extent practicable oppose off-airport land-use changes or practices within the separations identified in Sections 1-2 through 1-4 that may attract hazardous wildlife. Failure to do so may lead to noncompliance with applicable grant assurances. The FAA will not approve the placement of airport

development projects pertaining to aircraft movement in the vicinity of hazardous wildlife attractants without appropriate mitigating measures. Increasing the intensity of wildlife control efforts is not a substitute for eliminating or reducing a proposed wildlife hazard. Airport operators should identify hazardous wildlife attractants and any associated wildlife hazards during any planning process for new airport development projects.

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APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. **GENERAL.** This appendix provides definitions of terms used throughout this AC.

    1. **Air operations area.** Any area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved areas or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiways, or apron.

    2. **Airport operator.** The operator (private or public) or sponsor of a public-use airport.

    3. **Approach or departure airspace.** The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

    4. **Bird balls.** High-density plastic floating balls that can be used to cover ponds and prevent birds from using the sites.

    5. **Certificate holder.** The holder of an Airport Operating Certificate issued under Title 14, Code of Federal Regulations, Part 139.

    6. **Construct a new MSWLF.** To begin to excavate, grade land, or raise structures to prepare a municipal solid waste landfill as permitted by the appropriate regulatory or permitting agency.

    7. **Detention ponds.** Storm water management ponds that hold storm water for short periods of time, a few hours to a few days.

    8. **Establish a new MSWLF.** When the first load of putrescible waste is received on-site for placement in a prepared municipal solid waste landfill.

    9. **Fly ash.** The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

    10. **General aviation aircraft.** Any civil aviation aircraft not operating under 14 CFR Part 119, Certification: Air Carriers and Commercial Operators.

    11. **Hazardous wildlife.** Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard

    12. **Municipal Solid Waste Landfill (MSWLF).** A publicly or privately owned discrete area of land or an excavation that receives household waste and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under 40 CFR § 257.2. An MSWLF may receive

other types wastes, such as commercial solid waste, non-hazardous sludge, small-quantity generator waste, and industrial solid waste, as defined under 40 CFR § 258.2. An MSWLF can consist of either a stand alone unit or several cells that receive household waste.

13. **New MSWLF.** A municipal solid waste landfill that was established or constructed after April 5, 2001.

14. **Piston-powered aircraft.** Fixed-wing aircraft powered by piston engines.

15. **Piston-use airport.** Any airport that does not sell Jet-A fuel for fixed-wing turbine-powered aircraft, and primarily serves fixed-wing, piston-powered aircraft. Incidental use of the airport by turbine-powered, fixed-wing aircraft would not affect this designation. However, such aircraft should not be based at the airport.

16. **Public agency.** A State or political subdivision of a State, a tax-supported organization, or an Indian tribe or pueblo (49 U.S.C. § 47102(19)).

17. **Public airport.** An airport used or intended to be used for public purposes that is under the control of a public agency; and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft is publicly owned (49 U.S.C. § 47102(20)).

18. **Public-use airport.** An airport used or intended to be used for public purposes, and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft may be under the control of a public agency or privately owned and used for public purposes (49 U.S.C. § 47102(21)).

19. **Putrescible waste.** Solid waste that contains organic matter capable of being decomposed by micro-organisms and of such a character and proportion as to be capable of attracting or providing food for birds (40 CFR §257.3-8).

20. **Putrescible-waste disposal operation.** Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

21. **Retention ponds.** Storm water management ponds that hold water for several months.

22. **Runway protection zone (RPZ).** An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the airport design, aircraft, type of operation, and visibility minimum.

23. **Scheduled air carrier operation.** Any common carriage passenger-carrying operation for compensation or hire conducted by an air carrier or commercial

operator for which the air carrier, commercial operator, or their representative offers in advance the departure location, departure time, and arrival location. It does not include any operation that is conducted as a supplemental operation under 14 CFR Part 119 or as a public charter operation under 14 CFR Part 380 (14 CFR § 119.3).

24. **Sewage sludge.** Any solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and a material derived from sewage sludge. Sewage does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works. (40 CFR 257.2)

25. **Sludge.** Any solid, semi-solid, or liquid waste generated form a municipal, commercial or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility or any other such waste having similar characteristics and effect. (40 CFR 257.2)

26. **Solid waste.** Any garbage, refuse, sludge, from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded material, including, solid liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or by product material as defined by the Atomic Energy Act of 1954, as amended, (68 Stat. 923). (40 CFR 257.2)

27. **Turbine-powered aircraft.** Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft rotary-wing aircraft.

28. **Turbine-use airport.** Any airport that sells Jet-A fuel for fixed-wing turbine-powered aircraft.

29. **Wastewater treatment facility.** Any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1987 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. (See 40 CFR Section 403.3 (q), (r), & (s)).

30. Wildlife. Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring thereof (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, wildlife includes feral animals and domestic animals out of the control of their owners (14 CFR Part 139, Certification of Airports).

31. Wildlife attractants. Any human-made structure, land-use practice, or human-made or natural geographic feature that can attract or sustain hazardous wildlife within the landing or departure airspace or the airport's AOA. These attractants can include architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquaculture activities, surface mining, or wetlands.

32. Wildlife hazard. A potential for a damaging aircraft collision with wildlife on or near an airport.

33. Wildlife strike. A wildlife strike is deemed to have occurred when:

a. A pilot reports striking 1 or more birds or other wildlife;

b. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;

c. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;

d. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified;

e. The animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Transport Canada, Airports Group, *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994).

2. RESERVED.

APPENDIX E
NOISE

APPENDIX E
NOISE

E.1 GENERAL

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in an urban or suburban surrounding, where noise from interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., aircraft noise) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The measurement and human perception of sound involves two basic physical characteristics - intensity and frequency. Intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The higher the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is sound frequency, that is, the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.

The loudest sounds, which can be detected comfortably by the human ear, have intensities that are a trillion times larger than those of sounds that can be detected at the lower end of the spectrum. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels behaves differently than that of ordinary numbers, such an addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that what is really happening when decibel values are added is each decibel value is first converted to its corresponding acoustic energy, then the energies are added using the normal rules of addition, and finally the total energy is converted to its decibel equivalent.

An important facet of decibel addition arises later when the concept of time-average sound levels is introduced to explain Day-Night Average A-Weighted Sound Level (DNL). Because of the logarithmic units, the louder levels that occur during the averaging period dominate the time-average sound levels. As a simple example, consider a sound level that is 100 dB and lasts for 30 seconds, followed by a sound level of 50 dB that also lasts for 30 seconds. The time-average sound level over the total 60-second period is 97 dB, not 75 dB.

Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the preferred scientific unit for cps. The normal human ear can detect sounds that range in frequency from about 20 Hz to about 15,000 Hz. Not all sounds in this wide range of frequencies, however, are heard equally well by the human ear, which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. In measuring community noise, this frequency dependence is taken into account by adjusting the sound levels of the very high and low frequencies to approximate the human ear's lower sensitivity to those frequencies. This is called "A-weighting" and is commonly used in measurements of community environmental noise.

Sound levels measured using A-weighting are most properly called A-weighted sound levels while sound levels measured without any frequency weighting are most properly called sound levels. However, since most environmental impact analysis documents deal only with A-weighted sound levels, the adjective "A-weighted" is often omitted, and A-weighted sound levels are referred to simply as sound levels. In some instances, it will be indicated that the sound

levels have been A-weighted by using the abbreviation dBA or dB(A), rather than the abbreviation dB, for decibel. As long as the use of A-weighting is understood to be used, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the units dB, dBA, and dB(A).

In this document and most Air Installation Compatible Use Zone (AICUZ) documents, all sound levels are A-weighted sound levels and the adjective "A-weighted" has been omitted and dB is used for the decibel units.

Sound levels do not represent instantaneous measurements but rather averages over short periods of time. Two measurement time periods are most commonly used - one second and one-eighth of a second. Most environmental noise studies use slow response measurements, and the adjective "slow response" is usually omitted. It is easy to understand why the proper descriptor "slow response A-weighted sound level" is usually shortened to "sound level" in environmental impact analysis documents.

E.2 NOISE METRICS

A "metric" is defined as something "of, involving, or used in measurement." In environmental noise analyses, a metric refers to the unit or quantity that quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics as individual researchers have attempted to understand and represent the effects of noise. As a result, past literature describing environmental noise abatement has included many different metrics.

Various federal agencies involved in environmental noise mitigation agree on common metrics for environmental impact analysis documents, and both the Department of Defense (DoD) and the Federal Aviation Administration (FAA) specified those that should be used for federal aviation noise assessments. These metrics are as follows.

E.2.1 MAXIMUM SOUND LEVEL

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on *(e.g.*, an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is usually abbreviated by ALM, $L_{max,}$ or L_{Amax}.

E.2.2 SOUND EXPOSURE LEVEL

Individual time-varying noise events have two main characteristics - a sound level which changes throughout the event and a period of time during which the event is heard. Although the

maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (abbreviated SEL or L_{AE}) combines both of these characteristics into a single metric.

SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as did the actual time-varying noise event. Since aircraft overflights usually last longer than 1 second, the SEL of an overflight is usually greater than the ALM of the overflight.

Note that sound exposure level is a composite metric that represents both the intensity of a sound level of the constant sound and its duration. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that SEL measures this impact much more reliably than just the ALM.

Because the SEL and the ALM are both A-weighted sound levels expressed in decibels, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

E.2.3 DAY-NIGHT AVERAGE SOUND LEVEL

Time-average sound levels are measurements of sound levels that are averaged over a specified length of time. These levels provide a measure of the average sound energy during the measurement period.

For the evaluation of community noise effects, and particularly aircraft noise effects, the DNL (mathematically represented as L_{dn}) is used. DNL averages aircraft sound levels at a location over a complete 24-hour period, with a 10-dB adjustment added to those noise events that take place between 10 p.m. and 7 a.m. (local time). This 10-dB "penalty" represents the added intrusiveness of sounds that occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours.

As noted earlier for SEL, DNL does not represent the sound level heard at any particular time. DNL provides a single measure of overall noise impact, but does not provide specific information on the number of noise events or the individual sound levels that occur during the day. For example, a DNL of 65 dB could result from a very few noisy events, or a large number of quieter events.

Scientific studies and social surveys that have been conducted to evaluate community annoyance to all types of environmental noise have found the DNL to be the best measure to predict annoyance. Its use is endorsed by the scientific community (see References E.1 through E.5 at the end of this section).

There is, in fact, a remarkable consistency in the results of attitudinal surveys about aircraft noise conducted in different countries to find the percentages of groups of people who express various degrees of annoyance when exposed to different levels of DNL.

Reference E.6 was published in 1978. A more recent study has reaffirmed this relationship (Reference E.7). In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise can be predicted quite reliably using DNL.

This relation between community annoyance and DNL has been confirmed, even for infrequent aircraft noise events. Reference E.8 reported the reactions of individuals in a community to daily helicopter overflights correlated quite well with the daily time-average sound levels over this range of numbers of daily noise events.

The use of DNL has been criticized as not accurately representing community annoyance and land use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the basis for the measurement or calculation of L_{dn}. One frequent criticism is based on the principle that people inherently react more to single noise events and not as much to "meaningless" time-average sound levels.

In fact, a time-average noise metric, such as DNL, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.5 dB. Assume, as a second example, that ten such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period

does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-average sound metric, and specifically the DNL.

E.3 NOISE EFFECTS

E.3.1 HEARING LOSS

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period. An outdoor DNL of 75 dBA is considered the threshold above which the risk of hearing loss should be evaluated. Following guidelines recommended by the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research Council, the average change in the threshold of hearing for people exposed to DNL equal to or greater than 75 dBA was evaluated. Results indicated that an average of 1 dBA hearing loss could be expected for people exposed to DNL equal to or greater than 75 dBA. For the most sensitive 10 percent of the exposed population, the maximum anticipated hearing loss would be 4 dBA. These hearing loss projections must be considered conservative as the calculations are based on an average daily outdoor exposure of 16 hours (7 a.m. to 10 p.m.) over a 40-year period. Since it is unlikely that airport neighbors will remain outside their homes 16 hours per day for extended periods of time, there is little possibility of hearing loss below a DNL of 75 dB, and this level is extremely conservative.

E.3.2 NONAUDITORY HEALTH EFFECTS

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have never been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institute of Health Conference on Noise and Hearing Loss, held on 22-24 January 1990 in Washington, D.C.

> "The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day). At the recent (1988) International Congress on Noise as a Public Health Problem, most studies

> attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place." (Reference E.9; parenthetical wording added for clarification.)

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies which purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles (UCLA) researchers apparently found a relationship between aircraft noise levels under the approach path to Los Angeles International Airport and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Reference E.10). Nevertheless, three other UCLA professors analyzed those same data and found no relationship between noise exposure and mortality rates (Reference E.11).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft DNL below 75 dB.

E.3.3 ANNOYANCE

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the United States Environmental Protection Agency (USEPA) as any negative subjective reaction on the part of an individual or group (Reference E.3). As noted in the discussion of DNL above, community annoyance is best predicted by that metric.

It is often suggested that a lower DNL, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for airport environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a DNL of 65 dB:

- provides a valid basis for comparing and assessing community noise effects;
- represents a noise exposure level which is normally dominated by aircraft noise and not other community or nearby highway noise sources; and

- reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.

- United States Department of Housing and Urban Development also establishes a DNL standard of 65 dB for eligibility for federally guaranteed home loans.

E.3.4 SPEECH INTERFERENCE

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication" (Reference E.5). A steady A-weighted background sound level of 60 dB will produce 93 percent intelligibility; that of 70 dB will produce 66 percent intelligibility; and that of 75 dB will produce 2 percent intelligibility (Figure D-1 in Reference E.3).

E.3.5 SLEEP INTERFERENCE

Sleep interference may be measured in either of two ways. "Arousal" represents actual awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat louder noise level than does a change in sleep stage.

A recent analysis sponsored by the Air Force summarized 21 published studies concerning the effects of noise on sleep (Reference E.14). The analysis concluded that a lack of reliable studies in homes, combined with large differences among the results from the various laboratory studies and the limited in-home studies, did not permit development of an acceptable accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced in the home. None of the laboratory studies was of sufficiently long duration to determine any effects of habituation, such as those that would occur under normal community conditions.

Nevertheless, some guidance is available in judging sleep interference. The USEPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference (Reference E.3). Assuming a very conservative structural noise insulation of 20 dB for typical dwelling units, this corresponds to an outdoor DNL of 65 dB as minimizing sleep interference.

The Federal Interagency Committee on Noise (Reference E.5) reviewed the sleep disturbance issue and presented an Air Force-developed sleep disturbance dose-response prediction curve, which is based on data from Reference E.14, as an interim tool for analysis of potential sleep disturbance. This interim curve shows that for an indoor SEL of 65 dB, approximately 15 percent or less of those exposed should be awakened.

E.3.6 NOISE EFFECTS ON DOMESTIC ANIMALS AND WILDLIFE

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions. Secondary effects may include nonauditory effects similar to those exhibited by humans - stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

Many scientific studies are available regarding the effects of noise on wildlife and some anecdotal reports of wildlife "flight due to noise." Few of these studies or reports include any reliable measures of the actual noise levels involved.

In the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics proposed that protective noise criteria for animals be taken to be the same as for humans (Reference E.16).

E.3.7 EFFECTS OF NOISE-INDUCED VIBRATION ON STRUCTURES AND HUMANS

The sound from an aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some of the energy lost in the airspace. This surface then radiates sound into the dwelling interior. Vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressure impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of structural damage. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other

frequencies, conservatively, only sounds lasting more than 1 second above a sound level of 130 dB are potentially damaging to structural components (Reference E.17).

In terms of average acceleration of wall or ceiling vibration, the thresholds for structural damage (E.18) are:

- 0.5 meters/sec/sec—threshold of risk of damage to sensitive structures (e.g., ancient monuments); and
- meters/sec/sec—threshold of risk of damage to normal dwellings (e.g., houses with plaster ceilings and walls).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle," of objects within the dwelling - hanging pictures, dishes, plaques, and bric-a-brac. Loose windowpanes may also vibrate noticeably when exposed to high levels of aircraft noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally compatible with residential land use. Thus, assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

In the assessment of vibrations on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

- Type of excitation: steady state, intermittent, or impulsive vibration;
- Frequency of the excitation. ISO 2631-2 (Reference E.18) recommends a frequency range of 1 to 80 Hz for the assessment of vibration on humans;
- Orientation of the body with respect to the vibration;
- The use of the occupied space; and
- Time of day.

E.3.8 NOISE EFFECTS ON TERRAIN

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

E.3.9 NOISE EFFECTS ON HISTORICAL AND ARCHAEOLOGICAL SITES

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde airplane at Dulles (Reference E.19). There was a special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning.

As noted above for the noise effects of noise-induced vibrations of normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

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APPENDIX F
NOISE LEVEL REDUCTION GUIDELINES

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NOISE LEVEL REDUCTION GUIDELINES

In April 2005, Wyle Labs published a study for the Naval Facilities Engineering Command titled, "Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations". The study provides an in-depth, state-of-the-art noise level reduction guidelines. Copies of this study are available on-line at: http://afcee.af.mil/shared/media/document/AFD-070914-039.pdf

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