

**EGLIN AIR FORCE BASE
Florida**

TEST AREA C-74 COMPLEX

**FINAL PROGRAMMATIC
ENVIRONMENTAL ASSESSMENT**



October 2002

Report Documentation Page

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FINDING OF NO SIGNIFICANT IMPACT
Programmatic Environmental Assessment
For the Test Area C-74 Complex
of the
Air Armament Center
Eglin AFB, Fl
RCS 00-798

The Air Armament Center at Eglin Air Force Base, Florida, is proposing to authorize an increased level of military test and training activities on the Test Area (TA) C-74 Complex, composed of C-74, C-74A and C-74L. This test area complex is located in the northeastern quadrant of the Eglin Military Range Complex and is composed of TA C-74 (Kinetic Energy Munitions Test Facility), C-74A (Munitions Analysis Facility) and C-74L (Gunnery Ballistics Facility). The C-74A component of the complex is used primarily to analyze the internal conditions of munitions items through non-destructive techniques. It also serves to store munitions for Eglin test areas in the vicinity. During the baseline period (FY97-98), the open-air range components of the TA C-74 Complex (C-74 and C-74L) supported approximately 400 test and training missions.

The Proposed Action is for the 46th Test Wing Commander to establish an authorized level of activity at these test areas based upon an anticipated increased use. While four alternatives were developed for analysis, the proposed action is to authorize the level of activity described in Alternative 4. The alternatives are as follows:

- Alternative 1: (No Action): Maintain average level of activity (FY97-98 Range Utilization Reports, plus significant historical use);
- Alternative 2: Authorize activity at the baseline level (Alternative 1);
- Alternative 3: Authorize the activities contained in Alternative 2 and add a series of Best Management Practices designed to minimize potential environmental impacts resulting from these activities;
- Alternative 4: Authorize the activities contained in Alternative 3, adding a 200% increase in all mission activities to support the surge required for contingencies.

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS

The primary focus of the Programmatic Environmental Assessment was to address subject areas with the greatest likelihood for potential environmental impacts. In each case, through analysis of available literature and empirical and sampling/analysis experience at Eglin as well as other locations, it was determined that selection of the preferred alternative would not result in significant impacts.

Relevant Environmental Documents used in the preparation of this Programmatic Environmental Assessment:

- Eglin AFB Range Utilization Report - FY95-99
- Test Area C-74 Complex Environmental Baseline Document, 2000
- Effector Analysis Report, 1996
- Effector Characterization Report, 1996
- Outdoor Recreation, Hunting and Fresh Water Fishing Map and Regulations, 1998-1999, Eglin AFB.

BASIS FOR FINDING OF NO SIGNIFICANT IMPACT:

The Programmatic Environmental Assessment for the Test Area C-74 Complex has been conducted in accordance with the requirements of the National Environmental Policy Act, the Council on Environmental Quality Regulations and 32 CFR 989.

The Air Armament Center's Environmental Management Directorate (AAC/EM) and the 46th Test Wing are in the process of completing the following consultations and permit actions to enable timely recovery of test items that may accidentally come to rest in waters of the State of Florida at Test Area C-74:


- an Endangered Species Act (Section 7) consultation through the Natural Resources Management Branch (AAC/EMSN) with the US Fish & Wildlife Service.
- a Joint Application for Works in the Waters of the State (Section 404 of the Clean Water Act and Dredge and Fill Activities, 62-312 Florida Administrative Code) through the Environmental Compliance Branch (AAC/EMCE) with the Florida Department of Environmental Protection and US Army Corps of Engineers.

This FONSI is subject to the results of these consultation and permit actions.

Based on this assessment, it was determined that selection of Alternative 4, the preferred alternative, for the Test Area C-74 Complex would have no significant individual or cumulative impact upon the human or natural environment.

Therefore, an Environmental Impact Statement is not warranted and will not be prepared.

DATE 18 Aug 03


ROBERT W. CHEDISTER
Major General, USAF
Commander, Air Armament Center

TEST AREA C-74 COMPLEX

**FINAL PROGRAMMATIC
ENVIRONMENTAL ASSESSMENT**

Prepared for:

AAC

46 TW/XPE

**Range Environmental Planning Office
Eglin Air Force Base, FL 32542-6808**

RCS 00-798

October 2002



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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

46 OG/OGMT	46 th Operations Group/Weapons Test Flight
AAC	Air Armament Center
AAC/EMH	Cultural Resources Division of Environmental Management Directorate
AAC/EMSN	Natural Resources Branch, Stewardship Division of Environmental Management Directorate
AAC/SEU	Range Safety Office
ACE	Army Corps of Engineers
AFB	Air Force Base
AFDTC	Air Force Development Test Center
AGL	Above Ground Level
Al	Aluminum
AMRAAM	Advanced Medium Range Air-to-Air Missile
AOC	Area of Concern
AOI	Area of Influence
AP	Armor Piercing
AUP	Advanced Unitary Penetrator
Ba	Barium
BDA	Bomb Damage Assessment
BLU	Bomb Live Unit
BMP	Best Management Practices
C	Centigrade
CAA	Clean Air Act
CALCM	Conventional Air Launched Cruise Missile
CATEX	Categorically Excluded
CEC	Cation Exchange Capacity
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Cl₂	Chlorine
CO	Carbon Monoxide
CO₂	Carbon Dioxide
Cu	Copper
dB	Decibels
dBp	Pressure Weighted Decibels
DoD	Department of Defense
DOPAA	Description of Proposed Action and Alternatives
DU	Depleted Uranium
EA	Environmental Assessment
EAR	Effector Analysis Report
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FA	Floridan Aquifer
FCT	Foreign Comparative Test
FDEP	Florida Department of Environmental Protection
FFWCC	Florida Fish and Wildlife Conservation Commission
FMU	Fuzed Munitions Unit
FNAI	Florida Natural Areas Inventory
FONSI	Finding of No Significant Impact
FY	Fiscal Year
g	Grams
g/cm³	Grams per cubic centimeter
GB	Gun Bay
GBF	Gunnery Ballistic Facility

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS CONT'D

GBU	Guided Bomb Unit
GIS	Geographic Information System
GRIM	Gun Range Instrumentation Mobile
H₂	Hydrogen
H₂O	Water
H₂S	Hydrogen Sulfide
HCl	Hydrogen Chloride
HE	High Explosive
HEAT	High Explosive Anti-tank
HEDP	A foreign weapon
HEI	High Explosive Incendiary
HTW	Hardened Target Warhead
HVAR	High Velocity Air Rocket
IRP	Installation Restoration Program
IS	Intermediate System
JASSM	Joint Air-to-Surface Stand-off Missile
JAST	Joint Advanced Strike Technology
KEMTF	Kinetic Energy Munitions Test Facility
kg	Kilograms
lb	Pound
LOAEL	Lowest Observable Adverse Effects Level
LUU	Illuminating Unit (Flare)
m³	Cubic Meters
mg/kg	Milligram per kilogram
mg/L	Milligram per Liter
Mgal/d	Million Gallons per Day
mi²	Square Miles
Mk	Mark
MLRS	Multiple Launch Rocket System
MMTD	Miniaturized Munitions Technology Demonstration
MRTFB	Major Range Test Facility Base
MSL	Mean Seal Level
MSLE	Modified Soil Loss Equation
N₂	Nitrogen
NAPS	Noise Assessment Prediction System
NEPA	National Environmental Policy Act
NEW	Net Explosive Weight
ng	Nanograms
NO	Nitric Oxide
NO₂	Nitrogen Dioxide
O & M	Operation and Maintenance
OSHA	Occupational Safety and Health Act
pg	Picograms
Pb	Lead
PBX	Plastic Bonded Explosive
PEA	Programmatic Environmental Assessment
PGU	Precision Guided Unit
pH	Measurement of the basic or acid condition of a liquid
PM₁₀	10-micrometer Particulate Matter
RBC	Risk Based Criteria
RCA	Radiation Control Area
RCW	Red-cockaded Woodpecker
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
ROI	Region of Influence
RUT	Reusable Target

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS CONT'D

RW	Radioactive Waste
S	Sulfur
SA	Surficial Aquifer
SAIC	Science Applications International Corporation
SFS	SubFloridan System
SHPO	State Historical Preservation Officer
SPL	Sound Pressure levels
TA	Test Area
THI	Temperature-Humidity Index
TMD	Theater Missile Defense
TNT	2,4,6-Trinitrotoluene
TP	Target Practice
U	Uranium
µg/g	Micrograms per Gram
µg/kg	Micrograms per Kilogram
USAF	United States Air Force
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WGU	Weapons Guidance Unit
WHD	Warhead

1 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The Eglin Military Complex is a Department of Defense (DoD) Major Range Test Facility Base (MRTFB) that exists to support the DoD mission (Figure 1-1). Its primary function is to support research, development, test, and evaluation of conventional weapons and electronic systems. Its secondary function is to support training of operational units. The range is composed of four components:

- 1) Test Areas/Sites (Figure 1-2)
- 2) Interstitial Areas (areas beyond and between the test areas)
- 3) The Eglin Gulf Test Range
- 4) Airspace (over land and water)

The Air Force Air Armament Center (AAC) has responsibility for the Eglin Military Complex and for all its users, which include DoD, other government agencies, foreign countries, and private companies. For range operations, AAC provides environmental analyses and necessary National Environmental Policy Act (NEPA) documentation to ensure compliance with Air Force policy and applicable federal, state, and local environmental laws and regulations.

AAC includes two wings and four directorates that collectively operate, manage, and support all activities on the Eglin Military Complex. AAC accomplishes its range operations through the 46th Test Wing with support from the 96th Air Base Wing. The 46th Test Wing Commander is responsible for day-to-day scheduling, executing, and maintaining of this national asset. The continued DoD utilization of the Eglin Military Complex requires flexible and unencumbered access to land ranges and airspace, which support all of Eglin's operations. Eglin controls 127,868 square miles (mi²) of airspace, of which 2.5 percent (3,226 mi²) is over land and 97.5 percent (124,642 mi²) is over water as shown in Figure 1-1.

The 46th Test Wing is analyzing the cumulative environmental impacts of all current and anticipated future operations conducted on the TA C-74 Complex (Figure 1-2) in this Programmatic Environmental Assessment. The environmental analysis of TA C-74 Complex mission activities is part of the development of a range *Living Environmental Baseline* to support the diverse array of warfighters that use the Eglin Military Complex for research, development, testing, evaluation, and training. All mission operations (known as effectors) and physical and biological resources (known as receptors) are detailed within the *Test Area C-74 Complex Environmental Baseline Document*.

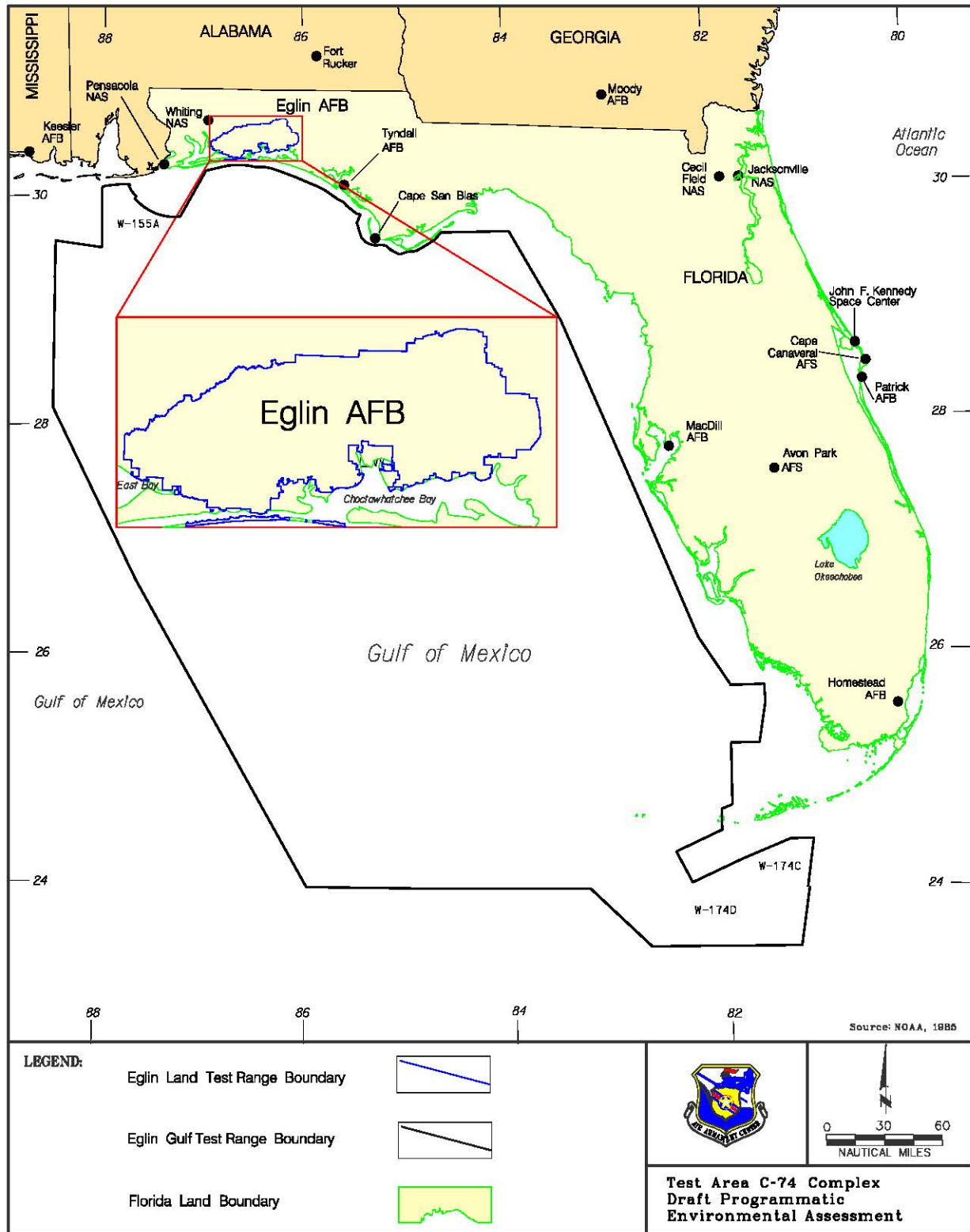


Figure 1-1. The Eglin Military Complex

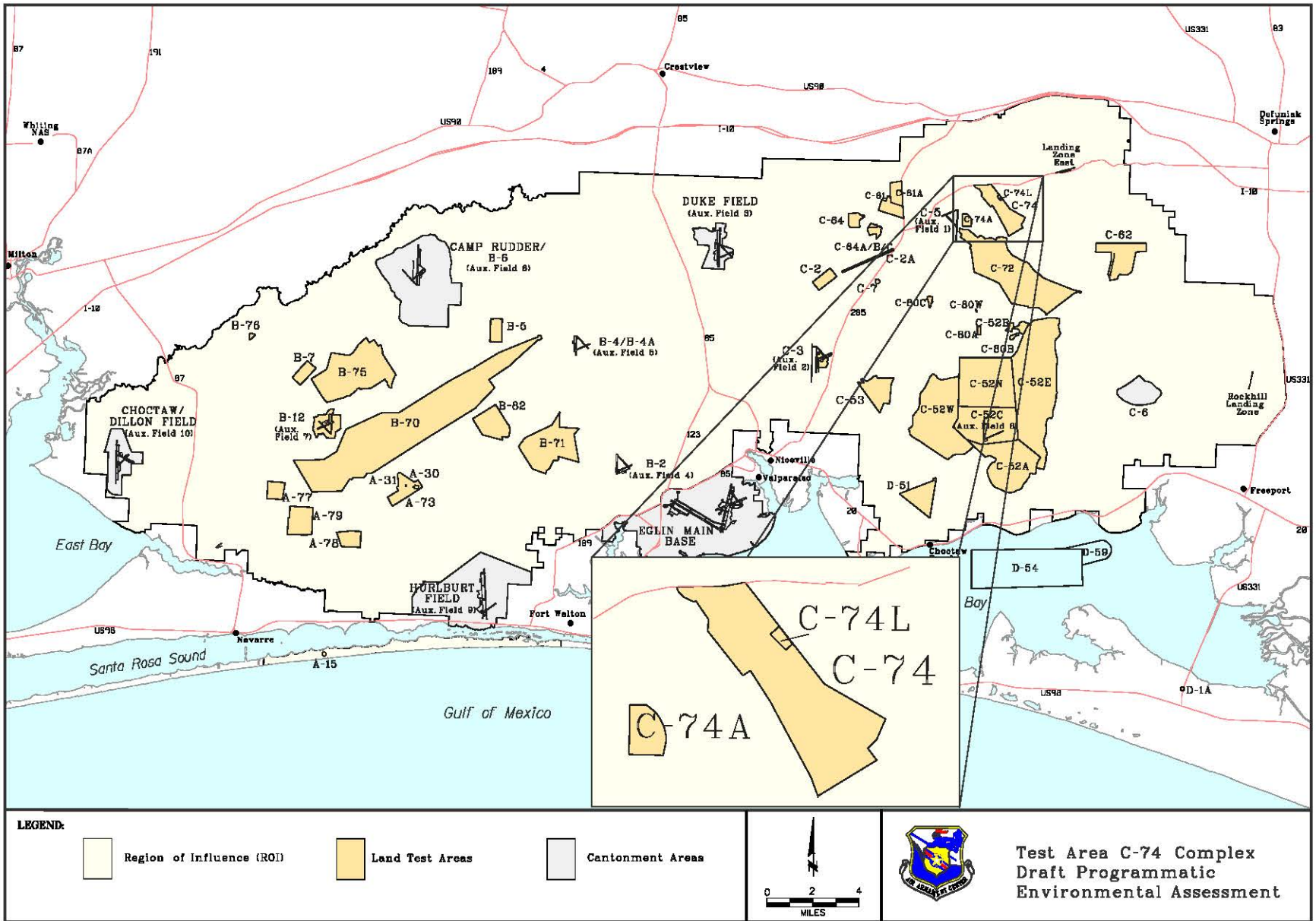


Figure 1-2. Eglin Land Test Areas and the TA C-74 Complex

1.2 PROPOSED ACTION

The **Proposed Action** is for the 46th Test Wing Commander to establish an authorized level of activity at the TA C-74 Complex based on an anticipated maximum usage with minimal environmental impacts. The purpose and need for this proposed action is two-fold. First, to quickly and efficiently process new programs requesting use of the land test areas during routine and crisis situations. The need associated with this purpose is to provide military users a quick response to priority needs during war or other significant military involvement, as well as improve the current approval process for routine uses. Second, to update the NEPA analysis by reevaluating the mission activities and by performing a cumulative environmental analysis of all mission activities. The need associated with this purpose is multifaceted and described below.

Eglin has performed environmental analyses on its mission activities on a case-by-case (i.e., each individual mission) basis since NEPA was enacted in 1970. Many of Eglin's mission activities have not ceased since the original environmental analyses were done to initiate the mission; thus no new environmental reviews have been required or performed. Currently, when approval for a new mission is requested, it may be categorically excluded from additional environmental analysis if it is similar in action to a mission that has been previously assessed and the assessment resulted in a finding of no significant environmental impact. The categorical exclusion (CATEX) designation is in accordance with NEPA and Air Force regulations (Council on Environmental Quality [CEQ] and AFI 32-7061).

Since some of these ongoing mission activities were originally assessed, and also since similar mission activities were assessed and CATEXed, changes have occurred at Eglin that could affect environmental analysis. These changes, outlined below, create a need to reevaluate the NEPA analysis individually and cumulatively.

- Additional species have been given federal and state protection status.
- Species have been discovered that were not previously known to exist at Eglin.
- Additional cultural resources have been discovered and documented.
- The population of communities along Eglin's borders has increased.
- Air Force regulations have changed.
- Military missions and weapons systems have evolved.

Additionally, with work performed during the 1990s by Eglin in conjunction with The Nature Conservancy, the Eglin ecosystems are better understood now than ever before.

Finally, while each mission has been analyzed individually, a cumulative analysis of potential environmental impacts from all mission activities has not been performed. The programmatic analysis performed in this report allows for a cumulative look at the impact on Eglin receptors from all mission activities. By implementing an authorized level of activity, sustainable range management will be streamlined and cumulative environmental impacts will be more fully considered.

1.3 SCOPE OF THE PROPOSED ACTION

The Test Area (TA) C-74 Complex is located on the eastern half of the Eglin Range Complex in Walton County, approximately 20 miles northeast of Eglin Main, as previously shown in Figure 1-2. The TA C-74 Complex is composed of TAs C-74, Kinetic Energy Munitions Test Facility, C-74A, Munitions Analysis Facility, and C-74L, Gunnery Ballistics Facility. TA C-74/74L is a 900-acre cleared test range approximately 2.5 miles long by 0.5 mile wide (U. S. Air Force, 1996). TA C-74A is used to store and analyze the internal condition of munitions items by nondestructive (X-ray) or destructive (sectioning) test techniques and to provide a temporary storage location for test munitions.

Mission activities on the TA C-74 Complex have been described in the *Test Area C-74 Complex Environmental Baseline Document* for the baseline period between FY95 and FY98. The baseline period TA C-74 Complex military mission testing operations are divided into three categories.

1.3.1 Sled Track Operations

Sled track operations utilize the Kinetic Energy Munitions Test Facility (KEMTF) located on TA C-74 (Figure 1-3). A typical testing event involves the attachment of a test item (usually an inert or live bomb or warhead) via straps to a “carrier sled,” while another “propelling sled” fitted with a number of rocket motors is placed directly behind the carrier sled. The propelling sled then moves the carrier sled along the sled track. The majority of tests involve delivery of munitions from the north end of the sled track to the south end. The rocket motors are remotely activated in stages along the sled track in order to achieve the desired speed for target impact. The ends of the sled track are equipped with blades that cut the straps, separating the test item from the sled. The test item is released from the sled and propelled forward into a target (usually consisting of concrete blocks of varying thickness weighing up to 160 tons) while the sled continues forward at a declination, eventually hitting a barrier before reaching the test target. Typically, inert test items pass through the target and continue down range, occasionally for thousands of feet. The test item is then recovered and taken to TA C-74A for analysis, the target is analyzed and removed, and the target area is cleaned of debris. Testing at the north end involves the RUT (Reusable Target), which is a building constructed to act as an underground bunker or chemical weapons facility. Both static testing (stationary detonation) and sled testing have been conducted using the RUT (Figure 1-3). Pictures of the sled track are provided in Appendix E.

1.3.2 Live Munition Detonations

Live munition detonations occur at the arena test area, located to the western side of the sled track (Figure 1-3) and at both ends of the sled track. Live munition detonations can be the end result of a sled track operation, where a live munition is delivered down the track and detonates upon exit of a target, either at the northwest end (the RUT) or the southeast end. Additionally, live munition detonations occur at the arena test area, where test items are either buried with or laid on top of targets and detonated. These types of tests are conducted to assess the damage potential of certain types of munitions on targets of varying thickness at varying depths and angles. Pictures of the sled track target area and arena test area are provided in Appendix E.

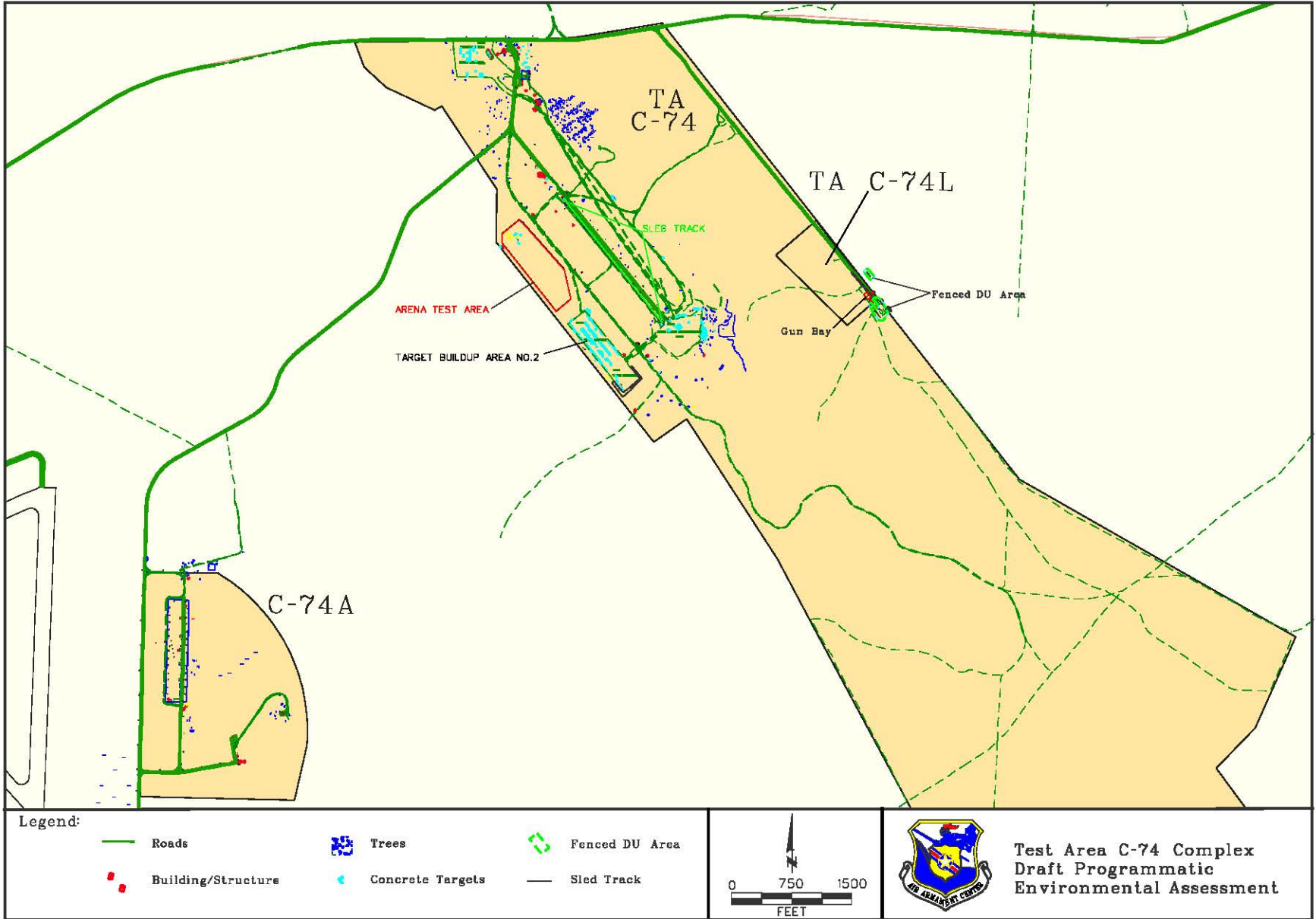


Figure 1-3. Areas of Mission Activity on the TA C-74 Complex

1.3.3 Gunnery Ballistics Testing

Gunnery ballistics testing takes place on both TA C-74 and TA C-74L. These activities are performed to evaluate the effectiveness of a weapon in penetrating and/or damaging targets. Typical gunnery ballistics testing on TA C-74 consists of warheads and scaled warhead fragment simulants that are launched from a gun into steel plates, concrete targets, or vehicles. These activities usually take place in the arena test area, shown in Figure 1-3. Gunnery ballistics testing on TA C-74L involves various caliber rounds using an automatic Gatling gun fired from the gun bay located at TA C-74L into a sand-filled gun-butt (Figure 1-3). Before testing the ammunition with the automatic gun, target practice (TP) rounds are fired as a single shot, manually fired from a “Mann gun” to calibrate instrumentation. Depleted uranium (DU) munitions testing was conducted at TA C-74L from 1973 to September of 1978. TA C-74L is no longer permitted for DU munitions testing, and, subsequently, DU munitions testing is no longer conducted at the TA C-74 Complex

1.4 DECISION DESCRIPTION

The 46th Test Wing wishes to authorize a level of activity for the land test areas, replacing the current approval process, which evaluates each program individually. A decision is to be made on the *level* of activity to be authorized. Currently, any new program that provides test area maintenance activities must anticipate at least a 60-day planning cycle. This period is required to complete the Test Directive, which includes the Method-of-Test, safety analysis and the environmental impact analysis. If the action does not qualify for a categorical exclusion, or if further environmental analysis is required, this process can be adjusted. **By authorizing a level of activity and analyzing the effects of this level of activity, future similar actions may be categorically excluded from further environmental analysis.** This will save both time and money in the review of proposed actions and will enable users to access the range more quickly and efficiently.

Procedures are in place that, in time of crisis, allow the AAC Commander to authorize an accelerated process. This process reduces planning time from 60 days to 3 days. These crisis procedures operate at the expense of all other work and cause major disruptions in the process. Authorization should streamline the environmental process, enhancing Eglin’s ability to quickly respond to high priority or crisis requirements.

1.5 ISSUES

Issues are the general categories used to distinguish the potential environmental impacts of the effectors on the receptors. Specifically, an issue is a mission effector product, by-product, and/or emission that may directly or indirectly impact the physical, biological and/or cultural environment receptors. A direct impact is a distinguishable, evident link between an action and the potential impact, whereas an indirect impact may occur later in time and/or may result from a direct impact. The five issues that were determined to be of potential consequence to the environments of the TA C-74 Complex include noise, chemical materials, habitat alteration, direct physical impact, and restricted access.

1.5.1 Noise

Noise is defined for the TA C-74 Complex as the unwanted sound produced by mission testing activities. Noise may directly inconvenience and/or stress humans and some wildlife species and may cause hearing loss or damage. Scientific data correlating the effects of noise on humans is well documented; however, information regarding the effects of noise events on wildlife species is limited. The impacts of noise to the public and on wildlife, particularly threatened and endangered species, are a primary concern.

Noise is produced on the TA C-74 Complex by sled track operations, live munition detonations, and gunnery ballistics testing. The environmental consequences analysis is twofold: 1) evaluate the potential impacts of mission noise events on the public and sensitive wildlife species, and 2) determine the influence of unfavorable weather conditions on individual noise events.

1.5.2 Chemical Materials

Chemical materials encompass liquid, solid, or gaseous substances that are released to the environment as a result of mission activities. These include organic and inorganic materials that can produce a chemical change or toxicological effect to an environmental receptor. Examples include gaseous air emissions (aircraft exhausts, smokes, combustion products of explosives), liquid materials (fuels and pesticides), and solid materials such as metals from ordnance and ammunition expenditures (zinc, copper, aluminum, and lead). The by-products of ordnance expenditures could potentially contaminate soil or underlying groundwater, or affect air quality.

Chemical materials primarily in the form of air emissions and metals were introduced to the environment of the TA C-74 Complex by sled track operations, live munition detonations, and gunnery ballistics testing. Potential air and soil pollutants produced by mission activity expenditures are evaluated during the environmental consequences analysis. The environmental analysis describes the amounts, extent, and concentration of chemical materials produced by these mission activities with regard to potential impacts to vegetation, sensitive wildlife species, and surface water and groundwater quality. The potential influences of the soil and water environment and food chain on the availability and translocation of chemical contaminants are also evaluated.

1.5.3 Direct Physical Impacts

Direct physical impact is the physical harm that can occur to an organism (plant or animal) or cultural resource as a result of mission activities. Examples include aircraft collisions with birds, vehicle-animal road collisions, crushing an organism by vehicle or foot traffic, and ordnance shrapnel or debris striking an organism. Direct physical impact is also a threat to prehistoric and historic cultural features; significant features, structures, artifacts, and site integrity may be damaged or lost due to physical disruptions. The mission activities of potential consequence to direct physical impacts on the TA C-74 Complex include:

- Sled Track Operations
 - Launching of test items down range
 - Recovery of test items
- Live Munition Detonations
 - Munition testing at the arena test area

1.5.4 Habitat Alteration

Habitat alterations characterize the physical damage, stress, or disruptions that may adversely alter or degrade the habitats of the TA C-74 Complex. A habitat in this instance refers to the ecologic and geomorphologic components, such as vegetation, soil, topography, and water that support organisms. Subsequent degradation of unique and diverse habitats may impact sensitive species. Examples of habitat alteration include soil erosion, sedimentation of aquatic habitats, physical changes in topography, wildfires, and physical stress, injury, or mortality to the biological components of habitats. The mission activities of potential consequence to the habitats of the TA C-74 Complex include:

- Sled Track Operations
 - Launching of test items down range
 - Recovery of test items
 - Sled track target area maintenance

1.5.5 Restricted Access

Restricted access is a decrease in the availability of Eglin resources to the public resulting from the temporary closure of test areas, interstitial/recreational areas, or public roads because of mission activities. Receptors potentially impacted include the military and the public desiring to use these areas. Guidance for restricted access is utilized to coordinate public and military use of airspace, water space (e.g., the Gulf of Mexico), and land areas within the Eglin region of influence (ROI). Test area mission activities that are of potential consequence to restricted access are sled track operations and live munition detonations due to areas that fall within the safety footprint of some missions.

1.6 FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

An Endangered Species Act (Section 7) programmatic biological assessment and consultation with the USFWS regarding the Okaloosa darter was completed in July 2002. The USFWS issued a Biological Opinion determining that test item recovery would likely kill or injure the darter. As a result, a number of terms and conditions were placed on test item recovery actions taking place within or near Rocky Creek. The Biological Opinion and the related terms and conditions are presented in Appendix I. Based on recommendations from the Florida State Historic Preservation Officer (SHPO), AAC/EMH is currently conducting a cultural resources survey in the C-74 Rocky Creek area. The results of this survey will determine the need for a National Historic Preservation Act (NHPA) Section 106 consultation with the SHPO. AAC has

also initiated a permit for test item recovery operations in wetland areas. TA C-74L falls under the Test Wing permit for low-level radioactive materials (for historical depleted uranium (DU) testing activities). However, this site is no longer active for DU testing, and Eglin is currently in the process of cleaning up the site and applying for a Nuclear Regulatory Commission decommissioning permit for C-74L.

1.7 ENVIRONMENTAL JUSTICE

On 11 February 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued with the directive that during the National Environmental Policy Act (NEPA) process, federal agencies adopt strategies to address the environmental concerns of minority and low-income communities that may be impacted by the implementation of federal missions. The intent of the Executive Order is to ensure that no individual or community, regardless of race, ethnicity, or economic status, should shoulder a disproportionate share of adverse environmental impacts to human health or environmental condition resulting from the execution of federal missions. The purpose of environmental justice is to identify disproportionately high and adverse socioeconomic and/or environmental impacts and identify appropriate alternatives.

There are no off-reservation human health concerns related to TA C-74 missions. Other non-health issues like noise below harmful levels, which do leave the reservation, do not occur frequently enough to exceed any known annoyance standards such as EPA recommended average day-night noise levels. The Environmental Justice issues that could potentially be associated with the decision regarding the preferred alternative for the TA C-74 Complex are public access to the lands associated with the TA C-74 Complex and Native American Programs. The access of the public to the TA C-74 Complex during mission activities is restricted regardless of socioeconomic status for safety and security reasons and does not adversely impact individuals or communities of concern.

The Executive Order also requires the application of equal consideration for Native American Programs. This may include the protection of Native American tribal lands and resources such as treaty-protected resources, cultural resources, and/or sacred sites. This issue, along with the associated public participation mechanisms, is fully addressed via Eglin's compliance with the following:

- The Native American Graves and Repatriation Act of 1990
- The American Indian Religious Freedom Act

There are no low-income or minority individuals or communities that are anticipated to be adversely impacted socioeconomically or environmentally by the execution of military missions on the TA C-74 Complex. As a result, an additional analysis of environmental justice was not included in this Programmatic Environmental Assessment.

2 ALTERNATIVES

2.1 INTRODUCTION

This section introduces the alternatives that will be evaluated for potential environmental impacts in the Programmatic Environmental Assessment for TA C-74 Complex activities. Alternatives identify an action or a series of actions that achieve the desired results. For the purposes of this document, the alternatives for the TA C-74 Complex are formulated with the following attributes:

- Support the current level of mission activities
- Promote the efficient use of the TA C-74 Complex in servicing military mission additions and surge and crisis needs in an environmentally responsible manner
- Identify Best Management Practices (BMPs) for minimizing the environmental impact potentials of sled track operations (down-range test item launching and the associated recovery of said items) and sled track target area maintenance activities on cultural resource areas and ecosystem quality

The proposed alternatives, which are analyzed in this document, are:

- Alternative 1 (No Action Alternative): Current level of activity as represented by the average of activity during Fiscal Years (FY) 97 and 98
- Alternative 2: Authorize current level of activity (Alternative 1)
- Alternative 3: Alternative 2 plus BMPs for minimizing potential environmental impacts resulting from mission activities
- Alternative 4: Alternative 3 plus a 200 percent increase in all missions

A brief description of each alternative is provided that includes the activity and expendables associated with it.

2.2 ALTERNATIVES CONSIDERED

This section provides a description of the alternatives that were considered during this evaluation.

2.2.1 Alternative 1 (No Action Alternative): Current Level of Activity

The No Action Alternative is based on the average of the current level of particular mission activities at the TA C-74 Complex for a baseline period between FY97 and FY98. For purposes of alternative comparison and environmental analysis, the average of these years was chosen as the baseline for sled track operations and live munition detonations. Because FY98 showed much more activity in Gunnery Ballistics Testing than any previous years, FY98 was chosen as the baseline for Gunnery Ballistics Testing. This combination of TA C-74 mission activities was chosen because it represents both the greatest amount of activity and the greatest diversity in test

items at the TA C-74 Complex that could occur within a time frame of one year. This alternative is defined as continuing the current practice of analyzing each interstitial area action on an individual basis. This process has served Eglin well and has allowed good stewardship of the Eglin resources for many years. ***This alternative does not authorize any level of activity.*** Therefore, each action is identified by the proponent and evaluated by a working group. If further environmental analysis is required, an Environmental Assessment is prepared. This is a time and resource intensive process. Crisis or surge activities can be handled reasonably quickly, but at the expense of other programs.

2.2.2 Alternative 2: Authorize Current Level of Activity

This alternative is defined as ***authorizing*** the current level of activity for the baseline period described in Section 2.2.1. Alternative 2 includes a cumulative evaluation of all activities occurring during the baseline period within the TA C-74 Complex. By authorizing this level of activity, similar mission requests would be quickly and efficiently approved. The current mission activities and expenditures are presented in Table 2-1.

Table 2-1. Alternatives 1, 2, 3, and 4 Mission Expenditures

Mission Activity		Expendable	Alternatives 1 - 3	Alternative 4
Sled Track Operations			Number of Events	
Location: KEMTF, TA C-74			17	51
			Number of Expenditures	
<i>Rocket Motors</i>		HVAR Rocket Motor	123	369
		Genie Rocket Motor	15	45
		Zuni Rocket Motor	10	30
<i>Inert Munitions</i>		BLU-109	5	15
		JAST WHD	1	3
		MLRS	1	3
		JASSM WHD	2	6
		BLU-113	1	3
<i>Live Munitions</i>		MMTD WHD	1	3
		BLU-109	1	3
		AUP WHD	2	6
		HTW 1,000-lb Bomb	1	3
		JASSM WHD	2	6
Live Munition Detonations			Number of Events	
Location: Arena Test Area, TA C-74			6	18
			Number of Expenditures	
		JASSM 920-Scale	2	6
		JASSM 1/3-Scale	2	6
		C-4, 1 lb	42	126
		C-4, 0.125 lb	3	9
		Colt 45 WHD	1	3
		Mk-84	1	3

Table 2-1. Alternatives 1, 2, 3, and 4 Mission Expenditures (Cont'd)

Mission Activity		Expendable	Alternatives 1 - 3	Alternative 4
Gunnery Ballistics Testing Location:		Number of Events		
		9/20	27/60	
TA C-74 Arena Test Area		JASSM 920-Scale (inert)	8	24
		JASSM 1/3-Scale (inert)	1	3
TA C-74L	30 mm HEI (PGU-13/B)	4,119	12,357	
	30 mm TP (PGU-15/B)	263	789	
	20 mm HEI	178	534	
	20 mm TP	216	648	
	25 mm HEI (PGU/38)	100	300	
	25 mm TP (PGU-23/U)	10	30	

2.2.3 Alternative 3: Alternative 2 Plus BMPs to Minimize Potential Environmental Impacts Resulting from Mission Activities

Alternative 3 includes the activities proposed in Alternatives 1 and 2, with the addition of best management practices (BMPs) designed to conserve soil resources, and protect water quality and the structural integrity of habitats associated with the TA C-74 Complex. Mission activities involving sled track operations and test item recovery have contributed to the degraded ecological condition of wetland areas, grassland/shrubland areas, and the darter stream down range from the sled track by facilitating soil erosion and creating direct physical impacts. Erosion control measures down range of the sled track in order to alleviate excessive soil erosion, begun in 2000, have been completed. The objective of Alternative 3 is twofold:

- Provide BMPs for mission activities that would help maintain the integrity of erosion control measures.
- Identify BMPs for suppressing direct physical impacts to sensitive habitat areas (i.e., wetland areas and the darter stream) and potential cultural resources.

This alternative presents opportunities to manage military mission activities of this Test Area while exercising proactive environmental stewardship that maintains compliance with federal and state environmental laws and regulations, as well as Air Force environmental directives.

BMPs for Mission Activities Potentially Affecting Erosion Control Measures

Active soil erosion due to overland water flow is a prevalent problem on TA C-74 and is a direct contributor to the alteration of terrestrial and aquatic habitats associated with the test area. The predominate Lakeland soil on TA C-74 has no active soil forming processes and is considered a nonrenewable resource as long as soil depletion rates exceed soil formation rates. Overall, the soil erosion rates on TA C-74 are exceeding soil formation rates. This means that the movement of soil from its point of origin constitutes nonrenewable soil loss. Also, lost with the moving topsoil are chemical compounds and materials, which may result in diminished site fertility and productivity. Appreciable soil loss then becomes an issue of greater concern to the overall condition of the ecosystem.

Erosion has been accelerated by the extent and frequency of bush hogging and roller drum chopping and other military mission activities on the test area. Accelerated soil erosion from human activities on TA C-74 has resulted in a change in the physical and chemical nature of the Lakeland soils, substantially reduced vegetative cover, and altered the slopes. The areas on TA C-74 most prone to soil erosion are the slopes. The slopes on the test area have become steeper and shorter as a consequence of long-term soil losses. Severe erosion is occurring on the sideslopes of some Lakeland soils, downrange access interior roads, and riparian zones.

Steps are currently being taken to control excessive soil erosion in heavily disturbed areas down range. Examples of such measures include reestablishment of vegetation in erosion areas, which will substantially reduce soil loss, and the construction of retention ponds and sediment basins in order to prevent excessive soil erosion due to stormwater runoff. Pictures of these erosion control measures are provided in Appendix E.

One objective of this Alternative would be to include BMPs to mitigate the potential impacts to these erosion control measures associated with mission activities such as sled track test item launches and test item recovery. These BMPs are as follows:

- Areas involved in erosion control projects would be afforded special consideration during mission activities.
- Heavy equipment or vehicles would be used cautiously in erosion control areas.
- Small-scale damage to designated erosion control areas resulting from mission activities would be repaired immediately.
- Large-scale damage to designated erosion control areas resulting from test item recovery operations would be repaired in coordination with AAC/EMSN.

BMPs for Minimizing Direct Physical Impact to Sensitive Habitats

The potential for direct physical impacts to wildlife, soils, vegetation, and cultural resources is mainly the result of the recovery of test items launched down range from the sled track. These types of mission activities frequently create situations that could damage critical habitat, physically impact sensitive animals, and damage undiscovered cultural resources via heavy equipment and vehicular/foot traffic.

With these factors under consideration, the following BMPs are included as part of this alternative:

- Using a programmatic approach, the TW, along with AAC/EMSN and AAC/EMH, has initiated an ESA Section 7 consultation with the USFWS regarding the potential impacts to the Okaloosa darter and its habitat from sled track operations and test item recovery activities. Additionally, the TW has initiated a permit with the FDEP for recovery activities in wetland areas on TA C-74. Any requirements outlined in the consultation or permit would be implemented as part of this alternative.

- The recovery of test items impacting wetlands on Test Area C-74 would involve recovery techniques that minimize damage to the ecosystem. Heavy equipment would avoid wetland areas when possible, test items would be removed from wetland areas using the least damaging techniques available, and all damage would be repaired.
- Test item recovery actions occurring within areas of cultural resource constraint would be coordinated with EMH to ensure minimal impacts to potential cultural resources until a cultural resources survey can be conducted of the downrange impact area.
- Vegetation control practices would be established along riparian zones and exposed slopes, as outlined in the Test Area Maintenance Programmatic Environmental Assessment, in order to minimize soil erosion.

2.2.4 Alternative 4: Alternative 3 Plus a 200 Percent Increase in All Missions

Alternative 4 proposes all of the activities described in Alternative 3 with an additional 200-percent increase in all missions over the previously outlined baseline period. Table 2-1 beginning on Page 2-2 inventories the level of expendables associated with the mission increase.

2.3 COMPARISON OF ALTERNATIVES

This section presents a summary comparison of the potential impacts of each of the Alternatives. Potential impacts include noise, chemical materials, direct physical impact, habitat alteration, and restricted access issues. Information concerning environmental analysis methods, rationale, criteria, scenarios, and calculations used to determine these potential impacts are found in Chapter 4, Environmental Consequences. Analysis of the Alternative 2 military mission baseline identified the potential impacts of sled track operations, associated test item recovery operations, and live munition detonations as the mission activities of greatest potential consequence to the environment of TA C-74 (Table 2-2).

Table 2-2. Comparison of Alternative Issues and Potential Environmental Consequences*

NOISE											
ISSUE		Mission Activity									
		Sled Track Operations**		Live Munition Detonations		Gun Testing					
		Number of Events Occurring in One Year/Alternative									
		Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4				
		17	51	13	39	29	87				
# events where noise reach levels >115 dBP at communities under favorable weather conditions		0	0	7	21	0	0				
# RCW cavity trees exposed to 140 dBP under largest event during favorable weather conditions		0	0	12	12	0	0				
# potential Southeastern American kestrel nesting trees exposed to 140 dBP under largest event during favorable weather conditions (no documented kestrels in vicinity)		0	0	28	28	0	0				
CHEMICAL MATERIALS											
ISSUE		THRESHOLD CRITERIA		Mission Activity							
				Sled Track Operations		Live Munition Detonations***		Gun Testing			
								C-74		C-74L	
				Number of Events Occurring in One Year/Alternative							
		Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4		
		17	51	13	39	9	27	20	60		
<i>Potential soil contamination</i>		Soil Cleanup Goal (mg/kg)		Estimated cumulative soil concentration (mg/kg) for activities associated with Alternatives							
		Aluminum (Al)	1,000,000 ^a	---		~2	~6	---		---	
		Copper (Cu)	82,000 ^a	---		~2	~6	---		---	
		Lead (Pb)	1,000 ^b	0.39	~1	~2	~6	0.8	2.4	117	350
		Barium (Ba)	84,000 ^b	---		~2	~6	---		---	
<i>Surface water and groundwater contamination</i>		No Potential Impacts Identified									
<i>Potential air contamination</i>		Based on 10% of Walton County 1998 Emissions (amount/year)		Estimated number of largest events needed to reach threshold criteria for all Alternatives							
		Carbon Monoxide	3.2 tons	3,111		1,500		1,000,000		230,000	
		Nitrogen Dioxide	1.2 tons	14,724		17,000		7,000,000		300,000	
		Particulate Matter	0.7 tons	54		---		---		---	
		Lead	48 lbs****	53		200		3,000		5,500	
		Sulfur Dioxide	1.3 tons	---		17,000		---		---	
<i>Potential chemical air exposure to wildlife†</i>		Suggested		Estimated potential maximum exposure dosage/10 minutes for all Alternatives							
		Carbon Monoxide	Animals: N/A	50000 – 100000 pg		300000 – 600000 pg		0.4 -1.0 pg		6.0 –10 pg	
		Nitrogen Dioxide	Animals: N/A	4000 – 10000 pg		4000 – 10000 pg		0.04 – 0.1 pg		1.0 – 3.0 pg	
		Particulate Matter	Animals: N/A	600000 – 2000000 pg		---		---		---	
		Lead	Animals: >5000000 pg/g dry weight kidney levels ^c	3000 – 8000 pg		100 – 400 pg		0.06 – 0.02 pg		0.2 – 0.5 pg	
		Sulfur Dioxide	Animals: N/A	---		4000 – 10000 pg		---		---	

*See Chapter 4, Environmental Consequences, for development of these metrics.

**Noise metrics are based on the 472 ft safety area as described in Section 4.2.1

***Chemical material metrics are for tritonal only

****Values for lead are derived from Eglin’s emission inventory, as Walton County data was unavailable. Forty-eight lbs. emitted during 1998 only represents large, stationary sources.

†See Tables 4-17, 4-23, and 4-28

^a EPA Risk-based Criteria for Industrial Uses

^c Heath et al., 1991

^e Will and Suter, 1995

^g Mortvedt et al., 1972

^b Florida Cleanup Goal for Industrial Uses

^d Ma, 1996

^f Opresko et al., 1995

^h Klassen et al., 1986

Table 2-2. Comparison of Alternative Issues and Potential Environmental Consequences (Cont'd)*

CHEMICAL MATERIALS										
ISSUE	THRESHOLD CRITERIA	Mission Activity								
		Sled Track Operations		Live Mmunition Detonations***		Gun Testing				
						C-74		C-74L		
		Greatest Number of Events Occurring in One Year / Alternative								
		Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	Alt. 1 - 3	Alt. 4	
		17	51	13	39	9	27	20	60	
Potential soil chemical exposure to biological organisms†	Suggested	Estimated potential maximum exposure dosage (assuming 1% bioavailability ¹ for plants, 100% availability through ingestion for animals, and 1 year of accumulation)								
	Pb	Plants: $2-5$ mg/kg soil ^f	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<2 mg/kg	~3.5 mg/kg
		Animals: >5000 ng/g dry liver weight ^d	2 - 7 ng/day	6.0 - 14 ng/day	40 - 100 ng/day	120 - 300 ng/day	2 - 5 ng/day	6 - 15 ng/day	100 - 500 ng/day	300 - 1500 ng/day
	Al	Plants: 50 mg/kg soil (LOAEL) ^e	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
		Animals: 23,000,000-44,500,000ng/kg/day (LOAEL) ^f	---	---	40 - 100 ng/day	120 - 300 ng/day	---	---	---	---
	Cu	Plants: 20 mg/kg soil ^g	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
		Animals: > 15,000,000 ng/kg body weight ^h	---	---	20 - 50 ng/day	60 - 15 ng/day	---	---	---	---
	Ba	Plants: 50 mg/kg soil (LOAEL) ^e	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
		Animals: 48,000,000-56,000,000 ng/kg/day (LOAEL) ^f	---	---	2 - 4 n/day	6 - 12 ng/day	---	---	---	---

DIRECT PHYSICAL IMPACTS					
ISSUE	Mission Activity				
	Sled Track Operations		Test Item Recovery	Live Mmunition Detonations (Arena Test Area)	
	Alt. 1 - 3	Alt. 4	All Alternatives	Alt. 1 - 3	Alt. 4
Greatest number of inert munition events occurring on TA C-74 in one year	10	30	~80-90%	---	---
Greatest number of live munition events occurring on TA C-74 in one year	7	21	Unknown	6	18
Linear feet of Okaloosa darter stream potentially impacted	~20,000		~20,000	0	
Acres of potential wetland potentially impacted	~47		~47	0	
Number of potential southeastern American kestrel nesting trees potentially impacted (no documented kestrels in vicinity)	54		0	40	
Number of RCW cavity trees potentially impacted	0		0	12	
Acres of potential Florida black bear habitat impacted	~380		0	~227	
Acres of Cultural Resource Areas of Constraint impacted	~396		~396	0	

*See Chapter 4, Environmental Consequences, for development of these metrics.

**Noise metrics are based on the 1,500 ft safety area as described in Section 4.2.1

***Chemical material metrics are for tritonal only

****Values for lead are derived from Eglin's emission inventory, as Walton County data was unavailable. As stated previously, 48 lbs. emitted during 1998 only represents large, stationary sources.

†See Tables 4-17, 4-23, and 4-28.

^a EPA Risk-based Criteria for Industrial Uses

^c Heath et al., 1991

^e Will and Suter, 1995

^g Mortvedt et al., 1972

ⁱ Brady, 1984

^b Florida Cleanup Goal for Industrial Uses

^d Ma, 1996

^f Opresko et al., 1995

^h Klassen et al., 1986

Table 2-2. Comparison of Alternative Issues and Potential Environmental Consequences (Cont'd)*

HABITAT ALTERATION						
ISSUE	Mission Activity					
	Sled Track Operations		Test Item Recovery	Sled Track Target Area Maintenance	Live Munition Detonations (Arena Test Area)	
	Alt 1-3	Alt. 4	All Alternatives	All Alternatives	Alt 1-3	Alt. 4
<i>Greatest number of inert munition events occurring on TA C-74 in one year</i>	10	30	~80-90%	---	---	---
<i>Greatest number of live munition events occurring on TA C-74 in one year</i>	7	21	Unknown	---	6	18
<i>Possible alteration of Sandhills habitat</i>	✓		✓	---		---
<i>Possible alteration of Grassland/Shrubland habitat</i>	✓		✓	---		---
<i>Possible alteration of Wetland habitat</i>	✓		✓	✓		---
<i>Possible alteration of Okaloosa darter habitat</i>	✓		✓	✓		---
<i>Possible contributor to soil erosion</i>	✓		✓	✓		---
RESTRICTED ACCESS						
ISSUE	Mission Activity					
	Sled Track Operations (Live Munition Detonations)			Arena Testing (Live Munition Detonations)		
	Alt. 1-3	Alt. 4		Alt. 1-3	Alt. 4	
<i>Greatest number of events resulting in military and public area closures</i>	13	39		2	6	
<i>Military and public areas affected</i>	Total Duration of Closure (min)					
Test Areas Closed	C-5 C-72 (part) C-74 A (whole)	30	90			
Range Roads Closed	212, 214, 215	240	720	15	45	
Recreation Management Units Affected	13A & 13B	120	360			
Public Roads Closed	285 (Bob Sikes)	120	360	15	45	

*See Chapter 4, Environmental Consequences, for development of these metrics.

**Noise metrics are based on the 1,500 ft safety area as described in Section 4.2.1.

***Chemical material metrics are for tritonal only.

****Values for lead are derived from Eglin’s emission inventory, as Walton County data was unavailable. 48 lbs. emitted during 1998 only represents large, stationary sources.

†See Tables 4-17, 4-23, and 4-28.

^a EPA Risk-based Criteria for Industrial Uses

^c Heath et al., 1991

^e Will and Suter, 1995

^g Mortvedt et al., 1972

^b Florida Cleanup Goal for Industrial Uses

^d Ma, 1996

^f Opresko et al., 1995

^h Klassen et al., 1986

2.4 PREFERRED ALTERNATIVE

The preferred alternative is Alternative 4. This alternative provides for a 200 percent increase in all missions at the TA C-74 Complex plus the addition of operations and maintenance (O&M) plans for mission activities that would help maintain the integrity of current erosion control measures and identify and suppress direct physical impacts to sensitive resource areas (i.e. wetland areas, darter streams, and potential cultural resources), thus potentially benefiting the TA C-74 Complex environment.

3 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The objective of the Affected Environment chapter is to define, inventory, and generally characterize the nature and condition of the physical, biological, and anthropogenic receptors within the realm of influence of TA C-74 and develop a framework for understanding spatial and temporal patterns.

Eglin AFB occupies 724 square miles of land area in the Northwest Florida panhandle, east of Pensacola (Figure 1-1). This represents a major portion of the Florida panhandle's land area. Consequently, Eglin has a rich diversity of unique landscapes, habitats, and species that often fall under federal and state regulatory mandates. Eglin's award-winning Natural Resources Management Program, implemented to facilitate the environmentally conscious use of Eglin's natural resources, has been recognized on a national scale and was selected as the best in the Department of Defense.

Long-term planning for environmental management and stewardship requires a *working knowledge* of the natural and cultural features (living and nonliving receptors) of the potentially affected environment of all ranges on Eglin AFB. Consequently, attention is devoted to developing an inventory and description of receptor features that may be affected by the mission activities described in the previous section. The goal of the Affected Environment chapter is to create the tools for making scientifically sound decisions that are beneficial to the missions of the TA C-74 Complex and the environment as a whole.

For this task, an attribute-driven inventory will identify, locate, characterize, and map the elements of individual receptors. The inventory will continue to operate through much of the Programmatic Environmental Assessment process to collect and manage information that reveals the structure, condition, and relationships of individual receptors. The TA C-74 Complex affected environment receptor parameters and sequence of discussions are listed below.

Physical Features

- *Geology* – underlying earth formations and materials
- *Geomorphology* – landforms and soils
- *Hydrology* – surface water and groundwater
- *Climate* – temperature, wind, rainfall

Biological Resources

- *Vegetation* – flora species and communities
- *Wildlife* – fauna species and communities

Anthropogenic Resources

- *Cultural Resources* – archaeological evaluations
- *Anthropogenic Features* – human impact features

Because TA C-74A is an indoor facility and its mission activities do not involve open air/outdoor testing, analysis of C-74A activities and its environment will be mentioned only briefly in this Programmatic Environmental Assessment (PEA). Furthermore, because TA C-74L lies within the boundaries of TA C-74, affected environment descriptions relating to TA C-74 also apply to TA C-74L.

3.2 SETTING DESCRIPTION

The Test Area C-74 Complex, located in the northeastern section of Eglin AFB in Walton County, Florida, is actually comprised of three Test Areas: TA C-74 (Kinetic Energy Munitions Test Facility), TA C-74A (Munitions Analysis Facility), and TA C-74L (Gunnery Ballistics Facility). TA C-74L is located within the boundaries of TA C-74. For this reason, descriptions of the TA C-74 environment will also apply to TA C-74L. TA C-74A is located approximately one mile to the southwest of TA C-74 (Figure 1-2). Because of the sensitive and potentially dangerous military missions performed on the C-74 Complex, the area is closed to public use (U.S. Air Force, 1992). Another test area in close proximity is the TA C-72 Complex. This six mile by one-mile tract is located to the southwest of TA C-74 and is immediately adjacent to TA C-74A (Figure 1-2).

The TA C-72 Complex is used primarily for air-to-ground and ground-to-ground missions involving the development or production testing of conventional munitions. The TA C-74 Complex is often within the safety footprint of many mission activities on the C-72 Complex because of its close proximity. Additional information on Eglin's land range and the TA C-72 Complex is available in the *Environmental Baseline Study Resource Appendixes* (U.S. Air Force, 1995) and the *Integrated Natural Resources Transitional Plan, Eglin AFB, 1998-2001* (U.S. Air Force, 1998b).

Test Area C-74 predominately consists of cleared areas with some partially cleared areas, as well as a few areas of dense vegetation adjacent to streams (Figure 3-1). The cleared areas consist of target areas, roadways, buildings, and downrange safety areas. The partially cleared areas are grassy plains and rolling hills with species of grass, forbs, and some small trees (U.S. Air Force, 1995). Only a limited number of trees exist within the cleared portions of the test areas, and the groundcover is maintained by mowing. Thicker vegetation exists adjacent to streambeds found in steep valleys on Test Area C-74.

The majority of soils on Test Area C-74 are well drained, sandy soils belonging to the Lakeland association. Sands and loamy sands belonging to the Foxworth, Chipley, and Troup associations cover a small portion of Test Area C-74. Additionally, some swampy wetland areas are comprised of the Dorovan-Pamlico association (muck). There are three watersheds in Test Area C-74: the Rocky Creek, Wildcat Creek, and Sandy Mountain Branch basins. Rocky Creek, however, is the only water body that crosses TA C-74, and it divides the test area into four areas. All of the surface water flows south to the Choctawhatchee Bay Drainage Basin.

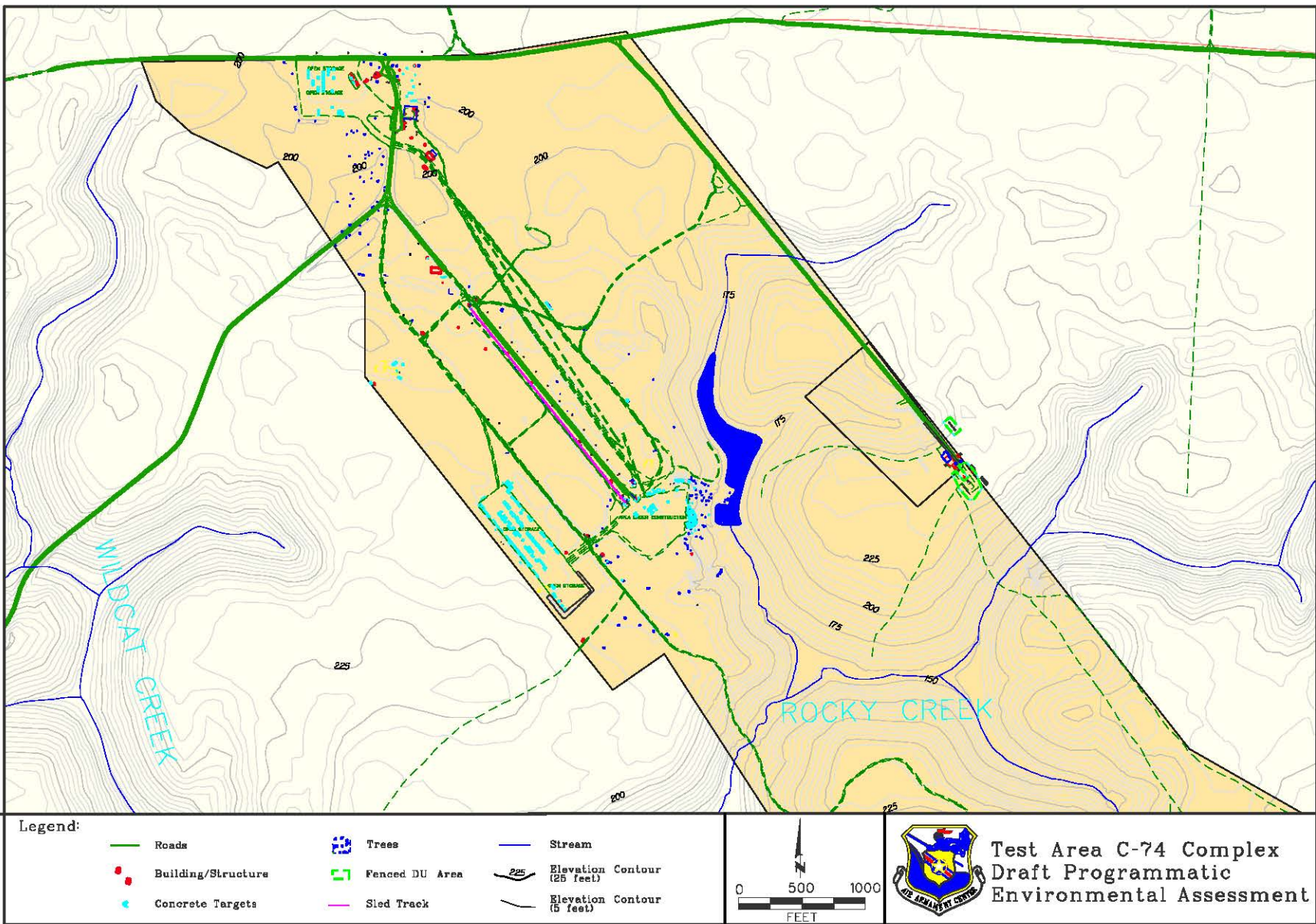


Figure 3-1. Physical Setting of TAs C-74 and C-74L

The Open Grassland and Shrubland ecological association dominates Test Area C-74. The interstitial areas between TA C-74 and TA C-72 support the Sandhills ecological association. Several sensitive plant and animal species, including the Okaloosa darter, are supported by habitats in Test Area C-74. These sensitive species are discussed in more detail in Section 3.3.5.

3.3 PHYSICAL FEATURES

3.3.1 Landforms and Soils

Test Area C-74 is located within the rolling uplands, gentle plateaus, and deep stream valleys of the Western Highlands Province (U.S. Department of Agriculture, 1995). The TA C-74 landform is generally characterized as an erosional landscape, fluvial drainage basin component. This type of landform is the unit of the land surface that collects, concentrates, and promotes the movement of water and sediment. Erosion rates typically outpace soil formation rates (Derbyshire et al., 1972).

Overall, the relief of TA C-74 is characterized as hilly, with broad to narrow ridges, relatively flat to gently undulating terraces, and broad to narrow basins. Elevations generally range from 140 to 265 feet above sea level. Landform slopes range from between 0 to 20 percent, with steeper slopes found along riparian zones that cut across the middle and southern end of the test area (Figure 3-2). These sloped areas tend to be sparsely vegetated, with the topsoil being largely exposed. Consequently, these slopes are prone to become unstable and suffer from moderate to severe erosion during heavy rainfall events. Runoff drainage scars resulting from the channelized flow of water facilitate the movement and transport of sediments in these areas of moderate to steep slope. Sheet erosion may also occur in areas of weak to moderate slope during extensive rainfall events. The topography of TA C-74 is shown in Figure 3-1.

The soil formation of TA C-74, an on-going process determined by the nature of parent material and influenced by environmental factors (i.e. climate, geology, topography, and vegetation), has developed from the Citronelle Formation and alluvial material (gravel, sand, silt, and clay deposited by water) in the floodplains of Rocky and Wildcat Creeks. These soils are mapped as soil associations. Soil associations are groups of soil series (soils with similar profiles) with common characteristics, associated geographically, and delineated as a single map unit.

The majority of soils within C-74 belong to the Lakeland association and are primarily excessively drained, brownish-yellow sands formed in thick, sandy marine sediments on nearly level to steep uplands. Typically, they have sandy surface layers with sandy subsoils that are more than 80 inches deep. Foxworth, Chipley, and Dorovan-Pamlico soil associations occur in small pockets throughout Test Area C-74. Foxworth soil series consist of deep, moderately well drained, very rapidly permeable soils that are formed in thick deposits of sandy marine or aeolian sediments on broad, nearly level, and gently sloping uplands. The Chipley association usually coincides with a high water table closer to the surface than Foxworth soils, and consists of deep, somewhat poorly drained, rapidly permeable soils. They are found on nearly level to sloping uplands and on nearly level, low ridges on flatwoods. Dorovan-Pamlico series soils are found on

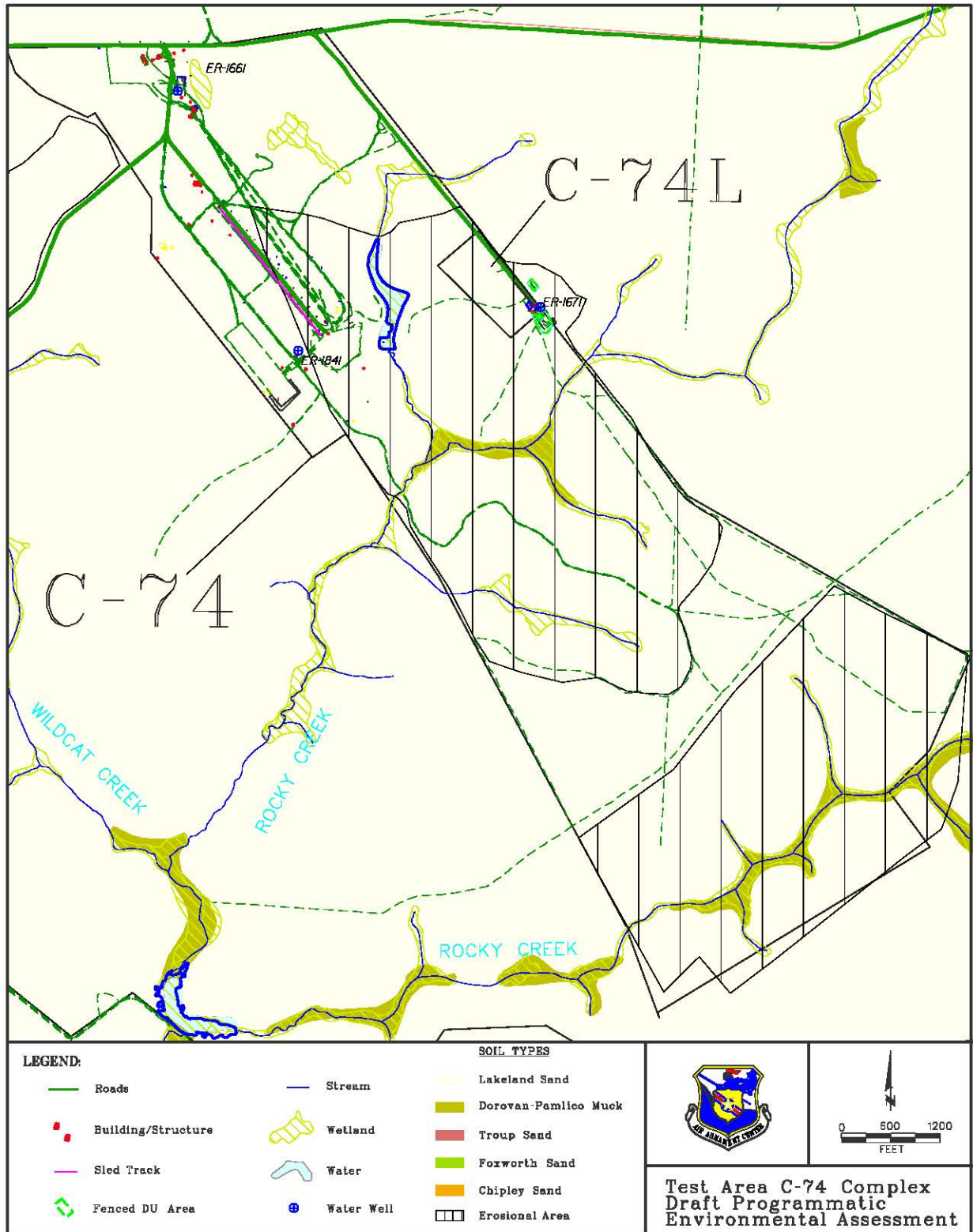


Figure 3-2. Soils and Hydrological Features of TAs C-74 and C-74L

nearly level floodplains of large streams and hardwood swamps. These soils are formed from the decomposition of woody and herbaceous plant remains. The high water table in these areas results in frequent to constant inundation (U.S. Department of Agriculture, 1995). Soils of TA C-74 are shown in Figure 3-2. The physical and chemical properties of the soil types found at TA C-74 are given in Table 3-1.

Table 3-1. Physical and Chemical Data of Soils on Test Area C-74

Soil Type	Soil Depth (approx. inches)	Texture	Slope (%)	pH	Cation Exchange Capacity (meq/100 g)	Organic Matter (%)	Clay (%)	Permeability (inches/hour)
Lakeland	0 - 40	sand, fine sand	0 - 30	4.5 - 6.0	< 3.47	<1	2 - 8	6.0 - 20
Foxworth	0 - 54	sand, fine sand	0 - 5	4.5 - 6.0	< 2.19	<1	1 - 8	> 20
Chiplely	0 - 80	sand, fine sand	0 - 8	3.6 - 6.5	< 2.17	2 - 5	1 - 7	6.0 - 20
Dorovan-Pamlico	0 - 60	muck	< 1	3.6 - 5.5	< 114.02	20 - 60	0	0.6 - 6.0

The Lakeland soils lack cohesiveness and have limited water-holding capacity. The establishment and maintenance of vegetation is difficult because the soils are too wet, too sandy, low in productivity, or are on steep slopes (U.S. Air Force, 1995).

Erosion problems on TA C-74 have been particularly substantial on the steeper slopes cleared of vegetation for the downrange safety area, sloped areas along the pond and Rocky Creek, and along the downrange access road. Alternate methods of range maintenance are being assessed to reduce erosion potential. Currently, construction of storm water retention ponds and sediment basins is under way along the southeastern slopes of the pond and Rocky Creek (Figure 3-2) in order to reduce the amount of sediments eroding into these surface water bodies from the downrange impact area. Construction of erosion control measures along the northwestern slopes was completed in 2000.

Active soil erosion due to overland water flow (detachment, suspension, translocation, and deposition of soil particles) is a prevalent problem on the test area and is a direct contributor to the alteration of terrestrial and aquatic habitats associated with TA C-74. The predominate Lakeland soil on TA C-74 has no active soil forming processes and is considered a nonrenewable resource as long as soil depletion rates exceed soil formation rates. Appreciable soil loss then becomes an issue of greater concern not only to the overall condition of the ecosystem, but the test area as well.

Erosion has been accelerated by the extent and frequency of the surface disturbances associated with bush hogging and roller drum chopping, and to a lesser extent, military mission activities. Accelerated soil erosion on TA C-74, a consequence of human activities, has resulted in a change in the physical and chemical nature of the Lakeland soils, substantially reduced vegetative cover, and altered the slopes. The landscape positions on TA C-74 most prone to soil erosion are the slopes. The slopes on the test area have become steeper and shorter as a

consequence of long-term soil losses. Severe erosion is occurring on the sideslopes of some Lakeland soils, downrange access interior roads, and riparian zones.

Additionally, the variables of surface disturbance, vegetative cover, runoff, soil structure, and other features collectively have a direct bearing on soil movement. As a result of vegetation management practices, the vegetative cover of slope areas has been generally reduced to levels between 40 percent and 10 percent. Based on these attributes, it is concluded that slopes on TA C-74 have low resistance to erosion forces. Figure 3-3 delineates the areas most sensitive to erosion with adjacent streams receiving most of the sediment. However, the recent implementation of erosion control measures in these areas should serve to minimize erosion potentials along the stream banks. Test area road erosion problems and controls are covered under the Range Roads Environmental Consequences document (U.S. Air Force, 1998d) and were not included here.

The model used to estimate historic soil erosion rates on TA C-74, the Modified Soil Loss Equation (MSLE) (U.S. Environmental Protection Agency, 1980), was designed for use in forest environmental conditions and was selected as a “best-fit” methodology for analysis of soil erosion and sedimentation on TA C-74 before the implementation of erosion control measures. The MSLE is an empirical model that provides a long-term estimate of soil loss for a given set of conditions. It estimates soil loss on an average annual basis. The MSLE model is presented as Equation A-21 in Appendix A.

Overall, the soil erosion rates on TA C-74 have exceeded soil formation rates. This means that the movement of soil from its point of origin constitutes nonrenewable soil loss. Also lost with the moving topsoil are chemical compounds and materials, which may result in diminished site fertility and productivity. The sensitive slope areas occur along riparian units, which reflect the destination of sediment. The riparian units tend to redistribute sediment along the sideslopes and deposit sediment into streams within the test area, with portions of these sediments eventually being transported along the length of the streambed outside of the test area. The estimated historic soil loss potentials in tons/acre/year for each erosion area depicted in Figure 3-3 are presented in Table 3-2.

Table 3-2. Estimated Historic Nonrenewable Soil Loss Potentials for TA C-74.

Erosion Area	Total Acreage	Soil Loss (tons/year)	
		Per Unit	Per Acre
E1	25	250	10
E2	8	288	36
E3	6	264	44
E4	39	1,482	38
E5	21	1,827	87
E6	19	1,881	99
E7	76	2,204	29
E8	46	1,518	33
E9	34	1,496	44
E10	66	2,178	53
E11	50	2,700	54
E12	75	3,300	44

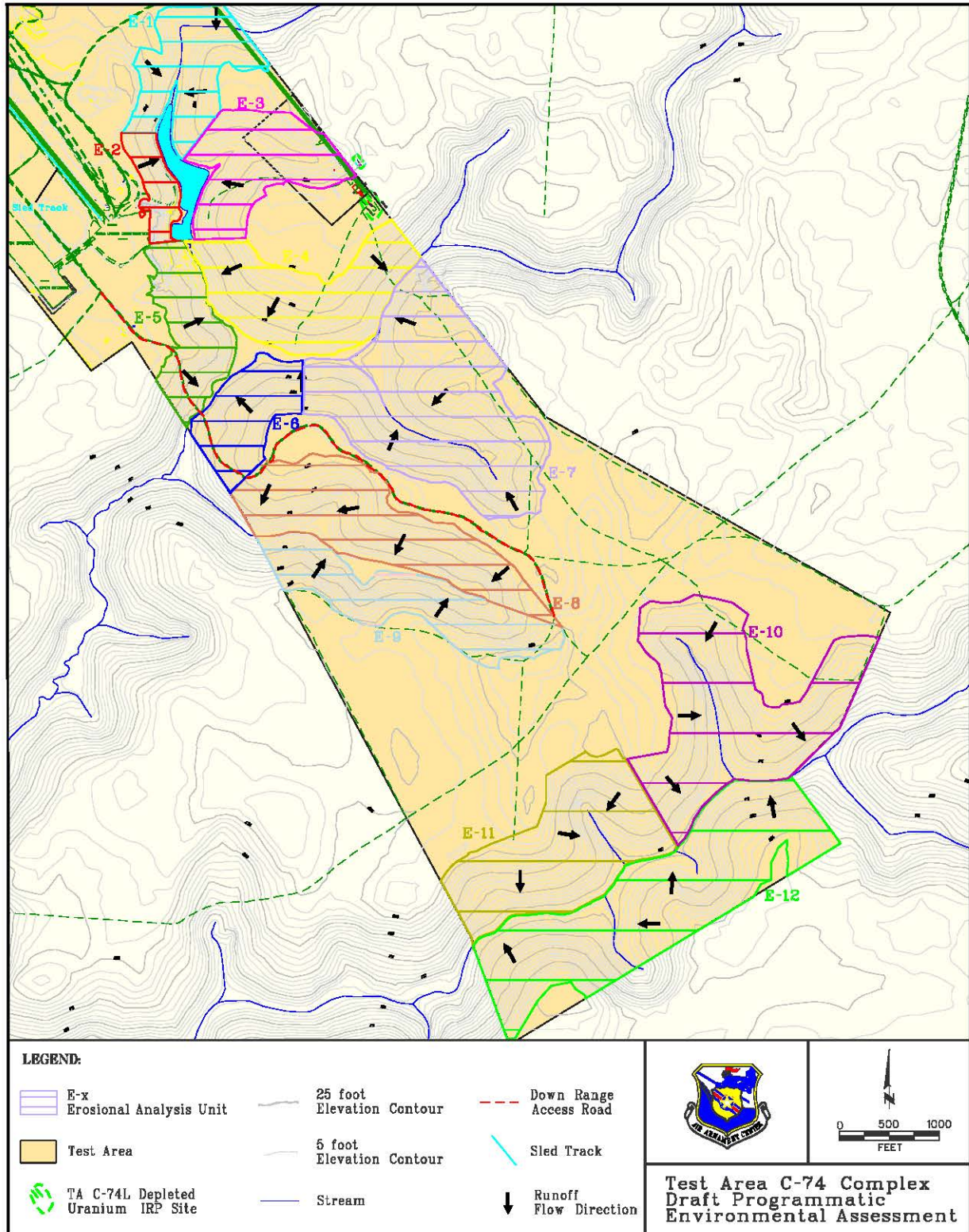


Figure 3-3. Location of Erosion Areas on TA C74

3.3.2 Hydrology

Florida is well known for its crystal clear, sandy bottom streams and rivers and quality drinking water. The value of these waterways and related groundwater systems are innately linked to various environmental regulations (darter streams), socioeconomics (silviculture), aesthetics and recreation, water resources (drinking water, transportation, and irrigation), military mission activities of Eglin, and other issues. The attributes of the hydrologic and geohydrologic systems found at TA C-74 are discussed in the following narrative. A summary hydrologic features map is presented in Figure 3-2.

Geohydrology

Once water moves below the realm of the surface and into the vertical zones of the soil and geologic formations, it becomes soil water and groundwater. These geohydrologic layers are known as the vadose zone (soil water) and phreatic zone (groundwater).

Soil Water and Groundwater

Soil water is the unsaturated (vadose) zone beginning just below the surface at the point of water entry into the soil by means of infiltration. This zone is defined as unsaturated because soil pore spaces are only partially filled with water. The rate of infiltration is dependent on the soil type and amount of moisture present; a dry soil would have a relatively high infiltration rate. Following infiltration into the soil, water moves through the profile by means of percolation.

Beneath the unsaturated zone lies the saturated (phreatic) zone. All the pore spaces in this zone are filled with water. The top surface of the saturated zone is called the water table and the water below is called groundwater. The water table generally parallels the land surface topography. However, where the water table is exposed, discharge in the form of springs and streams occurs. The level of the water table at TA C-74 ranges from exposure at the land surface at the bottom of ravines to 20 feet below ground level at higher elevations. Recharge occurs when surface water percolates through the soil and into the saturated zone. When the saturated zone is capable of yielding a usable amount of water, it is called an aquifer.

Aquifers

The northwest Florida aquifers associated with C-74 are divided into four hydrostratigraphic units. In descending order from the surface, these units are the:

- Surficial Aquifer (SA)
- Intermediate System (IS)
- Floridan Aquifer (FA)
- SubFloridan System (SFS)

The Surficial Aquifer and Floridan Aquifer move and store substantial amounts of water because of their medium to high permeability, whereas the Intermediate and SubFloridan Systems are

primary confining units of the aquifer system that have low permeability. The primary water supply for northwest Florida comes from the Surficial and Floridan Aquifers.

Surficial Aquifer

The Surficial Aquifer, also referred to as the Sand-and-Gravel Aquifer, is primarily comprised of clean, fine-to-coarse sand and gravel, some silt and silty clay, and sparse amounts of peat (U.S. Air Force, 1995). The sand and gravel components allow water to percolate through the SA with relative ease. The thickness of the SA ranges from less than 50 feet in eastern Walton and central Okaloosa County to greater than 500 feet in western Escambia County. Variations in thickness follow changes in topography and the irregularities in the underlying Intermediate System.

Water exists in mainly unconfined conditions (water table) in the upper portion of the aquifer and semiconfined conditions (under pressure) in the lower portion of the aquifer. Rainfall is the primary contributor to SA recharge; a small amount of recharge from the FA occurs in areas where the FA is higher than the SA system. Conversely, the SA may act as a recharge source in areas where the SA is higher than the FA system. Recharge measurements of the SA system in Walton County indicate a recharge rate of approximately 1,000 Mgal/d (Vecchioli et al., 1990). Eglin uses small amounts of water from the SA for landscape irrigation; however, the FA is used extensively for potable water uses (U.S. Air Force, 1995).

The quality of water in the SA has been rated good (i.e., meets its intended use) by the Florida Department of Environmental Protection. Raw water has a pH ranging from 3.0 to 10.2 with an average pH of 4.9 in the upper zone and of 7.2 in the lower (production) zone. Average values for nitrate are 0.81 milligram per liter (mg/L) in the upper zone and 0.11 mg/L for the lower zone. The iron content ranges from 0.07 mg/L to 95 mg/L with a median of 2.05 mg/L. Water from this aquifer is not a primary source of domestic or public supply water on Eglin because of the large quantities of higher quality water available from the underlying Floridan Aquifer (Becker et al., 1989; U.S. Air Force, 1995).

The position of the SA near the surface and above the confining Intermediate System and its relatively high percolation rates make the SA vulnerable to contamination by surface pollutants. Lateral migration of contaminants towards surface water discharge points potentially facilitates the transfer of groundwater pollutants to area streams, rivers, and wetlands.

Floridan Aquifer

The Floridan Aquifer (FA), which underlies the Intermediate System and the entire state of Florida, is one of the most productive sources of water in the United States, providing water for public, industry, agriculture, and rural uses. In the panhandle, the surface of the FA ranges from more than 100 feet above mean sea level (MSL) to 1,450 feet below MSL, with the portion of the aquifer containing freshwater being approximately 2,000 feet thick (Katz, 1992).

Because of the Bucatunna Clay unit, the FA is divided into the Upper and Lower Floridan Aquifers. Generally, the undifferentiated portion of the FA lies just west of the Okaloosa-Walton County boundary, with the Pensacola Clay confining unit overlaying the FA west of the boundary (SAIC, 1999).

Groundwater storage and movement occurs in interconnected, intergranular pore spaces, small solution fissures, and larger solution channels and cavities. The water quality of the FA is suitable for most uses. Water pH ranges between 7.5 and 8.5, and water temperature varies between 18° C and 26° C. Hardness is normally below 150 mg/L, but can range up to 280 mg/L (U.S. Air Force, 1995).

Surface Water

Surface water is any water that lies above groundwater, such as lakes, rivers, streams, and springs. Surface water hydrology on Eglin AFB is directly linked to geology and geomorphology. Lakes, ponds, and wetlands occur where local shallow clay and silt layers restrict the downward movement of water to the regional water table (U.S. Air Force, 1995). The hydrologic characteristics of each drainage basin can be directly related to watershed geology and drainage density.

Although the Floridan Aquifer is not hydraulically connected to the streams of Eglin, the Surficial Aquifer is in direct hydraulic contact with streams. Rainfall percolates into the Citronelle Formation and recharges the aquifer, which enters streams directly through discharge points (steepheads, springs, and seepage) along valley walls as stream baseflow. The close relationship between groundwater and surface water means streamflow remains fairly constant throughout the year (Resource Consultants and Engineers, Inc., 1993).

Generally, there is an increase in drainage on Eglin from the west to the east that results from higher elevations in the east. Also, there is an increased clay content and hardpan development in the soils and underlying sediments to the east. This produces lower permeability, more surface run-off and attendant channel development.

Three drainage systems exist on TA C-74: the Sandy Mountain Branch basin (~342 acres), the Rocky basin (~590 acres), and the Wildcat Creek basin (~139 acres). Although these three drainage basins are present on TA C-74, the only perennial stream system that interacts directly with the test area is Rocky Creek (Figure 3-2).

Rocky Creek, one of the major stream systems of Eglin AFB, is a 162.5 channel mile, south draining stream that runs from the northeastern portion of Eglin AFB and drains to Rocky Bayou, just east of Niceville. Approximately four miles of channel exist on TA C-74. Rocky Creek's total drainage area is approximately 95 square miles (Resource Consultants and Engineers, Inc., 1993), with about 590 acres occurring on TA C-74. The Florida Department of Environmental Protection (FDEP) has rated the water quality of Rocky Creek as good. One of the headwater streams occurring on TA C-74 has been dammed, creating a small four-acre pond on the test area (Figure 3-2). The riparian slopes on TA C-74 adjacent to Rocky Creek are bush hogged as part of the vegetation management program. Additionally, the surface water streams of TA C-74 are considered sensitive Okaloosa Darter habitat.

The surface waters of TA C-74 are subject to large amounts of sediment loading due to excessive erosion occurring during large precipitation events. In order to alleviate the problem and preserve this sensitive darter habitat, an erosion control project has been implemented involving the construction of retention ponds and sediment collection basins along the northwest and southeast slopes of Rocky Creek and the pond just south of the sled track.

3.3.3 Climate and Meteorology

Eglin is located in a transitional zone between temperate and subtropical climates. The climate is characterized by warm, humid summers and mild winters, prevailing southerly winds, and intense thunderstorm events and hurricane cycles (U.S. Air Force, 1995). Atmospheric and climatic features are major forces in the area.

Temperatures range from a minimum average temperature near 43° F (6° C) in the winter to a maximum average temperature near 90° F (32° C) in the summer. Occasional frosts occur between November and February (Becker et al., 1989). Winter temperatures can reach as low as 15° F to 20° F with temperatures dropping to single digits during brief winter cold fronts (U.S. Air Force, 1996f). The relative humidity is high throughout the year. By early June, the temperature-humidity index (THI) is about 79 and remains between 79 and 81 during most afternoon hours until late September.

Rainfall

Rains occur primarily during the summer (June to August) and the late winter to early spring (February to April) and result from frontal-type weather systems and thunderstorms (Becker et al., 1989). Frontal storms cover a larger area and produce showers of longer duration and lower intensity than thunderstorms. The majority of summer rainfall is from intense thunderstorms in the late afternoon or early evening that last only one or two hours. The natural pH of Florida rainwater is 4.65 to 4.75 (Becker et al., 1994).

Based on data collected at the National Weather Service Cooperative Observation Site, Niceville, Florida, located a few miles due east of Eglin, the annual rainfall ranges from 65 to 84 inches (Becker et al., 1994). The data also shows the large variation in annual rainfall totals from year to year.

Lightning

The high intensity storms that frequent this area not only deliver significant amounts of rain, they also create frequent air-to-ground lightning strikes. The heat from these electrical discharge events reaches 20,000 degrees C, which is three times the temperature of the surface of the sun. Contact with fuel sources such as timber can easily start wildfires.

Instances of violent storms and wildfires have been described by many of the early explorers of Florida, with recent history having shown that wildfires can still have wide-spread, devastating effects on the landscape. Two small wildfires occurred on TA C-74 in 1997 (Figure 3-4, page 3-16).

Winds

Prevailing winds are usually from the south in summer and the north in winter. Warm westerly winds originate from the Gulf of Mexico during the summer, providing cooling on-shore breezes along the coast. The Gulf of Mexico moderates extremes in winter temperatures by providing heat in the winter. Winds from the northwest bring frontal systems of low precipitation and long

duration in the winter. The lowest average velocity winds occur in August, and the windiest month is March.

For northwest Florida, daytime mixing heights are higher than for most of the continental United States. Average morning mixing heights for northwest Florida range from 500 to 1,000 meters (1,600 to 3,300 feet) above ground level (AGL) in the summer to 500 to 700 meters (1,600 to 2,300 feet) AGL in the winter. Average afternoon mixing heights are from 800 to 1,000 meters (2,600 to 3,300 feet) AGL in the winter to 1,400 to 1,600 meters (4,600 to 5,200 feet) AGL in the summer. Measurements of wind speed for 1995 through 1996 at Eglin Main showed a monthly average ranging from 6 to 9 knots.

Inversions

Almost every morning, ground-based inversions occur on the Eglin reservation and break during the morning with surface heating. When the air temperature increases with height at a rate such that the air remains very stable and little mixing of the air occurs, there is an inversion. Ground-based inversions occur due to radiative cooling at the ground. For approximately five to seven days in the winter, the inversion does not break up due to a deep layer of sea fog that slows surface heating. Low wind speeds in these situations are typical (U.S. Air Force, 1995).

3.3.4 Air Quality

Although mission activities at Eglin result in significant sources and volumes of air emissions, the regional air quality is good, attaining both federal and state standards. The input of air emissions from land areas within Santa Rosa, Okaloosa, Walton, Escambia, and Gulf counties is small due to the lack of heavy industry. Air pollutants are emitted from mobile and stationary sources and general maintenance activities, government and privately owned vehicles, jet engine testing, aircraft operations, prescribed burning, wildfires, mission test and training operations, and the open burning/open detonation of unexploded ordnance (U.S. Air Force, 1995). Table 3-3 describes the 1999 total volumes of air emissions (tons per year) for the primary pollutants covered by federal and state standards (U.S. Air Force, 2000).

Table 3-3. Total Volumes of Air Emissions at Eglin Air Force Base in CY99

Emissions	Tons/Year
Carbon monoxide	104.86
Nitrogen oxides	112.86
Volatile organic compounds	97.76
Particulate matter	235.11
Sulfuric oxides	14.33
Hazardous air pollutants	11.70
Ozone depleting compounds	29.11
Lead	0.03

Source: U.S. Air Force, 2000c

3.3.5 Summary

Overall, the relief on TA C-74 is characterized as hilly, with deep ravines along the southern and mid portions of the test area, and relatively flat to gently undulating terraces along the northern end. The key properties of the dominate Lakeland soils include: a quartz sand texture throughout; excessively drained; high permeability rates; low organic matter and clay content; poor soil structure; low cation exchange capacity (CEC) values; and absence of active soil-forming processes. Overall, these conditions contribute to soil erosion potentials on TA C-74. The combination of these geologic materials, dramatic changes in sea level, and fluvial system development during the Pleistocene period were instrumental in sculpting the current landforms and ecosystems of TA C-74. The combination of high precipitation and permeable surficial geologic layers creates conditions that influence water infiltration, runoff and subsurface flow.

The runoff and groundwater seepage of TA C-74 is in direct contact with the streamflow of Rocky Creek, as well as Wildcat Creek (although on a smaller scale). The vegetative management operations performed on TA C-74 overlap into the riparian zone of Rocky Creek along the middle and southern parts of the test area.

The approximately 160-foot thick Surficial Aquifer below TA C-74 occurs under water table conditions with the main water-producing zone at about 120 feet. The down gradient direction of groundwater flow in the Surficial Aquifer is towards Rocky Creek. The confining Pensacola Clay in the Intermediate System restricts movement between the Surficial and Floridan Aquifers. The top layer of the underlying Floridan Aquifer is at about 150 feet below MSL. Two limited use potable water supply water wells (ER-1661 and ER-1671) are located on TA C-74/C4L.

The abundance of rainfall, sunlight, and a long growing season make for a climate that can support a diversity of flora and fauna. However, the northwest Florida coast is also home to many potentially catastrophic weather events. The average return times of these events may vary from a day to a decade. The short duration, high intensity thunderstorms that frequently occur in summer and winter are a primary contributor to soil erosion and lightning wildfires.

3.4 BIOLOGICAL RESOURCES

This section describes the vegetation and wildlife resources that comprise the biological component of the TA C-74 landscape. Emphasis is placed on identifying sensitive habitats and species that are within federal and/or state mandates or are of special concern.

3.4.1 Vegetation

Ecological Associations

A classification system of ecological associations has been developed based on flora, fauna, and geophysical characteristics. These ecological associations are described in the *Integrated Natural Resources Transitional Plan*, Eglin AFB, 1998-2001 (U.S. Air Force, 1998b) and the *Environmental Baseline Study Resource Appendices* (U.S. Air Force, 1995). Eglin has seven major ecological associations; however, only the Grassland/Shrubland and Wetland ecological associations are found within TA C-74. The interstitial areas surrounding the test area are part of the Sandhills ecological association. Figure 3-4 provides a graphical representation of the ecological associations found in the vicinity of TA C-74, as well as wildfire occurrences from 1997 – 2000 (three mission related in 1997) and controlled burn areas. A discussion of these ecological associations follows.

Grassland/Shrubland

The Grassland/Shrubland association is a product of vegetation control and management. This association occurs in disturbed, open areas of the Sandhill association and is inclusive of TA C-74. Roller/drum chopping and mowing are employed to remove and prevent reestablishment of tall vegetation.

Vegetation on TA C-74 is dominated by sprouting oaks and native grasses such as switchgrass, broomsedge, big bluestems, yellow Indian grass, purple lovegrass, woolly panicum and various forbs. A list of plant species that may occur on TA C-74 is provided in Table 3-5.

Sandhills

The Sandhills are generally described as a forest of widely spaced overstory of longleaf pines, a sparse midstory of xeric oaks and other hardwoods, and a dense understory of grasses, forbs, and ferns on rolling hills of sand. This association commonly occurs on deep, sandy Lakeland soils characterized by relatively flat to steeply sloped ridges, hilltops, gently rolling hills, and stream terraces. Loamy sands, sandy loams, loamy clay, and muck soils are found in lower lying areas (U.S. Air Force, 1995).

The predominate physical feature of Sandhills is the extent and nature of the sandy soils. The xeric environment created by the sandy soils is accentuated by the absence of a closed longleaf pine overstory. Burrowing animals such as gophers and gopher tortoises play an important role in recycling nutrients that easily leach through the sandy soils (Noss, 1987). The sandy soils make the Sandhills important to aquifer recharge by allowing water to quickly infiltrate the surface with little runoff and evaporation.

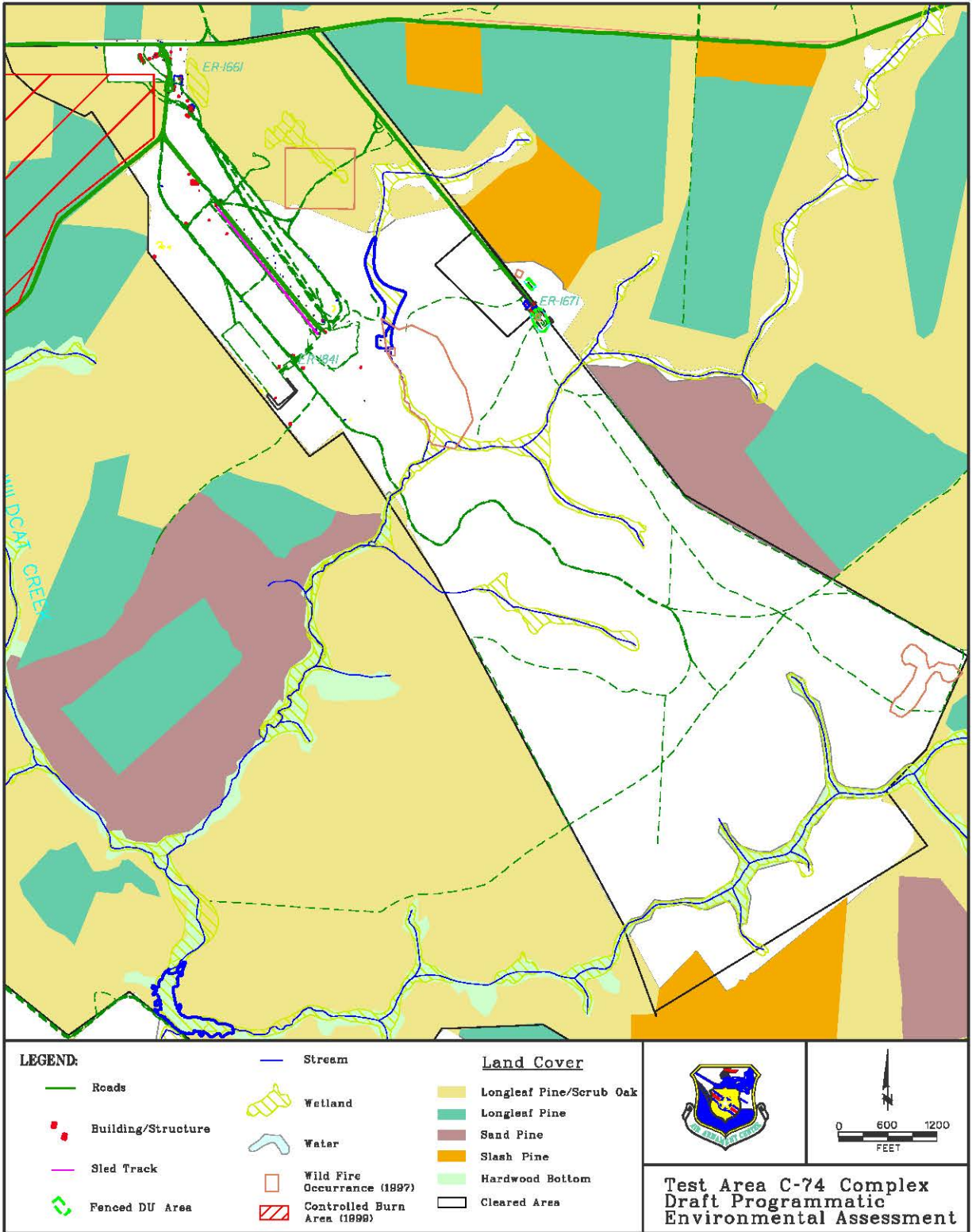


Figure 3-4. Ecological Associations of the TA C-74 Complex

The Sandhills are a fire climax community that is dependent on frequent fire events to restrict hardwood competition and promote timber stands dominated by longleaf pines and grasses such as wiregrass. Without frequent fires every two to five years, the Sandhills succeed to a Xeric Hammock dominated by scrub oaks, live oaks, and southern magnolia.

Conversion to other uses and forest types, as well as large-scale reduction in fires in the Sandhills, has resulted in dramatic declines in this ecological association. Over the extent of its total presettlement range in the southeast, the Longleaf Pine-Wiregrass associations have been reduced by as much as 98 percent (Noss, 1987).

The Sandhills association is primarily comprised of a longleaf pine overstory, a midstory of hardwood trees such as southern magnolia, sweetbay, live oak, persimmon, sparkleberry, winged sumac, and scrub oaks including turkey oak, bluejack oak, and sand post oak. Although tree species diversity is relatively low, there is a wide variety of understory herbaceous plants such as wiregrass, Indian grass, wild buckwheat, beggars' tick, partridge pea, yellow foxglove, milk pea, queen's delight, bracken fern, goats rue, dollarweeds, wild indigo, gopher apple, golden-aster, and other plants that provide fairly complete ground cover.

Swamp/Wetlands

Consisting of flat, poorly drained soils, this association maintains vegetation characteristic of wet environments and can include floodplain forest, floodplain swamp, bottomland forest, wet prairie, hydric hammock, blackwater stream, marsh lake, and bogs. Dominant vegetation found within this ecological association includes oak and magnolia trees, along with other plants such as ferns, arrowheads, sawgrass, and cordgrasses (U.S. Air Force, 1995). Approximately 83 acres of wetland areas exist on TA C-74.

Sensitive Habitats/Species

Wetland areas around creek beds are the only sensitive habitats on Test Area C-74. Documented rare plant areas, significant botanical sites, or Florida Natural Areas Inventory Tier I areas do not exist on Test Area C-74. The management of sensitive habitats is the responsibility of the Natural Resources Branch, Stewardship Division of Environmental Management Directorate (AAC/EMN). Activities that may affect wetlands (protected by the Clean Water Act) go through a permit process with the state as well as with the U.S. Army Corps of Engineers (ACE). Activities minimizing impacts to wetlands are preferred and the planning process should reduce or minimize ground-disturbing projects or actions occurring in a wetland (U.S. Air Force, 1995).

Air Force projects that may affect federally protected species, species proposed for federal listing, and critical habitat for protected species are subject to Sections 7 and 10 of the Endangered Species Act prior to the irreversible or irretrievable commitment of these resources (U.S. Air Force, 1995). Eglin has developed an overall goal within the *Integrated Natural Resources Transitional Plan* to continue to protect and maintain populations of native threatened and endangered plant and animal species within the guidelines of ecosystem management (U.S. Air Force, 1998b). In 1992, Eglin, along with the U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission, entered into a cooperative agreement to manage individual species on the installation, including both federal- and state-listed species.

Sensitive species include those with federal endangered or threatened status, federal candidate species, and state endangered, threatened, and species of special concern status (U.S. Air Force, 1995). An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is any species that is likely to become endangered in the future throughout all or a significant portion of its range due to loss of habitat, anthropogenic effects, or other causes. Federal candidate species and state species of concern are those that should be given consideration during planning of projects, but have no protection under the Endangered Species Act.

No sensitive plant species have been identified as occurring within the Grassland/Shrubland habitats of TA C-74. However, there are seven plant species that are listed by the state of Florida as threatened or endangered that have been identified as occurring within one kilometer of TA C-74. These plant species and their state status and habitats are presented in Appendix D.

3.4.2 Wildlife

Eglin supports a rich diversity of game and non-game wildlife due to the variety of habitats found on the base. Approximately 559 animal species have been identified, 35 of which are sensitive animal species (U.S. Air Force, 1995). Eglin has managed its wildlife since 1949; the current wildlife management plan is incorporated into the Integrated Natural Resources Draft Transitional Plan (U.S. Air Force, 1998b). The Sikes Act provides a mechanism for the management of wildlife on military reservations and extends protection to migrating game birds. In 1991, the Air Force signed a Memorandum of Agreement to participate in the U.S. Fish and Wildlife Service's (USFWS) Federal Neotropical Migratory Bird Conservation Program, which promotes and protects neotropical birds and their habitats (U.S. Air Force, 1995).

Birds

Avian species found on the Eglin reservation range from ground-dwelling game birds and wading birds to raptors and the endangered red-cockaded woodpecker. Gamebirds include the wild turkey, wood duck, and quail. The woodlands of the Sandhills surrounding TA-C74 and the open areas of the Grassland/Shrubland ecological associations on the test area provide nesting and hunting areas for raptors such as the red-shouldered hawk, the screech owl, and the great horned owl, which are found throughout Eglin (U.S. Air Force, 1995). The Sandhills and Open Grassland/Shrubland ecological associations are also home to the southeastern American kestrel, a small raptor that preys on small rodents, reptiles, and insects in clearings and woodland edges (U. S. Air Force, 1995). Large trees near large bodies of water in the Sandhills and Swamp/Wetlands ecological associations are used by the bald eagle for nesting and perching.

The red-cockaded woodpecker (RCW) resides in the cavities of live, old longleaf pines with heart rot, and there are RCW nesting locations just north of TA C-74. Eglin AFB is monitoring approximately 260,000 acres of this bird's habitat located primarily in the Sandhills ecological association (U. S. Air Force, 1995).

Many neotropical migrants use high quality sandhills and slope forest plant communities found within the Sandhill ecological association around TA C-74 (U. S. Air Force, 1995). Neotropical migrants are birds that winter in South and Central America and migrate to temperate regions in the summer to breed. The ruby-throated hummingbird, blue grosbeak, great crested flycatcher,

common yellowthroat, and summer tanager are among the neotropical migrants occurring on the Eglin reservation. The bottomland hardwood swamps associated with the major drainages and riparian areas on TA C-74 provide the most important habitat for these birds (U. S. Air Force, 1995).

Sandhill upland lakes provide feeding areas for wading birds, while riparian, wetlands, and adjacent woodlands are common habitat for wood ducks. There are wood duck nest boxes located at Indigo Pond, about 1,200 feet north of TA C-74. Marshy areas are home to clapper rails and the red-winged blackbird (U. S. Air Force, 1995). Belted kingfishers are common to shallow riparian habitats. Marshes and swampy areas also accommodate the great blue heron, black-crowned night heron, and northern harrier (U. S. Air Force, 1995).

Amphibians

Representatives of amphibians of TA C-74 include newts, salamanders, frogs, and toads. Gopher frogs reside around ephemeral ponds and upland sandhill lakes and also wander in the surrounding upland sandhills (U. S. Air Force, 1995). The Sandhills ecological association provides habitat for the barking treefrog and the central newt.

Reptiles

Reptiles found on TA C-74 include turtles, lizards, snakes, and pit vipers. Pit vipers, such as the eastern diamondback rattlesnake, can be found in the Sandhills and Open Grassland/Shrubland associations, while the cottonmouth is found near sandhill upland lakes and marshes and swampy areas. Snakes include the eastern coachwhip and the southern black racer, both of which are found in the Sandhills and Open Grassland/Shrubland associations. Eastern fence lizards inhabit the Sandhills, and gopher tortoises inhabit the Sandhills and Open Grassland/Shrubland associations. Gopher tortoises are part of a habitat that includes the sensitive indigo snake and gopher frog as well as several other species. However, none of these species have been documented as occurring on TA C-74.

Mammals

Many types of mammals inhabit the Eglin reservation including moles and shrews, bats, rabbits, rats, mice, squirrels, gophers, beavers, cats (feral and bobcat), dogs (coyote and fox), raccoons, black bears, otters, weasels, skunks, and the white-tailed deer. Most of these mammals are found throughout the reservation, and are not specific to any test area or ecological association. Rather, the same species can be found in a number of different habitats.

3.4.2.1 Sensitive Species

Federally listed endangered, threatened, and candidates for listing, as well as state threatened, endangered, and species of special concern that occur on and around TA C-74 are listed in Table 3-4. Figure 3-5 shows the location of certain sensitive species occurring in the vicinity of the TA C-74 Complex. Comprehensive descriptions of these species are presented in Appendix D. The federal candidate category is for listing by the federal government when sufficient biological information is available to support a proposal to list the species as endangered or threatened.

An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is any species that is likely to become endangered within the future throughout all or a significant portion of its range due to factors such as loss of habitat and anthropogenic effects. A candidate species is one for which the U.S. Fish and Wildlife Service (USFWS) has on file sufficient information on biological vulnerability to warrant a listing but the listing is precluded at the present time. Once legally protected, it is a federal offense to “take” (import, export, kill, harm, harass, possess, or remove) protected animals from the wild. Similar regulations are in place for state-listed species (endangered, threatened, or species of special concern).

Air Force projects that may affect federally protected species, species proposed for federal listing, and critical habitat for protected species are subject to Sections 7 and 10 of the Endangered Species Act prior to the irreversible or irretrievable commitment of these resources (U.S. Air Force, 1995). Eglin has developed an overall goal within the Integrated Natural Resources Draft Transitional Plan to continue to protect and maintain populations of native threatened and endangered plant and animal species within the guidelines of ecosystem management (U.S. Air Force, 1998b). In 1992, Eglin, along with the U.S. Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission (FFWCC), entered into a cooperative agreement to manage individual species on the installation, including both federal- and state-listed species.

Special incidental take permits and relocation permits may be granted from the FFWCC for state-listed species. These permits are only granted if the “taking” does not prove detrimental to the survival potential of the species. If military mission activities are going to be performed that might lead to the incidental take of a species of special concern, a permit is required. The accidental killing of a species of special concern should be documented and reported to the FFWCC. Incidental “takes” of threatened species, authorized by special permit, are permitted only if the activity does not have a negative effect on the survival potential of the species. The pursuing, molesting, harming, harassing, capturing, or possession of any endangered species or parts of their nests or eggs, except as authorized by special permit, are allowed only when the activity clearly enhances the survival potential of the species. The killing or wounding of an endangered species is punishable as a second degree misdemeanor under State of Florida Laws and Regulations, Wildlife Code (Chapter 39, Florida Administrative Code).

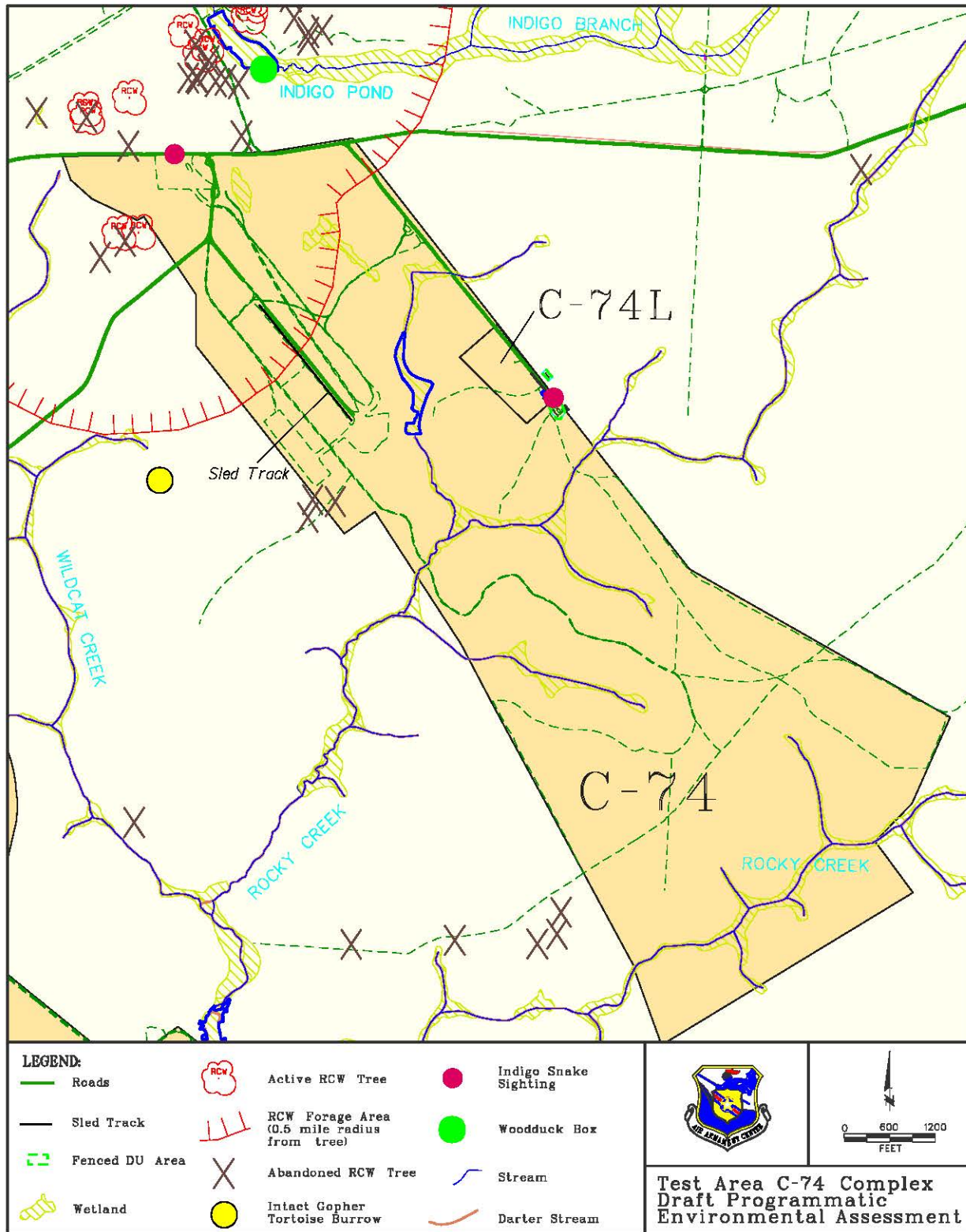


Figure 3-5. Sensitive Species Occurring in the Vicinity of the TA C-74 Complex

The six sensitive wildlife species listed as federally and/or state endangered, threatened or species that merit consideration that have been identified as potentially occurring within and/or adjacent to the Grassland/Shrubland habitats on C-74 include:

- Southeastern American kestrel (*Falco sparverius paulus*)
- Gopher tortoise (*Gopherus polyphemus*)
- Okaloosa darter (*Etheostoma okaloosae*)
- Dusky gopher frog (*Rana capito sevosa*)
- Eastern indigo snake (*Drymarchon corais couperi*)
- Red-cockaded woodpecker (*Picoides borealis*)

The two additional federal- and/or state-listed wildlife species that have been identified as occurring within one kilometer or potentially visiting TA C-74 include:

- Florida black bear (*Ursus americanus floridanus*)
- Florida pine snake (*Pituophis melanoleucus*)

These species and their state status and habitats are presented in Table 3-4. Locations of these species and their habitat in relation to TA C-74 are shown in Figure 3-5, and a comprehensive description of each species is presented in Appendix D.

Table 3-4. Federal- and State-Listed Wildlife Species Associated with TA C-74

<i>Federally-Listed Endangered Species</i>	
Sensitive Species	Habitat
Okaloosa Darter	Small, shallow tributaries of Choctawhatchee Bay
Red-cockaded Woodpecker	Longleaf pine forests over most of Eglin AFB.
<i>Federal/State-Listed Threatened Species</i>	
Sensitive Species	Habitat
Eastern Indigo Snake	Occurs in xeric Sandhills and is a frequent user of gopher tortoise burrows and stumpholes.
<i>State-Listed Threatened Species</i>	
Sensitive Species	Habitat
Florida Black Bear	Utilizes riparian areas and may pass through the test area.
Southeastern American Kestrel	Preys on animals in clearings and woodland edges.
<i>State-Listed Species of Special Concern</i>	
Sensitive Species	Habitat
Gopher Tortoise	Primarily found in longleaf pine and xerophytic oak woodlands and open grasslands of the test areas.
Florida Pine Snake	Retreats to loosely packed sand, rodent burrows, and occasionally gopher tortoise burrows.
Dusky Gopher Frog	The frog is associated with gopher tortoise and mouse burrows, hollow stumps, and other holes.

Source: U.S. Fish and Wildlife Service, 2000; Florida Natural Areas Inventory, 2000

3.4.3 Summary

There are no documented sensitive plant species identified on or adjacent to TA C-74. A Florida Natural Areas Inventory (FNAI) designated High Quality Natural Sandhills community is located to the southwest, adjacent to TA C-74.

The Okaloosa darter, RCW, and eastern indigo snake (all federally listed), the southeastern American kestrel (state threatened), and the gopher tortoise, and dusky gopher frog (state listed species of special concern) are six species documented to occur near or on TA C-74. These specialist species have specific behaviors and habitat requirements that may be sensitive to certain types of habitat alteration. Specific information regarding these species is provided in Appendix D.

Table 3-5 provides a listing of both plant and animal species commonly found within the ecological associations on and surrounding TA C-74.

Table 3-5. Plant and Animal Species Commonly Found in the Ecological Associations of TA C-74

Plants		Animals	
Sandhills Ecological Association			
Longleaf Pine	<i>Pinus palustris</i>	Red Cockaded Woodpecker	<i>Picoides borealis</i>
Turkey Oak	<i>Quercus laevis</i>	Bobwhite Quail	<i>Colinus virginianus</i>
Blackjack Oak	<i>Q. marilandica</i>	Great Horned Owl	<i>Bubo virginianus</i>
Bluejack Oak	<i>Q. incana</i>	Gopher Tortoise	<i>Gopherus polyphemus</i>
Wiregrass	<i>Aristida stricta</i>	Indigo Snake	<i>Drymarchon corais</i>
Saw Palmetto	<i>Serona repens</i>	Diamondback Rattlesnake	<i>Crotalus adamanteus</i>
Bracken Fern	<i>Pteridium aquilinum</i>	Six-lined Racerunner	<i>Cnemidophorus sexlineatus</i>
Blueberry	<i>Vaccinium</i> spp.	Florida Black Bear	<i>Ursus americanus floridanus</i>
Yaupon	<i>Ilex vomitoria</i>	Fox Squirrel	<i>Sciurus niger</i>
Gallberry	<i>Ilex glabra</i>	Least Shrew	<i>Cryptodus parva</i>
Gopher Apple	<i>Licania michauxii</i>	Cottontail Rabbit	<i>Sylvilagus floridanus</i>
Blackberry	<i>Rubus cuneifolius</i>	Pocket Gopher	<i>Geomys pinetus</i>
Swamp Ecological Association			
Yellow Water Lilly	spp.	Raccoon	<i>Procyon lotor</i>
Saw Grass	<i>Cladium jamaicensis</i>	Florida Black Bear	<i>Ursus americanus floridanus</i>
Cattail	<i>Typha domingensis</i>	Sherman's Fox Squirrel	<i>Sciurus niger shermani</i>
Phragmites	<i>Phragmites australis</i>	American Alligator	<i>Alligator mississippiensis</i>
White Cedar	<i>Chamaecyparis thyoides</i>	Pine Barrens Tree Frog	<i>Hyla andersonii</i>
Water Tupelo	<i>Nyssa biflora</i>	Five-lined Skink	<i>Eumeces fasciatus</i>
Pitcher Plant	<i>Sarracenis purpurea</i>	Green Anole	<i>Anolis carolinensis</i>
Red Titi	<i>Cyrilla racemiflora</i>	Garter Snake	<i>Thamnophis sirtalis</i>
Tulip Poplar	<i>Liriodendrom tulipifera</i>	Indigo Snake	<i>Drymarchon corais</i>
Sweet Bay Magnolia	<i>Magnolia virginiana</i>	American Beaver	<i>Castor canadensis</i>
Red Bay	<i>Persea borbonia</i>	Parula Warbler	<i>Parula americana</i>

Source: Snyder, 1999; Wolfe and Reidenauer, 1988; U.S. Air Force, 1995

3.5 ANTHROPOGENIC RESOURCES

Humans inevitably create features on the landscape or exercise activities that have varying degrees of influence on the environment. This section identifies existing conditions or features that characterize historic and active human influence on the environment associated with TA C-74. Anthropogenic considerations on the TA C-74 Complex include Installation Restoration Program/Area of Concern and Radioactive Waste (IRP/AOC/RW) sites and cultural resources. Recreation and public access is not permitted on the test area; therefore, recreational issues are not a concern. There are two AOCs on TA C-74/C-74L (U.S. Air Force, 2000a).

3.5.1 Installation Restoration Program/Area of Concern/Radioactive Waste Sites

The IRP/AOC/RW sites and associated test areas found on or near the C-74 Complex are listed below and shown in Figure 3-6:

- AOC 63/67 Test Area C-74
- RW 41 (AOC 41) Test Area C-74L

AOC 63/67 - Isotope Burial Site. AOC 63 and AOC 67 are the same site. AOC 63/67 is a closed, inactive, burial site created during a test project in 1960 to dispose of Zinc-65 contained on bullets used during the testing. The Zinc-65 isotope has a half-life of 244 days. A 1994 AOC investigation states that because at least 30 years have passed since the burial, no potential radioactive contamination is expected to remain. Based on the final Preliminary Assessment Report (9/22/98) the site has not been impacted and No Further Action has been approved by regulatory authorities (U.S. Air Force, 2000a).

AOC 41 (RW 41) - Test Area C-74L Depleted Uranium (DU) Site. This site covers approximately three acres of land that is divided into two areas: the Radiation Control Area (RCA) and the Holding Area. This site was used from the mid to late 1970s for testing penetrating munitions containing depleted uranium, which were shot into sand-filled bunkers. An estimated 7,400 kilograms of DU were expended at TA C-74L during the period of 1973 to about September of 1978 (Becker et al., 1994). The sand from the bunkers was periodically sifted to remove larger pieces of DU. Some of the particles that were sand-sized and smaller fell out onto the ground during this process (the area labeled as the RCA). In 1980, a portion of this site was remediated. Sand was removed, mixed with concrete and water for stabilization, sealed in containers, and held in the Holding Area until about 1987. These drums were then transported to a low-level radioactive waste disposal site (U.S. Air Force, 2000a). Through clean-up activities, an estimated 4,200 kilograms of DU was removed from the site, leaving approximately 3,200 kilograms of DU remaining at TA C-74L (Becker et al., 1994).

It is estimated that uranium concentrations in the soils of the RCA on TA C-74L are on the order of 21.3 $\mu\text{g}/\text{kg}$. This was derived with mass balance calculations assuming a uniform concentration over the entire RCA (Becker et al., 1994).

RW-41 is under investigation as part of Phase I of a Base-wide Low-Level Radioactive Materials investigation. A Characterization Study (CS) and Interim Corrective Measure (ICM) were conducted in 1999.

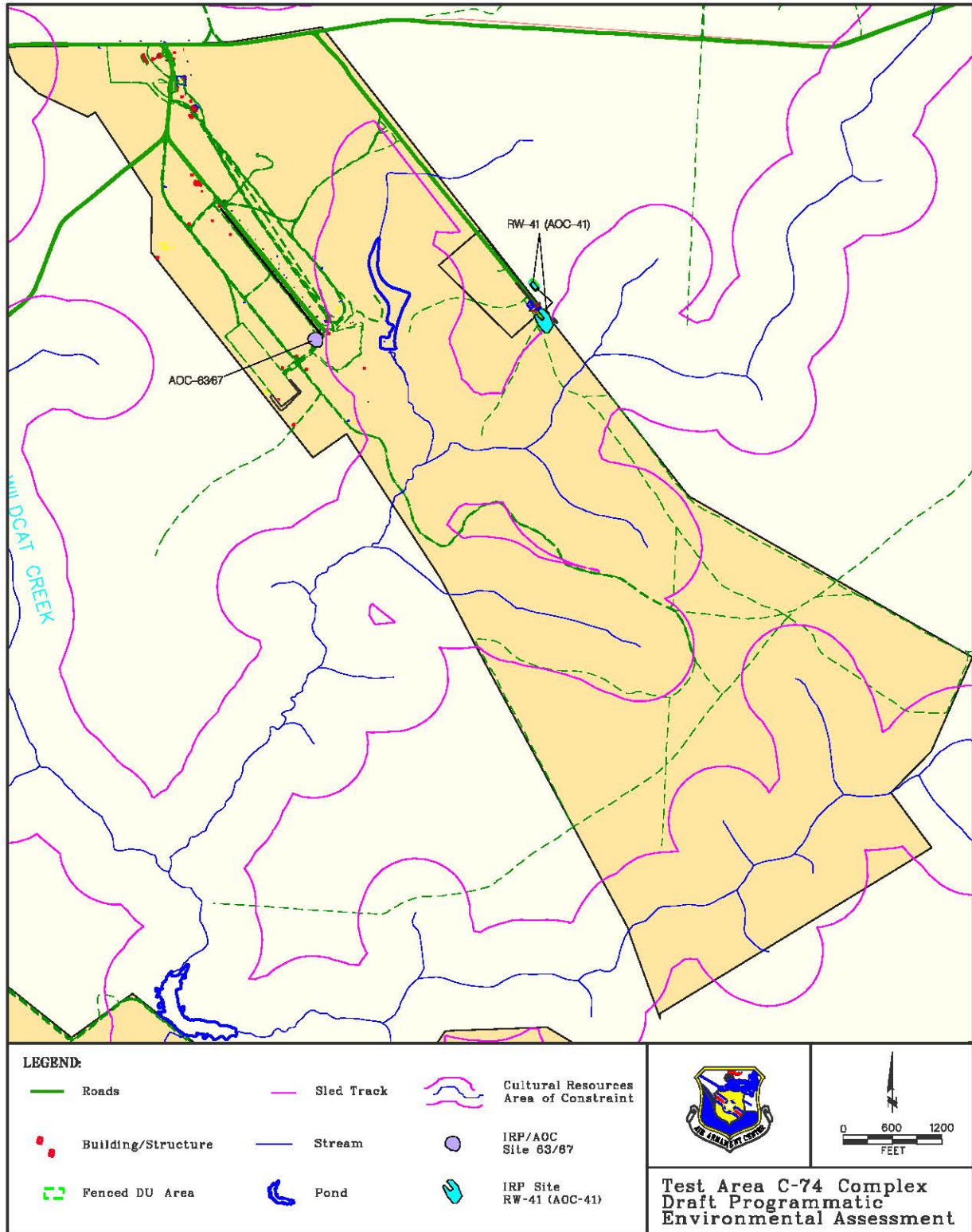


Figure 3-6. Anthropogenic Features of TAs C-74/C-74L

The ICM consisted of the collection and off-site disposal of discrete DU penetrator fragments on the ground surface and shallow subsurface. The CS/ICM Report was submitted to regulatory agencies in January 2000. Leachability and vegetative uptake studies have also been conducted at the site. Based on soil samples taken during the CS, no contaminants were found in the soil more than six inches below ground surface. This indicates that contaminant transport to surface waters via runoff and ground water via leaching is highly unlikely (Abdalla, 2001 and Crews 2001, pers. comm.). While the results of all analyses have been below regulatory concern, RW 41 is part of an ongoing basewide radiological survey. More detailed information on DU at C-74L may be found in the *Uranium Transport Investigations at Eglin AFB, Florida* report by Becker et al. (1994). A Remedial Action (cleanup) was scheduled for completion in May, 2001, however the completion date has since been delayed. The start date is now on hold pending approval of the C-74L decommissioning plan, due out in December 2001, from the Nuclear Regulatory Commission (NRC). Remedial Action is tentatively scheduled to begin in April or May of 2002 (Abdalla, 2001). More information regarding the status of RW-41 can be found in Eglin AFB's *Installation Restoration Management Action Plan*, October, 2000 or by contacting the Restoration section of Environmental Management at Eglin AFB.

Naturally, uranium atoms exist in several different isotopes. Natural uranium (U) contains three isotopes; ^{238}U (99.27%), ^{235}U (~0.72%), and ^{234}U (0.0057%) (Weast, 1967). Uranium-235 is the most radioactive component of naturally occurring uranium and has a half-life of 713 million years. When the amount of ^{235}U in a uranium sample has decreased from its natural abundance of 0.72 percent to 0.3 percent, it is referred to as DU. Depleted uranium is a result of uranium processing, and does not occur naturally (RAND, 1999). DU is less radioactive than naturally occurring uranium. DU is a heavy metal, thereby having many of the same characteristics and toxicological risks as other heavy metals such as lead, cadmium, and nickel. Transport of many heavy metals, including DU, can occur from a number of environmental transport mechanisms. Water is the primary transport mechanism, potentially carrying DU to streams and ponds via runoff or to the groundwater system via leaching. Wind can also carry dust containing DU particles. Other pathways include biological transport through the food chain (U.S. GAO, 1993).

Health effects are primarily determined by three factors: the amount of DU the subject is exposed to, the chemical and physical properties of the DU, and the duration and mode of exposure. DU, a low level radioactive material, emits alpha and beta particles, and gamma rays. Alpha particles have a limited ability to penetrate materials, and are unable to penetrate epidermis. Although alpha particles present no external radiation hazard, they are an internal radiation hazard under certain conditions. When internalized into the body via ingestion, inhalation, or by other means, alpha radiation can cause localized cell damage. The risk of cancer is the most significant adverse health hazard from low-level exposure to alpha particles. Beta particles possess a greater ability to penetrate materials than alpha particles. When DU is in close proximity to the body beta radiation creates a skin exposure hazard. However, the significance of skin exposure hazards are dependant on, and have a direct relation to, the proximity and duration of exposure. Similar to alpha particles, beta particles, when internalized, present internal radiation hazards. Gamma rays are the most penetrating of the radiations emitted by DU, however a significant fraction of the gamma rays emitted are self-absorbed by the DU. As a result, gamma radiation exposure is normally not a significant hazard (U.S. Air Force, 2000b).

3.5.2 Cultural Resources

Section 106 of the National Historic Preservation Act requires that federal agencies analyze the impacts of federal activities on historic properties. Areas potentially impacted by mission activities are surveyed as part of the Air Force Environmental Impact Analysis Process. Mitigative measures are developed to minimize impacts. Defining zones of constraint aids project planners and managers in decision-making for relocation of a project site to avoid delays necessitated by additional investigation and/or consultation.

The following paragraphs describe Eglin's cultural resources as either 1) Areas of Cultural Resource Constraint, or 2) Constraint-Free Areas.

1. Areas of Cultural Resources Constraint - These areas may require cultural resources investigation and/or consultation between Eglin and the State Historic Preservation Office (SHPO) during the planning stages of a project. These areas are defined as one of the following:
 - a. 100-acre (or greater if warranted by site size) area around sites eligible or potentially eligible for the National Register of Historic Places.
 - b. Non-surveyed areas within high or indeterminate probability zones. High probability zones are defined as 1) areas within 200 meters of water and situated no more than 50 feet above the water source, and 2) areas where the historic record indicates activity may have occurred prior to military ownership.
2. Constraint-Free Areas - These areas do not require cultural resources consideration or consultation prior to mission activity, although Eglin's Cultural Resources Branch must be notified promptly if any cultural material is discovered. Eglin's Cultural Resources Branch will work to ensure that discovery does not impede the mission. Constraint-free areas include two subsets:
 - a. Surveyed areas (regardless of probability) with the exception of the buffer zones around eligible or potentially eligible sites (which fall into Category 1 above).
 - b. Low probability areas with the exception of buffer zones around eligible or potentially eligible sites (which fall into Category 1 above).

Of the 463,000 acres comprising the Eglin Military Complex, 100,000 acres have been surveyed and over 1,300 cultural sites identified. A total of 213,000 acres has been removed from consideration because of the low probability of finding prehistoric cultural resources.

Figure 3-6 indicates Areas of Cultural Resource Constraint on TA C-74. A surveyed site, site 8WL1485 (which is not shown in the figure), located on TA C-74 was found to be non-eligible for listing on the National Register of Historic Places by the SHPO (Appendix F). Areas of constraint occupy ~567 acres of TA C-74's land area, and include, but are not limited to, previously unsurveyed property determined to have a high probability for the occurrence of cultural resources and significant historic properties. Constraint areas are systematically surveyed as part of Eglin's compliance requirements to inventory all of its cultural resources. As these are continuously being updated, consultation with the Air Armament Center, Cultural

Resources Division of Environmental Management Directorate (AAC/EMH) is required to obtain the latest information for any activities that would impact a constraint area.

The AAC/EMH has inventoried approximately 124,000 acres of the Eglin Reservation most of which falls within high probability areas designated as a 150 meter zone along streams and the bayfront. It is estimated that there are approximately 210,000 acres of high probability on Eglin. Less the number of acres already inventoried, there are roughly 86,000 acres remaining that comprise test area as well as interstitial lands.

The use of test area lands falling within cultural resource areas of constraint has been a sensitive land-use issue in the past, and will continue to be in the future. As a result, EMH and the Test Wing (TW) are presently coordinating a proactive, accelerated survey process for specific areas identified by the TW as “high interest” areas. This involves identifying test areas with cultural resource constraints as a land-use issue, prioritizing these areas for cultural resource surveys, conducting surveys, and then designating the area as non-constrained or as specific sites for protection/further study. This proactive approach would serve to eliminate potential future cultural resource/land-use issues for the test areas in question.

Areas not specifically indicated as constrained in Figure 3-6 are considered constraint free. Activities planned in constraint free areas do not require consultation with AAC/EMH. In the event of unexpected discovery of cultural resources in areas shown to be constraint free, all activity in the immediate vicinity will cease until the Base Historic Preservation Officer has been notified and a determination of significance has been rendered. EMH is currently integrating their maps into a GIS system to better describe these definitive areas of cultural resources. A map of all of the constraint zones on Eglin is in production and upon completion will be placed in the GIS viewer and on the Eglin internal web site. More specific information is sensitive and AAC/EMH should be consulted on a need-to-know basis. Until a complete survey of the constraint areas has been accomplished, direct physical impact to unknown cultural resources would be possible.

In lieu of additional inventories of the Eglin Reservation, Air Staff supports the development of a Programmatic Agreement with the SHPO to clear 378,000 acres of Eglin as either inventory complete or low probability not requiring inventory. Consultation under Section 106 of the National Historic Preservation Act would only be required if the proposed action has the potential to impact known archaeological/historic sites previously inventoried or areas not yet inventoried which AAC and SHPO agree have a high probability for cultural resources (approximately 86,000 acres). Until such time that such an agreement is developed and in place, all actions having the potential to affect resources known or unknown are subject to Section 106 consultations, and Section 110 inventory requirements will remain in place.

3.5.3 Summary

A zone of high probability for cultural resources is located on lands that skirt streams on or adjacent to TA C-74. Two IRP Sites, AOC 63/67 (TA C-74, designated as No Further Action) and RW 41 (AOC 41, TA C-74L currently in a Remedial Action cleanup phase), are present on the Test Area C-74 Complex.

4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

The purpose of this chapter is to analyze the potential impacts of current mission effectors (Chapter 2) on the TA C-74 Complex affected environment receptors (Chapter 3). Through analysis of this cause-effect relationship between effectors and receptors, the nature and possible consequences of mission activities on the TA C-74 Complex can be identified and characterized. Analysis will focus on quantifying potential environmental impacts to both the physical (air, water, and soil) and biological (plants and wildlife) resources of the TA C-74 Complex. The levels of mission activity, as described in Chapter 2 under Alternatives 1 and 2, are treated as the environmental baseline. This section will identify environmental issues associated with the baseline and quantify these issues by using units of measurement called metrics. Analysis then proceeds by identifying the potential impacts associated with the Alternatives described in Chapter 2. The organization of this chapter and the environmental analysis process utilized is described as follows.

4.1.1 Organization

Mission Activities

For the environmental analysis, the military mission activities are divided into the following categories:

- Sled Track Operation (*Kinetic Energy Munitions Test Facility: TA C-74*)
- Live Munition Detonations (*Kinetic Energy Munitions Facility, Arena Test Area: TA C-74*)
- Gunnery Ballistics Testing (*Arena Test Area: TA C-74, Gun Bay: TA C-74L*)

TA C-74A, the Munitions Analysis Facility, is used primarily to store and analyze the internal condition of munitions by nondestructive (X-ray) or destructive (sectioning) test techniques and to provide temporary storage for test munitions. TA C-74A is an indoor facility. As such, mission activities utilizing this facility do not result in any emissions to the environment, and therefore do not contribute to the environmental issues identified and analyzed in this document. Storage and handling of munitions and residual chemical by-products are handled in accordance with strict guidelines and regulations (including AFM 91-201; *Explosive Safety Standards*, DoD 6055.9 STD; *DoD Ammunition and Explosives Safety Standards*, 29 CFR 1910.120; *Occupational Safety and Health Act (OSHA)*, *Chemical Hazard Communication Program* and *Air Force Instruction 32-7042; Solid and Hazardous Waste Compliance*) and do not pose a threat to humans or physical and biological resources. With these factors under consideration, mission activities associated with TA C-74A are not analyzed within the context of this document.

The targets and areas of military mission activity associated with the environmental analysis in this document on the TA C-74 Complex are presented in Figures 4-1 and 4-2. General descriptions of these mission activities follow the figures.

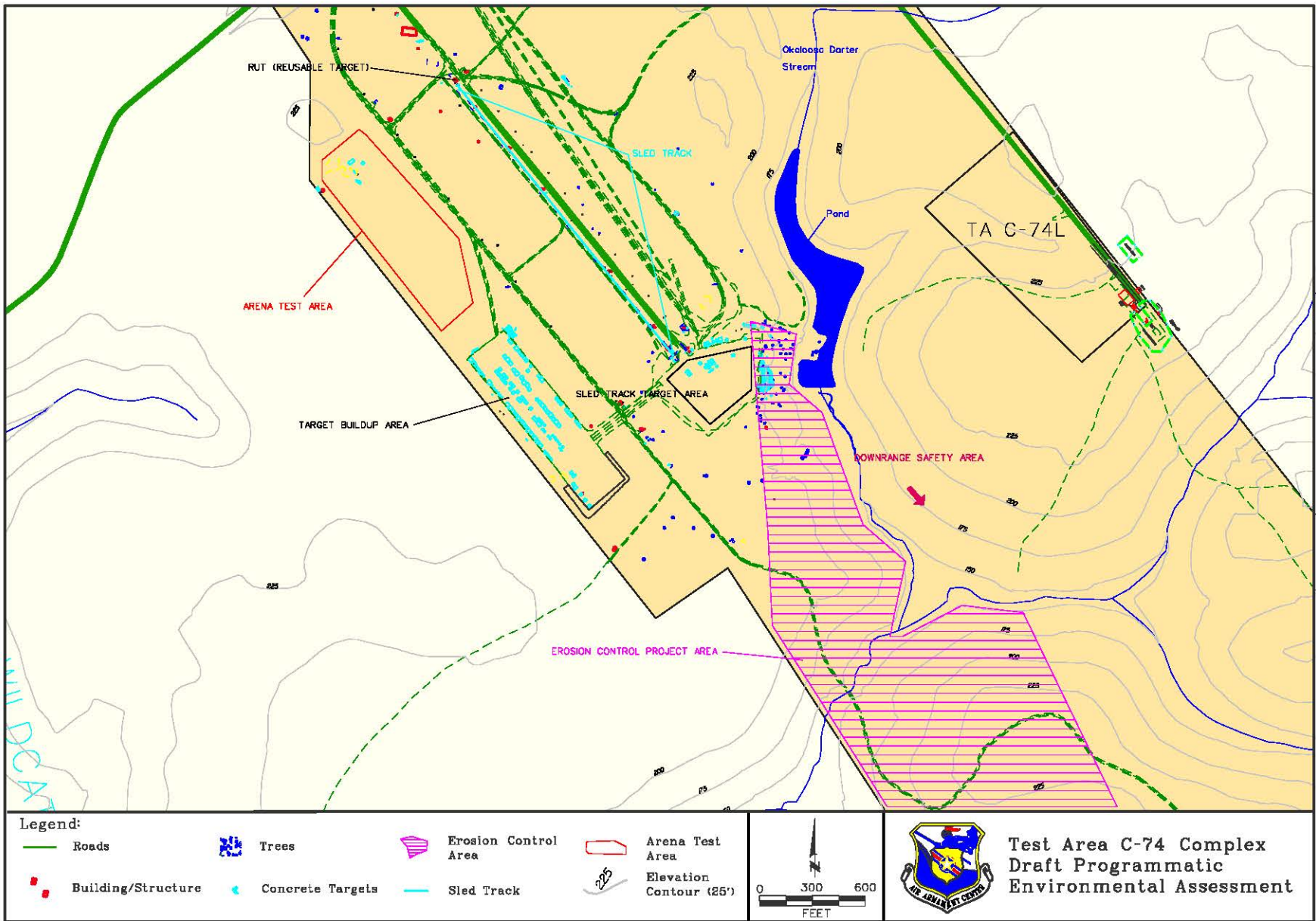


Figure 4-1. Targets and Areas of Mission Activity on TA C-74

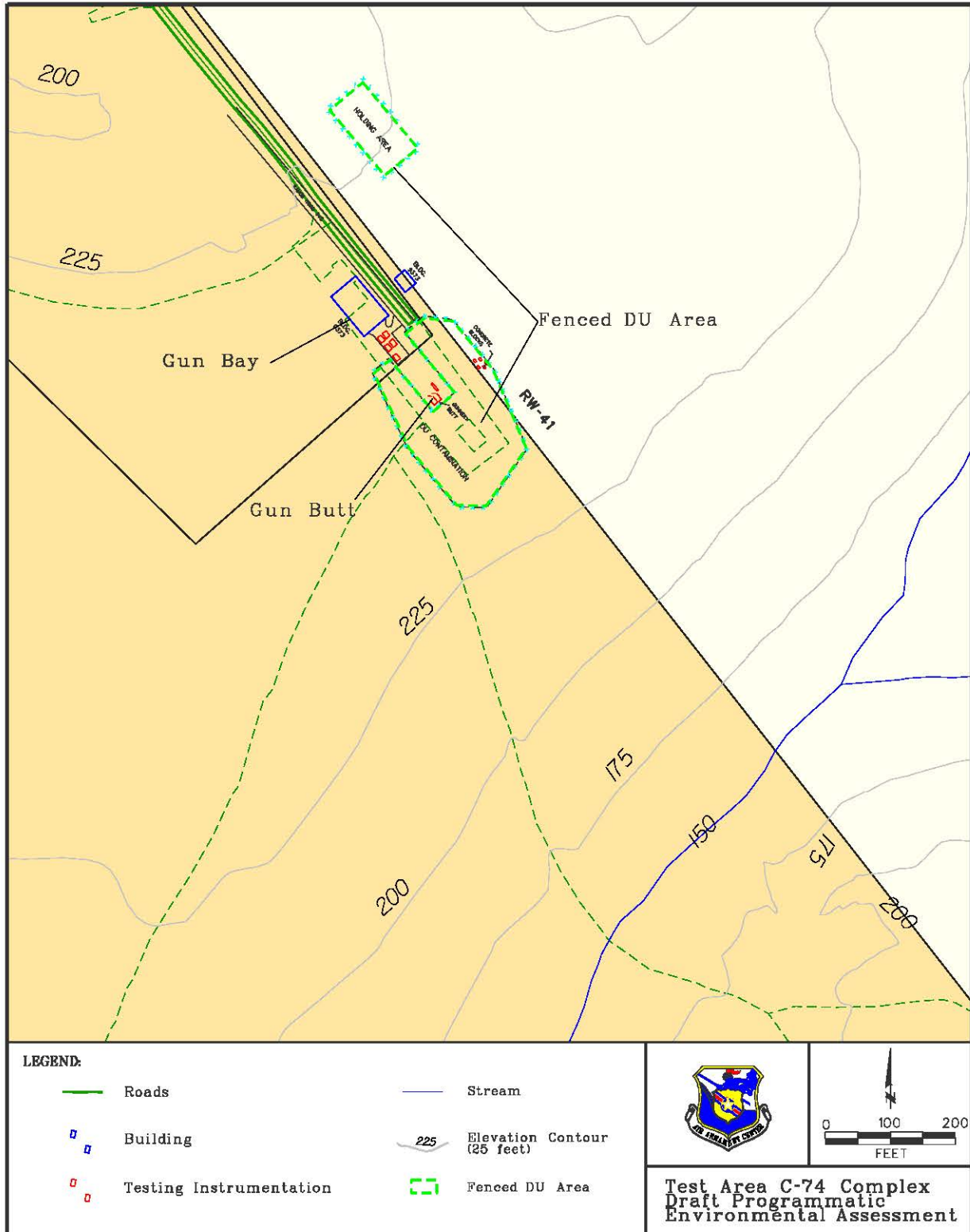


Figure 4-2. Targets and Areas of Mission Activity on TA C-74L

Sled Track Operations

Sled track operations utilize the Kinetic Energy Munitions Test Facility (KEMTF) located on TA C-74 (Figure 4-2). The KEMTF is a dynamic facility capable of performing the following tests:

- Ballistics - Test item, either a live or inert bomb or warhead, is propelled into a stationary target.
- Reverse Ballistics - Target is propelled into a stationary test item.
- Aeroballistics - Test item is launched from a moving platform.
- Simulated Dispersion Testing - End section of the track is angled upward and the test item is kinetically propelled through the air at a set trajectory into a target.
- Dynamic Arena Testing – Test item is propelled into an instrumented arena and detonated.

A typical testing event involves the attachment of a test item (usually an inert or live bomb or warhead) via straps to a “carrier sled,” while another “propelling sled” fitted with a number of rocket motors is placed directly behind the carrier sled. The propelling sled then moves the carrier sled along the sled track. The majority of tests involve delivery of munitions from the north end of the sled track to the south end. The rocket motors are remotely activated in stages along the sled track in order to achieve the desired speed for target impact. The ends of the sled track are equipped with blades that cut the straps, separating the test item from the sled. The test item is released from the sled and propelled forward into a target (usually consisting of concrete blocks of varying thickness weighing up to 160 tons) while the sled continues forward at a declination, eventually hitting a barrier before reaching the test target. Typically, inert test items pass through the target and continue down range, occasionally for thousands of feet. The test item is then recovered and taken to TA C-74A for analysis, the target is analyzed and removed, and the target area is cleaned of debris. Live test items are also used in sled track testing, in which case the test is designed so that the item detonates upon exit of a target. Testing at the north end typically involves the RUT (Reusable Target), which is a building constructed to simulate as an underground bunker or chemical weapons facility (without the chemicals). The RUT was developed to support multiple test events and is easily repaired and instrumented. Both static testing (stationary detonation) and sled testing have been conducted using the RUT. Other missions are occasionally fired toward the north end of the sled track against targets other than the RUT.

Live Munition Detonations

In addition to both ends of the sled track, live munition detonations also occur at the arena test area, located west of the sled track (Figure 4-2). As mentioned previously, live munition detonations can be the end result of a sled track operation, where a live munition is delivered down the track and detonates upon exit of a target, either at the northwest end (the RUT) or the southeast end. At the arena test area test items are either buried with, or lain on top of, targets and detonated. These types of tests are conducted to assess the damage potential of certain types of munitions on targets of varying thickness at varying depths and angles.

Gunnery Ballistics Testing

Gunnery ballistics testing takes place on both TA C-74 and TA C-74L. These activities are performed to evaluate the effectiveness of a weapon in penetrating and/or damaging targets. Typical gunnery ballistics testing on TA C-74 consists of warheads and scaled warhead fragment simulants that are launched from a gun into steel plates, concrete targets, or vehicles. These activities usually take place in the arena test area, shown in Figure 4-2. Gunnery ballistics testing on TA C-74L involves various caliber rounds using an automatic Gatling gun fired from the gun bay located at TA C-74L into a sand-filled gun-butt (Figure 4-3). Before testing the ammunition with the automatic gun, target practice (TP) rounds are fired as a single shot, manually fired from a “Mann-gun” (a specifically modified, oversized and reinforced test gun tube named after its inventor, Dr. Franklin W. Mann) for interior ballistic evaluation of small to medium caliber cartridges. Depleted uranium (DU) testing was discontinued at TA C-74L in 1978, and is no longer conducted at the complex.

Identified Resources

The Affected Environment (Section 3) resources have been summarized into three general resource categories for impact analyses:

- Physical Resources
 - Air Quality
 - Soil Quality
 - Water Quality
- Biological Resources
 - Plants (includes threatened and endangered species)
 - Wildlife (includes threatened and endangered species)
- Anthropogenic (Human Related) Resources
 - Public
 - Cultural

4.1.2 Issues

Issues are defined as the general categories used to distinguish the potential environmental impacts of mission activities on the Affected Environment resources. Specifically, an issue is a mission effector product, by-product, and/or emission that may directly or indirectly impact the physical, biological and/or anthropogenic environment receptors. A direct impact is a distinguishable, evident link between an action and the associated impact, whereas an indirect impact may occur later in time and/or may not exhibit a visible link between an action and an impact. For the purposes of analysis, the issues associated with the mission activities on the TA C-74 Complex include the following:

- Noise (Section 4.2)
- Chemical Materials (Section 4.3)
- Direct Physical Impact (Section 4.4)
- Habitat Alteration (Section 4.5)
- Restricted Access (Section 4.6)

Noise

Noise is defined for the TA C-74 Complex as the sound produced by munitions testing activities. Noise may directly inconvenience and/or stress humans and some wildlife species and may cause hearing loss or damage. Noise effects can be perceived as pressure, vibration, sound, or combinations of these depending on the proximity of a resource to the source of noise and the type of resource potentially affected. Buildings could be affected by vibration, while the sudden onset of noise may elicit a startle response from nesting birds that could cause them to abandon their nests. Scientific data correlating the effects of noise on humans is well documented; however, information regarding the effects of noise events on wildlife species is limited. The impacts of noise to the public and threatened and endangered species are a primary concern. Noise is produced on the TA C-74 Complex by sled track operations, live munition detonations, and gunnery ballistics testing.

Chemical Materials

Chemical materials encompass liquid, solid, or gaseous substances that are released to the environment as a result of mission activities. These include organic and inorganic materials that can produce a chemical change or toxicological effect to an environmental receptor. Examples include gaseous air emissions (aircraft exhausts, smokes, combustion products of explosives and propellants), liquid materials (fuels and pesticides), and solid materials such as metals from ammunition expenditures (zinc, copper, aluminum, and lead). The by-products of ordnance expenditures could potentially contaminate soil or underlying groundwater, or affect air quality. The mission activities on the TA C-74 Complex of potential consequence to chemical materials include sled track operations, live munition detonations, and gunnery ballistics testing.

Direct Physical Impact

Direct physical impact is the physical harm that can occur to organisms (plant or animal) or cultural resources as a result of mission activities. Examples include aircraft collisions with birds, vehicle-animal road collisions, crushing of an organism by vehicle or foot traffic, and ordnance shrapnel or debris striking an organism. Direct physical impact is also a threat to prehistoric and historic cultural features; significant features, structures, artifacts, and site integrity may be damaged or lost due to physical disruptions. Test area mission activities that are of potential consequence to direct physical impact are sled track operations and live munition detonations.

Habitat Alteration

Habitat alterations involve damage, stress, or disruptions to test area habitats resulting in the alteration or degradation of ecologic and geomorphologic components that support organisms. Subsequent degradation of unique and diverse habitats may impact sensitive species. Habitat alteration is a consequence of such things as soil erosion, sedimentation of aquatic habitats, and physical changes in topography. Any of these may result in physical stress, injury, or mortality to the biological components of habitats. The mission activities of potential consequence to the habitats of the TA C-74 Complex are sled track operation, the associated recovery of the test item, and the maintenance of the sled track target impact area at the southeast end of the sled track.

Restricted Access

Restricted access pertains to the temporary closure of test areas, interstitial areas, or public roads because of mission activities. Receptors potentially impacted include the military and the public desiring to use roads, test areas or recreational areas. Test area mission activities that are of potential consequence to restricted access are sled track operations and live munition detonations.

4.1.3 Process

Environmental Analysis

Each military activity category was associated with potential issues related to the activity. Then, for each issue category, the receptors that are potentially impacted by each issue are identified and environmental analysis is performed. The mission activities, associated issues, and potentially impacted receptors pertaining to the TA C-74 Complex are listed in Table 4-1.

Table 4-1. TA C-74 Complex Mission Activities, Associated Issues, and Potentially Impacted Receptors

Mission Activity	Receptor	Issue				
		Noise	Chemical Materials	Direct Physical Impact	Habitat Alteration	Restricted Access
Sled Track Operation	Physical Resources	-	⊗	⊗	⊗	-
	Biological Resources	⊗	⊗	⊗	⊗	-
	Anthropogenic Resources	⊗	-	⊗	-	⊗
Gunnery Ballistics Testing	Physical Resources	-	⊗	-	-	-
	Biological Resources	⊗	⊗	-	-	-
	Anthropogenic Resources	⊗	-	-	-	-
Live Munition Detonations	Physical Resources	-	⊗	⊗	-	-
	Biological Resources	⊗	⊗	⊗	-	-
	Anthropogenic Resources	⊗	-	-	-	⊗

- No potential impact

⊗ Potential impact

The analysis of mission activities and their potential effects on resources associated with the TA C-74 Complex produces a measure for each prescribed issue, which can be used for comparison when considering alternatives. Data from the baseline, plus selected historical activities, are used for environmental analysis. The baseline data indicates the location of the activity and the mission expendables (e.g., bombs). For the environmental analysis on the TA C-74 Complex, a scenario method of analysis was utilized based on historical mission activities. For a particular mission category, the combined baseline years of the mission activity are used for evaluation. The purpose is to provide a point of reference for evaluating current and future mission activity levels and their potential impacts.

Mission activity scenarios are developed to establish a measurement of effector-receptor impacts. Assumptions, based on a combination of established scientific methodologies and professional judgments, are then formulated to reflect the behavior, condition, and/or interactions of mission effectors and receptors. Mission impacts to receptors are then measured based on a comparison to available threshold criteria presented in scientific literature in order to exhibit the extent of impacts to receptors. In some cases, criterion for evaluating potential impacts is unavailable. In such cases, the discussion is based on what is known in the literature about impacts related to the issue.

The *Effector Analysis Report*, or EAR, (U.S. Air Force, 1996d) is an example of the scientific literature mentioned above and is referenced as part of the environmental analyses performed for this chapter. As stated in the introduction, the EAR was developed to serve as a comprehensive reference for the environmental effects of the Eglin expendables on the Eglin environment. The EAR is a compendium of detailed analyses that is based on a collection of over 300 references. The analyses in this chapter summarize the information presented in the EAR as it relates to mission activities on the TA C-74 Complex. Issues necessitating further elaboration are analyzed accordingly. A reference to the EAR is not one reference in and of itself, but a comprehensive assortment of references. The calculations involved in the environmental analysis process are presented in Appendix A. Pertinent laws and regulations driving the analysis process are listed in Appendix B, and Best Management Practices, offered in order to reduce the potential for environmental impacts from mission activities, are shown in Appendix C.

4.2 NOISE

Noise may be defined in terms of sound pressure level and sound frequency. Sound pressure levels (SPLs) are fluctuations in atmospheric pressure resulting from the movement of sound waves and are measured on a logarithmic scale in decibels (dB). When analyzing impacts from low frequency impulsive noise, such as an explosion, peak sound pressure levels (dBP) are used to express noise intensity (U.S. Air Force, 1996d). Impulsive noise, resulting from munitions or weapons testing, artillery, or ground impact of high explosive warheads, is a significant fraction of the noise environment at Eglin AFB (U.S. Air Force, 1996g). Noise resulting from munitions testing and training activities (Air Force and other DoD agencies) has regularly been the source of complaints from the local community (U.S. Air Force, 1996g). For noise analysis, mission

activities occurring on the TA C-74 Complex that contribute to the noise environment consist of the following:

- Sled Track Operation
- Detonation of Live Munitions
- Gunnery Ballistics Testing

Noise levels from these mission activities may extend beyond reservation boundaries into communities and may impact wildlife, including sensitive species, that inhabit both the TA C-74 Complex and the surrounding area. Impacts on these receptors from the aforementioned mission activities will be investigated in the following sections. The type and intensity of activity and environmental analyses of potential noise is discussed as well.

4.2.1 Alternative 1 (No Action) and Alternative 2

Noise events associated with sled track operations (as described in Section 4.1) and contributing to the noise environment result from the activation of rocket motors, the detonation of live munitions, and gunnery testing. Table 4-2 lists the number of *noise generating events and expendables* related to mission activities on the TA C-74 Complex for both Alternatives 1 and 2, as well as the net explosive weights (NEW), propellant weights, and TNT equivalents associated with those expendables. Inert weapons are excluded from this list because, generally, they lack an explosive warhead and are filled with concrete and/or a data-gathering telemetry package. As a result, potential noise effects from inert munitions do not apply.

Table 4-2. Alternative 1 and 2 Noise Generating Events and Associated Expendables

Mission Activity	NEW (lbs)		Total TNT NEW Equivalent* (lbs)	Alternative	
	Exp.	Pro.		1 and 2	
Expendable					
Sled Track Operations				Total Number of Mission Events	
Location: KEMTF, TA C-74				17	
				Number of Expenditures	
	HVAR Rocket Motor	-	24.83	30.5	123
	Genie Rocket Motor	-	319.8	393	15
	Zuni Rocket Motor	-	35	43	10
Live Munition Detonations				Total Number of Mission Events	
Location: TA C-74				13	
				Number of Expenditures	
<i>Arena Test Area</i>	JASSM 920 Scale, live	22	-	27	2
	JASSM 1/3 Scale, live	9	-	11	2
	C-4, 1 lb HE, live	1	-	1	42
	C-4, 0.125 lb HE, live	0.125	-	1.40	3
	Colt 45 WHD, live	370	200	701	1
	Mk-84, live	945	-	1,162	1
<i>Sled Track</i>	BLU-109 Bomb, live	535	-	658	1
	MMTD WHD, live	42	-	51	1
	AUP WHD, live	126	-	155	2
	HTW 1,000-lb bomb, live	245	-	301	1
	JASSM WHD, live	256	-	315	2

Table 4-2. Alternative 1 and 2 Noise Generating Events and Associated Expendables (Cont'd)

Mission Activity		NEW (lbs)		Total TNT NEW Equivalent* (lbs)		Alternative 1 and 2
		Exp.	Pro.			
Expendable				Exp.	Pro.	
Gunnery Ballistics Testing						Total Number of Mission Events **
						9/20
						Number of Expenditures
C-74	JASSM 920 Scale, inert	-	3.5		4.0	8
	JASSM 1/3 Scale, inert	-	1.2		1.5	1
C-74L	30 mm HEI (PGU-13/B)	0.1	0.33	0.1	0.2	4,119
	30 mm TP (PGU-15/B)	-	0.33		0.2	263
	20 mm HEI	0.03	0.09	0.04	0.04	178
	20 mm TP	-	0.09		0.04	216
	25 mm HEI (PGU/38)	0.07	0.21	0.1	0.1	100
	25 mm TP (PGU-23/U)	-	0.21		0.1	10

Exp. = Explosive

Pro. = Propellant

* See Equation A-1, Appendix A for calculation of TNT NEW Equivalent.

** Number of events = C-74/C-74L

TNT equivalencies are based on a conversion factor. For rocket motors and large munitions, a factor of 1.23 (the TNT equivalency of nitroglycerin) is used. No TNT equivalencies were available for the smokeless powder propellants used in the cartridges used at TA C-74L. For this reason, a conversion factor of 0.46 is used for these propellants (the TNT equivalency of black powder). Although black powder is somewhat more volatile than smokeless powder, the TNT equivalency of 0.46 more accurately represents the actual TNT equivalency of these cartridges than does the equivalency of 1.23 for nitroglycerin (Allen, 2000, pers. comm.). This is because smokeless powder, when ignited in a confined state (such as a cartridge), burns rather than detonates, creating gas pressure that bursts the shell and creates enough pressure to propel the projectile towards the target. While this does create noise, it is not as intense as that created by the detonation of an explosive.

4.2.1.1 Environmental Analysis

Noise Metrics

Harmful levels of noise are defined in terms of what is harmful to humans and begin at decibels above 140 dBP. Harmful effects are related to blast pressure or overpressure of the detonation, which is a supersonic pressure wave moving out from the point of detonation. After about 140 dBP, the pressure wave slows down to the speed of sound and effects become more noise-related than pressure-related. A study determined that humans exposed to 100 consecutive 140-dBP noise events without hearing protection would experience some permanent hearing loss (Pater, 1976). At 151 dBP, there is a risk of hearing impairment; eardrum rupture occurs at 185 dBP, lung hemorrhage at 194 dBP, and death at 201 dBP. Table 4-3 offers a noise effects summary.

Table 4-3. Acoustic Thresholds for Humans*

Sound Pressure Level (dBp)	Overpressure (psi)	Threshold of Concern
100	0.0003	Moderate risk of annoyance from the public
115	0.002	May elicit noise complaints
140	0.03	Maximum exposure without hearing protection
154	0.15	Increased risk of hearing impairment

Source: U.S. Air Force, 1996g

* See Equation A-2, Appendix A for calculation of dBp and psi.

Two criteria, the 115-dBP and 140-dBP noise levels, have been selected for impacts analysis. The 115-dBP level has been suggested as a level of noise that causes moderate annoyance to people (Pater, 1976). The 140-dBP level is the maximum safe exposure level for humans without ear protection. Therefore, noise above this level could potentially damage hearing in humans.

While there are many studies available regarding the effects of noise on wildlife, no definitive "threshold level" in regards to noise and animals has been established. However, the National Research Council, National Academy of Sciences has proposed that noise level criteria for animals be considered the same as that established for humans (described above). Potential impacts from excess noise may be in the form of behavioral response, auditory damage, interference with foraging or predation, and interference with mating (Efroymsen et al., 1999). In the absence of species specific data, the criteria chosen for analyzing the potential impacts of single-impulse noise events on biological receptors in this document is 140 dBp and greater. The prediction of the distance, in feet, from the point of detonation that noise up to 140 dBp would travel under favorable weather conditions (no temperature inversions with altitude and light, uniform, east/northeast surface winds with a moderate wind speed gradient aloft) is done using Equation A-3:

$$\text{Distance (in feet) of 140 dBp} = (600) \times \sqrt[3]{\text{NEW (lbs)}}$$

This equation is stated as 600 times the cube root of the TNT equivalent amount of net explosive weight (in pounds) (see Appendix A for application). The calculation is based on TNT equivalent net explosive weight (in pounds) (U.S. Air Force, 1999).

Weather, primarily winds and temperature inversions, may increase or decrease the distance noise will travel in a particular direction. Therefore, environmental impact analysis must also take into account the fluctuations in the extent and magnitude of sound pressure waves caused by changes in the weather. Variations in climatic conditions such as changes in wind speed and temperature inversions have a distinct influence on the behavior of sound as it moves through the atmosphere. These climatic variables concentrate and focus sound waves in a particular direction and reflect or refract sound energy. The result is potentially high sound pressure levels far from the noise source that may vary by 30 dBp or greater at 20 miles or less (U.S. Air Force, 1996c).

The noise prediction model, NAPS (Noise Assessment Prediction System), was used to determine the distance to which noise of 140 dBp under unfavorable weather conditions (cool season day; low-altitude, layered, or multiple temperature inversions; and strong north/northwest winds) and 115 dBp under both favorable and unfavorable weather conditions would travel for various explosive weights.

The determination of sound pressure levels is based on type and number of rockets used, type and location of munitions detonated, and the type and location of gun testing. Noise contours are then generated and used to establish an area of influence (AOI) reflecting the criteria described in Section 4.2.2 (115 and 140 dBP). The GIS is then used to determine the physical, biological, and anthropogenic resources within the AOI in order to assess potential impacts from noise generating events.

Potential Receptors

Plants

No data were available concerning the impacts of noise overpressures on plants. It is estimated, however, that impacts to plants from sound overpressures may occur at 201 dBP and greater, causing the potential rupturing of the plant cells and subsequent death of the plant. Because sound overpressures from mission activities would not reach levels >201 dBP, and no sensitive plants have been identified as occurring within the vicinity of TA C-74, no impacts to plants from noise are anticipated. As a result, plant species are excluded from noise impacts analysis.

Wildlife

The sensitive species on or within one kilometer of the borders of TA C-74 that may be potentially impacted by noise from sled track operation, the detonation of live munitions, and gun testing include the Florida black bear (*Ursus americanus floridanus*), gopher tortoise (*Gopherus polyphemus*), eastern indigo snake (*Drymarchon corais couperi*), Florida pine snake (*Pituophis melanoleucus*), dusky gopher frog (*Rana capito sevosa*), southeastern American kestrel (*Falco sparverius paulus*), and red-cockaded woodpecker (RCW) (*Picoides borealis*). Since each of these species is not equally at risk to noise disturbance impacts, screening is performed to identify those species that are most likely to be adversely impacted by the noise events generated by mission activities on TA C-74. Wetlands and FNAI Tier I designated habitats within the noise AOI are also identified because of their propensity to attract sensitive species.

According to the U.S. Fish and Wildlife Service (USFWS), reptiles and amphibians are often regarded as nonsusceptible to noise impacts due to their lack of a demonstrated startle response (USFWS, 1988). This would exclude such species as the gopher tortoise, eastern indigo snake, Florida pine snake, dusky gopher frog, and the flatwoods salamander from noise impacts. Additionally, gopher tortoise burrows are frequently used as habitat for these animals, which provides some protection against the effects of noise disturbances. There is, however, the potential to entomb some species occupying these burrows if noise overpressures cause burrow collapse. In addition to data supporting this occurrence being unavailable, no documented gopher tortoise burrows exist on the test area. Therefore, it is assumed that noise impacts to these species would not result from mission activities occurring on TA C-74.

The sensitive species that will be the focus of this analysis will include the state threatened Florida black bear and southeastern American kestrel, and the federally endangered red-cockaded woodpecker (RCW). The Florida black bear utilizes the Titi floodplain region to the north, east, and west of TA C-74 as foraging habitat and as a travel corridor. The swamps and

bottomland hardwoods of the Titi River floodplain surrounding TA C-74 provide important habitat for the Eglin bear population, which often prefers this type of habitat to most others. Verified signs of bear presence in the region include scat and tracks. Data providing specific den locations were unavailable. Because the floodplain associated with the Titi River is preferred habitat for the Florida black bear and its presence has been identified in the area surrounding TA C-74, the potential for noise events to impact this species does exist. As a result, the Florida black bear will be included in the noise environmental analysis. Potential noise impacts will be evaluated with regard to the amount of Titi River floodplain habitat area within the noise event AOI.

As described in Chapter 3, the southeastern American kestrel is a small raptor that frequently nests in live tree cavities along forest edges created and abandoned by other birds such as the RCW (DeGraaf et al., 1991), and prefers to hunt in the Open Grassland/Shrubland ecological association. Potential noise impacts to this species would be in the form of disturbance of its hunting and nesting activities. The kestrel has been sighted in the area of TA C-74, as the habitats in and around the test area provide prime habitat for both nesting and hunting. Although the inactive and abandoned RCW nests (tracked by Eglin's RCW monitoring program) in close proximity to TA C-74 could potentially provide kestrels with nesting habitat, no site verification data of inactive/abandoned RCW nest occupancy were available. Potential noise impacts will be evaluated with regard to the number of inactive RCW cavity trees within the noise event AOI.

The RCWs inhabit the Sandhills north, west, and southeast of the test area with the nearest active cavity tree being approximately 160 feet from the western test area boundary. The occurrence and population densities of this species are closely monitored on Eglin's land range through the EMN RCW monitoring program, and nesting sites and live animal identifications are documented on Eglin's GIS databases. The analysis of potential noise impacts to RCWs will concentrate on the potential for noise events to alter behavior in a manner that adversely impacts breeding and foraging success. As such, potential noise impacts will focus on identified nesting trees and foraging areas within the TA C-74 noise event AOI.

There is limited data on the correlation between noise events and the physical well being of sensitive species; however, there are studies that have identified distinct avian behaviors associated with certain noise events. Selected studies have been chosen for review, and the following narrative provides a summary of their findings.

Nest abandonment induced by ground-based noise disturbance during the nesting season has been shown to adversely impact the nesting success of some birds (Hohman, 1986). Studies of several species of raptors and other birds reported increased nest abandonment when subjected to ground-based and aerial noise disturbance, with ground-based disturbance having a greater impact (Platt, 1977; Anderson et al., 1989; Grubb and King, 1991; Delaney et al., 1999).

A recent study by Pater et al. (1998) examined the RCW flushing response (an abrupt temporary abandonment of a nest) to artillery, vehicle and small arms noise at an Army test range at Fort Stewart, Georgia. The goal of this study was to determine the point at which noise events would affect successful nesting (Pater et al., 1998). Noise sources included live gun fire (155, 120, and 25 mm), small arms live and blank fire (5.56, 7.62, 9 and .50 caliber), artillery simulators, multiple launch rocket system (MLRS), and helicopter flights. Behavioral responses in the form of nest flushing, recovery time, nest attentiveness, prey deliveries, trips from the nest, effects on

individual fitness (mortality or reduced nesting success), and effects to the cluster population were used as noise response criteria for the study. Noise level measurements were taken at the base of the RCW tree and within the tree cavity.

Flushing responses were noted during repetitious artillery fire occurring 500 meters (1,600 feet) from the cavity tree (Pater et al., 1998). Repetitive artillery noise up to 105 dBP did not have an apparent effect on nesting success, and less than three percent of noise events ranging from 90 - 105 dBP led to nest flushing. Even in the few cases where flushing occurred, nesting success was not adversely affected (Pater et al., 1998). A summary of the threshold noise levels for military ordnance training activities in the Pater study, that did not cause RCWs to flush from their nests, is presented in Table 4-4.

Table 4-4. Threshold Noise Levels for Military Training Activities that did not Result in an RCW Flush Response

Military Activity	Noise Levels (dB unweighted)	Distance from Nests (feet)
Gun Training	<105	>5,900
Small Arms Training	<76	>3,300
Artillery Simulators	<82	>5,200
MLRS	<59	>7,900

Source: Pater et al., 1998

Flushing response may, however, be related to a combination of factors including noise intensity (loudness), the frequency and duration of the noise event, the distance of the noise source from the RCW, and whether a visual presence is associated with the noise. Additionally, a study by Efroymson et al. (1999) suggested that lack of previous exposure to noise events could cause some species to be more sensitive to exposure. However, a lack of response may occur from prior exposure and acclimation of RCWs to similar noise events. Adaptation over time by animals to noise has been reported in the literature (Busnel, 1978).

In July 1999, 15,000 pounds of explosive were detonated on TA C-72 of Eglin AFB. Two RCW cavity trees, located approximately 1000 and 1,800 meters (3,000 and 6,000 feet) from the blast, were equipped with noise meters that recorded the amount of noise that actually reached the cavity trees. The active RCW cavities in these trees were also monitored before and after the blast, with no visible differences in activity. It is unknown if the birds were in the cavities at the time of the detonation; however, RCWs usually stay within approximately 0.5 miles of their cavity trees. Additionally, the ability of the RCW to adapt to, or at least tolerate, high noise levels is suggested by the presence of nesting RCWs near TA B-70 in areas exposed to >153 dBP from sonic booms (U.S. Air Force, 1998c).

The sound pressure level threshold for lethality and physical injury to sensitive species associated with TA C-74 is unknown. As a result, the metric threshold selected for analyzing the potential physical injury impacts of single-impulse noise events on biological receptors in this analysis is 140 dBP and greater. Based on the findings of Pater et al. (1998), exposure to 115 dBP or less at a distance of 2000 meters (6,000 feet) from the point-of-origin is not likely to result in a nest flush response by the red-cockaded woodpecker.

Anthropogenic Resources

Residential areas, schools, hospitals, and businesses are likely locations in local communities where annoyance and property damage resulting from noise events could be a concern. For the purpose of analyzing the potential impacts of noise to the public, the population density data for areas on and off Eglin have been incorporated into the digital analysis process (U.S. Bureau of the Census, 1992). Population density categories include <3, 3 to 39, and >39 individuals per square mile. There are several areas north of Interstate 10, such as the community of Mossy Head, that have a population density greater than 39 persons per square mile. Two schools are identified as being near (within a 10-mile radius) TA C-74, both in the western portion of DeFuniak Springs.

With respect to impact potential, rapidly repeating noise events have historically received the greatest number of complaints by local residents. Of the 343 complaints received in FY95, 87 were for single-impulse events and 256 were for subsonic aircraft noise. Of the 87 single-impulse complaints, 84 were received from individuals that lived to the south and east of Eglin (U.S. Air Force, 1996g). Although there are a number of active test areas within the southern and eastern portion of the Eglin Range (such as TA C-52 and TA D-51) that use live munitions, no specific data regarding the actual source of noise that generated these complaints were available. Since TA C-74 is in the eastern section of Eglin, some of the complaints may have been due to activities on the test area.

Sled Track Operations

The primary focus of noise analysis regarding sled track operations is on determining the sound pressure levels associated with the activation of the rocket motors propelling the sled along the sled track. Detonations of munitions resulting from sled track tests are analyzed separately.

As described in Section 4.1, sled track testing operations typically involve the attachment of a test item (usually an inert or live bomb or warhead) via straps to a sled propelled by a number of rocket motors. Depending on the size of the item to be tested and the required testing parameters, a variety of combinations of rocket motors can be used to propel the sled. Table 4-5 provides examples of some typical sled configurations for test item delivery.

Table 4-5. Typical Rocket Motor Sled Configurations

Test Item	Rocket Motor	Quantity	NEW*
BLU 109 Bomb	Genie	1	393.4
	HVAR	8	30.5
HTW 1000 lb Bomb	HVAR	6	30.5
JAST 1000 lb WHD	HVAR	16	30.5
AUP-1 WHD w/Schroud	Genie	1	393.4
	HVAR	10	30.5
BLU 113 Bomb	Genie	4	393.4
	Zuni	10	43
JASSM	HVAR	16	30.5

* TNT equivalent

Noise from rocket motor operation is created by the propellant, which is contained in the rocket motors and is ignited to propel the motor down the sled track. The rocket motors are remotely activated in stages along the sled track in order to achieve the desired speed for target impact. This results in the repetitive, simultaneous firing of multiple rockets along the length of the sled track. Low frequencies, short duration, and subsonic velocities characterize the noise generated by the rocket motors. Because of the dynamics and variances involved in sled track testing requirements (particularly the speed and trajectory of sled movement for test item delivery), adequate data needed for noise analysis regarding the HVAR, Genie, and Zuni rocket motors were unavailable. However, in the *Environmental Assessment for General Purpose Heat Source Safety Verification Testing*, conducted in February 1995 by the U.S. Department of Energy Albuquerque Operations Office, it was calculated that the noise safety distance for humans for a cluster of 20 HVARs was 144 meters (472 feet). Although the maximum number of HVARs used during one sled test on TA C-74 is 16, for analysis purposes the safety area calculated in the U.S. Department of Energy Environmental Assessment (EA) will be used, and can be interpreted as a rectangular buffer zone, the perimeter of which would extend around all sides of the sled track to a distance of 144 meters (472 feet) (Figure 4-3). As a safety precaution, no persons are allowed within 144 meters (472 feet) of the sled track during operation; therefore, there would be no noise impacts to humans.

Biological Resources

Wildlife

The safe distance in respect to noise associated with the operation of rocket motors on TA C-74 has been identified as approximately 144 meters (472 feet) for humans without hearing protection. Because documented noise safety distances for wildlife were unavailable, the 472-foot distance will be applied to biological resources as a noise safety distance, although the safety distance for animals would likely be smaller. Potential noise impacts to biological receptors within this area may occur from the activation of rocket motors during sled track operations. There are 28 acres of RCW foraging area identified within the 144 meter (472 feet) buffer area around the sled track.

Table 4-6 provides a summary of potential noise impacts resulting from rocket motor operation on TA C-74 (Figure 4-4).

Table 4-6. Potential Noise Impacts to Wildlife from Rocket Motor Operation

Noise Impact Area (acres)	Receptor			
	Wetlands (acres)	Active RCW Trees (No.)	RCW Foraging Area (acres)	Potential Kestrel Nesting Trees (No.)
64	0	0	28	0

Because the amount of RCW foraging area within the sled track noise impact footprint (28 acres) comprises only about three percent of the total foraging area associated with TA C-74 (~1,048 acres), noise impacts to sensitive species from sled track operations should be negligible.

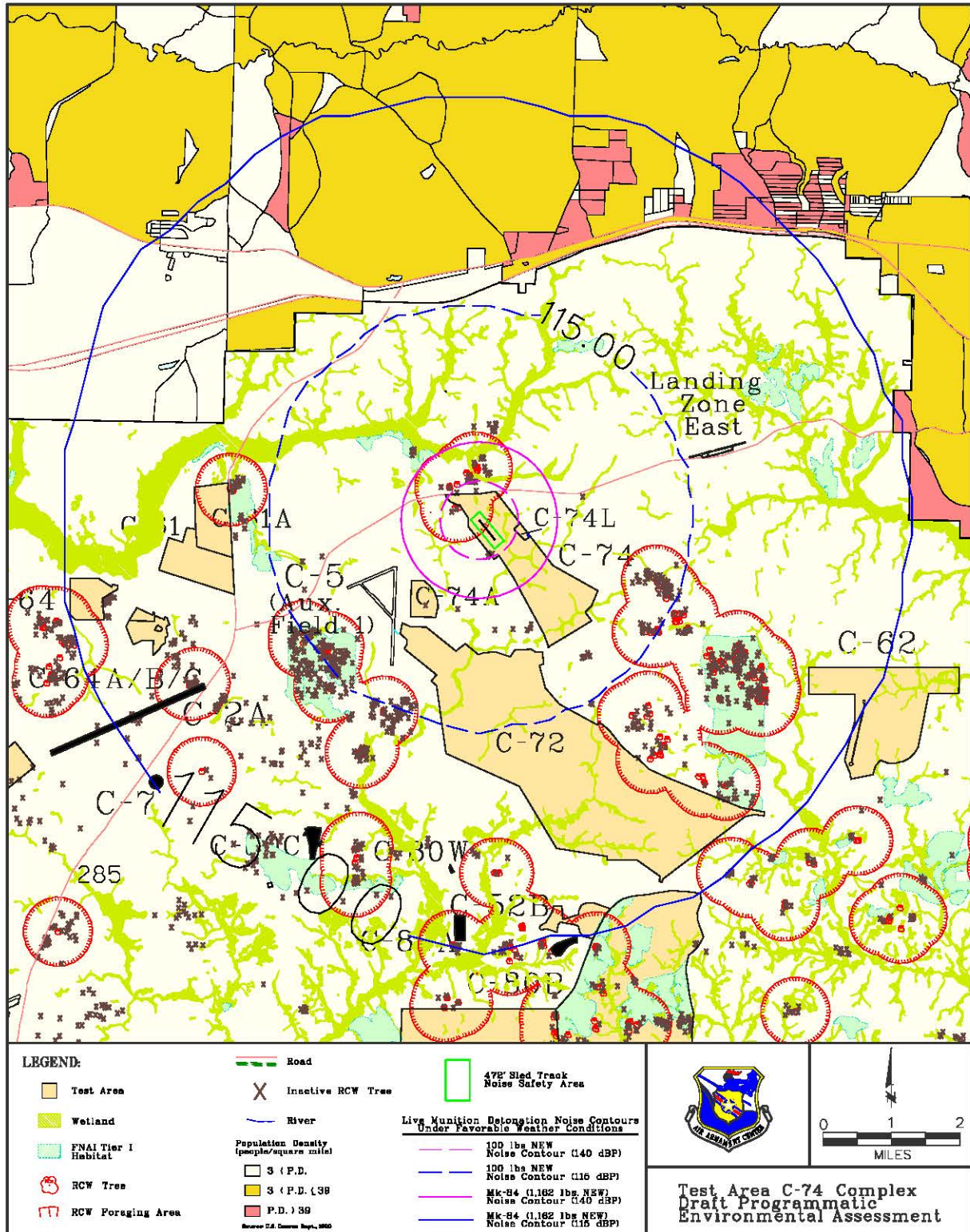


Figure 4-3. Sled Track, 100 lb. NEW, and Mk-84 Noise Contours During Favorable Weather Conditions

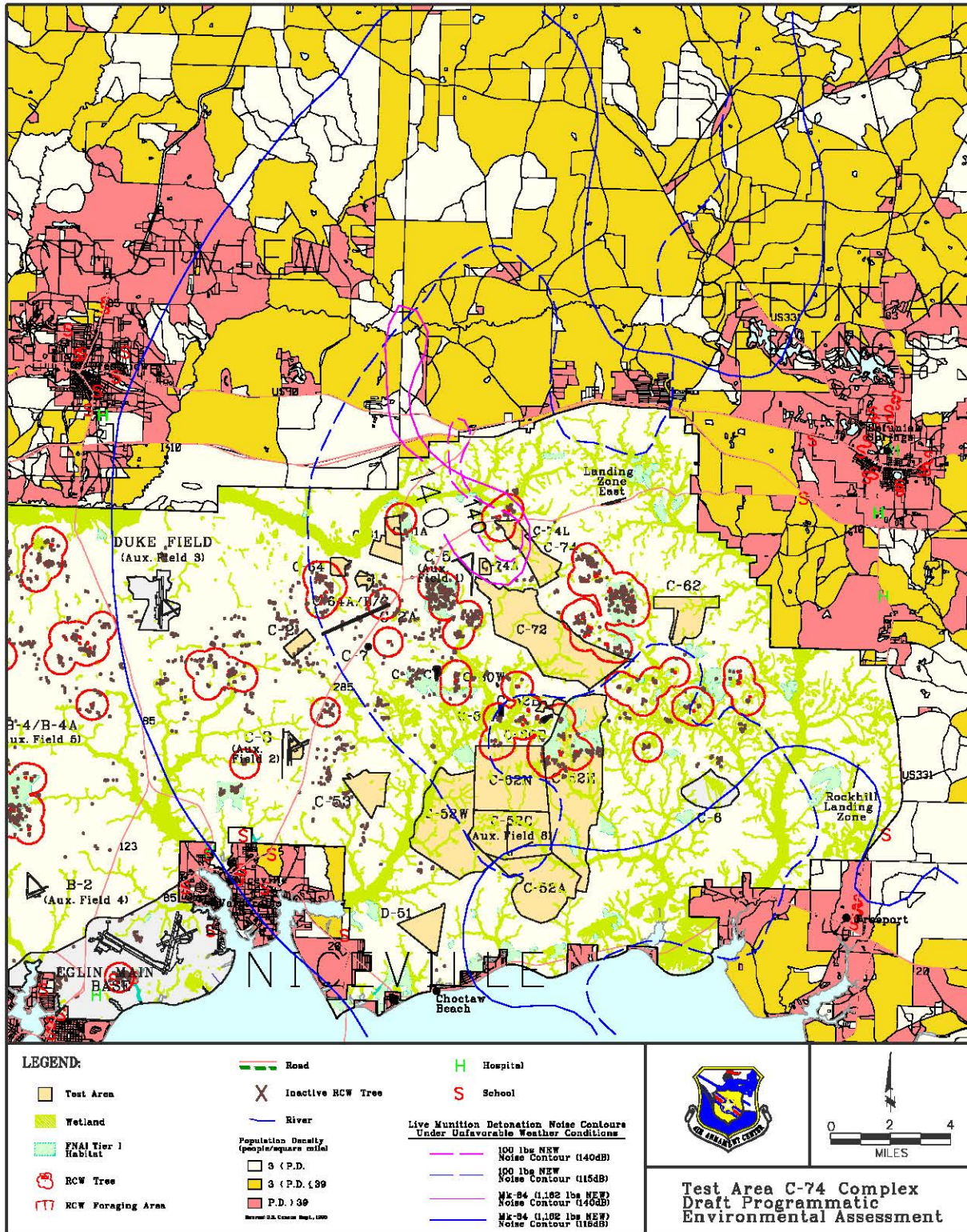


Figure 4-4. 100 lb. NEW/Mk-84 Noise Contours During Unfavorable Weather Conditions

Live Munitions Detonation

Live munition detonations on TA C-74 result from mission activities involving both sled testing and arena testing. Expendable NEWs associated with these activities range from 1 to 1,162 pounds TNT equivalent, and are listed in Table 4-2, Page 4-9. The detonation of live munitions as the end result of sled testing usually occurs at the south end of the sled track. On occasion, however, munitions are detonated at the north end of the track. Detonation of live munitions during arena testing takes place in the area along the western border, towards the northern end, of TA C-74, as shown in Figure 4-1.

Noise contours under both favorable and unfavorable weather conditions for the detonation of live munitions were generated from the NAPS model for munitions exhibiting NEWs of 100 and 1,162 pounds TNT equivalent. These numbers reflect the lower and upper limits of munitions detonated on TA C-74. The north end of the sled track was chosen as the point of origin for the generation of noise contours in order to provide a more conservative scenario because it is closest to the Eglin reservation boundary. Additionally, the largest NEW associated with sled track activities was 658 pounds TNT equivalent (BLU-109/B live warhead), while the largest NEW associated with arena testing was 1,162 pounds TNT equivalent (Mk-84).

The noise contours as generated from the NAPS model under both favorable and unfavorable weather conditions for sled track operations and live munitions detonations, their areas of influence, and the receptors associated with the AOIs, are displayed in Figures 4-3 and 4-4.

Anthropogenic Resources

Public

Noise analyses revealed that 115 dBP noise generated by >100 pounds NEW TNT equivalent detonations, under favorable weather conditions, at either end of the sled track could extend beyond the Eglin Range boundary. Sound pressure levels of 140 dBP generated from the detonation of >100 pounds NEW TNT equivalent during unfavorable weather conditions have the potential to extend beyond the Eglin AFB boundary. Additionally, sound pressure levels of 115 dBP generated from the detonation of as little as 10 pounds of NEW TNT equivalent under unfavorable weather conditions at either end of the sled track extend beyond Eglin AFB's boundaries.

Based on the noise contours presented in Figures 4-3 and 4-4, the primary region off Eglin AFB potentially exposed to 140 dBP noise contours generated under the conditions stated above is generally populated at a density of three persons or less per square mile. However, the detonation of an Mk-84 or greater NEW TNT equivalent munition during unfavorable weather conditions may expose a small region with a population density of over 39 individuals per square mile. Noise levels of 115 dBP for an Mk-84 or greater NEW TNT equivalent munition detonated under unfavorable weather conditions may reach several schools and hospitals as well, as shown in Figure 4-5.

Sound pressure levels of 115 dBP generated from the detonation of >100 pounds NEW TNT equivalent during unfavorable weather conditions could reach as far as Crestview and DeFuniak Springs, communities with population densities in excess of 39 people per square mile. Even

under favorable conditions, sound pressure levels of 115 dBP generated from the detonation of >100 pounds NEW TNT equivalent may potentially affect small areas having a population density of greater than 39 people per square mile. Table 4-7 provides a summary of noise impact analysis to the public from mission activities involving the detonation of live munitions.

Table 4-7. Potential Noise Impacts to the Public from the Detonation of Live Munitions

Weather Condition	Detonation Event (TNT equivalent)	Sound Pressure Level (dBP)	Population Density (people/square mile)		
			≤ 3	4 – 39	> 39
Favorable	>100 lbs NEW	115	✓	✓	✓
		140	-	-	-
	>1,162 lbs NEW	115	✓	✓	✓
		140	-	-	-
Unfavorable	10 lbs NEW	115	✓	✓	✓
		115	✓	✓	✓
	>100 lbs NEW	140	✓	✓	-
		115	✓	✓	✓
	>1,162 lbs NEW	140	✓	✓	✓
		140	✓	✓	✓

Biological Resources

Wildlife

Potential impacts to sensitive wildlife species could result from exposure to >140 dBP. Table 4-8 provides a summary of the results of the noise analysis.

Animals within the immediate vicinity of a live munition detonation may be killed or severely injured. However, most animals would likely be flushed from the area during preparation activities prior to testing. Species such as birds will frequently return during the time between preparation and testing and could be impacted by noise overpressures.

Table 4-8. Potential Noise Impacts to Wildlife from Live Munitions Detonations

Weather Condition	Detonation Event (TNT equivalent)	Sound Pressure Level (dBP)	Receptor				
			Wetlands / Tier 1 Habitat (acres)	Potential Black Bear Habitat (acres)	Active RCW Trees (No.)	RCW Foraging Area (acres)	Potential Kestrel Nesting Trees (No.)
Favorable	100 lbs NEW	140	10/0	0	2	366	7
	1,162 lbs NEW	140	46/0	24	12	978	28
Unfavorable	100 lbs NEW	140	70/43	1,082	12	663	27
	1,162 lbs NEW	140	700/76	2,753	12	980	39

As shown in Figures 4-3 and 4-4, the greatest potential for impacts to sensitive species occurs at detonations of >100 lbs NEW under both favorable and unfavorable conditions, with detonations of >100 lbs NEW under unfavorable conditions resulting in the possible migration of sound overpressures of 140 dBP beyond the Eglin Reservation boundary (Figure 4-4). Additionally, it is further estimated that wetland, FNAI Tier I, and Titi Creek black bear habitat areas may be exposed to the 140 dBP noise threshold under both favorable and unfavorable weather conditions from the detonation of >100 lbs NEW (Figures 4-3, 4-4).

Gunnery Ballistics Testing

The noise produced by the gun ammunition testing on TAs C-74 and C-74L is proportional to the type, size, and mode of firing of the ammunition. Gunnery ballistics testing takes place at the arena testing area at TA C-74, located to the west of the sled track (Figure 4-1) and at TA C-74L (Figure 4-2). Gun testing at the arena test area usually consists of a gun mounted above a target (usually made of concrete) with the barrel oriented in a vertical position. The munition is then fired downward into the target. Expendables associated with gun testing at the TA C-74 arena test area are shown in Table 4-2, Page 4-10.

Gun testing at TA C-74L consists of gun firing from a gun bay towards a gun butt located to the southeast of the gun bay (Figure 4-2). Guns used consist of automatic 30 mm GAU-8/A, 20 mm M61-A1, and 25 mm GAU-12/B, which are mounted within an enclosed gun bay. During firing events, the metal doors are opened to expose the gun to the gun butt target. The rounds are fired automatically by the guns and produce short bursts of noise. These guns also have Mann-gun equivalents, which are guns that manually fire one round at a time.

A typical mission activity using an automatic gun begins with the firing of TP rounds for instrument calibration and then the firing of about eight bursts of live rounds consisting of 30-40 rounds each. There are typically intervals of about 10-15 minutes between each burst. A typical day of firing results in the expenditure of about 320 live rounds and 72 TP rounds. Typical mission activities involving the use of the manual guns consist of firing TP rounds, then test rounds at a single shot rate with about 4-6 minutes between each shot. Typical expenditures consist of about 40-90 test rounds and 10 TP rounds per firing day.

Noise analysis for gun testing at TA C-74 is based on the firing of the JASSM 920-Scale munition, while noise analysis at TA C-74L is based on noise from the propellant at the gun bay and the HEI detonation at the gun butt associated with the firing of 30 mm HEI munitions.

Both munitions represent the upper limits of TNT NEW propellant equivalents used for gun testing. Table 4-2 on page 4-10 provides a summary of the mission expenditures under Alternatives 1 and 2.

Anthropogenic Resources

Public

No impacts to the public were identified with typical gun testing activities during favorable weather conditions at either location. However, populated areas may be exposed to sound

pressure levels of 115 dBP from gun testing during unfavorable weather conditions. Based on the noise contours presented in Figure 4-5, the primary region off Eglin AFB potentially exposed to 115 dBP noise contours generated during gun testing at TAs C-74 and C-74L during unfavorable weather is generally populated at a density of three persons or less per square mile. However, there are some areas with population densities greater than 39 persons per square mile that could be exposed to 115 dBP. Exposure to 115 dBP may elicit noise complaints from the public. Given that the risk of complaints is low to moderate at this level, no significant annoyance impacts are anticipated. Furthermore, the noise model used in the analysis does not account for the effects of the gun bay or surrounding vegetation and elevation on the noise contours, which would likely reduce the potential for public exposure to 115 dBP noise levels.

Biological Resources

Wildlife

No adverse impacts to wildlife were identified resulting from noise during gun testing at TA C-74L or TA C-74 under favorable weather conditions. Gun testing at TA C-74 during unfavorable weather conditions may result in the exposure of sensitive species to sound pressure levels of 140 dBP. Figure 4-5 provides a graphical representation of the biological noise analysis using the NAPS model and the GIS, while Table 4-9 provides a summary of the results of this analysis.

Table 4-9. Potential Noise Impacts to Wildlife from Gun Testing

Weather Condition	Gun Testing Location	Sound Pressure Level (dBP)	Receptor				
			Wetlands/ Tier 1 Habitat (acres)	Potential Black Bear Habitat (acres)	Active RCW Trees (No.)	RCW Foraging Area (acres)	Potential Kestrel Nesting Trees (No.)
Favorable	TA C-74	140	-	-	-	68	-
Unfavorable			82/38	293	3	410	5

As Figure 4-5 shows, noise contours generated from the NAPS model associated with gun testing at TA C-74, using typical mission activity baseline munitions and associated NEWs (Table 4-2), have the potential to expose sensitive species to noise levels of 140 dBP during unfavorable weather conditions. While gun testing during favorable weather conditions would not expose any sensitive species to sound overpressure levels of 140 dBP, approximately 68 acres of RCW foraging habitat could be exposed to 140 dBP by JASSM 920-Scale gun testing at the arena test area on TA C-74.

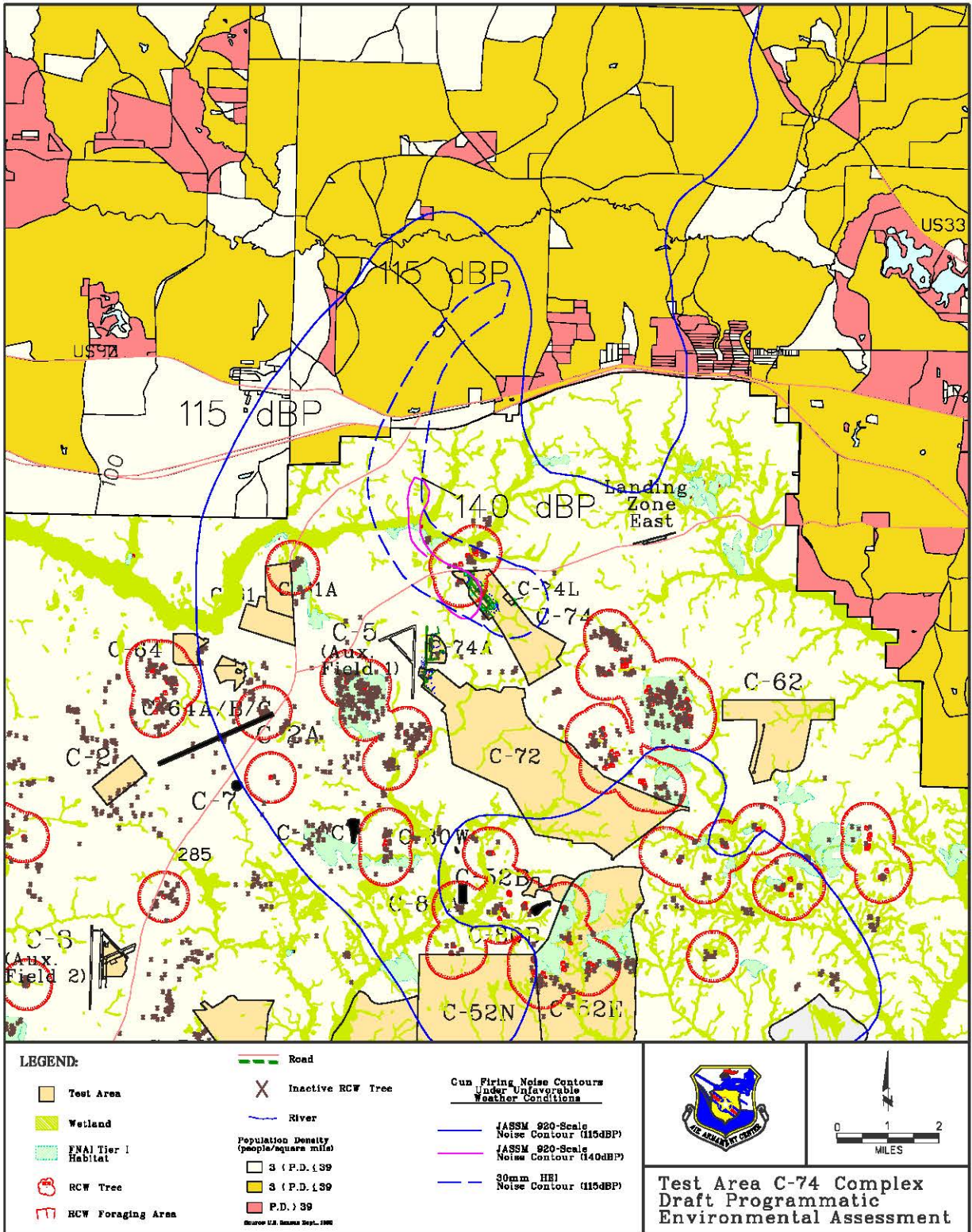


Figure 4-5. Unfavorable Weather Condition Noise Contours for 30 mm Gun Testing at TA C-74/74L

4.2.2 Alternative 3

Alternative 3 involves the same types of missions and expendable quantities as Alternatives 1 and 2. There would be no increase in the size of rocket motors, sled configurations, munitions or frequency of testing. As a result, potential noise impacts under Alternative 3 would be the same as those identified under Alternatives 1 and 2.

4.2.3 Alternative 4

Under Alternative 4, there would be a 200-percent increase in mission activities. Although this means that the frequency of noise generating events would effectively triple, there would be no increase in the size of rocket motors, sled configurations, or munitions tested. Therefore there would be no increase in the coverage of the noise contours shown in Figures 4-3 through 4-5. Table 2-1 in Section 2.2.2 shows the number of testing events associated with Alternative 4, while Table 4-2 shows the NEW and TNT equivalents associated with those expendables.

The tripling of noise event frequency would increase the potential for noise complaints in public areas; however, as stated previously in Section 4.2.1, it is not known with any certainty that noise complaints from the public are the result of mission activities on TA C-74. Additionally, tripling the frequency of noise generating events would potentially increase the chances of 140 dBP exposure to sensitive species. In summary, while the potential noise impacts under Alternative 4 would be substantively similar to those under Alternatives 1-3, the frequency of potential impacts would increase three-fold.

4.2.4 Noise Summary

In summary, the criteria for potential noise impacts to wildlife and the public are:

- **>140-dBP** for wildlife and sensitive species exposed to impulsive noise events. At this level, an animal may experience hearing-related pain, based on knowledge of and comparison with human physiology. Survival and reproduction (at least of RCWs) are likely unaffected given that RCWs exist and thrive in similar and higher noise environments on Eglin.
- **>115-dBP** for the public. Moderate risk of annoyance from impulsive noise events as recommended by Pater (1976).

Noise resulting from sled track operations, live munitions detonations, and gun testing was analyzed for impacts to anthropogenic (public) and biological (plants and wildlife) resources. Subtle changes in wind direction and speed, and atmospheric inversion characteristics, can alter the direction and intensity of noise levels leaving the range such that areas other than TA C-74 and TA C-74L may be affected, potentially impacting the public and wildlife. Table 4-10 provides a summary of the noise analysis conducted in Section 4.2.

Table 4-10. Noise Impacts Analysis Summary

Alternative (# of Events)	Weather Condition	Resource Impacted								
		Anthropogenic				Biological*				
		Noise Exposure Level (dBP)	< 3 People /mi ²	4-39 People /mi ²	> 39 People /mi ²	Wetlands /Tier I Habitat (Acres)	Black Bear Habitat (Acres)	Active RCW Trees (No.)	RCW Foraging Area (Acres)	Potential Kestrel Nesting Trees (No.)
<i>Sled Track Operations</i>										
1 & 2 (17)	472 ft Noise Safety Area									
3 (17)		-	-	-	-	-	-	28	-	
4 (51)										
<i>Live Munitions Detonations**</i>										
>100 lb NEW										
1 & 2 (8)	Favorable	115	✓	✓	✓	-	-	-	-	-
3 (8)		140	-	-	-	10/0	0	2	366	7
4 (24)	Unfavorable	115	✓	✓	✓	-	-	-	-	-
		140	✓	✓	-	70/43	1,082	12	663	27
>1,162 lb NEW (Mk-84)										
1 & 2 (1)	Favorable	115	✓	✓	✓	-	-	-	-	-
3 (1)		140	-	-	-	46/0	24	12	663	28
4 (3)	Unfavorable	115	✓	✓	✓*** (11S/1H)	-	-	-	-	-
		140	✓	✓	✓	700/76	2,753	12	980	39
<i>Gun Testing</i>										
TA C-74										
1 & 2 (9)	Favorable	115	-	-	-	-	-	-	-	-
3 (9)		140	-	-	-	0	0	0	68	0
4 (27)	Unfavorable	115	✓	✓	✓	-	-	-	-	-
		140	-	-	-	82/38	293	3	410	5
TA C-74L										
1 & 2 (20)	Favorable	115	-	-	-	-	-	-	-	-
3 (20)		140	-	-	-	-	-	-	-	-
4 (60)	Unfavorable	115	✓	✓	✓	-	-	-	-	-
		140	-	-	-	-	-	-	-	-

* Noise impacts analysis for biological resources was limited to sound overpressures of 140 dBP.

** Represents TNT equivalent NEWs.

*** S = School; H = Hospital

Alternatives 1 - 3

Noise impacts to humans from sled track operation are not anticipated. Noise resulting from rocket motor activation during sled track operations has the potential to disturb habitat suitable for sensitive species, in particular RCW foraging areas. However, no specific individual species have been identified within the established 144-meter (472-foot) noise safety distance. As a result, impacts to sensitive species from sled track operations would be negligible.

Noise impacts to the public could result from live munition detonations, and may occur under a variety of scenarios. 115 dBP noise levels resulting from the detonation of >100 lbs NEW munitions under any weather condition may affect the public, and could result in noise complaints. If detonations of >100 pounds NEW occur in the presence of north-northeast winds and temperature inversions (the scenario described for unfavorable weather conditions), noise in excess of 115 dBP could reach neighboring communities and such noise sensitive areas as schools and hospitals, causing brief disturbances but no injury. Additionally, detonations under these conditions may cause hazardous noise overpressures of 140 dBP to extend beyond the Eglin Reservation boundary. Some areas off the range were exposed to noise >115 dBP resulting from gun testing during unfavorable weather conditions, a level determined to potentially cause moderate annoyance to people.

The effects of noise on wildlife are unclear. Noise above 140 dBP may cause hearing damage in humans and could possibly have similar effects on wildlife. On a very infrequent basis, considerable areas are exposed to noise >140 dBP from mission activities involving live munitions detonations and gun testing. And, although safety procedures prevent the exposure of people to such levels, wildlife within this area would be exposed. This may result in negative impacts to sensitive species.

Under detonations of >1,162 pounds NEW (Mk-84) during favorable weather conditions, approximately 978 acres of RCW forage area, 12 active RCW trees, and approximately 24 acres of potential black bear habitat could be potentially exposed to this noise level. The continued presence of RCWs near the TA C-74 Complex may indicate that noise impacts, if any, are not significant enough to affect this species.

The noise models used in this analysis only represent a few possible weather scenarios. However, this analysis shows that the propensity for negative noise impacts to the public and to wildlife species resulting from mission activities on the TA C-74 Complex occurs mainly when testing activities occur during unfavorable weather conditions. The chance for negative noise impacts would be greatly diminished by incorporating day-of-test weather monitoring and noise modeling in order to determine the potential impacts associated with a given test.

No impacts to the public were identified with typical gun testing activities during favorable weather conditions at either location. However, populated areas may be exposed to sound pressure levels of 115 dBP from gun testing during unfavorable weather conditions. Additionally, no adverse impacts to wildlife were identified resulting from noise during gun testing under favorable weather conditions. However, gun testing at TA C-74 during unfavorable weather conditions may result in the exposure of sensitive species to sound pressure levels of 140 dBP.

Alternative 4

Mission activities would increase by 200 percent, effectively tripling the number of sled track operations, live munition detonations, and gunnery ballistic tests. Potential noise impacts under Alternative 4 would be substantively similar to those described under Alternatives 1-3, although the frequency of occurrences would triple.

4.3 CHEMICAL MATERIALS

Chemical materials are the constituents or by-products of effectors that may result in chemical changes to physical resources (air, soil, and water) or toxicological effects to biological organisms (humans, plants, and animals). Chemical materials resulting from mission activities may be in the form of particulate matter, gases, and other residues. A review of the fate and transport mechanisms for chemical materials in the environment is found in the *Effector Analysis Report* (U.S. Air Force, 1996d).

4.3.1 Alternative 1 (No Action) and Alternative 2

The chemical materials by which mission generated chemical materials may affect test area receptors are air emissions, metals, and chemical residual by-products produced by:

- Sled Track Operation
- Detonation of Live Munitions
- Gunnery Ballistics Testing

Sled track operations can introduce combustion by-products into the air, soil or water via the activation of rocket motors, while live munition detonations and gunnery ballistics testing often involve the release of by-products through detonations or burning of propellants. Table 4-11 lists the types and amounts of explosives and propellants associated with mission activities at TA C-74/C-74L under Alternatives 1 and 2.

Table 4-11. Amounts of Explosives/Propellant Expended from Mission Activities Under Alternatives 1 and 2^a

Mission Activity	NEW (lbs)		Type of Explosive/Propellant	Alternative	
	Exp.	Pro.		1 and 2	
Expendable					
Sled Track Operation				Total Number of Events	
Location: KEMTF, TA C-74				17	
				Total Amount of Explosive/Propellant (lbs.)	
HVAR Rocket Motor	-	25	JPN nitrocellulose-nitroglycerin	3,075 (123)	
Genie Rocket Motor	-	320	Ammonium perchlorate	4,800 (15)	
Zuni Rocket Motor	-	35	X-8	350 (10)	
Gunnery Ballistics Testing				Total Number of Events *	
				9/20	
				Total Amount of Explosive/Propellant (lbs.)**	
C-74	JASSM 920-Scale (Inert)	-	3.5	Propellant Not Available	28 (8)
	JASSM 1/3-Scale (Inert)		1.2	Propellant Not Available	1.2 (1)
C-74L	30 mm HEI (PGU-13/B)	0.1	0.33	H-761/HC-25FS	1,648 (4,119)
	30 mm TP (PGU-15/B)	-	0.33	HC-25FS	87 (263)
	20 mm HEI	0.03	0.09	H-761/WC872	21 (178)
	20 mm TP	-	0.09	WC872	19 (216)
	25 mm HEI (PGU/38)	0.07	0.21	H-761/WC872	28 (100)
25 mm TP (PGU-23/U)	-	0.21	WC872	2 (10)	
Live Munition Detonations				Total Number of Events	
Location: TA C-74				13	
				Total Amount of Explosive/Propellant (lbs.)**	
<i>Arena Test Area</i>	JASSM 920 Scale, live	22	-	PBX-109	44 (2)
	JASSM 1/3 Scale, live	9	-	PBX-109	18 (2)
	C-4, 1 lb HE, live	1	-	C-4	42 (42)
	C-4, 0.125 lb HE, live	0.125	-	C-4	<1(3)
	Colt 45 WHD, live	370	200	Not Available	570 (1)
	Mk-84, live	945	-	Tritonal	945 (1)
<i>Sled Track</i>	MMTD WHD, live	42	-	Tritonal	42 (1)
	BLU-109 Bomb, live	535	-	Tritonal	535 (1)
	AUP WHD, live	126	-	PBX-109	252 (2)
	JASSM WHD, live	256	-	AFX-757	512 (2)
	HTW 1,000-lb bomb, live	245	-	PBX-109	245 (1)

Exp. = Explosive * Number of events = C-74/C-74L a = Numbers in parenthesis indicate actual
 Pro. = Propellant ** Based on quantities of expendables identified in Table 4-2 number of units used.

Projectile and rocket propellants and warhead high explosives are the principal ordnance materials that generate chemical material by-products on the TA C-74 Complex. The by-products resulting from the thermal degradation of these materials are the focus of this analysis. The materials evaluated include High Velocity Air Rocket (HVAR), Zuni, and Genie rocket motor propellant, and 30mm HEI PGU-13/B and JASSM 920-scale propellants and explosives. The primary high explosives used on TA C-74 include Tritonal, PBX, C-4, and

black powder. Although RDX is a minor component of some gun propellants, its analysis is restricted to expenditures in high explosives.

Environmental Analysis

The thermal degradation (combustion) of rocket and gun ammunition propellants and high explosives generate chemical by-products that under certain concentrations may exceed certain risk criteria. It is the purpose of this analysis to identify the chemical materials generated by mission expenditures and assess the relationship between expenditure chemical material concentrations and these criteria. Air emissions, metals, and other chemical residuals generated by combustion of the aforementioned propellants and explosives during mission activities will be analyzed with respect to potential impacts to sensitive species and habitats, water column transport, and bioaccumulation. Chemical materials exposures to the public are not anticipated since individuals are not allowed entry to the test area during mission activities, and virtually all testing activities are performed by remote control with mission personnel a safe distance away.

The performance of mission activities on the TA C-74 Complex could expose biological receptors (flora and fauna) to concentrations of air, water, and/or soil-borne chemical materials that may adversely impact the well-being and reproductive success of species. The long-term repetition of ordnance testing at the same locations can increase the potential for chemical materials to accumulate in soils or aquatic resources within the region of influence at concentrations that could exceed risk criteria. The following analysis provides an estimate of the amount of chemical by-products that are generated by mission activities in order to determine a maximum level of missions that could be conducted without exceeding air, soil, or biological quality standards.

A summary of the approach is outlined as follows:

- Missions and associated explosive/propellant materials were selected to represent the typical usage of the TA C-74 Complex for testing.
- Chemical by-products of selected explosives/propellants were identified using known air emission factors.
- By-products previously identified by federal or state agencies, or in available scientific literature, as air, soil, water, or biological pollutants were identified.
- Concentrations of mission by-products were calculated and compared with available criteria.
- The maximum number of each mission type that could be conducted without exceeding criteria was estimated.

Estimations of explosive/propellant by-product amounts associated with mission activities were made using similar methods to those used by Army scientists at Dugway Proving Ground (U.S. Air Force, 1996d). Experiments at Dugway Proving Ground have shown that various explosives produce by-products in consistent proportions (U.S. Air Force, 1996d). These proportions are termed “emission factors” and are specific for each explosive by-product. Multiplying the original amount of explosive/propellant by known emission factors will yield the total weight of each explosive/propellant by-product. These by-products include water, carbon dioxide,

nitrogen gas, carbon monoxide, and lesser amounts of other materials. Carbon dioxide, which accounts for greater than 97 percent of carbon emissions, has no significant toxic effects on the environment, and thus is not included in the analysis. The additional materials generated by mission activities on the TA C-74 Complex are comprised of gases including carbon monoxide, nitrogen dioxide, sulfur dioxide, and methane; metals such as barium, beryllium, aluminum, and lead; and other materials such as benzene, paraffins, olefins, phenol, naphthalene, and methyl naphthalene (Becker, 1995).

Once the amounts of explosive/propellant by-products were calculated, a potential exposure area was defined. Figures 4-6 and 4-7 provide graphical representations of the exposure areas. Because no models were available to predict the area of exposure to pollutant by-products from explosions or propellant burning, an area that might be expected to contain pollutant by-products for a short time was defined to represent a likely scenario. Time of exposure is expected to be brief since airborne pollutants will disperse and mix with the atmosphere. The exact duration of exposure is unknown, but would vary depending on the climatic conditions at the time of the test. The expected amounts of the various by-products produced during a combustion event were then applied to a defined area of the atmosphere or land. By doing this, potential concentrations of by-products were obtained that could be compared with federal, state, or scientific standards for air, soil, and water quality, as well as risk criteria for biological organisms.

Air Quality

Potential impacts to air quality are associated with chemical material emissions from mission activities involving the operation of rocket motors, the detonation of live munitions, and the firing of guns. The quality of air in a given location or region is generally described by the concentrations of various measurable substances known as “criteria pollutants,” which are such pollutants as carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), particulate matter (PM₁₀), and sulfur dioxide (SO₂).

An air quality analysis scenario was used in this document to establish the combustion by-product volumes (using emission factors) associated with mission events versus the volume of air present within a hypothetical enclosure, then comparing the results to pollutant exposure criteria.

Depending on the mission activity, the peak concentration enclosure selected for air quality is either cylindrical or spherical in nature, placed over the point of emission origin. For the applications of this environmental analysis, it is proposed that these enclosures represent a realistic distribution of air emission concentrations as these shapes conform to the typical shape of the emissions cloud. It is also assumed that the “ground cloud” that occupies the enclosure contains all emissions generated by the mission event or activity under analysis.

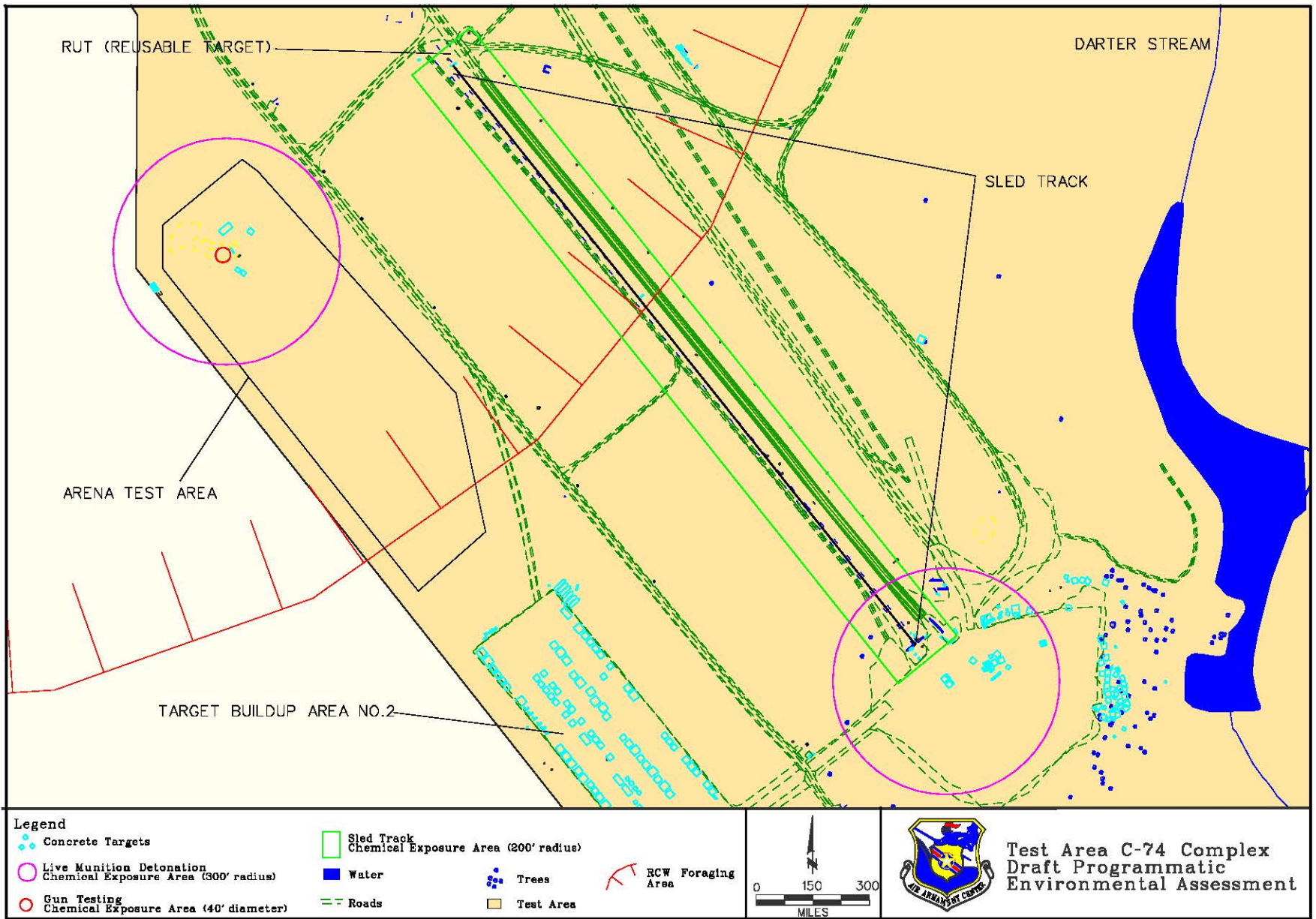


Figure 4-6. Potential Chemical Material Exposure Areas at TA C-74

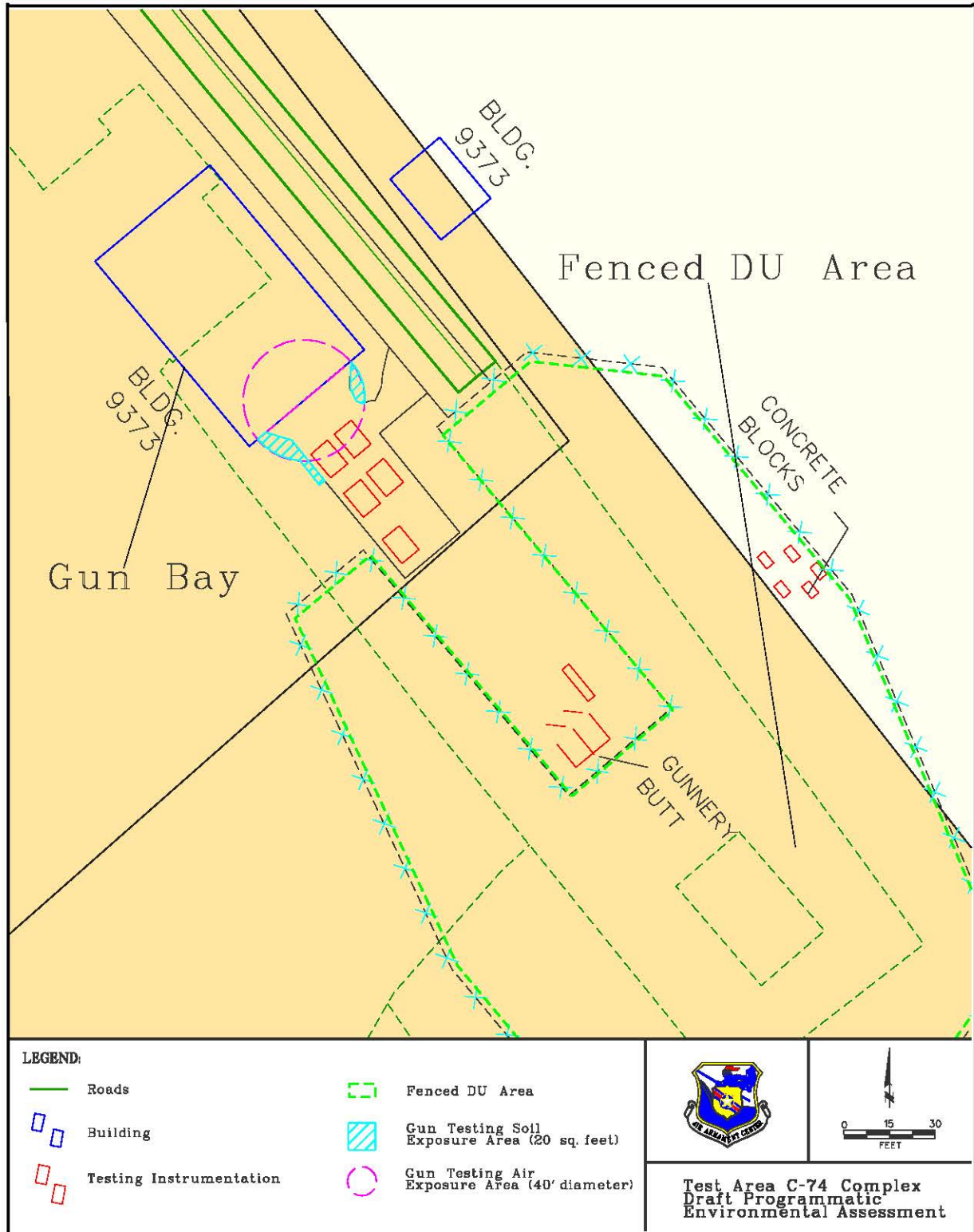


Figure 4-7. Potential Chemical Material Exposure Areas at TA C-74L

The ground cloud generated by the mission expenditure(s) would be warmer than the surrounding air due to the heat of combustion. As a result, it will initially rise, then drift as it cools. It would eventually reach a stabilization altitude, cooled to the point where it would no longer rise, but disperse while continuing to drift. Part of the cloud would eventually reach the ground and ultimately disperse to the point of having no measurable impact on ambient air quality.

Once air-borne pollutants are generated, the process of atmospheric mixing, dilution, and dispersion can quickly alter the extent and duration of pollutant peak concentrations. Weather conditions have a direct bearing on the impact of air-borne pollutants on air quality. The capability and expediency by which the atmosphere is able to disperse and thereby reduce air emission concentrations is primarily dependent on temperature inversions and wind conditions. The most unfavorable weather conditions on Eglin for pollutant dispersal occur during the months of July and August when calm winds (less than four miles per hour) and temperature inversions at 3,000 feet and less blanket the atmosphere and limit the vertical movement and mixing of air-borne pollutants generated at the surface. Under these conditions, the extent and duration of localized concentrations could increase.

For impact analysis, the resultant air emissions are compared to Walton County's 1998 air emissions inventory. Potential impacts to air quality are then identified as an increase of 10 percent or more in Walton County criteria pollutant emissions, based on Walton County's 1998 emissions inventory. This approach is outlined according to Section 176(c) of the Clean Air Act (CAA), the EPA promulgated "General Conformity Rule" that is codified as 40 CFR 51, Subpart W.

An air emissions inventory is an effort to qualitatively and quantitatively describe the amount of emissions from a facility or within an area. Inventories are designed to locate pollution sources, define the type and size of sources, define and characterize emissions from each source, determine relative contributions to air pollution problems by classes of sources and by individual sources, and determine the adequacy of regulations. The air emissions inventory is an estimate of total mass emissions of pollutants generated from a source or sources over a period of time, normally a year. Accurate inventories are needed for estimating the interrelationship between emissions sources and air quality and for determining whether an emission source requires an operating permit based on actual emissions or the potential to emit.

Eglin's Title V permit requires that emissions from expenditures of munitions on the Reservation be tracked and reported to the State each year. All data regarding expenditures of munitions is currently being collected on a physical year basis and published in the Range Utilization Report through AAC/XPE. This report is used to determine munitions-related emissions on test ranges on the Reservation.

Soil Quality

Soil quality is the capacity of the soil environment to function within natural or managed ecosystem boundaries, sustain plant and animal productivity, maintain or enhance water quality, and support organism health and habitation (Karlen et al., 1996).

The U.S. Environmental Protection Agency Region III has developed risk-based criteria (RBC) for over 500 chemical compounds. The primary purpose of the RBC is for screening chemicals to determine the need for a risk assessment. If the RBC is exceeded, then a risk assessment would be required. Risk is defined as the expected frequency or probability of undesirable effects resulting from exposure to known or expected chemicals that could induce an adverse response in biological receptors. RBC concentrations have been calculated for tap water, ambient air, fish tissue, and industrial and residential soil, and represented as cancerous or noncancerous effects.

Metals, such as lead, that can be a component of explosives and propellants are included in this analysis. Primer mechanisms usually contain lead styphnate and some types of ammunition may contain lead azide or lead salicylate as an ingredient of the energetic material. Other metals such as copper and aluminum may also be constituents of the ordnance material. There may be an extensive degree of variability in the metals composition of the energetic material primarily based on the type and manufacturer of the material. For the purposes of this analysis, the average lead emission factor for the thermal combustion of explosive and propellant ordnance expended on the TA C-74 Complex is 0.0005 pounds per pound of energetic material, unless otherwise noted.

Soil quality then, as discussed here, is an indication of the pollutant levels (i.e., explosive by-products) in soil, which are then compared with federal or state standards. However, pollutant levels (other than DU) have not been measured in TA C-74 soils. In lieu of measurements, estimates based on emission factors of explosive by-products provide an indicator of soil quality. Only the solid particles, such as metals, would be deposited since gaseous items would remain airborne and move off site. A percentage of gaseous components may be forced into the ground by the initial explosion, but these would diffuse quickly. Thus, only the solid by-product components are analyzed for potential soil quality impacts. The estimated soil concentrations for solid explosive or propellant by-products were calculated by dividing the total weight of by-products by the density of the area in which they are deposited.

In this analysis, Florida soil cleanup goals for industrial applications, as well as Region III RBC concentrations for industrial soil, will be used as the screening levels for chemical materials generated by mission activities. The criteria used in this analysis do not constitute federal regulation or guidance and should not be viewed as a substitute for a site-specific ecological risk assessment.

Since contaminant soil concentration potentials are a component of the environmental analysis, an estimated volume has been developed for the Lakeland soils that dominate the test area lands. No soil density measurements of the TA C-74 Complex were available; however, the dry mass of natural soil per unit volume, or bulk density, ranges from 1.2 g/cm³ for clay soils to 1.7 g/cm³ for sandy soils (University of Florida, 1999). Soil particle density is the mass per unit volume of the solid particles, minus air and water spaces. Since soils on the TA C-74 Complex are primarily sandy, a density of 1.7 g/cm³ is used to estimate potential soil concentrations of explosive and propellant by-products. Additionally, the proportion of available versus total nutrients associated with plant uptake in soil is quite low, on the order of ~1% of the total quantity (Brady, 1984). This factor is used to assess the potential availability and maximum potential exposure doses of chemical constituents for plants.

Water Quality

Water quality analysis will focus on the potentials for chemical material by-products to enter the pond located at the southeast end of the sled track, Rocky Creek which bisects the Complex, and groundwater resources. The potential contaminant transport systems include surface runoff and groundwater recharge. As with air and soil analyses, reasonable scenarios are created to estimate the potential for chemical by-products to be transported via surface runoff into local water bodies based on the proximity of water bodies to the testing site and the associated slope and direction of the surrounding landscape. Groundwater impacts are assessed based on the potential types and amounts of chemical by-products that could infiltrate the soil and their likelihood of reaching groundwater resources. Potential pollutant loads are then compared to associated water quality standards. Detailed information regarding the surface water, groundwater, and storm water dynamics of the TA C-74 Complex can be found in Chapter 3, Affected Environment.

Biological Resources

Biological resource impact potentials will focus on sensitive species and habitats. The threatened and endangered species potentially exposed to chemical materials on the TA C-74 Complex include the southeastern American kestrel, gopher tortoise, Okaloosa darter, dusky gopher frog, and eastern indigo snake. Exposure to chemical materials includes air-borne emissions and particulate matter and ingestion of chemicals directly or indirectly through bioaccumulation in the food chain. The kestrel may be most prone to impact by contaminant bioaccumulation because of its primary food source and foraging habitats. The kestrel is a raptor that hunts smaller birds, rodents, insects, and reptiles that may occur in the open grassland/shrubland habitat of the test area. Vegetation may be adversely impacted by the deposition of chemical material by-products on plant surfaces or uptake by root systems. Where applicable, contaminant concentrations that result in a measurable reduction in plant growth and yield as calculated by Suter et al. (1993) will be presented.

The methodology selected to evaluate the potential for the concentration of chemical materials in the air, water, or soil associated with mission activities on the TA C-74 Complex to impact biological species includes:

- Establish a reasonable scenario involving typical mission activities. A mission activity on the TA C-74 Complex may include the operation of the sled track, the expenditure of individual ordnance as in the detonation of a warhead, the multiple gun firing bursts associated with testing 30mm gun ammunition by an automatic gun, or a combination of such.
- Create a simulated enclosure that represents the volume of space where exposures to peak emission concentrations are likely to occur.
- Identify a time frame during which peak concentrations could persist within the simulated enclosure.
- Calculate an estimated peak exposure concentration for the enclosure/time frame scenario.
- Identify the pathways of exposure to biological organisms, and the potential for exposure.

For the purpose of environmental analysis, mission-specific scenarios are created in order to suggest a reasonable representation of the potential for pollutants to enter the environment. The analysis scenario is structured to represent an estimation of the peak concentration of pollutants generated by mission activities, which is based on the known volume of pollutant versus a known volume of air, soil, and/or water. In the sections that follow, the environmental consequences of chemical by-products generated by TA C-74 Complex mission activities under Alternatives 1 and 2 on the air, soil, water quality, and biological receptors associated with the TA C-74 Complex are identified and analyzed.

Sled Track Operations

The primary focus of chemical analysis regarding sled track operations is to determine the chemical by-products associated with the activation of the rocket motors propelling the sled along the sled track. As described in Section 4.1, sled track testing operations typically involve the attachment of a test item (usually an inert or live bomb or warhead) via straps to a sled propelled by a number of rocket motors. Depending on the size of the munition to be tested and the required testing parameters, a variety of combinations of rocket motors can be used to propel the sled. As a result, this analysis would be better served by analyzing the chemical by-products associated with typical sled rocket motor configurations rather than an individual motor. Live munition detonations resulting from sled track tests are analyzed separately. Table 4-12 provides a list of typical rocket motor configurations and their associated propellants.

Table 4-12. Typical Rocket Motor Sled Configurations and Their Associated Propellants

Configuration # (test item delivered)	Rocket Motor	Quantity	Propellant	Total Amount of Propellant (lbs)
1 (BLU 109)	Genie	1	Ammonium perchlorate	320
	HVAR	8	JPN	200
2 (HTW 1,000-lb)	HVAR	6	JPN	149
3 (JASSM WHD)	HVAR	14	JPN	400
4 (AUP WHD)	Genie	1	Ammonium perchlorate	320
	HVAR	10	JPN	250
5 (BLU 113)	Genie	4	Ammonium perchlorate	1,280
	Zuni	10	X-8	350

The HVAR propulsion rocket motor is composed of ~25 pounds of JPN nitrocellulose-nitroglycerin propellant within a cellulose-aerate liner. The Zuni rocket motor is composed of 35 pounds of standard X-8 propellant with an ethyl cellulose liner. The Genie rocket motor is composed of ~320 pounds of ammonium perchlorate propellant with a rubber liner. The lower temperatures, greater reaction times, and extended availability of oxygen can dramatically affect the type and amounts of by-products produced by rocket motor combustion events. The primary chemical by-products of rocket motor exhaust include carbon monoxide (CO), carbon dioxide (CO₂), nitrogen (N₂), nitric oxide (NO), nitrogen dioxide (NO₂), hydrogen sulfide (H₂S), hydrogen (H₂), hydrogen chloride (HCl), sulfur (S), chloride (Cl₂), and water (H₂O) (Atkins and Dibben, 1989).

Multiplying the original amount of explosive/propellant by known emission factors will yield the total weight of each by-product. Carbon dioxide, which accounts for greater than 97 percent of carbon emissions, has no significant toxic effects on the environment, and thus is not included in the analysis. Table 4-13 lists the emission factors for criteria pollutants associated with the rocket motors used at TA C-74. Because emission factors were unavailable for the Zuni rocket propellant, emission factors for a generic, double-based propellant were used.

Table 4-13. Emission Factors for Rocket Motors Used at TA C-74

Criteria Pollutant	Emission Factor (lb/lb)		
	HVAR Rocket Propellant	Zuni Rocket Propellant	Genie Rocket Propellant
Carbon monoxide (CO)	0.0016	0.0015	0.0012
Nitrogen dioxide (NO ₂)	0.0001	0.0001	0.0001
Particulate Matter (PM ₁₀)	0.019	0.019	0.015
Lead	0.0005	0.0005	0.0005

Air Quality

A conservative scenario for evaluating the potential air quality impacts of chemical materials generated by sled operation during the performance of a mission event is based on the following assumptions:

- The rocket propellants undergo complete thermal combustion. No propellant remains at the end of the mission event.
- The rocket propellants contain 0.0005 pounds of lead in the form of lead styphnate, lead azide, and/or lead salicylate per pound of energetic material.
- No pre-launch tethering operations were performed during the mission event.
- The sled recovery crew does not return to the site for 20 minutes following a mission event for safety precautions.
- Peak exposure concentration would occur within a cylindrical enclosure 640.08 meters (2,100 feet) long and 60.96 meters (200 feet) in radius (Figure 4-6). This cylinder is placed laterally along the length of the track, covering the track in an elongated “dome” type enclosure. The total volume of the “half cylinder” is 3,700,000 m³ (See Equation A-4, Appendix A).
- The longest duration of peak emission concentrations within the exposure cone is 15 minutes.
- Unfavorable weather conditions of calm winds and a 3,000-foot inversion extended throughout the selected sled track testing mission event.

The estimated by-products and potential exposure concentrations for typical rocket sled operation based on the assumptions and emission factors discussed above are presented in Table 4-14. They are then compared to data from Walton County’s 1998 emissions inventory. It should be noted that the air emissions inventory for Walton County does not include small area

stationary sources and mobile sources, and only accounts for stationary “large” sources. In the case of lead emissions, no data were available for Walton County. Consequently, Eglin’s lead emissions were used as a comparison. As with Walton County, Eglin’s air emissions inventory does not include small stationary sources and mobile sources, and only accounts for stationary “large” sources.

Table 4-14. Estimated Air Emissions Generated by Typical Sled Configurations at TA C-74*

Criteria Pollutant	Sled Configuration	Total Emission By-product/ Sled Mission Event		1998 Walton County Emissions (tons/year)	No. of Events Needed to Reach 10% of Walton County Emissions
		Total Emission (grams)	Exposure Area Peak Concentration (µg/m ³)		
Carbon monoxide (CO)	1	319	86	~32	10,000
	2	108	29		26,904
	3	288	78		10,089
	4	354	95		8,208
	5	934	250		3,111
Nitrogen dioxide (NO ₂)	1	24	6	~12	45,400
	2	7	2		155,657
	3	18	5		60,533
	4	26	7		41,908
	5	74	20		14,724
Particulate Matter (PM ₁₀)	1	3,892	1,042	~7	163
	2	1,284	344		495
	3	3,422	916		186
	4	4,315	1,155		147
	5	11,710	3,134		54
Lead (Pb)	1	117	32	No data were available for Pb emissions in Walton County. Eglin’s 1998 emission inventory indicates Pb emissions on the order of 48 lbs.	168**
	2	34	9		578**
	3	90	24		218**
	4	130	35		150**
	5	370	99		53**

* See Equation A-5, Appendix A.

**Values for lead are derived from Eglin’s emission inventory, as Walton County data were unavailable. As stated previously, 48 pounds emitted during 1998 only represents large, stationary sources. Values indicate number of events necessary to reach 10% of Eglin’s 1998 lead emissions.

The sled track mission events terminate with the impact and destruction of the rocket casing at the end of the sled track. Concrete targets placed at the end of the sled track serve to intercept and direct the ricochet of debris, to the degree possible, towards recovery areas. Individual pieces of rocket casing are recovered following each mission event.

For those chemical by-products where comparative data was available, none of the sled configurations analyzed resulted in emissions that would significantly contribute to Walton County’s emission inventory. In the case of lead emissions, comparative data was unavailable. Although Eglin lead emission data was available, it does not provide an adequate representation

of the lead emissions for the region of influence. The Eglin lead emission data only represents large, stationary sources on the Eglin Range. Consequently, lead emissions on Eglin and within Walton County are likely much higher than indicated in available data. Taking these factors into consideration, it is anticipated that no adverse impacts to air quality would result from the operation of the sled track.

Soil Quality

No adverse impacts to soil quality from CO or NO₂ emissions generated by sled operations were identified. The analysis of potential lead concentrations in the soil resulting from a sled-test mission event is based on the following assumptions:

- Of the 370 grams of lead emitted by a mission event involving sled configuration number five, using 4 Genie and 10 HVAR rockets (two missions in FY97), 50 percent or 185 grams would be deposited on the land surface to an average depth of 0.0508 meters (2 inches) within an exposure area 640.08 meters (2,100 feet) long and 60.96 meters (200 feet) wide. The total volume of the soil exposure area is 1,982 m³ (See Equation A-6, Appendix A). The remainder of the lead emission would remain suspended for an undetermined period, would be dispersed throughout the test area, and not be deposited within the exposure area.
- All 185 grams would be evenly dispersed along the length of the sled track (Figure 4-6).
- The average bulk density of the sandy soils in the exposure area is estimated to be 1.7 g/cm³.
- The particulate lead by-product materials deposited on the surface of the exposure area require little or no chemical degradation to become mobile in the soil solution or be immobilized by soil constituents and are susceptible to surface movement by erosion.
- Unfavorable weather conditions of calm winds and a 3,000-foot inversion extended throughout the selected sled track mission event.

The total estimated soil concentrations of lead generated by sled track operations at TA C-74, as compared to risk-based soil criteria, are given in Table 4-15 below.

Table 4-15. Comparison of Sled Track Lead By-product Amounts with Federal and State Soil Criteria*

Location	Sled Track Rocket Motor Configuration	Chemical Material	Criteria (mg/kg)	Amount of By-Product Produced (g)/Event Reaching the Soil	Predicted Soil Concentration (mg/kg)	Number of Events Needed to Exceed Criteria
TA C-74	#5	Lead (Pb)	1,000 ^a	185	0.06	~16,000

* See Equation A-7, Appendix A.

^aFlorida soil cleanup goal for industrial applications

Within the parameters of the scenario outlined above, the total estimated soil concentration of lead within the soil exposure area is 0.06 mg/kg. The estimated cumulative lead concentration

for *all* mission activities performed at the sled track test area under Alternatives 1 and 2 is approximately 0.4 mg/kg (derived from Equation A-7). These estimated lead concentrations are well below the 10.3 mg/kg background concentration for Eglin's surface soils and Florida soil cleanup goal for industrial applications of 1,000 mg/kg.

Water Quality

The Rocky Creek riparian zone is approximately 168 meters (550 feet) to the east-southeast of the southern end of the sled track (Figure 4-6). Since the rocket propellants undergo complete thermal combustion during the course of the mission event, no remnant, unburned portions of propellant are likely to be expended at the end of the mission event. The topography of the sled track area is relatively flat to gently sloping with grassy cover of 90 percent and greater. These factors would inhibit excessive and channelized flow of storm water runoff around the sled track, and the active erosion and pollutant transport associated therewith. As a result, no impacts to groundwater or surface water resources were identified resulting from chemical materials associated with sled track operations.

Biological Resources

No impacts to plants from the release of CO, NO₂, and PM₁₀ were identified. The threshold for lead associated with adverse effects to plants is between 2 and 5 mg/kg (Heath et al., 1991). The cumulative soil concentration for Alternatives 1 and 2 of 0.4 mg/kg is well below this threshold. As a result, no adverse impacts to plants from chemical materials resulting from sled track operation are anticipated.

Analysis for chemical material impacts to biological organisms focuses on screening for environmental contamination, estimating contaminant intakes or doses by various routes of exposure, and comparing those estimates to established threshold criteria. Exposure mechanisms vary not only between species, but also between different populations of the same species. The potential for exposure is often governed by behavioral attributes, diet, and habitat preference, while routes of exposure vary between inhalation, dermal (skin absorption), and ingestion mechanisms (both direct and through bioaccumulation). These routes of exposure play a large part in the potential toxicity of the contaminant in question. As a result, toxicity threshold values associated with the criteria pollutants for wildlife vary by route of exposure.

No data were available regarding threshold levels associated with animals and emissions of CO, NO₂, and PM₁₀. Regarding lead, analyses suggest that liver levels above 5 micrograms/gram (µg/g) of dry weight and kidney levels above 15 µg/g dry weight can be used as a chemical biomarker of toxic exposure to lead in mammals. Absorption rates of lead vary in mammals from 10 to 15 percent for inhalation and 2 to 20 percent for ingestion (Ma, 1996). This analysis thereby focuses on establishing exposure dosage potentials, based on ingestion and inhalation rates derived from allometric (growth) correction factors for size and metabolic rate of the receptor, for selected wildlife species, and determining the potential for adverse effects. Likely scenarios were established to analyze the potential for exposure based on the following:

- The maximum exposure area peak concentrations for air and soil are based on information in Tables 4-15 and 4-16, respectively, for Sled Configuration #5.

- For air, peak exposure is assumed to occur within a time frame of 10 minutes. That is to say that the organism in question remains within the exposure area for the full ten minutes before dispersion of the emission cloud. For soil, peak exposure is assumed to occur over the course of one day, dependent on the amount of soil ingested during that time period.
- Species specific information was unavailable. Inhalation and ingestion rates vary not only by species, but within different populations of the same species. The species analyzed here only serve as a point of reference.

The results of the analysis are given in Table 4-16.

Table 4-16. Estimated Sled Track Operation Chemical Exposure Potentials for Animals

Species	Mean Body Weight (grams)*	Route of Exposure*	Rate	Absorption Factor****	Chemical	Estimated Maximum Exposure Dosage**	Criteria/ Threshold	
American Kestrel	103 (Male in Fall)	Inhalation ^a	0.079 m ³ /day	-	CO	0.1 µg	Data Not Available	
					NO _x	0.01 µg		
					PM ₁₀	2 µg		
		Food Ingestion (estimated 2% soil in diet) ^b	0.31g/g-day***	-	15%	Pb	0.008 µg	****Liver levels >5 µg/g dry weight
						CO	-	Data Not Available
						NO _x	-	
Food Ingestion (estimated 2% soil in diet) ^b	0.31g/g-day***	-	20%	Pb	0.000008 mg/day	****Liver levels >5 µg/g dry weight		
				CO	-	Data Not Available		
				NO _x	-			
Short-tailed Shrew	19 (Male in Summer)	Inhalation ^a	0.026 m ³ /day	-	CO	0.005 µg	Data Not Available	
					NO _x	0.004 µg		
					PM ₁₀	0.6 µg		
		Food Ingestion (estimated 2% soil in diet)	0.62g/g-day***	-	15%	Pb	0.003 µg	****Liver levels >5 µg/g dry weight
						CO	-	Data Not Available
						NO _x	-	
Food Ingestion (estimated 2% soil in diet)	0.62g/g-day***	-	20%	Pb	0.000002 mg/day	****Liver levels >5 µg/g dry weight		
				CO	-	Data Not Available		
				NO _x	-			

a Estimated for an adult male during winter months

b Estimated for an adult male during summer months

* Body weights and inhalation and food ingestion rates acquired from EPA's *Wildlife Exposure Factors Handbook, Vol. 1, 1993*

** See Equation A-8, Appendix A; *** g/g-day = grams ingested per gram of body weight per day; ****Source: Ma, 1996

In addition to the assumptions outlined earlier, atmospheric dilution and dispersion is estimated to drastically reduce elevated air emissions concentrations within 10 minutes, even under weather conditions that would tend to facilitate pollutant loading of the air column (i.e., little or no winds and a high inversion ceiling). It is also unlikely that an animal would remain within an exposure cloud for the full ten-minute time frame. A bird would either have to hover within the cloud or perch within the exposure area. It is more likely that if an animal experienced difficulty breathing it would move from the area. These factors would likely further reduce the exposure potentials estimated above. As a result, the analysis above represents a conservative scenario of events. Even so, estimated inhalation and ingestion exposure dosages are extremely low. Consequently, the potential for adverse impacts to biological resources resulting from rocket motor emissions is expected to be negligible.

Live Munition Detonations

The addition of chemical materials to the environment associated with live munition detonations results from arena testing mission activities and as the end result of sled track operations. Under Alternatives 1 and 2, a number of different types of munitions could be detonated. This analysis will focus on the by-products of the explosives used most often during testing activities in the past involving the detonation of live munitions at TA C-74. These explosives are as follows:

- Tritonal, comprised of 80 percent TNT and 20 percent aluminum powder.
- PBX-109, comprised of 64 percent RDX, 20 percent aluminum, and 16 percent binder.
- C-4, composed of 91 percent RDX and 9 percent plastique.
- AFX-757. The exact percent composition of AFX-757 was unavailable. However, AFX-757 is a propellant-like plastic bonded explosive composed of aluminum and ammonium perchlorate. For purposes of analysis, it is assumed to be of similar composition to PBX-109.

The types of munitions detonated and the associated amounts of explosives/propellant that would be expended under Alternatives 1 and 2 are given in Table 4-11.

The following analysis focuses on estimating the amount of chemical by-products that are generated by the detonations of live munitions at TA C-74 in order to determine a maximum level of missions that could be conducted without exceeding air, soil, or biological quality standards. The analytical process is as follows:

- The mission activity using the largest amount of explosive material was analyzed. This equates to 945 pounds of tritonal, associated with a live Mk-84 warhead.
- Chemical by-products of tritonal were identified using known air emission factors.
- By-products previously identified by federal or state agencies, or in available scientific literature, as air, soil, water, or biological pollutants were identified.
- Concentrations of mission by-products were calculated and compared with available criteria.
- The maximum amount of explosives that could be used without exceeding criteria was estimated.

Tritonal has been the dominant explosive used on TA C-74, with approximately 3,000 pounds expended between FY95 and FY98. Table 4-17 lists the explosive by-products of tritonal, associated emission factors, and the by-product amounts for the Mk-84 containing 945 pounds of tritonal.

Table 4-17. Explosive By-products of Tritonal*

Primary Explosive By-Products of Tritonal	Emission Factor (EF)**	By-Product Amounts/Mission in grams for the Mk-84
Carbon monoxide	0.0047	2,019
Nitrogen dioxide	0.00015	64.3
Sulfur dioxide	0.00016	68.6
2,4-dinitrotoluene	0.0000676	29.0
Phenol	0.0000252	10.8
Naphthalene	0.0000141	6.04
Aluminum	0.00672	2,880
Copper	0.00136	583
Lead	0.0000274	11.7
Barium	0.000184	78.9

* See Equation A-9, Appendix A.

** USEPA, 1998

Air Quality

The dispersion and deposition rates of explosive by-products are unknown and may vary depending on present weather conditions; therefore, it is assumed that all by-products persist within a defined area of exposure for a 15-minute period, after which they would disperse. Particulate matter such as metals would eventually deposit onto the surface. These assumptions about the behavior of the airborne pollutants were made in order to estimate potential impacts. A conservative scenario for evaluating the potential air quality impacts of chemical materials generated by live munition detonations during the performance of a mission event is based on the following assumptions:

- The energetic materials (explosives) undergo complete thermal combustion. No combustive materials remain at the end of the mission event.
- Recovery crews do not return to the site for 20 minutes following a mission event for safety reasons.
- Peak exposure concentration would occur within a dome-shaped enclosure 90 meters (300 feet) in radius (Figure 4-6). This dome is placed over the detonation point-of-origin; in this case, located at the southeast end of the sled track, the arena test area to the west of the track, and the RUT. The total volume of the dome is 1,601,280 m³ (see Equation A-10, Appendix A). Detonations occurring at the northeast end of the track usually occur within the RUT; however, an open-air target such as those used at the southeast end of the sled track may be used. Therefore, emissions at the northeast end of the sled track may be contained within the RUT or released into the air using the same assumptions used in this analysis.
- The longest duration of peak emission concentrations within the exposure dome is 10 minutes.
- Unfavorable weather conditions of calm winds and a 3,000-foot inversion extended throughout the selected detonation event.

Of the explosive by-products listed in Table 4-17, only carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead are regulated by USEPA. Particulate matter is also a criteria pollutant produced during explosions. Particulate matter was not included in the analysis because emission factor information for this pollutant was unavailable. It should be noted that particulate matter from dirt and soil disturbed by the explosion would exceed that produced as a by-product of explosive material. The criteria pollutant, ozone, is not produced during detonations, and thus is not included in chemical materials analysis. The estimated by-products and potential exposure concentrations for live munition detonations based on the assumptions and emission factors discussed above are presented in Table 4-18. They are then compared to data from Walton County's 1998 emissions inventory. It should be noted that the air emissions inventory for Walton County does not include small area stationary sources and mobile sources, and only accounts for stationary "large" sources. In the case of lead emissions, no data were available for Walton County. Consequently, Eglin's lead emissions were used as a comparison. As with Walton County, Eglin's air emissions inventory does not include small area stationary sources and mobile sources, and only accounts for stationary "large" sources.

Table 4-18. Comparison of Emission By-Product Amounts of the Mk-84 to 1998 Walton County Emissions Inventory*

Criteria Pollutant	Total Emission By-products for Mk-84 (945 lbs of Tritonal)		1998 Walton County Emissions (tons/year)	Number of Mk-84 Bombs Needed to Reach 10% of Emissions Inventory	Pounds of Tritonal Needed to Reach 10% of Walton County Emissions (lbs.)	Greatest Amount of Explosive Materials Detonated in One Year Under Alt. 1 & 2 (lbs)
	Total Emission (grams)	Exposure Area Peak Concentration ($\mu\text{g}/\text{m}^3$)				
Carbon monoxide (CO)	2,019	1,261	~32	1,500	~1,400,000	~3,080
Nitrogen dioxide (NO ₂)	64	20	~12	17,000	~16,000,000	
Sulfur dioxide (SO ₂)	68	22	~13	17,000	~16,000,000	
Lead (Pb)	12	4	No data were available for Pb emissions in Walton County. Eglin's 1998 emission inventory indicates Pb emissions on the order of 48 lbs.	200	176,000**	

* See Equation A-11, Appendix A.

**Values for lead are derived from Eglin's emission inventory, as Walton County data was unavailable. As stated previously, 48 pounds emitted during 1998 only represents large, stationary sources. Values indicate number of events necessary to reach 10% of Eglin's 1998 lead emissions.

According to the values in Table 4-18, it would take the detonation of substantial amounts of explosives during the course of one year to significantly contribute to Walton County's emissions inventory. In the case of lead emissions, comparative data were unavailable for Walton County. Although Eglin lead emission data were available, it does not provide an adequate representation of the lead emissions for the region of influence. The Eglin lead emission data only represents large, stationary sources on the Eglin Range. Consequently, lead

emissions on Eglin and within Walton County are likely much higher than indicated in available data. Taking these factors into consideration, it is anticipated that no adverse impacts to air quality would result from the detonation of live munitions at TA C-74.

Soil Quality

No adverse impacts to soil quality were identified from gaseous emissions generated by live munition detonations. The analysis of potential particulate concentrations in the soil resulting from a munition detonation event is based on the following assumptions:

- Of the particulates emitted by the mission event, 50 percent would be deposited on the land surface to an average depth of 0.05 meters (2 inches) within an exposure area 152 meters (500 feet) in diameter positioned over the center of the detonation as a central point-of-origin (Figure 4-6). The total volume of the exposure cylinder is 927 m³ (See Equation A-12, Appendix A). The remainder of the particulate emissions would remain suspended for an undetermined period and not be deposited within the exposure area, being dispersed throughout the test area via atmospheric spreading. Detonations occurring at the northeast end of the track usually occur within the RUT; however, an open-air target such as those used at the southeast end of the sled track may be used. Therefore, emissions at the northeast end of the sled track may be contained within the RUT or released into the air using the same assumptions used in this analysis.
- The average bulk density of the sandy soils in the exposure area is estimated to be 1.7 g/cm³.
- The particulate by-product materials deposited on the surface of the exposure area require little or no chemical degradation to become mobile in the soil solution or be immobilized by soil constituents and are susceptible to surface movement by erosion.
- Unfavorable weather conditions of calm winds and a 3,000-foot inversion extended throughout the selected detonation event.

Dividing the amount of by-product by the density of the soil within the exposure area yields predicted concentrations of explosive materials in soil. Estimated concentrations of by-products are listed in Table 4-19 and, if available, compared with federal or state criteria.

Table 4-19. Comparison of Tritonal Explosive By-product Amounts with Federal and State Soil Criteria*

Chemical Material	Criteria (mg/kg)	Amount of By-Product Produced (g/Event)	Predicted Soil Concentration (mg/kg)	Amount of Tritonal Needed to Exceed Criteria (lbs)	Greatest Amount of Explosive Materials Detonated in One Year Under Alt. 1 & 2 (lbs)
Tritonal (945 lb)					
Aluminum (Al)	1,000,000 ^b	2,900	1	~945,000,000.	~3,080
Copper (Cu)	82,000 ^b	580	0.4	~200,000,000	
Lead (Pb)	1,000 ^a	12	1	~945,000	
Barium (Ba)	84,000 ^a	80	0.05	~1,600,000,000	

*See Equation A-13, Appendix A.

^aFlorida soil cleanup goal for industrial applications; ^bEPA Region III Risked-Based Criteria (RBC) for industrial applications

Within the parameters of the mission event scenario defined above, the total estimated soil concentrations of chemical by-products resulting from the detonation of live munitions are below federal and state soil criteria, as well as Eglin's background soil concentrations. The amounts of chemical by-products generated by the use of explosive material are very small. Consequently, the amounts of explosives needed to exceed soil criteria exceed, by several orders of magnitude, the amounts used within the baseline period. As a result, no adverse impacts to soil quality from the detonation of live munitions are anticipated.

Water Quality

Because of the lack of cohesiveness inherent in Lakeland soils and the limited capacity to hold water, subsurface transport mechanisms for relocating particulates deposited within the soil exposure area exist for both the arena test area and the areas at either end of the sled track. The soils in these areas have a pH of 4.5 – 6.0, and <1-percent organic matter. The combination of these factors helps to reduce the binding properties of soils, and allow for the infiltration and percolation of water-borne particulates into and through subsurface soils. The upper level of the Sand and Gravel Aquifer exists about 20 feet below land surface in these areas. Although heavy storm events could transport particulates through the subsurface, the estimated constituent soil concentrations are relatively low. It is therefore anticipated that the binding properties of the soil, limited though they may be, would further reduce the concentration of constituents as the particulates move through 20 feet of soil before reaching subsurface water resources, thereby reducing the potential for groundwater impacts.

No natural or constructed (ditch) drainage corridors that could accumulate and transport contaminants to surface waters were identified at the arena test area. Moreover, no surface water bodies are located within 1,000 feet of the arena test area or the northwest end (RUT) of the sled track (Figure 4-1). Additionally, soil erosion potentials are limited by the relatively flat to gently sloping topography and soil binding properties of the native grasses on the areas outside the arena test area and the northwest end of the sled track. Consequently, no impacts to surface waters from the transport of constituents were identified resulting from the use of explosive materials at the arena test area or the northwest end of the sled track.

Surface runoff and soil erosion does have the potential to transport explosive by-products generated from explosives detonated at the southeast end of the sled track to the darter stream located ~800 feet to the east of the area (Figure 4-1). An erosion control project involving the construction of retention ponds and sediment basins at the southeast end of the sled track along the northwest slopes of Rocky Creek and the pond was completed in 2000. A similar project along the southeastern slope of the creek in the downrange impact area is currently underway. These erosion mitigations should serve to inhibit the transport of residual chemical by-products to the pond and creek by trapping them within geotextile and rip-rap (concrete and rock debris)-lined swale filtration retention systems. The presence of these retention ponds collecting storm water and the constituent residues carried therein minimizes the potential for chemical by-products to enter the darter stream or pond. As a result, no impacts to the water quality of the darter stream or pond are anticipated from chemical materials associated with the detonation of munitions at the southeast end of the sled track.

Biological Resources

The methodology presented on Page 4-39 provides a mechanism for analyzing the potential impacts to biological resources resulting from the detonation of munitions at TA C-74. As stated previously, toxicity threshold values associated with the criteria pollutants for wildlife vary by route of exposure. No data were available regarding threshold levels associated with animals and emissions of CO, NO_x, and PM₁₀. Suggested chemical threshold criteria for biological resources associated with aluminum (Al), lead (Pb), copper (Cu), and barium (Ba) are given in Table 4-20.

Table 4-20. Suggested Chemical Threshold Criteria for Animals

Chemical	Organism	Criteria/Threshold	Reference
CO	Animals	Data Not Available	---
NO _x	Animals	Data Not Available	---
PM ₁₀	---	Data Not Available	---
Pb	Animals	Liver levels >5 µg/g dry weight	Ma, 1996
	Plants	Background soil levels of 2-5 mg/kg	Heath et al., 1991
Al	Animals	23-44.5 mg/kg/day (LOAEL)	Opresko et al., 1995
	Plants	50 mg/kg soil (LOAEL)	Will and Suter, 1995
Cu	Animals	>15 mg/kg body weight	Klassen et al., 1986
	Plants	20mg/kg by weight	Mortvedt et al., 1977
Ba	Animals	48-56 mg/kg/day (LOAEL)	Opresko et al., 1995
	Plants	50 mg/kg soil (LOAEL)	Will and Suter, 1995

Analysis thereby focuses on establishing exposure dosage potentials, based on ingestion and inhalation rates derived from allometric (growth) correction factors for size and metabolic rate of the receptor, for selected wildlife species, and determining the potential for adverse effects. Conservative scenarios were established to analyze the potential for exposure based on the following:

- The maximum exposure area peak concentrations for air and soil are based on information in Tables 4-18 and 4-19, respectively.
- For air, peak exposure is assumed to occur within a time frame of 10 minutes. That is to say that the species in question remains within the exposure area for the full ten minutes before dispersion of the emission cloud. For soil, peak exposure is assumed to occur over the course of one day, dependent on the amount of soil ingested during that time period.
- Species specific information was unavailable. Inhalation and ingestion rates vary not only by species, but within different populations of the same species. The species analyzed here only serve as a point of reference.

Based on the methodology presented on Page 4-45, no adverse impacts to plants from chemical materials resulting from the use of explosives at either the arena test or the sled track are anticipated. Regarding wildlife, in addition to the assumptions outlined earlier, atmospheric dilution and dispersion is estimated to drastically reduce elevated air emissions concentrations within 10 minutes, even under weather conditions that would tend to facilitate pollutant loading of the air column (i.e., little or no winds and a high inversion ceiling). Also, it is unlikely that an animal would remain within an exposure cloud for the full ten-minute time frame. A bird would

either have to hover within the cloud or perch within the exposure area. It is more likely that if an animal experienced difficulty breathing it would remove itself from the area. These factors would likely further reduce the exposure potentials estimated above. As a result, the analysis above represents a conservative scenario of events. Even so, estimated inhalation dosages are low, with estimated ingestion exposure dosages being below the suggested criteria in Table 4-20. As a result, estimated chemical material soil concentrations associated with munition detonations were not identified as a threat to individual species or to bioaccumulation in the food chain. The results of the analysis are given in Table 4-21.

Table 4-21. Estimated Live Munition Detonation Chemical Exposure Potentials for Animals

Species	Mean Body Weight (grams)*	Route of Exposure*	Rate	Absorption Factor****	Chemical	Estimated Maximum Exposure Dosage**
American Kestrel	103 (Male in Fall)	Inhalation ^a	0.079 m ³ /day	-	CO	0.6 µg
					NO _x	0.01 µg
					SO ₂	0.01 µg
				15%	Pb	0.0004 µg
		Food Ingestion (estimated 2% soil in diet) ^b	0.31g/g-day***	-	CO	-
					NO _x	-
					SO ₂	-
				20%	Pb	0.0001 mg/day
					Al	0.0001 mg/day
					Cu	0.00005 mg/day
Ba	0.000004 mg/day					
Short-tailed Shrew	19.21 (Male in Summer)	Inhalation ^a	0.026 m ³ /day	-	CO	0.3 µg
					NO _x	0.004 µg
					SO ₂	0.004 µg
				15%	Pb	0.0001 µg
		Food Ingestion (estimated 2% soil in diet)	0.62g/g-day***	-	CO	-
					NO _x	-
					SO ₂	-
				20%	Pb	0.00004 mg/day
					Al	0.00004 mg/day
					Cu	0.00002 mg/day
Ba	0.000002 mg/day					

^a Estimated for an adult male during winter months

^b Estimated for an adult male during summer months

*Body weights and inhalation and food ingestion rates acquired from EPA's *Wildlife Exposure Factors Handbook, Vol. 1, 1993*

** See Equation A-8, Appendix A; *** g/g-day = grams ingested per gram of body weight per day; ****Source: Ma, 1996

Gunnery Ballistics Testing

The addition of chemical materials to the environment associated with gunnery ballistics testing at TA C-74/C-74L results from the thermal combustion of both propellants and small amounts of explosives. Under Alternatives 1 and 2, a number of different gunnery ballistics testing activities could take place. This analysis will focus on the by-products of the propellants and explosives used most often during testing activities in the past involving gunnery ballistics at TA C-74/C-74L.

As described earlier, gun testing at the arena test area (TA C-74) usually consists of a gun mounted above a target (usually made of concrete) with the barrel oriented in a vertical position. The munition is then fired downward into the target. Gun testing at TA C-74L consists of gun firing from a gun bay towards a gun butt located to the southeast of the gun bay (Figure 4-3). Guns used consist of 30 mm GAU-8/A, 20 mm M61-A1, and 25 mm GAU-12/B. These are all automatic guns. The guns are mounted within an enclosed gun bay. During firing events, metal doors are opened to expose the gun to the gun butt target. The rounds are fired automatically by the guns and produce short bursts of noise. These guns also have Mann-gun equivalents, which are guns that manually fire one round at a time.

A typical mission activity using an automatic gun begins with the firing of TP rounds for instrument calibration and then the firing of about eight bursts consisting of 30-40 rounds each. There are typically intervals of about 10-15 minutes between each burst. A typical day of firing results in the expenditure of about 300 rounds and 72 TP rounds.

Typical mission activities involving the use of the manual guns consist of firing TP rounds, then test rounds at a single shot rate with about 4-6 minutes between each shot. Typical expenditures consist of about 40-90 test rounds and 10 TP rounds per firing day. Table 4-11, Page 4-28 provides a summary of the mission expenditures and the associated propellant and explosive types/weights during the baseline period for gunnery ballistics testing.

TA C-74 Analysis Scenario

A likely scenario for evaluating the potential environmental impacts of chemical materials generated by gun expenditures at TA C-74 during the performance of a mission event is as follows:

- 1 JASSM 920-Scale is fired as single shot.
- The JASSM is fired from a gun mounted in the air 30 feet above a target with the barrel oriented in a vertical position.
- The propellant of the JASSM contains 0.0005 pounds of lead in the form of lead styphnate, lead azide, and/or lead salicylate per pound of energetic material.
- The exact percent composition of the JASSM's propellant, AFX-757, was unavailable. However, AFX-757 is a propellant-like plastic bonded explosive composed of aluminum and ammonium perchlorate. For purposes of analysis, it is assumed to be of similar composition to PBX-109.
- One hundred percent of emissions are released into the air unfiltered.

TA C-74L Analysis Scenario

A likely scenario for evaluating the potential environmental impacts of chemical materials generated by gun expenditures at TA C-74L during the performance of a mission event is as follows:

- Nine rounds of 30 mm TP PGU-15/B test ammunition are fired as single, hand-loaded shots one minute apart to calibrate instrumentation and test ammunition firing parameters before running an ammunition test lot.
- A test lot of 320 rounds of 30 mm HEI PGU-13/B ammunition is fired from the automatic GAU-8 gun in eight test batch firing “bursts” of approximately 40 rounds each. During each test batch firing, the rounds are shot in a series of four 0.3 second and two 3.0 second automatic bursts with a 10-minute period between firing bursts.
- Each firing run takes one hour and the entire lot test takes eight hours. No breakdowns or notable malfunctions are assumed to occur during the lot testing.
- One percent of air-borne emissions is captured and filtered by the HEPA filter system in the gun bay and the other 99 percent is released out the front of the gun through the front opening of the gun bay unfiltered.
- For HEI rounds, the chemical by-products of the HEI explosives are released once contact is made with the gun butt target. Therefore, emissions associated with HEI rounds are derived from the propellant at the firing end and the explosive at the target impact end.
- The propellant of the 30 mm HEI contains 0.0005 pounds of lead in the form of lead styphnate, lead azide, and/or lead salicylate per pound of energetic material.

The TP ammunition does not contain a high explosive warhead. The source of thermal combustion emissions is the ammunition propellant. The propellants are assumed to be of a double-base propellant mixture of nitrocellulose, nitroglycerin, and diphenylamine. Combustion of the propellant converts most of the original material to carbon dioxide (CO₂), with small amounts of carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO₂), nitrogen gas (N₂), and water (U.S. Air Force, 1996c). The HEI rounds contain less than 0.9 pounds of explosive and similar amounts of propellant as their TP counterparts. According to the Toxic Release Inventory Data Delivery System, a computer application/database developed by the U.S. Department of Defense to report toxic chemical releases resulting from the demilitarization of munitions, the explosives contained in the HEI munitions used at TA C-74L are composed of RDX. Typical by-products of explosives include carbon dioxide (CO₂), with small amounts of carbon monoxide (CO), nitrogen gas (N₂), and water (U.S. Air Force, 1996c).

Air Quality

The mission event activity selected for analysis that represents the potential peak air emission concentration for gun testing at TA C-74 is the firing of the JASSM 920-Scale munition. The mission event activity selected for analysis that represents the potential peak air emission concentrations for gun testing at TA C-74L is a typical mission day with the firing of 320 rounds of 30 mm HEI PGU-13/B ammunition by the automatic gun in burst events of 40 rounds each. The amounts of chemicals generated by these mission activities are calculated by multiplying the amount of energetic material by an emission factor. Calculations are then performed to determine peak exposure concentrations for the spherical enclosures surrounding these areas. No emission factors were available for the 30 mm HEI. However, emission factors for the 20 and 40 mm HEI were available. Emission factors for the 30 mm HEI were therefore estimated by averaging between the 20 and 40 mm HEI, as the amounts of RDX differ between all three

munitions. No emission factors for NO₂ were available for any of these HEI munitions. As a result, the NO₂ emission factor for the 30 mm AP PGU-14/B was used.

The dispersion and deposition rates of explosive by-products are unknown and may vary depending on present weather conditions; therefore, it is assumed that all by-products persist within a defined area of exposure for a ten-minute period, after which they would disperse. Particulate matter such as metals would eventually deposit onto the surface. These assumptions about the behavior of the airborne pollutants were made in order to estimate potential impacts. A reasonable scenario for evaluating the potential air quality impacts of chemical materials generated by gun testing during the performance of a mission event is based on the following assumptions:

- The energetic materials undergo complete thermal combustion. No combustive materials remain at the end of the mission event.
- For TA C-74, peak exposure concentration would occur within a spherical enclosure 12.2 meters (40 feet) in diameter with a volume of 950 m³ (see Equation A-14, Appendix A) surrounding the gun in mid-air (Figure 4-6).
- For TA C-74L, peak exposure concentration associated with propellants would occur within a spherical enclosure 12.2 meters (40 feet) in diameter with a volume of 720 m³ (see Equation A-15, Appendix A) positioned immediately outside the gun bay doors and overlapping the gun bay itself (Figure 4-7). Peak exposure concentration associated with explosives would occur within a spherical enclosure approximately 12.2 meters (40 feet) in diameter surrounding the target, with a volume of 950 m³.
- The longest duration of peak emission concentrations within the exposure spheres is 10 minutes.
- Unfavorable weather conditions of calm winds and a 3,000-foot inversion extended throughout the sled track testing mission events for the baseline period.

The estimated emission factors, by-products, and potential exposure concentration for gun test mission activities at TA C-74 and C-74L Under Alternatives 1 and 2 are presented in Table 4-22.

Table 4-22. Estimated Emission Factors, By-Products, and Peak Concentration of Air Emissions Generated by Gun Testing at TA C-74 and C-74L Under Alternatives 1 and 2*

Criteria Pollutant	Location	Munition	Emission Factor (lb/lb)	Total Emission By-product/ Firing Burst		Greatest Number of Firing Bursts in One Year
				Emission (grams)/ Firing Burst**	Exposure Sphere Peak Concentration (g/m ³)*	
Carbon monoxide (CO)	C-74	JASSM 920-Scale	0.0015	2/0	0.003/-	8 (FY98)
	C-74L	30mm HEI	0.07****	363 ^a /127	0.5/0.1	13 (FY98)
Nitrogen dioxide (NO ₂)	C-74	JASSM 920-Scale	0.0001	0.2/0	0.0003/-	8 (FY98)
	C-74L	30mm HEI	0.00047*****	3 ^a /0.84	0.004/0.0009	13 (FY98)
Lead (Pb)	C-74	JASSM 920-Scale	0.0005	0.8/0	0.001/-	8 (FY98)
	C-74L	30mm HEI	0.0005	3 ^a /0	0.004/0	13 (FY98)

^a Reduced by 1% to account for emissions filtered by the Gun Bay HEPA filter system

* See Equation A-16, Appendix A.

** Propellant/Explosive

*** Point of Origin/Target

**** Estimated using an average between the 20 mm HEI and 40 mm HEI emission factors

***** Emission factor for 30mm AP PGU-14/B used here

The estimated by-products and potential exposure concentrations for gun testing operations, based on the assumptions and emission factors discussed above, are presented in Table 4-23. They are then compared to data from Walton County's 1998 emissions inventory. It should be noted that the air emissions inventory for Walton County does not include small area stationary sources and mobile sources, and only accounts for stationary "large" sources. In the case of lead emissions, no data were available for Walton County. Consequently, Eglin's lead emissions were used as a comparison. As with Walton County, Eglin's air emissions inventory does not include small area stationary sources and mobile sources, and only accounts for stationary "large" sources.

It is anticipated that the 10-minute period between test bursts of the automatic gun would be sufficient for the atmospheric dilution and dispersion of air emissions. The unfavorable weather conditions that could increase exposure to peak concentrations are calm winds and 300 to 500 foot inversions that commonly occur during July or August. Additionally, the air-borne lead in the one percent of emissions within the gun bay building after firing would be removed by the HEPA filter system before release.

According to the values in Table 4-23, it would take the use of substantial amounts of gun propellant and explosive materials during the course of one year to significantly contribute to Walton County's emission inventory. In the case of lead emissions, comparative data was unavailable for Walton County. Although Eglin lead emission data was available, it does not provide an adequate representation of the lead emissions for the region of influence. The Eglin lead emission data only represents large, stationary sources on the Eglin Range. Consequently, lead emissions on Eglin and within Walton County are likely much higher than indicated in available data. Taking these factors into consideration, it is anticipated that no adverse impacts to air quality would result from gunnery ballistics testing at TA C-74 or TA C-74L.

**Table 4-23. Comparison of Emission By-Product Amounts of Gun Testing to 1998
Walton County Emissions Inventory***

Location	Criteria Pollutant	1998 Walton County Emissions (tons/year)	Estimated Total Amount of Propellant/ Explosives needed to reach 10% of Emissions Inventory (lbs.)	Total Amount of Gun Propellants/Explosives Used During the Baseline FY95-FY98 (lbs.)
C-74 (JASSM-920 Scale)	Carbon Monoxide (CO)	~32	~4,000,000	~45
	Nitrogen Dioxide (NO ₂)	~12	~24,000,000	
	Lead (Pb)	No data were available for Pb emissions in Walton County. Eglin's 1998 emission inventory indicates Pb emissions on the order of 48 lbs.	~10,000	
C-74L (30 mm HEI)	Carbon Monoxide (CO)	~32	~91,000	~4,000
	Nitrogen Dioxide (NO ₂)	~12	~5,000,000	
	Lead (Pb)	No data were available for Pb emissions in Walton County. Eglin's 1998 emission inventory indicates Pb emissions on the order of 48 lbs.	~10,000	

* See Equation A-17, Appendix A

Soil Quality

No adverse impacts to soil quality from CO or NO₂ emissions generated by gunnery ballistics testing at TA C-74 or TA C-74L were identified; however, there is the potential for lead concentration in soils. The concentration potential of air-borne lead particulate is dependent on various deposition factors. Once released from the gun, the prevalent weather variables and physical features influence the destination of the lead particles. Winds, rainfall, and temperature could cause the particles to remain suspended or promote deposition on surrounding surfaces, effectively reducing or increasing the amount of particulate deposited. Typically, lead that is deposited on the soil surface by atmospheric variables will, over time, become relatively soluble and prone to leaching. The conditions that induce leaching are the presence of lead in soil at concentrations that approach or exceed the sorption capacity of the soil, lack of soil organic matter, the presence of complexes that are capable of forming soluble chelates with lead, and a decrease in the soil pH and increase in acidity (USEPA, 1986).

The Eglin Installation Restoration Program has determined, through several studies, that lead exhibits limited vertical migration when deposited in the soil (U.S. Air Force, 2000a). This would indicate that lead degrades slowly in the Eglin soil environment and tends to remain close to the point of origin, rather than readily move through the soil profile. It is anticipated, however, that, due to the limited binding properties of Lakeland soils, lead in these areas will eventually, over time, degrade and be carried downward through the soil profile, especially during heavy storm events, thus reducing the overall concentration.

TA C-74 Analysis Scenario

The particles generated by gun testing at TA C-74 would be deposited on the ground immediately underneath and surrounding the suspended gun. The analysis of potential lead concentration in the soil resulting from gun testing at TA C-74 is based on the following assumptions:

- Of the total lead particulate emitted during a JASSM 920-Scale test event, 50 percent or 0.4 grams would be deposited on the surface within an exposure area 12.2 meters (40 feet) in diameter positioned immediately underneath and surrounding the suspended gun (Figure 4-6). The remainder of the lead emission would remain suspended for an undetermined period and not be deposited within the exposure area.
- 0.4 grams of lead is then evenly distributed on the surface of the uncompacted, sandy soils of the 117 square meter (1,300 square feet) exposure area to a depth of 0.0508 meters (2 inches) for a total volume of 6 m³ (see Equation A-18, Appendix A).
- The average bulk density of the sandy soils of the exposure area is 1.7 g/cm³.
- The particulate lead by-product materials deposited on the surface of the exposure area require little or no chemical degradation to become mobile in the soil solution or be immobilized by soil constituents and are susceptible to surface movement by erosion.
- Unfavorable weather conditions of calm winds predominantly out of the east and a 500-foot inversion extend through the lot testing mission event.

TA C-74L Analysis Scenario

The particles deposited on the asphalt pad immediately outside the gun bay could become interlocked with the asphalt material or be transported by winds or rainfall off the pad area. The analysis of potential lead concentration in the soil is based on the following assumptions:

- Of the total lead particulate emitted from propellants during a 320 round lot testing mission, 50 percent, or 12 grams (see Equation A-19, Appendix A), would be deposited on the surface within an exposure area shaped like a “semi-circle” 20 feet in radius immediately outside the gun bay (Figure 4-7). The remainder of the lead emission will remain suspended for an undetermined period and not be deposited within the exposure area, being dispersed by atmospheric conditions.
- One hundred percent of the total deposited lead particulate, or 12 grams, would be deposited on the asphalt pad outside the gun bay within an area of 59 square meters. Of the amount deposited on the asphalt pad, 75 percent or 9 grams, would permanently adhere to the asphalt material, and 25 percent or 3 grams, would be evenly distributed by wind or water to surrounding soil surfaces.
- Because the slope of the pad is relatively stable, the 3 grams of lead particulate would be evenly distributed to both sides of the asphalt pad by weather events (i.e., wind or rain). Eventually, the lead would incorporate into the uncompacted, sandy soils along each edge of the pad to an approximate exposure area of 1.9 square meters (20 square feet) at a

depth of 0.0508 meters (2 inches). The total volume of the exposure area on each side of the asphalt pad is then 0.1 m³.

- The average bulk density of the sandy soils of the exposure area is 1.7 g/cm³.
- The particulate lead by-product materials deposited on the surface of the exposure area require little or no chemical degradation to become mobile in the soil solution or be immobilized by soil constituents and are susceptible to surface movement by erosion.
- Unfavorable weather conditions of calm winds predominantly out of the east and a 500-foot inversion extend through the lot testing mission event.

Total estimated soil concentrations of lead generated by gun testing at TA C-74 and TA C-74L under Alternatives 1 and 2, as compared to the Florida soil cleanup goal for industrial applications, are given in Table 4-24.

Table 4-24. Comparison of Gun Testing Lead By-product Amounts with Florida Soil Criteria*

Location	Munition	Chemical Material	Florida Soil Criteria (mg/kg)	Amount of By-Product Produced (g)/Mission Event Reaching the Soil	Predicted Soil Concentration (mg/kg)	Number of Mission Events Needed to Exceed Criteria	Actual Greatest Number of Mission Events in One Year For Alt. 1 & 2
TA C-74	(1) JASSM 920-Scale	Lead (Pb)	1,000	0.4	0.04	25,000	8
TA C-74L	(320) 30 mm HEI			1.5**	9	112	13

* See Equation A-20, Appendix A.

** A total of 3 grams reaches the soil surface, but is evenly distributed on both sides of the asphalt pad, thus equaling 1.5g/side.

Within the parameters of the scenarios defined above, a JASSM 920-Scale testing mission event at TA C-74 would result in an estimated lead soil concentration of 0.04 mg/kg. A 320-round 30mm HEI ammunition test lot expended at TA C-74L equates to an estimated potential soil concentration of 9 mg/kg in the area along the edges of the asphalt pad, adjacent to the gun bay. Both values are below Eglin’s average background lead concentration of 10.30 mg/kg for surface soils. Additionally, cumulative soil concentrations over the four-year baseline period are below the Florida soil cleanup goal for industrial applications of 1,000 mg/kg. As a result, no adverse impacts to soil quality are anticipated.

Water Quality

Potential pathways for lead deposited on soils is infiltration and leaching into groundwater and transport to streams or waterways by soil erosion. At TA C-74, the nearest waterway is Wildcat Creek, which is over 305 meters (1,000 feet) to the west of the arena test area, where gun testing occurs. No land surface corridors amenable to sheet, rill, or gully erosion are identified. At TA C-74L, the topography is relatively flat, with slopes of less than one percent for the first 500 feet between the asphalt pad exposure area and the ravine located to the southeast. After that, slopes increase to approximately 15 percent down to the small tributary of Rocky Creek (Figure 4-2). Although these steeper slopes are amenable to erosion, and erosion is occurring southeast of the gun butt, vegetative cover over the area between the gun bay facility and the ravine is comprised

mainly of grassy areas, which limits storm water flow and erosion potential. With these factors under consideration, surface transport of lead particulates by water erosion to surface water bodies associated with both TA C-74 and TA C-74L under Alternatives 1 and 2 is not anticipated.

Although heavy storm events could transport particulates through the subsurface, the estimated constituent soil concentrations are relatively low. It is therefore anticipated that the binding properties of the soil, limited though they may be, would further reduce the concentration of constituents as the particulates move through 20 feet of soil before reaching subsurface water resources, thereby reducing the potential for groundwater impacts.

Biological Resources

The methodology presented on Page 4-49 provides a mechanism for analyzing the potential impacts to biological resources resulting from gun testing at the TA C-74 Complex. As stated previously, toxicity threshold values associated with the criteria pollutants for wildlife vary by route of exposure. No data were available regarding threshold levels associated with animals and emissions of CO, NO₂, and PM₁₀. Suggested chemical threshold criteria for biological resources associated with aluminum (Al), lead (Pb), copper (Cu), and barium (Ba) are given in Table 4-20, Page 4-47. Representative scenarios were established to analyze the potential for exposure based on the following:

- The maximum exposure area peak concentrations for air and soil are based on information in Tables 4-23 and 4-24, respectively.
- For air, peak exposure is assumed to occur within a time frame of 10 minutes. That is to say that the species in question remains within the exposure area for the full ten minutes before dispersion of the emission cloud. For soil, peak exposure is assumed to occur over the course of one day, dependent on the amount of soil ingested during that time period.
- Species specific information was unavailable. Inhalation and ingestion rates vary not only by species, but within different populations of the same species. The species analyzed here only serve as a point of reference.

Based on the methodology presented on Page 4-49, no adverse impacts to plants from chemical materials resulting from the use of explosives at either the arena test area or the sled track area are anticipated. Regarding wildlife, in addition to the assumptions outlined earlier, atmospheric dilution and dispersion are estimated to drastically reduce elevated air emissions concentrations within 10 minutes, even under weather conditions that would tend to facilitate pollutant loading of the air column (i.e., little or no winds and a high inversion ceiling). Also, it is unlikely that an animal would remain within an exposure cloud for the full ten-minute time frame. A bird would either have to hover within the cloud or perch within the exposure area. It is more likely that if an animal encountered an unpleasant odor it would remove itself from the area before experiencing difficulty in breathing. These factors would likely further reduce the exposure potentials estimated above. As a result, the analysis above represents an extremely conservative scenario of events. Even so, estimated inhalation and ingestion exposure dosages are extremely low. Consequently, the potential for adverse impacts to biological resources resulting from gun testing emissions is expected to be negligible. The results of the analysis are given in Table 4-25.

Table 4-25. Estimated Gun Testing Chemical Exposure Potentials for Animals for Alternatives 1 and 2

Species	Mean Body Weight (grams)*	Route of Exposure*	Rate	Absorption Factor****	Chemical	Location	Estimated Potential Maximum Exposure Dosage**	Criteria/ Threshold		
American Kestrel	103 (Male in Fall)	Inhalation ^a	0.079 m ³ /day	-	CO	C-74	0.000001 µg	Data Not Available		
						C-74L	0.00001 µg			
					NO _x	C-74	0.0000001 µg			
						C-74L	0.000003 µg			
					15%	Pb	C-74		0.00000006 µg	****Liver levels >5 µg/g dry weight
							C-74L		0.0000005 µg	
		Food Ingestion (estimated 2% soil in diet) ^b	0.31g/g-day***	-	CO	C-74	-	Data Not Available		
						C-74L	-			
					NO _x	C-74	-			
						C-74L	-			
					20%	Pb	C-74		0.000005 mg/day	****Liver levels >5 µg/g dry weight
							C-74L		0.0001 mg/day	
Short-tailed Shrew	19.21 (Male in Summer)	Inhalation ^a	0.026 m ³ /day	-	CO	C-74	0.0000004 µg	Data Not Available		
						C-74L	0.000006 µg			
					NO _x	C-74	0.00000004 µg			
						C-74L	0.000001 µg			
					15%	Pb	C-74		0.00000002 µg	****Liver levels >5 µg/g dry weight
							C-74L		0.0000002 µg	
		Food Ingestion (estimated 2% soil in diet) ^b	0.62g/g-day***	-	CO	C-74	-	Data Not Available		
						C-74L	-			
					NO _x	C-74	-			
						C-74L	-			
					20%	Pb	C-74		0.000002 mg/day	****Liver levels >5 µg/g dry weight
							C-74L		0.0005 mg/day	

a Estimated for an adult male during winter months

b Estimated for an adult male during summer months

* Body weights and inhalation and food ingestion rates acquired from EPA's *Wildlife Exposure Factors Handbook, Vol. I, 1993*

** See Equation A-8, Appendix A; *** g/g-day = grams ingested per gram of body weight per day; ****Source: Ma, 1996

4.3.2 Alternative 3

Alternative 3 involves the same types of missions and expendable quantities as Alternatives 1 and 2 (Table 4-11). There would be no change in the type or increase in the amount of chemical constituents released into the environment associated with the testing of rocket motors, munitions, or gun ammunition. As a result, potential chemical material impacts under Alternative 3 would be the same as those identified under Alternatives 1 and 2.

4.3.3 Alternative 4

Under Alternative 4 there would be a 200-percent increase in mission activities. Although there would be no change in the types of chemicals released into the environment, the amounts of chemical constituents associated with rocket motors and munitions would effectively triple. Table 2-1 in Section 2.2.2 shows the number of testing events and expendables associated with Alternative 4, while Table 4-11, page 4-28 shows the types of propellants and explosives

associated with those expendables. The chemical exposure areas associated with the mission activities on the TA C-74 Complex, as shown in Figures 4-6 and 4-7, would remain the same.

Tables 4-26 and 4-27 in the following section (Section 4.3.4) provide a quantification of the potential chemical releases and resultant environmental concentrations associated with a 200 percent increase in mission activities under Alternative 4.

4.3.4 Chemical Materials Summary

The mission activities, estimated concentrations of associated chemical materials, and the respective impact criteria used to establish environmental consequences are listed in Tables 4-26 and 4-27.

Table 4-26. Chemical Materials Biological Exposure Analysis Summary Table

ISSUE	THRESHOLD CRITERIA		Mission Activity							
			Sled Track Operations		Live Munition Detonations***		Gun Testing			
							C-74		C-74L	
			Greatest Number of Events Occurring in One Year / Alternative							
		Alt. 1 – 3	Alt. 4	Alt. 1 – 3	Alt. 4	Alt. 1 – 3	Alt. 4	Alt. 1 – 3	Alt. 4	
		17	51	13	39	9	27	20	60	
Potential soil chemical exposure to biological organisms [†]	Suggested		Estimated potential maximum exposure dosage (assuming 1% bioavailability ^g for plants, 100% availability through ingestion for animals, and 1 year of accumulation)							
	Pb	Plants: 2-5 mg/kg soil ^f	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<1 mg/kg	<2 mg/kg	~3.5 mg/kg
		Animals: >5000 ng/g dry liver weight ^d	2 – 7 ng/day	6.0 – 14 ng/day	40 – 100 ng/day	120 – 300 ng/day	2 – 5 ng/day	6 – 15 ng/day	100 – 500 ng/day	300 – 1500 ng/day
	Al	Plants: 50 mg/kg soil (LOAEL) ^e	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
		Animals: 23,000,000-44,500,000ng/kg/day (LOAEL) ^f	---	---	40 – 100 ng/day	120 – 300 ng/day	---	---	---	---
	Cu	Plants: 20 mg/kg soil ^g	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
		Animals: > 15,000,000 ng/kg body weight ^h	---	---	20 – 50 ng/day	60 – 15 ng/day	---	---	---	---
	Ba	Plants: 50 mg/kg soil (LOAEL) ^e	---	---	<1 mg/kg	<1 mg/kg	---	---	---	---
Animals: 48,000,000-56,000,000 ng/kg/day (LOAEL) ^f		---	---	2 – 4 n/day	6 – 12 ng/day	---	---	---	---	
Potential chemical air exposure to wildlife [†]	CO	Animals: N/A	50000 – 100000 pg		300000 – 600000 pg		0.4 -1.0 pg		6.0 –10 pg	
	NO ₂	Animals: N/A	4000 – 10000 pg		4000 – 10000 pg		0.04 – 0.1 pg		1.0 – 3.0 pg	
	PM ₁₀	Animals: N/A	600000 – 2000000 pg		---		---		---	
	Pb	Animals: >5000000 pg/g dry weight kidney levels ^c	3000 – 8000 pg		100 – 400 pg		0.06 – 0.02 pg		0.2 – 0.5 pg	
	SO ₂	Animals: N/A	---		4000 – 10000 pg		---		---	

^a Heath et al., 1991

^b Ma, 1996

^c Will and Suter, 1995

^d Opreško et al., 1995

^e Mortvedt et al., 1972

^f Klassen et al., 1986

^g Brady, 1984

Table 4-27. Chemical Materials Physical Resources Analysis Summary Table

Expenditure Used in Analysis	No. of Events/Alt.		Criteria Pollutant	Exposure Area Air Emission Concentrations				Exposure Area Peak Soil Concentrations (mg/kg)				
				Total Emission /Mission (grams)	Exposure Area Peak Concentration / Event	10% County Emission Criteria (grams)	Cumulative Emission/ Alternative (g)		Per Mission	Cumulative Concentration/ Alternative		Soil Cleanup Criteria
	1 - 3	4					1 - 3	4				
Sled Track Operation												
<i>Sled Configuration</i>	Sled Configurations are based on Table 4-12, page 4-36											
1	6	18	Carbon monoxide (CO)	319	86 µg/m ³	3,200,000	4,816	14,448	-	-	-	
2	1	3		108	29 µg/m ³							
3	4	12		288	77 µg/m ³							
4	2	6		354	95 µg/m ³							
5	1	3		934	250 µg/m ³							
1	6	18	Nitrogen dioxide (NO ₂)	24	6 µg/m ³	1,200,000	349	1,047	-	-	-	
2	1	3		7	2 µg/m ³							
3	4	12		18	5 µg/m ³							
4	2	6		26	7 µg/m ³							
5	1	3		74	20 µg/m ³							
1	6	18	PM ₁₀	3,892	1,042 µg/m ³	700,000	56,664	169,992	-	-	-	
2	1	3		1,284	344 µg/m ³							
3	4	12		3,422	916 µg/m ³							
4	2	6		4,315	1,155 µg/m ³							
5	1	3		11,710	3,134 µg/m ³							
1	6	18	Lead (Pb)	117	32 µg/m ³	22,000*	1,726	5,178	0.02	0.39 ^a	~1 ^a	1,000 ^b
2	1	3		34	9 µg/m ³				0.01			
3	4	12		90	24 µg/m ³				0.01			
4	2	6		130	35 µg/m ³				0.02			
5	1	3		370	99 µg/m ³				0.06			
Live Munition Detonations**												
Mk-84 (945 lbs. Tritonal)	1	3	Carbon monoxide (CO)	2,019	1,261 µg/m ³	3,200,000	2,019	6,057	-	-	-	-
			Nitrogen dioxide (NO ₂)	64	20 µg/m ³	1,200,000	64	192	-	-	-	-
			Sulfur dioxide (SO ₂)	68	22 µg/m ³	1,300,000	68	204	-	-	-	-
			Lead (Pb)	12	4 µg/m ³	22,000*	12	36	1	<1	~3	1,000 ^b
			Aluminum (Al)	2,900	-	-	2,900	8,700	1	2	6	1,000,000 ^c
			Copper (Cu)	580	-	-	580	1,740	0.4	<1	~2	82,000 ^c
			Barium (Ba)	80	-	-	80	240	0.05	<1	~2	84,000 ^c
Gunnery Ballistics Testing												
JASSM 920-Scale (TA C-74)	8	24	Carbon monoxide (CO)	2	0.002 g/m ³	3,200,000	16	48	-	-	-	
30 mm HEI (TA C-74L)	13	39		490	(GB) 0.5 g/m ³ (T) 0.1 g/m ³							6,730
JASSM 920-Scale (TA C-74)	8	24	Nitrogen dioxide (NO ₂)	0.2	0.0002 µg/m ³	1,200,000	1.6	3	-	-	-	
30 mm HEI (TA C-74L)	13	39		50	(GB) 0.004 g/m ³ (T) 0.0009 g/m ³							50
JASSM 920-Scale (TA C-74)	8	24	Lead (Pb)	0.8	0.0008 g/m ³	22,000*	6.4	19	0.04	0.8	2	1,000 ^b
30 mm HEI (TA C-74L)	13	39		24	0.006 g/m ³							

a Cumulative value includes all rocket motor emissions.

b Florida Soil Cleanup Goal for industrial uses

c EPA Risk Based Criteria for industrial uses

*Values for lead are derived from Eglin's emission inventory, as Walton County data was unavailable. As stated previously, 48 lbs. emitted during 1998 only represents large, stationary sources.

**Cumulative values are for events using tritonal only.

(GB) = Gun Bay; (T) = Target

Alternatives 1 - 3

Estimated cumulative air emissions and soil concentrations resulting from sled track operations were less than selected air and soil quality impact criteria (10 percent of Walton County's air emissions and Florida's Soil Cleanup Goal/EPA Region III's RBC, respectively).

Additionally, estimated exposure doses were found to be low and, in cases where exposure criteria were available for comparison, estimated doses were lower than suggested toxicity exposure criteria. The dynamics of air emission concentrations in ambient air are quite variable and are primarily governed by the physical and chemical parameters of mission event expenditure activities and the prevalent weather conditions. Changes in weather and mission parameters would drastically alter the actual concentration potentials of each mission event. It is concluded that the air-borne emission estimates for mission events on the TA C-74 Complex are within time frame tolerances for single event expenditures and that the actual measured post-event concentrations will vary based on mission and climatic variables. Also, behavioral response, foraging habits, and other such factors would limit chemical exposure to organisms, resulting in lower exposure doses than estimated in the analyses found in this document. Consequently, there would be no adverse impacts to biological resources resulting from rocket motor emissions.

Estimated cumulative air emissions and soil concentrations resulting from the detonation of live munitions were less than selected air and soil quality impact criteria. However, surface runoff and soil erosion has the potential to transport chemical by-products generated from explosives detonated at the southeast end of the sled track to the stream and pond, located ~244 meters (800 feet) to the east of the area (Figure 4-1, Page 4-2). An erosion control project involving the construction of retention ponds and sediment basins at the southeast end of the sled track along the northwest slopes of Rocky Creek and the pond was completed in 2000. A similar project along the southeastern slope of the creek in the downrange impact area is currently underway. These erosion mitigations should serve to inhibit the transport of residual chemical by-products to the pond and creek by trapping them within the retention ponds and sediment basins. As a result, there would be no impacts to the water quality of the darter stream or pond from chemical materials associated with the detonation of munitions at the southeast end of the sled track.

Estimated cumulative air emissions and soil concentrations resulting from gun testing at the TA C-74 Complex were substantially less than selected air and soil quality impact criteria. No direct exposure or contamination pathways that could adversely impact sensitive plant or animal species were identified. Although the threshold value for plants is exceeded in the immediate vicinity of the asphalt pad at TA C-74L, the area around the gun bay is maintained grassland and disturbed soil. No documented sensitive plant species occur within the lead exposure area. As a result, no adverse impacts to plants from chemical materials resulting from gun testing are anticipated.

Alternative 4

Under Alternative 4 there would be a 200-percent increase in mission activities, resulting in approximately 51 sled track operations, 18 live munition detonations, and 27 gunnery ballistics tests at TA C-74 and 60 at TA C-74L. Although there would be no change in the location and

types of chemicals released into the environment, the amounts of chemical constituents associated with these missions and expendables would effectively triple. Even so, estimated cumulative air emissions and soil concentrations resulting from these activities under Alternative 4 were still less than selected air and soil quality impact criteria. Estimated chemical exposure doses were found to be low, with cases where exposure criteria were available for comparison being lower than suggested toxicity exposure criteria. With these factors under consideration, there would be no adverse impacts to physical or biological resources from sled track operations, live munition detonations, or gunnery ballistics testing under Alternative 4.

4.4 DIRECT PHYSICAL IMPACT

Direct physical impacts to wildlife, soils, vegetation, and cultural resources could result from the launching of inert munitions via sled track operations and live munition detonations. These types of mission activities frequently produce fragments and debris that could potentially cause physical injury and/or death to wildlife species, destroy critical habitat, create seismic effects that could physically impact underlying soils and burrowing animals, and damage undiscovered cultural resources. Additionally, the recovery of test items down range could directly impact sensitive species and habitat and cultural resources via vehicular and foot traffic.

For TA C-74, direct physical impacts from high-velocity fragments produced by the launching of inert test items during sled track operations and their subsequent recovery, and the detonation of live munitions are analyzed. The potential impacts of vegetation management equipment on physical, biological, and cultural resources are discussed in the Test Area Maintenance Programmatic Environmental Assessment (U.S. Air Force, 1999a) and are not a part of this analysis.

Because TA C-74 and the surrounding area is cleared of military and nonmilitary personnel prior to the initiation of mission activities, there is no chance of fragments or debris hitting humans. However, the potential for damaging sensitive plants and wildlife and their habitat, including the red-cockaded woodpecker, Okaloosa darter, and wetland habitat exists. No known prehistoric or historic structures are present on or near the test area. Potential underground cultural resources (e.g. burial sites) receive protection from direct impacts by vegetation and soil overburden.

4.4.1 Alternative 1 (No Action) and Alternative 2

For the purposes of analysis, mission activities that may result in direct physical impacts to sensitive habitats and species and cultural resources are analyzed in this section as follows:

- Sled Track Operations (the end result being the delivery of inert or live test items into concrete targets and possibly down range)
- Recovery of Test Items (retrieval of test items from the downrange safety area)
- Live Munition Detonations (either the end result of a sled track operation or during a static detonation at the arena test area)

Table 2-1, page 2-2 lists the relevant test items used under Alternatives 1 and 2.

Environmental Analysis

Analysis of mission activities having the potential for direct physical impacts to sensitive species and habitat is outlined as follows:

- Mission activities were selected to represent the typical usage of the TA C-74 Complex for testing.
- Potential impact zones associated with representative missions were identified using best available data.
- Sensitive species and habitat and areas of cultural resource restraint associated with the potential impact zones were identified using Eglin AFB's Geographic Information System (GIS) files.

Sled Track Operations

The launching of test items (munitions) during a sled track testing operation into a concrete target can result in not only the fragmentation of the target, but the continued progression of the test item down range. Typically, live munition tests are such that the munition detonates immediately upon exit of the target. However, on occasion, the munition fails to detonate and continues as a projectile down range. Inert munitions typically exit the target and continue down range. Because of the dynamics involved in such operations, test engineers must consider a number of factors to determine the direction, distance, and speed with which a munition, having passed through a concrete target, would travel down range, as well as the fragmentation footprint of the target. These factors include:

- a) The size and weight of the test item,
- b) The distance of the target from the end of the sled track,
- c) The size and thickness of the target,
- d) The angle of impact with the target, and
- e) The speed with which the test item impacts the target.

Physical Resources

Due to the above factors, the establishment of a target fragmentation zone is difficult. Generally, the impact of a test item with a concrete target is a relatively passive event, with only a small amount of target fragmentation occurring immediately behind and to the sides of the target (Schneider, 2000). The test item will impact the target, which is composed of concrete and reinforced with re-bar. It will create an entrance hole about the size of the test item, and upon exit will leave an exit hole approximately 4-5 feet in diameter on the opposite side. Concrete fragments are propelled outward from the exit hole to a distance of approximately 300-500 feet at an angle of about 80 degrees. Live munitions will detonate upon exit of the target, while inert munitions will continue to travel. The estimated concrete fragmentation zone is well away from the wetland and riparian zone to the east (~500 feet). The fragmentation of a concrete target would, therefore, have no adverse impacts to these areas.

Test engineers can, with some degree of certainty, predict the outcome of most tests, including the test item exit speed. Based on predicted parameters, the distance to which a test item will

travel after exiting the target can also be predicted. Live munitions are then detonated at a predetermined time or distance from target exit. However, due to variables and unknowns inherent in all tests, the test item impact zone is considered to be the entire downrange safety area (Figure 4-8) for obvious reasons. Although uncommon, test items have, on occasion, been known to continue onward for thousands of feet, skipping along the ground until finally resting, partially buried, in the sand. Interviews with C-74 personnel revealed that these occurrences are usually due to anomalies in testing parameters. Normally, the test item is detonated as planned (in the case of live munitions), or travels only a few hundred feet from the target before coming to rest (in the case of inert munitions).

Therefore, the possibility exists for test items to impact downrange wetland areas and Okaloosa darter streams. The impact of a test item in the streams could disrupt substrates and bottom sediments, having a direct physical impact on short-term water quality by increasing the turbidity of these waters. Damage to wetland habitat from the gouging or crushing of sensitive wetland vegetation is also a possibility as the test item skids or slides along the ground.

Biological Resources

Because target fragments are usually confined to within 500 feet of their original location, no direct physical impacts to biological resources from target fragmentation were identified.

The impact of a test item in the streams of the downrange impact area has the potential to adversely affect the Okaloosa darter, which lives in these water bodies. The chances of actually injuring or killing a darter are unknown, but assumed to be remote. Additionally, an increase in turbidity from the disruption of bottom sediments due to test item impact may have temporary adverse effects on darter stream water quality.

Cultural Resources

Eglin's Cultural Resources Branch (AAC/EMH) has identified areas within 200 meters (656 feet) of water bodies and situated no more than 15.2 meters (50 feet) above the water's surface as being zones of high probability for the occurrence of cultural resources. These areas have been labeled as "Areas of Cultural Resource Constraint." These areas exist throughout the TA C-74 downrange impact area (Figure 4-8), with a total area of 396 acres (~84% of C-74's total area).

No identifiable direct physical impacts to cultural resources from target fragmentation were identified.

Although past vegetative management practices such as roller drum chopping and bush hogging have disturbed the surface soils in these areas, potential adverse impacts to as yet undiscovered cultural resources could occur if a test item lands within areas of cultural resource restraint identified by AAC/EMH. Adverse impacts could be in the form of crushing of artifacts using heavy equipment or the exposure of artifacts to naturally degrading elements (e.g., rain and wind).

Based on recommendations from the Florida State Historic Preservation Officer (SHPO), AAC/EMH is currently conducting a cultural resources survey in the C-74 Rocky Creek area. The results of this survey will determine the need for a National Historic Preservation Act (NHPA) Section 106 consultation with the SHPO.

EMH and the Test Wing (TW) are presently coordinating a proactive, accelerated survey process for specific areas identified by the TW as “high interest” areas. This involves identifying test areas with cultural resource constraints as a land-use issue, prioritizing these areas for cultural resource surveys, conducting surveys, and then designating the area as non-constrained or as specific sites for protection/further study. Once completed, the surveys serve to eliminate potential future cultural resource/land-use issues for the land areas in question.

Recovery of Test Items

After a test item has been launched and finally comes to rest down range, the recovery process begins. Test personnel track the item by watching the dust cloud created by the item as it skips along the ground. A crew then proceeds to the recovery site to retrieve the test item. Depending on the size and disposition (i.e., depth to which it is buried) of the item, recovery crews may use a backhoe or large truck and chains to pull the item back to a central repository. It is then either stored on site or taken to TA C-74A for analysis. It is estimated that approximately 98 percent of test items launched from the sled track are recovered down range.

Physical Resources

Depending on the location and disposition of the test item and the subsequent recovery requirements, direct physical impacts may occur to wetland habitats and the stream and pond to the east of the sled track. Use of heavy equipment or vehicular traffic could negatively impact water quality and destroy sensitive wetland habitat. Recovery of a test item within these areas (including the riparian zone along the darter stream and pond) involving the use of heavy equipment is considered as having the potential for adverse impact to these areas. As a result, permit acquisition for recovery actions in wetland areas has been initiated with the FDEP.

Biological Resources

Any recovery of a test item within wetland areas can potentially damage sensitive wetland vegetation (including the riparian zone along the darter stream and pond). Additionally, recovery operations in the stream or pond could injure or kill darters, or render the short-term water quality unsuitable for the species. As a result, recovery operations involving the use of heavy equipment are considered as having the potential for adverse impact to these biological resources. An Endangered Species Act (Section 7) programmatic biological assessment and consultation with the USFWS regarding the Okaloosa darter was completed in July 2002. The USFWS issued a Biological Opinion determining that test item recovery would likely kill or injure the darter. As a result, a number of terms and conditions were placed on test item recovery actions taking place within or near Rocky Creek. The Biological Opinion and the related terms and conditions are presented in Appendix I.

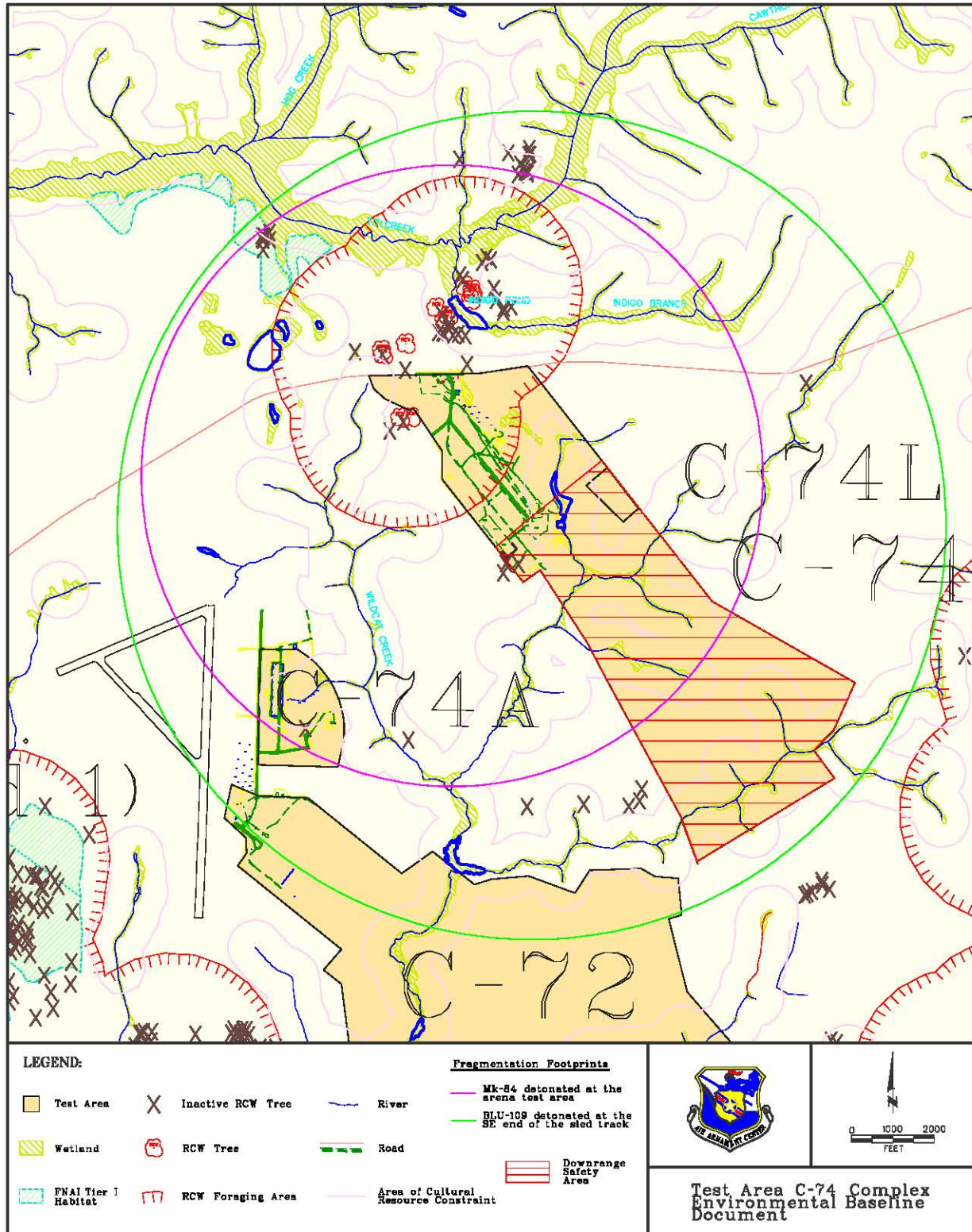


Figure 4-8. BLU-109 and Mk-84 Fragmentation Zones

Cultural Resources

Although past vegetative management practices such as roller drum chopping and bush hogging have disturbed the surface soils in these areas, any test item recovery activities involving the disruption of the ground surface within Areas of Cultural Resource Constraint, as established by AAC/EMH (Figure 4-8), have the potential for adverse impacts to as yet undiscovered cultural resources. Again, these areas are currently being surveyed by AAC/EMH to determine the whether or not cultural resources exist on the test area.

Live Munition Detonations

Live munition detonations take place either as the end result of a sled track operation (usually at the southeast end of the track) or at the arena test area. In the case of sled track operations, the munition is usually detonated in the air as it exits the target. At the arena test area, the detonation occurs as a static ground test, where the munition is either placed on the ground directly, or is buried. The potential for direct physical impacts to physical resources comes from the seismic effects of static ground testing, while impacts to biological resources may occur from the fragmentation of the warhead upon detonation and from burrow collapse due to seismic tremors. Live munition detonations do not occur within Areas of Cultural Resource Constraint. As such, impacts to cultural resources from these activities are not anticipated.

Safety footprints for fragmentation of the largest munitions detonated on TA C-74, the BLU-109 (southeast end of the sled track) and the Mk-84 (arena test area), are analyzed (see Table 4-28). These two munitions are the largest detonated on TA C-74. Safety footprints of 10,000 feet for the BLU-109 and 7,500 feet for the Mk-84 (in radius from the point of detonation) have been established by the Range Safety office (AAC/SEU) based on historical observations and technical analysis. These footprints represent the furthest distance to which bomb fragments have been observed. The fragmentation pattern of a detonated munition is dependent on a number of factors, including orientation of the bomb and whether or not safety precautions (such as encasing the tail in concrete) to minimize fragmentation have been implemented (Caldwell, 2000).

Physical Resources

Direct physical impact potentials are dependent on the type of munition detonated, location of the detonation, and the associated fragmentation footprint. As mentioned above, the largest munition that would be detonated at the sled track under Alternatives 1 and 2 would be the BLU-109. The fragmentation footprint of the BLU-109 as established by Eglin's Range Safety Office is 10,000 feet (Figure 4-8). Adverse impacts to surface water quality from live munition detonations were not identified.

The largest munition that would be detonated at the arena test area would be the Mk-84, with an established fragment safety footprint of 7,500 feet (Figure 4-8). A study of ground shock stress at TA C-74 using a TNT NEW equivalent of 1,000 pounds was conducted by SAIC in 1996, the results of which are published in the *Effector Analysis Report* (U.S. Air Force, 1996d). In summary, it was concluded that explosively generated ground shock stresses from the detonation of explosives of this size should not damage the clay layer. Additionally, it was concluded that sand greatly attenuates ground shock stress (U.S. Air Force, 1996d). As a result of this analysis,

no seismic impacts to physical resources from static ground testing of live munitions are anticipated. Adverse impacts to surface water quality from live munition detonations were not identified.

Biological Resources

Impacts from seismic effects to sensitive burrowing animals or those that use burrows would not occur since there are no documented gopher tortoise burrows within 2,000 feet of any detonation site.

Based on velocity and impact variables, fragments and debris may remain on the surface, become buried in the soil, and/or interact with biological features. Bomb fragments may impact the vegetation within the fragmentation zones. A relatively sparse vegetation density of less than 50 percent and immaturity of plant growth caused by bush hogging and chopping every other year on the TA C-74 range reduces the potential for detrimental injury to individual plants and plant communities. The impact of plant foliage and stems on fragment trajectory, velocity, and range is unknown.

It is not possible to calculate the chances of a fragment strike on these species, due to the many variables involved in the dispersion of bomb fragments and activities of the various animal species in question. Consequently, analysis focuses on identifying those species documented to occur, or may potentially occur, within the fragmentation footprints of the BLU-109 and Mk-84, as established by Eglin's Range Safety Office.

The floodplain associated with the Titi River is preferred habitat for the Florida black bear and its presence has been identified in the area surrounding TA C-74; thus the potential for bomb fragments to impact this species does exist. As a result, the Florida black bear will be included in the direct physical impact analysis. Potential impacts will be evaluated with regard to the amount of Titi River floodplain habitat area within the fragmentation safety footprints.

The southeastern American kestrel, described in Chapter 3, has been sighted in the area of TA C-74, as the habitats in and around the test area provide prime habitat for both nesting and hunting. Although the inactive and abandoned RCW nests in close proximity to TA C-74 (tracked by Eglin's RCW monitoring program) could potentially provide kestrels with nesting habitat, no site verification data of inactive/abandoned RCW nest occupancy were available. Potential impacts to the kestrel will be evaluated with regard to the number of inactive RCW cavity trees within the fragmentation safety footprints.

The RCWs inhabit the Sandhills north, west, and southeast of the test area with the nearest active cavity tree being approximately 49 meters (160 feet) from the western test area boundary. The occurrence and population densities of this species are closely monitored on Eglin's land range through the Jackson Guard RCW monitoring program, and nesting sites and live animal identifications are documented on Eglin's GIS databases. The analysis of potential impacts to RCWs will focus on identified nesting trees and foraging areas within the TA C-74 fragmentation footprints.

Additionally, wetland areas and FNAI Tier I designated habitats within the fragmentation safety footprints are also identified because of their propensity to attract sensitive species. The results

of this analysis, given in Table 4-28 and shown in Figure 4-8, identifies species and habitat that are most likely to be adversely impacted by bomb fragments generated by mission activities on TA C-74.

Table 4-28. Potential Direct Physical Impacts to Wildlife from Live Munitions Detonations

Munition	Activity Location	Associated Fragmentation Safety Footprint	Receptor				
			Wetlands/ Tier 1 Habitat (acres)	Potential Black Bear Habitat (acres)	Active RCW Trees (No.)	RCW Foraging Area (acres)	Potential Kestrel Nesting Trees (No.)
BLU-109	Sled Track	10,000 feet	~750/~58	~380	12	~1,054	54
Mk-84	Arena Test Area	7,500 feet	~650/~40	~227	12	~1,054	40

The values in Table 4-28, as well as the graphics in Figure 4-8, show that there is a potential for physical impacts to sensitive species and habitat in the vicinity of TA C-74 from bomb fragments caused by the detonation of live munitions. Although the chances of this occurring are incalculable, it is estimated that the odds of this occurring would be low due to the ratio of fragmentation zone area versus amount of fragments created.

By the time the shrapnel is dispersed to areas where sensitive species occur, individual pieces would be several hundred feet apart. In addition, sensitive species are not isolated, but are usually surrounded by other trees and vegetation. Trees and foliage would provide a buffer against shrapnel, blast, and noise from detonations. Any sensitive species on the fringe of the test area would be subject to the maximum effects of any given detonation. Additionally, impact by debris or shrapnel may not necessarily result in harm to an animal. Wildlife in close proximity to a detonation, or birds flying over the test area at the time of detonation, would be at more of a risk from blast pressure and noise than from shrapnel.

4.4.2 Alternative 3

Potential direct physical impacts to physical and biological resources from mission activities have been identified as occurring from downrange test item impacts and test item recovery operations. Alternative 3 involves the same types of missions and expendable quantities as Alternatives 1 and 2 (Table 2-1 page 2-2), with the addition of providing O&M plans and BMPs for mission activities that would help maintain the integrity of current erosion control measures and identify and suppress direct physical impacts to sensitive resource areas (i.e. wetland areas, darter streams, and potential cultural resources).

Areas involved in erosion control projects would be afforded special consideration during mission activities, with heavy equipment or vehicles associated with test item recovery operations being used cautiously in these areas. Additionally, small-scale damage to erosion control areas resulting from mission activities would be repaired immediately, while large-scale test item recovery operations in erosion-prone areas would be coordinated with Environmental Management to ensure that recovery would result in the least possible damage to the project, and that any damage to these erosion-prone areas would be repaired.

Using a programmatic approach, the TW, AAC/EM and AAC/EMH have coordinated natural and cultural resources consultations regarding the potential impacts to the Okaloosa darter, wetland areas, and potential cultural resources from sled track operations and test item recovery activities, thereby ensuring minimal potential impacts to physical, biological, and cultural resources. The establishment of sound vegetation control practices along riparian zones and exposed slopes, as outlined in the Test Area Maintenance Programmatic Environmental Assessment, would minimize soil erosion in these areas. Additionally, the recovery of test items impacting wetlands on Test Area C-74 would involve recovery techniques that minimize damage to the ecosystem. Heavy equipment would avoid wetlands areas when practicable, test items would be removed wetland areas using techniques that minimize disturbance, and all damage would be repaired.

With the O&M procedures described above firmly in place, the potential for impacts to physical, biological, and cultural resources associated with mission activities occurring on TA C-74 would be reduced. Consequently, there would be a lower potential for impacts under Alternative 3 than Alternatives 1 and 2, resulting in potentially beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74.

4.4.3 Alternative 4

Alternative 4 involves a 200-percent increase in mission activities (please refer to Section 2.2.2, Table 2-1 for a list of expendables associated with Alternative 4), as well as the O&M procedures described under Alternative 3. As identified earlier, potential direct physical impacts to physical and biological resources from mission activities occur as a result of downrange test item impacts and test item recovery operations. Although the frequency of these events would effectively triple under Alternative 4, the implementation of the O&M procedures outlined under Alternative 3 would lower the potential for adverse impacts to physical, biological, and cultural resources associated with TA C-74. Consequently, it is anticipated that there would be beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74 when compared to maintaining the baseline activities under Alternatives 1 and 2.

4.4.4 Direct Physical Impacts Summary

Potential direct physical impacts to the sensitive habitats, sensitive species, and potential cultural resources of TA C-74 primarily occur (1) as a result of the launching of test items (both inert and live munitions) down range subsequent to a sled track testing operation, (2) the recovery of said items, and (3) fragments produced by the detonation of live munitions at both the sled track and the arena test area. Table 4-29 summarizes the potential direct physical impacts of these mission activities to sensitive species under all alternatives.

Alternatives 1 and 2

Sled track test items launched down range would potentially impact sensitive physical and biological resources, specifically wetland areas and Okaloosa darters and their habitat. Test items may skip or skid along the ground, damaging wetland vegetation. Test items may also land in the darter streams within the downrange impact area, potentially causing physical injury or death to darters. Water quality would also be potentially affected by the impact of large, heavy test items in the stream or pond, which could disturb bottom sediments and cause

increases in short-term water turbidity. This would potentially reduce water quality and have adverse effects on the darters within these water bodies. Additionally, the landing of test items within Areas of Cultural Resource Constraint would also have potential adverse impacts to as yet undiscovered cultural resources. Due to the variables involved in testing parameters, calculating the chances of these occurrences was not possible.

Table 4-29. Direct Physical Impact Summary

Resource	Mission Activity									Potential Impact
	Sled Track Operations			Recovery of Test Items			Detonation of Live Munitions (>100 lbs)			
	Number of Events in One Year									
	Alt 1&2	Alt. 3	Alt. 4	Alt 1&2	Alt. 3	Alt. 4	Alt 1&2	Alt. 3	Alt. 4	
	17		51	98% of Inert Sled Track Missions*			13		39	
<i>Physical</i>										
Water Quality	⊗	-	-	⊗	-	-				Increased short-term turbidity of shallow streams.
Sensitive Habitat	⊗	-	-	⊗	-	-				Potential damage to wetland and darter habitat.
<i>Biological</i>										
Sensitive Plants	⊗	-	-	⊗	-	-				Potential damage to wetland vegetation.
Sensitive Animals	⊗	-	-	⊗	-	-	⊗	⊗	⊗	Potential animal strikes and habitat damage.
<i>Anthropogenic</i>										
Cultural Resources	⊗	-	-	⊗	-	-				Disturbance of areas of cultural resource constraint.

* Estimated based on information from the *Range Utilization Report* regarding number of inert test items launched from the sled track.

⊗ = Potential Impact

- = Reduced Potential for Impact

Blank = No Impact

Depending on the final disposition of the test item, recovery may involve the use of heavy equipment. The use of such equipment for the recovery of test items laying within wetland areas or the Okaloosa darter streams in the downrange impact area (~20,000 linear feet of darter stream exists within this area) may have adverse effects on wetland vegetation, the quality of water within the streams, and on the Okaloosa darter itself. This would require a Section 7 consultation with the USFWS for potential impacts to the Okaloosa darter. Recovery activities within Areas of Cultural Resource Constraint may have adverse impacts to as yet undiscovered cultural resource.

No direct physical impact potentials to cultural resources were identified from the detonation of live munitions at TA C-74. Direct physical impacts to sensitive species may occur from fragmentation events due to munition detonations at the end of the sled track and at the arena test area. The fragment safety footprints for the two largest munitions used on the range, the BLU-109 and the Mk-84, are 10,000 feet and 7,500 feet, respectively, from the point of detonation. Within these footprints are 12 active RCW trees and a number of potential southeastern American kestrel nesting sites (~49). Additionally, these footprints encompass

several hundred acres of potential black bear habitat, as well as wetland areas, which provide habitat for many sensitive species. The chances for the occurrence of a bomb fragment strike were incalculable; however, the chances of a strike would be minimal due to the ratio of fragmentation zone area versus amount of fragments created.

Alternative 3

Alternative 3 involves the same types of missions and expendable quantities as Alternatives 1 and 2, with the addition of providing O&M plans and BMPs for mission activities that would help maintain the integrity of current erosion control measures and identifying and suppressing direct physical impacts to sensitive resource areas (i.e. wetland areas, darter streams, and potential cultural resources). Although the frequency of sled track and test item recovery mission events and activities under Alternative 3, as described under Alternatives 1 and 2, would remain the same, there would be a lower potential for impacts associated with these events under Alternative 3 than Alternatives 1 and 2, resulting in potentially beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74 due to the implementation of O&M procedures. The potential impacts from live munition detonations under Alternative 3 would be the same as those identified under Alternatives 1 and 2.

Alternative 4

Alternative 4 involves a 200 percent increase in mission activities (please refer to Section 2.2.2, Table 2-1 for a list of expendables associated with Alternative 4), as well as the O&M procedures described under Alternative 3. Although the frequency of sled track operations and test item recovery mission events and activities would effectively triple under Alternative 4, it is anticipated that there would be beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74 when compared to maintaining the baseline activities under Alternatives 1 and 2. This would be due to the lowered potential for adverse impacts from the implementation of the O&M procedures outlined under Alternative 3. Additionally, live munition detonation events would also triple. Even though the safety zones associated with the expendables detonated under Alternative 4 would remain unchanged, the frequency of events would triple, thereby increasing the chances for the occurrence of a bomb fragment strike to sensitive species. However, the chances of a strike would be remain minimal due to the ratio of fragmentation zone area versus amount of fragments created.

4.5 HABITAT ALTERATION

Habitat alteration can have both positive and negative effects on a local ecosystem. Positive effects include the reestablishment of once destroyed wetland areas, restoring the habitat to its original state. Negative effects occur when an activity changes the local ecosystem in such a manner as to either make the area unsuitable for its current inhabitants or changes the landscape such that it can not naturally return to its original state. Examples of these actions are the damming of streams, the draining or filling of wetlands, or the creation of erosional landscapes.

4.5.1 Alternative 1 (No Action) and Alternative 2

The mission activities under Alternatives 1 and 2 that would potentially impact the habitats of TA C-74 include:

- Sled Track Operations (the end result being the launching of inert or live test items into a concrete target, and possibly down range)
- Recovery of Test Items (retrieval of test items from the downrange safety area)
- Sled Track Target Area Maintenance (the upkeep of the target impact area at the southeast end of the sled track)
- Live Munition Detonations (static ground testing of live bombs)

Refer to the Alternatives 1 and 2 Section (4.4.1) in the Direct Physical Impacts (4.4) analysis for a summary of test item launch operations.

Test item recovery and live bomb surface detonations have the greatest potential for physically impacting test area habitats on a large scale. The sled track operations and the subsequent launching of test items down range would potentially physically impact habitats on a small scale, and maintenance of the sled track target area would potentially impact the area in the immediate vicinity of the target area. The potential impacts of live bomb and target fragments are analyzed in the Direct Physical Impacts section.

Environmental Analysis

This section analyzes the potential for mission activities to negatively impact the physical condition of habitats associated with TA C-74. Habitats include Sandhills, Grassland/Shrubland, wetlands, and stream systems. Ecological sensitivities of special concern include Okaloosa darter stream degradation, active erosion and sedimentation, destruction of wetland areas, and wildfire. Measures and/or threshold criteria will be used to quantify potential impacts.

Sled Track Operations

Potential impacts resulting from the sled track operations are associated with the launching of test items from the sled track down range. Potential impacts include effects to Sandhills communities, Grassland/Shrubland communities, and Okaloosa darter habitat.

Sandhills

Although the Sandhill communities adjacent to the test area are outside the TA C-74 boundary, they could be impacted by test items launched from the sled track. However, the occasional landing of inert test items in the woods and/or detonation of a spotting charge would have no adverse impact on the overall physical condition of Sandhill habitats.

Should a live test item fail to detonate upon exit of its target and land in the Sandhill community, the possibility exists for it to detonate where it lands (however, no documented or anecdotal evidence of such an occurrence was found, and such an occurrence is believed to be unlikely). If surrounding conditions are favorable for ignition (i.e., it lands in dry brush during the summer), a wildfire may result. The Sandhills surrounding TA C-74 are dominated by longleaf pine timber stands that are under active prescribed burning programs every three to five years, developed and managed by Eglin's Natural Resources Fire Management section. Prescribed burning of longleaf pine is used to reduce excess fuel, control understory hardwoods, stimulate height growth,

improve wildlife habitat, thin stands, control brown-spot needle blight, and improve seedbed preparation for germination (Crocker and Boyer, 1975).

Much of the Sandhill longleaf pine timber to the north and west of the test area was burned through the prescribed burning program between 1995 and 1996. The risk of a destructive wildfire in the near future is reduced since these stands burned within the last three to five years and fuel levels would be relatively low.

Grassland/Shrubland

The downrange impact area is located on a broad ridgetop exhibiting rolling hills and deep ravines. Vegetation management of the area results in the presence of a relatively sparse density of small saplings, grasses, and shrubs with exposed sandy soils. A site visit showed no physical evidence that launched test items had directly impacted the physical condition of the habitat. However, the sloped regions along the ravines and hills are areas where soil disturbance caused by frequent test item impacts could adversely affect soil stability under current vegetative cover conditions. Reduction in vegetative cover on the slopes of the ravines and hills of the impact zone has increased soil erosion potentials (Figure 4-9) and is primarily a result of disturbances associated with vegetation management practices discussed in the Test Area Maintenance Programmatic Environmental Assessment (U.S. Air Force, 1999a). The possibility also exists for live munitions that have failed to detonate upon exit from the target to detonate down range (however, no documented or anecdotal evidence of such an occurrence was found). Between FY97 and FY00, six wildfire events occurred on the test area, resulting in a total burn of about 41 acres. The cause of these fires is unknown.

Okaloosa Darter Habitat

Habitat requirements of the Okaloosa darter include shallow, flowing streams, the margins of which are fringed by vegetation and detrital matter. The darters are typically found in and around the root masses of the fringing vegetation and woody debris (USFWS 1998). Large, heavy test items landing in or near the shallow darter stream could potentially degrade the quality of darter habitat by causing partial or complete bank collapse along the stream, not only entombing fringing vegetation but filling shallow areas of the stream.

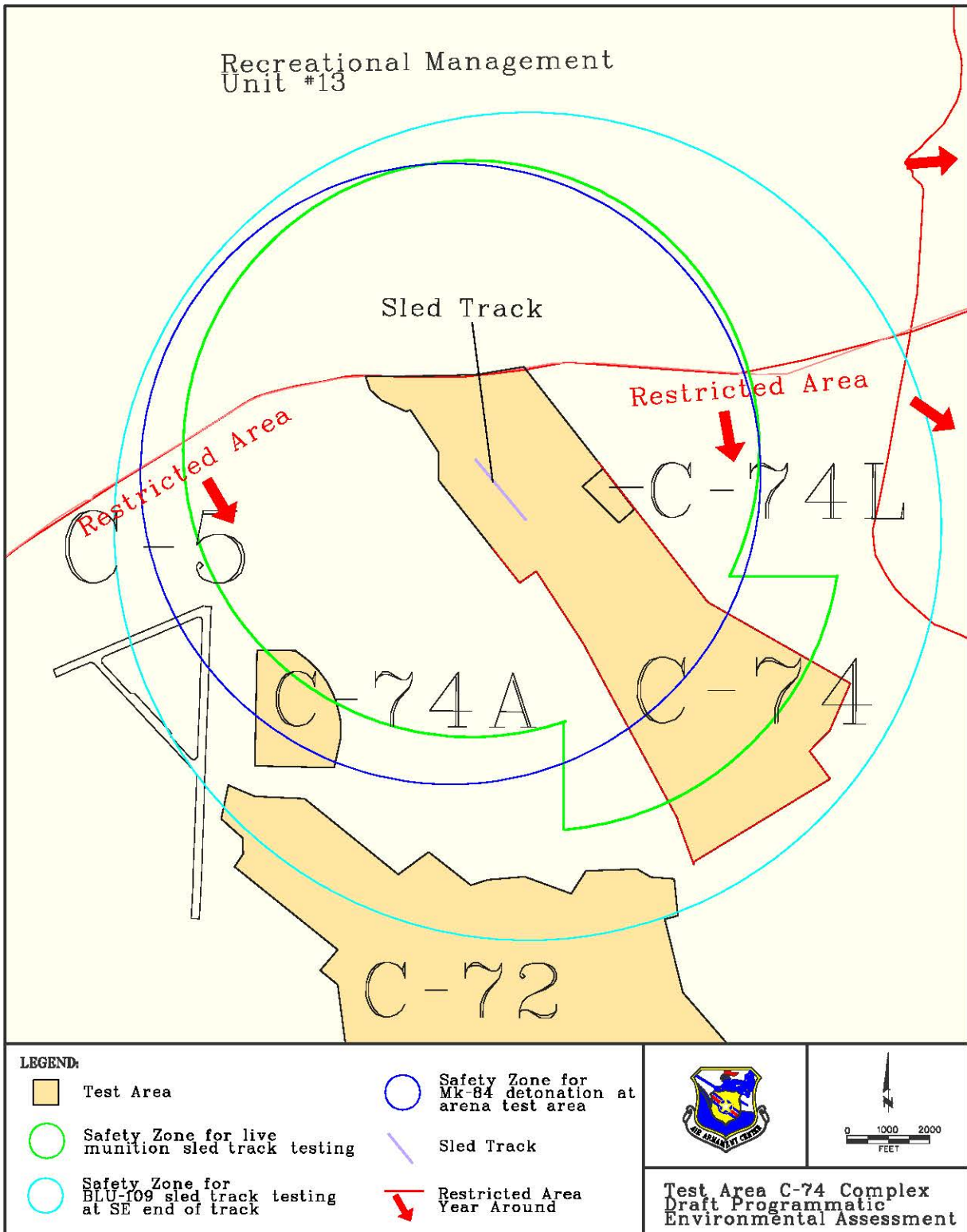


Figure 4-9. Example of Safety Footprints for Typical TA C-74 Mission Activities

Additionally, test item impact would potentially cause a cratering effect in the interior of the stream, resulting in partial or complete damming of shallow areas or an increase in depth of the stream in certain areas. Frequent test item impacts to areas fringing the darter stream may potentially contribute to erosion and sedimentation of the stream due to the lack of vegetative cover along the hills surrounding the stream. Test area maintenance activities (i.e. roller drum chopping and bush hogging) contribute to the erosion potentials of the stream banks, and likely exacerbate erosion caused by test item impacts along these areas due to the removal of vegetation. Erosion, impoundment, and alteration of flow or depth of the darter habitat would all have detrimental effects to the species.

No records were available as to how many past missions resulted in a test item landing in the darter stream or caused alteration of the stream. However, anecdotal evidence through interviews with test area personnel indicated that test items landing in or near the stream immediately to the southeast of the sled track target area was an occasional occurrence (Schneider, 2000 pers. comm.).

Test Item Recovery

Potential alterations to the Sandhill and Grassland/Shrubland communities, Okaloosa darter habitat, and wetlands would result from the use of recovery equipment in these areas.

Sandhills

Although the Sandhill communities associated with TA C-74 are beyond the TA boundary, it is possible for test items to land in these areas. As a result, recovery operations would take place within this community. The trees and foliage would most likely make recovery of the test item difficult, which would undoubtedly disturb the habitat. However, no records exist of a test item landing beyond the test area boundary, and, based on anecdotal evidence acquired from test area personnel, it is believed that this is a rare occurrence (Schneider, 2000 pers. comm.).

Grassland/Shrubland

Impacts to this ecological system would potentially result from vehicular traffic (which may crush vegetation), and from recovery operations involving digging and dragging of large, heavy test items resulting in the uprooting of vegetation. Both of these actions contribute to erosion potentials. A site visit found a few large sandpits at various locations along the downrange access road on the upland areas, although it was unclear as to their origin (possibly the result of test item recovery operations). Because of the reduced vegetative cover along the hills and ravines due to test area maintenance activities, excessive vehicular traffic and frequent recovery operations in these areas contribute to soil erosion potentials along these slopes (Figure 3-3).

Okaloosa Darter Habitat

Recovery operations involving heavy equipment within or adjacent to the Okaloosa darter streams located down range of the sled track would potentially adversely impact the darter habitat. Recovery operations would potentially collapse the banks of the stream, causing disruption of flow or entombment of vegetation or darters located in the stream. Additionally, the removal of test items from the stream would potentially disrupt bottom sediments and

increase turbidity, or create gouges or craters in the streambed, affecting stream depth and flow dynamics. All of these actions would have potentially adverse effects on darter habitat. An Endangered Species Act (Section 7) programmatic biological assessment and consultation with the USFWS regarding the Okaloosa darter was completed in July 2002. The USFWS issued a Biological Opinion determining that test item recovery would likely kill or injure the darter. As a result, a number of terms and conditions were placed on test item recovery actions taking place within or near Rocky Creek. The Biological Opinion and the related terms and conditions are presented in Appendix I.

Wetlands

Test items may land in wetland areas. Depending on the weight of the item, the trajectory of impact, and the disposition of the wetland area (i.e., relatively wet or relatively dry, depending on the season) these items may either set on top of the soil or sink into the muck, becoming submerged. In either case, recovery may involve the use of heavy equipment in these areas, which would potentially result in the destruction of wetland vegetation. Executive Order 11990, Protection of Wetlands, requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in their activities. AAC/XPE has initiated a permit application with the FDEP for recovery activities in wetland areas.

Sled Track Target Area Maintenance

In order to facilitate location and recovery of the test item and cleanup of debris, the target area immediately south of the sled track, which is adjacent to Rocky Creek (Figure 4-1), is graded and kept clear of vegetation. This activity results in soil erosion along the northwest hill of the adjacent darter stream during large storm events, which causes active sheet erosion due to large quantities of storm water flow.

The movement of soils into the darter stream would potentially adversely impact darter habitat by increasing sedimentation, subsequently reducing water quality by increasing turbidity and altering flow dynamics. Construction of storm water retention ponds and sediment basins was completed in 2000 along the northern slopes of the pond and Rocky Creek (Figure 4-1) in order to reduce erosion potentials. A similar project is underway along the southeastern slopes of the pond and Rocky Creek.

Live Munition Detonations

The greatest potential impact to habitats resulting from live munition detonations would be cratering. Mission activities involving live munition detonations at the sled track are such that live munitions detonate in the air before reaching the ground (assuming the test goes as planned). The only place where live munitions would be detonated on or in the ground is at the arena test area. Depending on the amount of explosive, a crater of varying size and depth would form following a surface or near surface detonation (does not include subsurface detonation). As an example, the detonation of a 100-pound net weight explosive bomb would create a crater 5 feet in diameter and 1 foot deep, whereas a 1 kiloton explosion could, theoretically, produce a crater 130 feet in diameter and 30 feet deep. The arena testing area is specially configured for such activities, and although the cratering events produced by ground test detonations of large

munitions would potentially displace relatively large amounts of soil, the impact area would be confined to the boundaries of the target area and repairs would be made following mission activities.

Soil Erosion

Soil erosion resulting from vegetative management on TA C-74 is the primary factor contributing to habitat alteration and is addressed in the Test Area Maintenance Programmatic Environmental Assessment (U.S. Air Force, 1999a). However, test item recovery and other related mission activities tend to exacerbate the erosion problems on the test area, and accelerate erosion processes (See Section 3.3.1, Landforms and Soils, for a discussion of soil erosion). Erosion control efforts on TA C-74 have recently been completed, and should serve to alleviate much of the erosion potential on the TA.

4.5.2 Alternative 3

Potential habitat alteration impacts affecting physical and biological resources from mission activities have been identified as occurring from sled track operations, sled track target area maintenance activities, downrange test item impacts, test item recovery operations, and soil erosion associated with these, and test area maintenance, activities. Alternative 3 involves the same types of missions and expendable quantities as Alternatives 1 and 2, with the addition of providing O&M plans for mission activities helping to maintain the integrity of current erosion control measures and identifying and suppressing direct physical impacts to sensitive resource areas (i.e. wetland areas, darter streams, and potential cultural resources).

Implementation of O&M procedures described in Section 2.2.3 would reduce soil erosion potentials and the potential for impacts to physical, biological, and cultural resources associated with mission activities occurring on TA C-74. Consequently, there would be a lower potential for impacts under Alternative 3 than Alternatives 1 and 2, with potentially beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74.

4.5.3 Alternative 4

Alternative 4 involves a 200-percent increase in mission activities (please refer to Section 2.2.2, Table 2-1 for a list of expendables associated with Alternative 4), as well as the O&M procedures described under Alternative 3. As identified earlier, potential habitat alteration impacts to physical and biological resources from mission activities occur as a result of sled track operations, sled track target area maintenance activities, down-range test item impacts, test item recovery operations, and soil erosion associated with these, and test area maintenance, activities. Although the frequency of these mission events would effectively triple under Alternative 4, the implementation of the O&M procedures outlined under Alternative 3 would lower the potential for adverse impacts to physical, biological, and cultural resources associated with TA C-74. Consequently, it is anticipated that there would be beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74 when compared to maintaining the baseline activities under Alternatives 1 and 2.

4.5.4 Habitat Alteration Summary

The primary effectors and receptors evaluated in this analysis were (1) test item launches from the sled track, (2) subsequent test item recovery operations, (3) sled track target area

maintenance activities, and (4) live munition detonations and their associative effects on sensitive species and habitat, as well as soil erosion. A habitat alteration summary for all alternatives is presented in Table 4-30.

Table 4-30. Summary of Potential Habitat Alteration Consequences

Receptor	Mission Activity								Potential Impact
	Sled Track Operations		Recovery of Test Items		Sled Track Target Area Maintenance		Detonation of Live Munitions		
	Alt. 1&2	Alt. 3&4	Alt. 1&2	Alt. 3&4	Alt. 1&2	Alt. 3&4	Alt. 1&2	Alt. 3&4	
<i>Sandhills</i>			⊗	-			⊗	-	Potential risk of impact by recovery operations should a test item land in a Sandhill area, and risk of wildfire and cratering for live munitions landing in these areas.
<i>Grassland/Shrubland</i>	⊗	-	⊗	-					Frequent test item impacts along sloped areas affect soil stability. Recovery involving heavy equipment increases soil erosion potentials.
<i>Okaloosa Darter Habitat</i>	⊗	-	⊗	-	⊗	-			Launched test items may land in darter streams. Recovery operations and maintenance may contribute to siltation and subsequent degradation of streams.
<i>Wetlands</i>			⊗	-					Potential damage to wetlands from vehicular traffic and use of heavy equipment.
<i>Soil Erosion</i>	⊗	-	⊗	-	⊗	-			Potential soil erosion rates of >50 tons/acre/yr in some areas.

⊗ = Potential Impact
 - = Reduced Potential for Impact
 Blank = No Impact

Alternatives 1 and 2

Sled track operations involve the launching of a test item, independently, towards a target. As a consequence, test items, typically inert munitions, continue as projectiles down range after clearing the target. It is also possible for live munitions to clear the target without detonating and land down range. Frequent test item impacts would potentially cause soil disturbance on sloped areas along the ravines and hills, which would potentially adversely effect soil stability under current vegetative cover conditions. Should a live test item fail to detonate upon exit of its target and land in the Sandhill or Grassland/Shrubland communities, the possibility exists for it to detonate where it lands. If surrounding conditions are favorable for ignition (i.e., it lands in dry brush during the summer), a wildfire would potentially result. The conditions that minimize the risk of a destructive wildfire as a result of mission activities are the prescribed burning programs for the longleaf pine adjacent to the test area, which decrease levels of fuel that limit the extent of wildfire burns.

Large, heavy test items landing in or near the shallow darter stream would potentially degrade the quality of darter habitat by causing partial or complete bank collapse along the stream, not only entombing fringing vegetation but filling shallow areas of the stream. Additionally, test

item impact would potentially cause a cratering effect in the interior of the stream, resulting in partial or complete damming of shallow areas or an increase in depth of the stream in certain areas. Frequent test item impacts to areas fringing the darter stream may contribute to erosion and sedimentation of the stream due to the lack of vegetative cover along the hills surrounding the stream.

Test item recovery in Sandhill communities fringing the test area would most likely make retrieval difficult, and would undoubtedly disturb the habitat. Impacts to Grassland/Shrubland areas would result from vehicular traffic and the digging up and dragging of large, heavy test items, resulting in the crushing and uprooting of vegetation. These actions contribute to erosion potentials. Recovery operations involving heavy equipment within or adjacent to the Okaloosa darter streams located down range of the sled track would have potentially adverse impacts to darter habitat by affecting stream depth, flow dynamics, and overall quality of the habitat. An Endangered Species Act (Section 7) programmatic biological assessment and consultation with the USFWS regarding the Okaloosa darter was completed in July 2002. The USFWS issued a Biological Opinion determining that test item recovery would likely kill or injure the darter. As a result, a number of terms and conditions were placed on test item recovery actions taking place within or near Rocky Creek. The Biological Opinion and the related terms and conditions are presented in Appendix I. Test item recovery may involve the use of heavy equipment in wetland areas, resulting in the potential destruction and degradation of wetland vegetation and habitat, which is afforded protection under Executive Order 11990, *Protection of Wetlands*. A permit for these activities has been initiated with the FDEP.

Maintenance activities at the target area at the southeast end of the sled track would potentially result in disruption of topsoil along the northwest hill of the adjacent darter stream. During large storm events, active sheet erosion due to large quantities of storm water flow creates sedimentation problems for the darter stream. Construction of storm water retention ponds and sediment basins is along the northwestern slopes of the pond and Rocky Creek for the purposes of erosion control was completed in 2000, while a similar project along the southeastern slopes is currently underway.

Although the cratering events produced by live munition detonations would displace relatively large amounts of soil, the impact area is generally confined to the boundaries of the target area and repairs are made following mission activities. The potential for live munitions to land down range and subsequently detonate in Sandhill, Grassland/Shrubland, and Wetland associations does exist, and would, therefore, pose potential adverse impacts to these areas.

Mission activities involving maintenance of the sled track target impact area and test item recovery create conditions that do not allow the reestablishment of vegetation along slopes with reduced vegetative cover due to test area maintenance activities. This increases the potential for erosion in these areas.

Alternative 3

Although the frequency of sled track operations, test item recoveries, and sled track target area maintenance activities under Alternative 3, as described under Alternatives 1 and 2, would remain the same, there would be a lower potential for impacts under Alternative 3 than Alternatives 1 and 2, due to the implementation of O&M procedures and subsequent reduction in

soil erosion wetland impact potentials. This would result in potentially beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74. The potential impacts from live munition detonations under Alternative 3 would be the same as those identified under Alternatives 1 and 2.

Alternative 4

The frequency of sled track operations, test item recoveries, and sled track target area maintenance activities would effectively triple under Alternative 4, but it is anticipated that there would be beneficial, rather than adverse, impacts to the physical, biological, and cultural resources of TA C-74 when compared to maintaining the baseline activities under Alternatives 1 and 2. This would be due to the lowered potential for soil erosion and adverse wetland impacts from the implementation of the O&M procedures outlined under Alternative 3.

4.6 RESTRICTED ACCESS

Restricted access pertains to the temporary closure of test areas, interstitial areas, public roads, or airspace because of mission activities. Receptors potentially impacted would include the military and the public desiring to use roads, test areas, recreational areas, or airspace. Restricted access impacts would be associated with mission activities at TA C-74 involving the detonation of live munitions.

4.6.1 Alternative 1 (No Action) and Alternative 2

Safety footprints vary not only in the size, but in the duration of closure. The detonation of a BLU-109 has a 10,000-foot safety footprint radius, extending horizontally to a maximum altitude of 5,000 feet (essentially creating a cylinder-shaped hazard zone). Ordinarily, closures of roads, test areas, recreational areas, and airspace for live munition tests are on the order of a few hours or less. An extreme example of closure duration would be 30 continuous hours.

Environmental Analysis

The closure of an area is dependent on the munition and associated mission characteristics, such as the size of munition detonated and the location of the detonation (i.e., southeast end of the sled track or the arena test area). Figure 4-9 shows the safety footprints, as established by the Egin Range Safety Office, associated with typical mission activities at C-74 (sled track testing of small live munitions and the BLU-109 and Mk-84). Although large portions of the safety footprints for mission activities involving the testing of live munitions fall within perennially restricted areas, mission activities involving large detonations (such as the BLU-109 and Mk-84) at TA C-74 would require closure of portions of the northern half of the Egin reservation. Real-time considerations and coordination with the Egin Safety Office would allow for the use of adjacent test areas within some safety footprints.

The exact area and duration of closure are determined by the type of munition used, whether it is statically detonated or used on the sled track and, if so, on which end the munition is delivered/detonated. The possibility exists, depending on mission parameters, for these areas to be restricted for extended periods of time. An example of such a situation would be a sled track

operation involving the use of a live BLU-109 at the south end of the sled track. If this item becomes stuck in the target or exits the target and lands a few hundred feet away without detonating, depending on the fuze, a period of anywhere between one to five days could take place before the fuze “times out” or is disarmed. This would require extended closures because the safety distance would be in effect until the munition detonates or is disarmed.

As a result of the detonation of live munitions at TA C-74, restricted access impacts would potentially occur to public and military personnel desiring to use Recreation Management Units, range roads, or (in the case of the military) adjacent test areas and airspace. The total area closed per mission varies, but typical examples are presented in Figure 4-9. Highway 285, Bob Sikes Highway, would be closed periodically. Table 4-31 in Section 4.6.4 below presents the details of restricted access impacts that would occur under Alternatives 1 and 2. For purposes of airspace closure, the cylinder-shaped hazard zone (to an altitude of 5,000 feet) also applies for the time frame indicated.

4.6.2 Alternative 3

Because the number of missions and associated expendables under Alternative 3 would be the same as those under Alternatives 1 and 2, potential restricted access impacts under this alternative would be the same as those for Alternatives 1 and 2.

4.6.3 Alternative 4

Under Alternative 4, the number, frequency, and expendables associated with TA C-74 mission activities would increase by 200 percent over Alternative 3, while the types of expendables would remain unchanged (see Table 2-1, Section 2.2.2). As a result, the safety footprints, restricted areas, and duration of closure would remain the same as those under Alternative 3, while the frequency of closures would effectively triple. Table 4-31 in Section 4.6.4 below presents the details of restricted access impacts that would occur under Alternatives 1 and 2.

4.6.4 Restricted Access Summary

Table 4-31. Summary of Restricted Access Impacts to Military and Public Areas Under All Alternatives

Mission Activity	Test Item Type	Associated Safety Footprint (feet)	Area Affected	Typical Duration of Closure*	Number of Events / Alternative/Year	
					1 - 3	4
<i>Arena Testing</i>	Live	7,000	RR 212 & 214, HWY 285	15 min	2	6
<i>Sled Testing</i>	Inert	1,000	214	15 min	8	24
	Live	3,000	RR 215, HWY 285, Recreation Unit 13 A & B	15 min	1	3
		4,000	RR 215, HWY 285, Recreation Unit 13 A & B	15 min	2	6
		5,000	RR 214, HWY 285, Recreation Unit 13 A & B	60 min	1	3
		10,000	RR 214, HWY 285, TA C-74A, TA C-72, TA C-5, Recreation Unit 13 A & B	15 min	1	3

* This excludes extraordinary events as described in Section 4.5.1.

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APPENDIX A
EQUATIONS

Equation A-1 (p. 4-10)**Conversion of net explosive weights (NEW) to TNT NEW equivalent:**

$$\text{TNT NEW equivalent} = x \text{ lbs. (amount of propellant of explosive)} \times 1.23$$

$$\text{TNT NEW equivalent} = x \text{ lbs. (amount of propellant or explosive)} \times 1.23$$

eg. 1 HVAR Rocket = 24.83 lbs. NEW propellant

$$24.83 \text{ lbs. propellant} \times 1.23 = 30.5 \text{ lbs. TNT NEW equivalent}$$

Equation A-2 (p. 4-11)*Conversion of dBP and psi:*

Pa = Pascals

dBP = Overpressure in decibels

psi = pounds per square inch

$$\text{dBP} = 20 \times (\log \text{Pa}) + 94$$

$$\text{Pa} = \text{psi} \times 6,894$$

$$\text{psi} = \text{Pa} \times 1.451 \cdot 10^{-4}$$

eg. **140 dBP to psi:**

$$140 \text{ dBP} = 20 \times (\log \text{Pa}) + 94$$

$$140 - 94 = 20 \times (\log \text{Pa})$$

$$\frac{46}{20} = \log \text{Pa}$$

$$10^{2.3} = \text{Pa}$$

$$200 = \text{Pa}$$

$$\text{psi} = \text{Pa} \times 1.451 \cdot 10^{-4}$$

$$\text{psi} = 200 \times 1.451 \cdot 10^{-4}$$

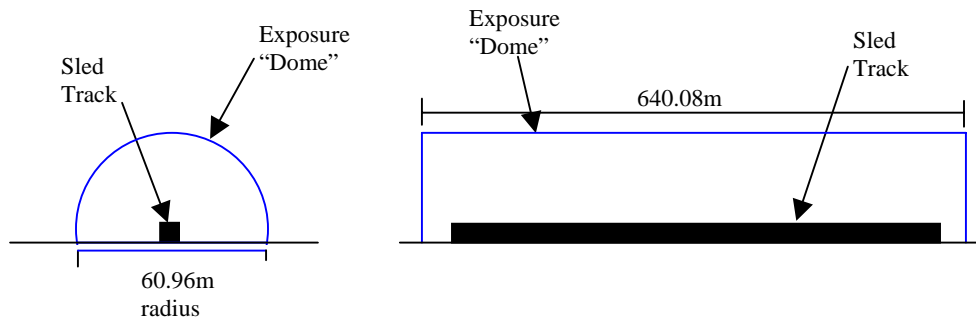
$$\text{psi} = 0.03$$

Equation A-3 (p. 4-11)

$$\begin{aligned}
 \text{Distance (in feet) of 140 dB from detonation point of origin} &= (600) \times \sqrt[3]{NEW} \\
 &= 600 \times \sqrt[3]{100} \\
 &= 600 \times 4.64 \\
 &= 2,790 \text{ feet}
 \end{aligned}$$

Equation A-4 (p. 4-37)

Volume of the enclosure according to the following diagram:



Volume of a cylinder:

$$v = \pi r^2 h$$

v = volume

r = radius = 60.96

m

where **h = altitude =**

640.08 m

$\pi = \text{pi} = 3.14$

Volume of $\frac{1}{2}$ a cylinder (dome) :

$$v = \frac{\pi r^2 h}{2}$$

Thus the volume of the sled track air-exposure enclosure is:

$$v = \frac{\pi \times 60.96 \text{ m}^2 \times 640.08 \text{ m}}{2}$$

$$v = \frac{7,500,000 \text{ m}^3}{2}$$

$$v = 3,700,000 \text{ m}^3$$

Equation A-5 (p. 4-38)

Typical Sled Configuration, #1:

1 Genie Rocket Motor with a total of 320 lbs. NEW propellant.

8 HVAR Rocket Motors with a total of 199 lbs. NEW propellant.

Carbon Monoxide (CO) Emission Factors (lb/lb):

Genie Rocket Motor: 0.0016

HVAR Rocket Motor: 0.0012

Total CO Emission for Sled Configuration #1:

$$\text{CO} = (0.0016 \times 199 \text{ lbs}) + (0.0012 \times 320 \text{ lbs})$$

$$\text{CO} = 0.69 \text{ lbs} \times \frac{500 \text{ grams}}{1.1 \text{ lbs}}$$

$$\text{CO} = 320 \text{ grams}$$

Peak CO Concentration of Air-exposure Enclosure:

$$\frac{320 \text{ g CO}}{3,700,000 \text{ m}^3} = \frac{86.6 \bullet 10^{-6} \text{ g CO}}{1 \text{ m}^3} \times \frac{1,000,000 \mu \text{ g}}{1 \text{ g}} = 86 \mu \text{ g CO/m}^3$$

Number of Sled Track Configuration #1 events needed for CO emissions to reach 10% of Walton County emissions:

Each event generates 320 grams of CO

Walton County Emissions = 32 tons

10% of 32 tons = 3.2 tons

$$\frac{320 \text{ g CO}}{1 \text{ event}} \times \frac{0.1 \bullet 10^{-5} \text{ tons}}{1 \text{ g}} = \frac{320 \bullet 10^{-6} \text{ tons CO}}{1 \text{ event}}$$

$$\frac{3.2 \text{ tons CO}}{320 \bullet 10^{-6} \text{ tons CO}} = 10,000 \text{ events}$$

Equation A-6 (p. 4-39)

Volume of the soil exposure area:

Volume (v) of a rectangle: $v = \text{length}(640.08 \text{ m}) \times \text{width}(60.96 \text{ m}) \times \text{height}(0.0508 \text{ m})$
 $v = 1,980 \text{ m}^3$

Equation A-7 (p. 4-39)

Lead (Pb) soil concentration resulting from Rocket Sled Configuration #5:
 4 Genie rocket motors
 10 HVAR rocket motors
 Pb emission from sled configuration reaching the soil: 185 grams
 Volume of exposure area: 1,982 m³
 Bulk Density of soil: 1.7g/cm³

Unit Conversions:

$$185 \text{ g Pb} \times \frac{1,000 \text{ mg}}{1 \text{ g}} = 185,000 \text{ mg Pb}$$

$$1,982 \text{ m}^3 \times \frac{1,000,000 \text{ cm}^3}{1 \text{ m}^3} = 1,982,000,000 \text{ cm}^3$$

$$\frac{1.7 \text{ g}}{\text{cm}^3} \times \frac{1 \text{ kg}}{1,000 \text{ g}} = \frac{.0017 \text{ kg}}{\text{cm}^3}$$

Density of Soil in Exposure Area:

$$\frac{.0017 \text{ kg soil}}{\text{cm}^3} \times 1,982,000,000 \text{ cm}^3 = 3,400,000 \text{ kg soil}$$

Lead Concentration in Soil Exposure Area:

$$\frac{185,000 \text{ mg Pb}}{3,400,000 \text{ kg soil}} = 0.06 \text{ mg Pb/kg soil}$$

Cumulative Lead Soil Concentration for All Sled Track Events During the Baseline Period:

<i>Rocket Motor</i>	<i>Total Amount of Propellant (lbs)</i>	<i>Emission Factor (lbs PB/lb propellant)</i>
HVAR	12,000	0.0005
Genie	18,000	
Zuni	1,400	

$$(12,000 + 18,000 + 1,400) \text{ lbs propellant} \times \frac{0.0005 \text{ lbs Pb}}{\text{lb propellant}} = 16 \text{ lbs Pb}$$

$$16 \text{ lbs Pb} \times \frac{500,000 \text{ mg}}{1.1 \text{ lb}} \times \frac{1}{3,400,000 \text{ kg soil}} = 2 \text{ mg Pb/kg soil}$$

Equation A-8 (p. 4-41)**Estimating the inhalation dosage of lead (Pb) for the American kestrel:**Maximum air exposure area peak Pb concentration using sled configuration #5: 99 $\mu\text{g}/\text{m}^3$

Exposure Area Peak Concentration Time Frame: 10 min

Inhalation Rate: 0.079 m^3/day

Absorption Factor: 15%

Estimated Amount of Air Inhaled in 10 min:

$$\frac{0.079 \text{ m}^3}{24 \text{ hours}} \times \frac{24 \text{ hours}}{1,440 \text{ min}} \times 10 = 0.0005 \text{ m}^3/10 \text{ min}$$

Estimated Amount of Pb Inhaled in 10 min:

$$\frac{0.0005 \text{ m}^3}{10 \text{ min}} \times \frac{99 \mu \text{ g Pb}}{1 \text{ m}^3} = 0.05 \mu \text{ g Pb}/10 \text{ min}$$

Estimated Amount of Pb Absorbed:

$$\frac{0.05 \mu \text{ g Pb}}{\text{day}} \times 0.15 = 0.008 \mu \text{ g Pb}/\text{day}$$

Estimating the ingestion dosage of lead (Pb) for the American kestrel:

Maximum soil exposure area peak Pb concentration using sled configuration #5: 0.06 mg/kg

Food Ingestion Rate: 0.31 g/g-day

Mean Body Weight: 103 g

Absorption Factor: 15%

Estimated % Soil in Diet: 2%

Estimated Amount of Food Ingested:

$$\frac{0.31 \text{ g}}{\text{g weight}} \times 103 \text{ g weight} = 32 \text{ g}/\text{day}$$

Estimated Amount of Soil Ingested:

$$\frac{32 \text{ g food}}{\text{day}} \times 0.02 = 0.6 \text{ g soil}/\text{day}$$

Estimated Amount of Pb Ingested:

$$\frac{0.6 \text{ g soil}}{\text{day}} \times \frac{0.001 \text{ kg}}{1 \text{ g}} \times \frac{0.06 \text{ mg Pb}}{1 \text{ kg soil}} = 0.00004 \text{ mg Pb}/\text{day}$$

Estimated Amount of Pb Absorbed:

$$\frac{0.00004 \text{ mg Pb}}{\text{day}} \times 0.2 = 0.000007 \text{ mg}/\text{day}$$

Equation A-9 (p. 4-43)

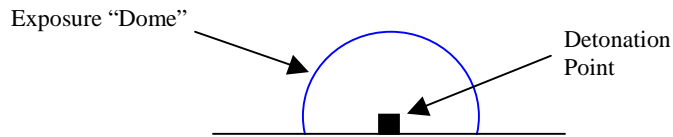
Amount of CO by-product resulting from the detonation of a Mk-84 containing 945 lbs. of tritonal: CO Emission Factor for tritonal = $4.7 \cdot 10^{-3}$

$$945 \text{ lbs tritonal} \times \frac{500 \text{ g}}{1.1 \text{ lbs.}} = 429,545 \text{ g tritonal}$$

$$429,545 \text{ g tritonal} \times 4.7 \cdot 10^{-3} = 2,019 \text{ g CO}$$

Equation A-10 (p. 4-43)

Volume of the enclosure according to the following diagram:



Volume of a Sphere:

$$v = \frac{4}{3} \pi r^3$$

Volume of a Dome:

$$v = \frac{\frac{4}{3} \pi r^3}{2}$$

Where: v = volume
r = radius (91.44 m)
 π = pi (3.14)

Volume of the Air Exposure Area:

$$\frac{\frac{4}{3} \times \pi \times (91.44 \text{ m})^3}{2} = 1,600,00 \text{ m}^3$$

Equation A-11 (p. 4-44)

Comparison of CO Emission By-Product Amounts of the Mk-84 to 1998 Walton County Emissions Inventory.

Total CO emission for an Mk-84 = 2,019 g (See Equation A-8)
Volume of exposure dome = 1,601,280 m³ (See Equation A-9)

Exposure Dome Peak CO Concentration:

$$\frac{2,019 \text{ g CO}}{1,600,000 \text{ m}^3} \times \frac{1,000,000 \mu \text{ g}}{1 \text{ g}} = 1,261 \mu \text{ g CO/m}^3$$

Comparison to 1998 Walton County CO Emissions:

$$\text{Each detonated Mk-84} = 2019 \text{ g CO} \times \frac{1.1 \text{ lbs.}}{500 \text{ g}} = 4.4 \text{ lbs. CO}$$

$$1998 \text{ Walton County CO Emissions} = 32 \text{ tons} \times \frac{2,000 \text{ lbs.}}{1 \text{ ton}} = 64,000 \text{ lbs. CO}$$

$$10\% \text{ of } 64,000 \text{ lbs. CO} = 6,400 \text{ lbs. CO}$$

Pounds of tritonal needed to emit 6,400 lbs. of CO:

$$\text{CO Emission Factor for tritonal (lb./lb.): } 4.70 \times 10^{-3}$$

$$6,400 \text{ lbs. CO} \times \frac{1 \text{ lb tritonal}}{4.70 \cdot 10^{-3} \text{ lbs. CO}} = 1,400,000 \text{ lbs. of tritonal}$$

Number of Mk-84s needed to equal 1,400,000:

$$1 \text{ Mk-84} = 945 \text{ lbs. of tritonal}$$

$$\frac{1,400,000 \text{ lbs. tritonal}}{945 \text{ lbs. tritonal}} = 1,500 \text{ Mk - 84s}$$

$$\text{Mk - 84}$$

Equation A-12 (p. 4-45)

Volume of the soil exposure area:

Volume of a cylinder:

$$v = \pi r^2 h$$

v = volume

r = radius = 76.2 m

where h = altitude = 0.0508

m

π = pi = 3.14

$$v = \pi (76.2 \text{ m})^2 \times 0.0508 \text{ m}$$

$$v = 930 \text{ m}^3$$

Equation A-13 (p. 4-45)

Aluminum (Al) soil concentration resulting from Mk-84 detonation:

Total Al emission from Mk-84 detonation: 2,900 grams

Amount of Al reaching the soil: 1,800 grams (50%)

Volume of exposure area: 930 m³

Bulk Density of soil: 1.7g/cm³

Unit Conversions:

$$1,800 \text{ g Al} \times \frac{1,000 \text{ mg}}{1 \text{ g}} = 1,800,000 \text{ mg Al}$$

$$930 \text{ m}^3 \times \frac{1,000,000 \text{ cm}^3}{1 \text{ m}^3} = 930,000,000 \text{ cm}^3$$

$$\frac{1.7 \text{ g}}{\text{cm}^3} \times \frac{1 \text{ kg}}{1,000 \text{ g}} = \frac{.0017 \text{ kg}}{\text{cm}^3}$$

Density of Soil in Exposure Area:

$$\frac{.0017 \text{ kg soil}}{\text{cm}^3} \times 930,000,000 \text{ cm}^3 = 1,600,000 \text{ kg soil}$$

Aluminum Concentration in Soil Exposure Area:

$$\frac{1,800,000 \text{ mg Al}}{1,600,000 \text{ kg soil}} = 1.1 \text{ mg Al/kg soil}$$

Amount of Tritonal Needed to Exceed Soil Criteria:

1 Mk-84 = 945 lbs. NEW Tritonal

1 Mk-84 = 1 mg/kg Al in soil

EPA Region III RBC Soil Criteria for Al = 1,000,000 mg/kg

$$\frac{1,000,000 \text{ mg/kg}}{1 \text{ mg/kg}} = 1,000,000$$

$$1,000,000 \times 945 \text{ lbs tritonal} = 945,000,000 \text{ lbs. tritonal}$$

Equation A-14 (p. 4-51)

The exposure area for gun testing at TA C-74 consists of a sphere surrounding the gun, which is suspended in the air above the target:

Volume of a Sphere:

$$v = \frac{4}{3} \pi r^3$$

Where: v = volume
 r = radius (6.1 m)
 π = pi (3.14)

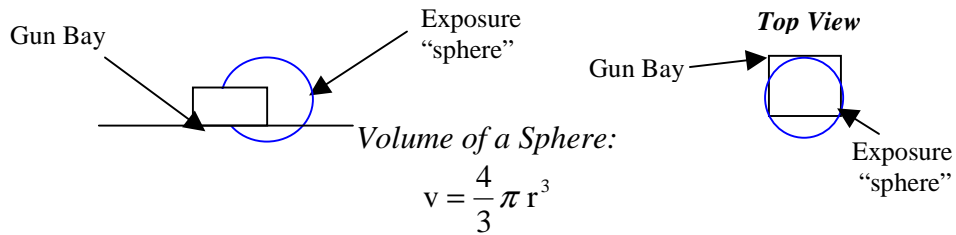
Volume of the Gun-testing Air Exposure Sphere at TA C-74:

$$v = \frac{4}{3} \pi (6.1 \text{ m})^3$$

$$v = 950 \text{ m}^3$$

Equation A-15 (p. 4-51)

Volume of the enclosure area according to the following diagram:



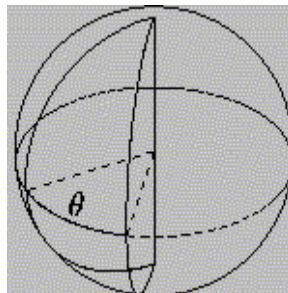
Where: v = volume
 r = radius (6.1m)
 π = pi (3.14)

Volume of the Sphere:

$$v = \frac{4}{3} \pi (6.1 \text{ m})^3$$

$$v = 950 \text{ m}^3$$

Because a segment of the sphere is occupied by the volume of the gun bay, that segment must be removed from the total volume of the sphere:



Spherical Segment

Volume of a Segment:

$$v = \frac{2}{3} \pi r^3 \theta$$

Where: v = volume
 r = radius (6.1m)
 π = pi (3.14)
 θ = angle measured in radians
 $1^\circ = 0.017$ radians

As the diagrams show, the gun bay bisects the exposure sphere so that the angle of the segment is equal to $180^\circ = 3.06$ radians. Additionally, the gun bay only occupies one half the volume of the segment, so that:

Volume of the Occupied Portion of the Segment:

$$v = \frac{\frac{2}{3} \times (6.1 \text{ m})^3 \times 3.06 \text{ radians}}{2}$$

$$v = \frac{463 \text{ m}^3}{2}$$

$$v = 230 \text{ m}^3 \text{ (This volume must be removed from the total volume of the sphere)}$$

Thus, the Total Volume of the Air Exposure Area Surrounding the Gun Bay:

$$950 \text{ m}^3 \text{ (volume of a sphere with a 6.86 m radius)} - 230 \text{ m}^3 \text{ (volume of gun bay within sphere)} \\ = 720 \text{ m}^3$$

Equation A-16 (p. 4-52)

Estimated CO Emission Factors, By-Products, and Peak Concentration of Air Emissions Generated by Gun Testing at TA C-74 and C-74L:

TA C-74:

Munition Used: JASSM 920 Scale

Amount of Explosives/Propellant: 3.5 lbs. NEW double-based propellant

CO Emission Factor: 0.0015

Volume of exposure sphere: 950 m^3

Total CO Emission:

$$3.5 \text{ lbs. propellant} \times \frac{0.0015 \text{ lbs. CO}}{1 \text{ lb. propellant}} = 0.00525 \text{ lbs CO}$$

$$0.00525 \text{ lbs CO} \times \frac{500 \text{ grams}}{1.1 \text{ lbs.}} = 2 \text{ g CO}$$

Exposure Sphere CO Concentration:

$$\frac{2 \text{ g CO}}{950 \text{ m}^3} = 0.002 \text{ g CO/m}^3$$

TA C-74L:

Munition Used: 30 mm HEI (PGU-13/B)

Amount of Explosives/Propellant: 0.43 lbs. NEW combined propellant and explosive/round

Number of rounds in 1 event: 40 (1 firing burst)

Estimated CO Emission Factor: 0.07

Volume of exposure sphere: 720 m³

Total CO Emission:

$$\frac{0.43 \text{ lbs. propellant}}{\text{round}} \times \frac{0.07 \text{ lbs. CO}}{1 \text{ lb. propellant}} = 0.03 \text{ lbs CO/round}$$

$$\frac{0.03 \text{ lbs CO}}{\text{round}} \times \frac{500 \text{ grams}}{1.1 \text{ lbs.}} \times \frac{40 \text{ rounds}}{\text{event}} = 55 \text{ g CO/event}$$

Exposure Sphere CO Concentration:

$$\frac{55 \text{ g CO}}{\text{event}} \times \frac{1}{720 \text{ m}^3} = 0.08 \text{ g CO/m}^3/\text{event}$$

Equation A-17 (p. 4-53)

Comparison of CO Emission By-Product Amounts of Gun Testing to 1998 Walton County Emissions Inventory.

CO emission factor for the JASSM 920-Scale: 0.0015
 1998 Walton County CO emissions: 32 tons
 10% of Walton County CO emissions: 3.2 tons

Unit Conversions:

$$3.2 \text{ tons CO} \times \frac{2,000 \text{ lbs}}{1 \text{ ton}} = 6,400 \text{ lbs CO}$$

Amount of Explosives/Propellant Needed to Reach 10% of Walton County's CO Emissions:

$$\frac{6,400 \text{ lbs CO}}{0.0015 \text{ lbs CO}} = 4,000,000 \text{ lbs. NEW}$$

lb NEW

Equation A-18 (p. 4-54)**Volume of TA C-74 Lead Exposure Area:**

Volume of a cylinder:

$$v = \pi r^2 h$$

v = volume

r = radius = 6.1 m

where **h = altitude =**

0.0508 m

π = pi = 3.14

$$v = \pi (6.1 \text{ m})^2 0.0508 \text{ m}$$

$$v = 6 \text{ m}^3$$

Equation A-19 (p. 4-54)**Lead Particulate Emitted During a 320 Round Lot Testing Mission:**

Amount of explosives/propellant per round: 0.43 lbs

Pb emission factor: 0.0005

$$0.43 \text{ lbs NEW} \times \frac{0.0005 \text{ lbs Pb}}{1 \text{ lb NEW}} \times \frac{500 \text{ grams}}{1.1 \text{ lbs}} \times 320 \text{ rounds} = 31 \text{ grams Pb}$$

Equation A-20 (p. 4-55)

Lead (Pb) soil concentration resulting from gun testing of the JASSM 920-Scale at TA C-74:

Total Pb emission from 1 mission event: 0.8 grams

Volume of exposure area: 6 m³

Bulk Density of soil: 1.7g/cm³

Unit Conversions:

$$0.8 \text{ g Pb} \times \frac{1,000 \text{ mg}}{1 \text{ g}} = 800 \text{ mg Pb}$$

$$6 \text{ m}^3 \times \frac{1,000,000 \text{ cm}^3}{1 \text{ m}^3} = 6,000,000 \text{ cm}^3$$

$$\frac{1.7 \text{ g}}{\text{cm}^3} \times \frac{1 \text{ kg}}{1,000 \text{ g}} = \frac{.0017 \text{ kg}}{\text{cm}^3}$$

Density of Soil in Exposure Area:

$$\frac{.0017 \text{ kg soil}}{\text{cm}^3} \times 6,000,000 \text{ cm}^3 = 10,200 \text{ kg soil}$$

Lead Concentration in Soil Exposure Area:

$$\frac{800 \text{ mg Pb}}{10,200 \text{ kg soil}} = .08 \text{ mg Pb/kg soil}$$

Number of Mission Events Needed to Exceed Soil Criteria

1 JASSM 920-Scale Event = 0.08 mg/kg

Florida State Soil Criteria for Pb = 500 mg/kg

$$\frac{500 \text{ mg/kg}}{0.08 \text{ mg/kg}} = 6,250 \text{ events}$$

event

Equation A-21 (p. 3-7)**Modified Soil Loss Equation:**

$$A = R K L S VM$$

Rainfall Factor

$$R = \frac{EI}{100}$$

$$E = 916 + 331 \log_{10} i$$

Soil Erodibility Factor

$$K = (2.1 \times 10^{-6}) (12 - 0m) (M^{1.14}) + 0.0325(S-2) + 0.025(P-3)$$

Slope Length Factor

$$L = (\lambda / 72.6)^m$$

Slope Gradient Factor

$$S = \frac{(0.43 + 0.30s + 0.043s^2)}{6.613}$$

Topographic Factor

$$LS = \left(\frac{\lambda}{72.6} \right)^m \left(\frac{0.43 + 0.30s + 0.043s^2}{6.613} \right) \left(\frac{10,000}{10,000+s^2} \right)$$

Vegetation Factor (Seasonal change variations)

$$VM = \frac{(VM_g M_g + VM_d M_d)}{M_g + M_d}$$

Specific limitations of the MSLE are:

- The model is empirical and may have a tendency to estimate erosion values too great when erosion rates are measured low and too low when measured rates are greater.
- The model only estimates soil loss and does not account for the probability of soil loss occurring.
- The model predicts soil loss on an average annual basis.
- The model does not quantify the material from gully erosion and soil mass movement.
- The combined LS factor has a low level of sensitivity to potential errors in the estimation of slope length and gradient.

APPENDIX B

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

RELEVANT AND PERTINENT LAWS, REGULATIONS, AND POLICIES

The TA C-74 Complex Programmatic Environmental Assessment was prepared with consideration and compliance of relevant and pertinent environmental laws, regulations and policies. This section includes federal executive orders and laws; Department of Defense (DoD) directives and instructions; Air Force instructions (AFI) and policy directives; and Florida state statutes and administrative codes. This list has been compiled and limited to include the most relevant laws, regulations, and policies that are pertinent to the specific mission activities defined in this document. It is further recognized that additional laws and regulations may exist and will be included with subsequent updates.

General

42 USC 4321 et seq.; 1969; National Environmental Policy Act of 1969 (NEPA); Requires that federal agencies (1) consider the consequences of an action on the environment before taking the action and (2) involve the public in the decision making process for major federal actions that significantly affect the quality of the human environment.

Executive Order 12372; 14-Jul-82; Intergovernmental Review of Federal Programs; Directs federal agencies to inform states of plans and actions, use state processes to obtain state views, accommodate state and local concerns, encourage state plans, and coordinate states' views.

Executive Order 12856; 3-Aug-93; Right to Know Laws and Pollution Prevention Requirements; Directs all federal agencies to incorporate pollution planning into their operations and to comply with toxic release inventory requirements, emergency planning requirements, and release notifications requirements of EPCRA.

Executive Order 12898; 11-Feb-94; Environmental Justice; Directs federal agencies to identify disproportionately high and adverse human health or environmental impacts resulting from programs, activities or policies on minority populations.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention.

Air Force Instruction 32-7045; 1-Apr-94; Environmental Compliance and Assessment; Implements AFPD 32-70 by providing for an annual internal self-evaluation and program management system to ensure compliance with federal, state, local, DoD, and Air Force environmental laws and regulations.

Air Force Instruction 32-7061; 24-Jan-95; The Environmental Impact Analysis Process; This Instruction provides a framework for how the Air Force is to comply with NEPA and the CEQ regulations.

Air Force Instruction 32-7062; 1-Apr-94; Air Force Comprehensive Planning; Implements AFPD 32-70 by establishing Air Force Comprehensive Planning Program for development of Air Force Installations, ensuring that natural, cultural, environmental, and social science factors are considered in planning and decision making.

Physical Resources

Air Quality

42 USC 7401 et seq.; **40 CFR Parts 50 & 51;** 1996; Clean Air Act, National Ambient Air Quality Standards (CAA, NAAQS); Emission sources must comply with air quality standards and regulations established by federal, state, and local regulatory agencies.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Clean Air Act.

Air Force Instruction 32-7040; 9-May-94; Air Quality Compliance; This AFI sets forth actions for bases to implement to achieve and maintain compliance with applicable standards for air quality compliance, and responsibilities for who is to implement them. Includes requirements for NEPA and RCRA as well as CAA.

F.S. Ch. 403, Part I; 1996; Florida Air and Water Pollution Control Act; Regulates air pollution within the state.

F.A.C. Chap. 62-204; 1996; Florida State Implementation Plan, with Ambient Air Quality Standards and PSD Program; Establishes state air quality standards and requirements for maintaining compliance with NAAQS.

F.A.C. Chap. 62-213; 1996; Operation Permits for Major Sources of Air Pollution; Adopted Prevention of Significant Deterioration (PSD) permit program, designed to control the impact of economic growth on areas that are already in attainment.

Air Space Use

49 USC 106 & Subtitle VII; 1997-Supp; Federal Aviation Act of 1958 (FAA); Created the FAA and establishes administrator with responsibility of ensuring aircraft safety and efficient utilization of the National Airspace System.

14 CFR Part 71; 1997; Federal Aviation Regulation (FAR); Defines federal air routes, controlled airspace, and flight locations for reporting position.

14 CFR Part 73; 1997; Federal Aviation Regulation (SFAR No. 53); Defines and prescribes requirements for special use airspace.

14 CFR Part 91; 1997; Federal Aviation Regulation (FAR); Governs the operation of aircraft within the United States, including the waters within three nautical miles of the U.S. Coast. In addition, certain rules apply to persons operating in airspace between three and 12 nautical miles from the U.S. coast.

Land Resources

16 USC 670a to 670o; 1997-Supp; Sikes Act, Conservation Programs on Military Reservations; DoD, in a cooperative plan with DOI and State, opens Air Force bases to outdoor recreation, provides the state with a share of profits from sale of resources (timber), and conserves and rehabilitates wildlife, fish, and game on each reservation. The Air Force is to manage the natural resources of its reservations to provide for sustained multipurpose use and public use

USC 1701 et seq., (Public Law 94-579); 1997-Supp; Federal Land Policy and Management Act of 1976 (FLPMA); Provides that the Secretary of Interior shall develop land use plans for public lands within BLM jurisdiction to protect scientific, scenic, historical, ecological, environmental, and archeological values and to accommodate needs for minerals, food, and timber.

Air Force Instruction 32-7062; 1-Apr-94; Air Force Comprehensive Planning; Implements AFPD 32-70 by establishing Air Force Comprehensive Planning Program for development of Air Force Installations, ensuring that natural, cultural, environmental, and social science factors are considered in planning and decision making.

Air Force Instruction 32-7063; 31-Mar-94; Air Installation Compatible Use Zone Program (AICUZ); Provides a framework to promote compatible development within area of AICUZ area of influence and protect Air Force operational capability from the effects of land use which are incompatible with aircraft operations.

Air Force Instruction 32-7064 22-Jul-94; Integrated Natural Resources Management; Provides for development of an integrated natural resources management plan to manage the installation ecosystem and integrate natural resources management with the rest of the installation's mission. Includes physical and biological resources and uses.

Noise

42 USC 4901 to 4918, Public Law 92-574; 1997-Supp; Noise Control Act of 1972 (NCA); Provides that each federal agency must comply with federal, state, interstate, and local requirements for control and abatement of environmental noise.

49 USC 44715; 1997-Supp; Controlling Aircraft Noise and Sonic Boom; Provides that the FAA will issue regulations in consultation with the USEPA to control and abate aircraft noise and sonic boom.

Executive Order 12088; 1978; Federal Compliance with Pollution Control Standards; Requires the head of each executive agency to take responsibility for ensuring all actions have been taken to prevent, control, and abate environmental (noise) pollution with respect to federal activities.

Air Force Instruction 32-7063; 1-Mar-94; Air Installation Compatible Use Zone Program (AICUZ); The AICUZ study defines and maps noise contours. Update when noise exposure in air force operations results in a change of Day-Night Average Sound Level of two decibels (dBs) or more as compared to the noise contour map in the most recent AICUZ study.

Water Resources

33 USC 1251 et seq.; 1997-Supp; Clean Water Act (CWA) (Federal Water Pollution Prevention and Control Act, FWPCA); In addition to regulating navigable water quality, the CWA establishes NPDES permit program for discharge into surface waters and storm water control; Army Corps of Engineers permit and state certification for wetlands disturbance; regulates ocean discharge; sewage wastes control; and oil pollution prevention.

42 USC 300f et seq.; 1997-Supp; Safe Drinking Water Act (SDWA); Requires the promulgation of drinking water standards, or MCLs, which are often used as cleanup values in remediation; establishes the underground injection well program; and establishes a wellhead protection program.

42 USC 6901 et seq.; 29-May-05; Resource Conservation and Recovery Act of 1976 (RCRA); Establishes standards for management of hazardous waste so that water resources are not contaminated: RCRA Corrective Action Program requires cleanup of groundwater that has been contaminated with hazardous constituents.

42 USC 9601 et seq., Public Law 96-510; 11-Dec-80; Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); Establishes the emergency response and remediation program for water and groundwater resources contaminated with hazardous substances.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Clean Water Act, Safe Drinking Water Act, and Water Quality Act of 1987.

Air Force Instruction 32-7041; 13-May-94; Water Quality Compliance; Instructs the Air Force on maintaining compliance with the Clean Water Act; other federal, state, and local environmental regulations; and related DoD and Air Force water quality directives.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; Sets forth requirements for addressing wetlands, floodplains, and coastal and marine resources in an integrated natural resources management plan (INRMP) for each installation.

Florida Statutes Chap. 403, Part I; Florida Air and Water Pollution Control Act; Establishes the regulatory system for water resources in Florida.

Biological Resources

Animal Resources

16 USC 703 - 712; 1997-Supp; Migratory Bird Treaty Act (MBTA); Makes it illegal to take, kill, or possess migratory birds unless done so in accordance with regulations. An exemption may be obtained from the Department of the Interior for taking a listed migratory bird.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; Explains how to manage natural resources on Air Force property, and to comply with federal, state, and local standards for resource management.

Threatened and Endangered Species

16 USC 1531 to 1544-16 USC 1536(a); 1997-Supp; Endangered Species Act 1973 (ESA); Federal agencies must ensure their actions do not jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify the habitat of such species and must set up a conservation program.

50 CFR Part 450; 1996; Endangered Species Exemption Process; These rules set forth the application procedure for an exemption from complying with Section 7(a)(2) of the ESA, 16 USC 1536(a)(2), which requires that federal agencies ensure their actions do not affect endangered or threatened species or habitats.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Endangered Species Act.

Air Force Instruction 32-7064; 22-Jul-94; Integrated Natural Resources Management; This AFI directs an installation to include in its INRMP procedures for managing and protecting endangered species or critical habitat, including state-listed endangered, threatened or rare species; and discusses agency coordination.

Human Safety

29 CFR 1910.120; 1996; Occupational Safety and Health Act, Chemical Hazard Communication Program (OSHA); Requires that chemical hazard identification, information and training be available to employees using hazardous materials and institutes material safety data sheets (MSDS) which provide this information.

Department of Defense Instruction 6055.1; Establishes occupational safety and health guidance for managing and controlling the reduction of radio frequency exposure.

Department of Defense Flight Information Publication; Identifies regions of potential hazard resulting from bird aggregations or obstructions, military airspace noise sensitive locations, and defines airspace avoidance measures.

Air Force Instructions 13-212v1 and v2; 1994; Weapons Ranges and Weapons Range Management; Establishes procedures for planning, construction, design, operation, and maintenance of weapons ranges as well as defines weapons safety footprints, buffer zones, and safest procedures for ordnance and aircraft malfunction.

Air Force Instruction 32-2001; 16-May-94; The Fire Protection Operations and Fire Prevention Program; Identifies requirements for Air Force fire protection programs (equipment, response time, and training).

Air Force Instruction 32-7063; 1-Mar-94; Air Installation Compatible Use Zone Program (AICUZ). The AICUZ Study defines and maps accident potential zones and runway clear zones around the installation, and contains specific land use compatibility recommendations based on aircraft operational effects and existing land use, zoning, and planned land use.

Air Force Manual 91-201; 12-Jan-96; Explosives Safety Standards; Regulates and identifies procedures for explosives safety and handling as well as defining requirements for ordnance quantity distances, safety buffer zones, and storage facilities.

Air Force Instruction 91-301; 1-Jun-96; Air Force Occupational and Environmental Safety, Fire Protection and Health (AFOSH) Program; Identifies occupational safety, fire prevention, and health regulations governing Air Force activities and procedures associated with safety in the workplace.

Habitat Resources

Executive Order 11990; 24-May-77; Protection of Wetlands; Requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in their activities. Construction is limited in wetlands and requires public participation.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements Executive Order 11988 and 11990.

Anthropogenic Resources

Hazardous Materials

7 USC 136 et seq., Public Law 92-516; 1997-Supp; Federal Insecticide, Fungicide, and Rodenticide Act Insecticide and Environmental Pesticide Control (FIFRA); Establishes requirements for use of pesticides that may be relevant to activities at Eglin Air Force Base.

42 USC 6901 et seq.; 1980; Resource Conservation and Recovery Act of 1976 and Solid Waste Disposal Act of 1980 (RCRA); Subchapter III sets forth hazardous waste management provisions; Subchapter IV sets forth solid waste management provisions; and Subchapter IX sets forth underground storage tank provisions; with which federal agencies must comply.

42 USC 9601 et seq., Public Law 96-510; 1997-Supp; Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA); Establishes the liability and responsibilities of federal agencies for emergency response measures and remediation when hazardous substances are or have been released into the environment.

42 USC 11001 to 11050; 1995; Emergency Planning and Community Right-to-Know Act (EPCRA); Provides for notification procedures when a release of a hazardous substance occurs; sets up community response measures to a hazardous substance release; and establishes inventory and reporting requirements for toxic substances at all facilities.

42 USC 13101 to 13109; 1990; Pollution Prevention Act of 1990 (PPA); Establishes source reduction as the preferred method of pollution prevention, followed by recycling, treatment, then disposal into the environment. Establishes reporting requirements to submit with EPCRA reports. Federal agencies must comply.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Provides for developing and implementing an Air Force Environmental Quality Program composed of four pillars: cleanup, compliance, conservation and pollution prevention. Implements Resource Recovery and Conservation Act, Comprehensive Environment Response Compensation and Liability Act of 1980, Emergency Planning and Community Right-to-Know Act, Pollution Prevention Act, Executive Order 12088, Executive Order 12777, and Executive Order 12586. Implements DoD Instruction 4120.14, DoD Directive 4210.15, and DoD Directive 5030.41.

Air Force Instruction 32-7020; 19-May-94; The Environmental Restoration Program; Introduces the basic structure and components of a cleanup program under the Defense Environmental Restoration Program. Sets forth cleanup program elements, key issues, key management topics, objectives, goals and scope of the cleanup program.

Air Force Instruction 32-7042; 12-May-94; Solid and Hazardous Waste Compliance; Provides that each installation must develop a hazardous waste (HW) and a solid waste (SW) management plan; characterize all HW streams; and dispose of them in accordance with the AFI. Plans must address pollution prevention as well.

Air Force Instruction 32-7080; 12-May-94; Pollution Prevention Program; Each installation is to develop a pollution prevention management plan that addresses ozone depleting chemicals; EPA 17 industrial toxics; hazardous and solid wastes; obtaining environmentally friendly products; energy conservation, and air and water.

Air Force Policy Directive 40-2; 8-Apr-93; Radioactive Materials; Establishes policy for control of radioactive materials, including those regulated by the US Nuclear Regulatory Commission (NRC), but excluding those used in nuclear weapons.

10 CFR Part 20; 1997; Nuclear Regulatory Commission; Standards for Protection Against Radiation; Establishes survey and monitoring protocols, as well as occupational dose limits, for radioactive materials.

Air Force Instruction 13-212 Vol. I; 1-Sept-00; Test and Training Ranges; Establishes policy and procedures for the use of Depleted Uranium (DU) by Air Force units.

Air Force Instruction 40-201; 1-Sept-00; Managing Radioactive Materials in the U.S. Air Force; Establishes how Air Force employees and activities acquire, receive, store, distribute, use, transfer, or dispose of any item or part that contains radioactive material.

Cultural Resources

10 USC 2701 note, Public Law 103-139; 1997-Supp; Legacy Resource Management Program (LRMP); Provides funding to conduct inventories of all scientifically significant biological assets of Eglin AFB.

16 USC 431 et seq.; PL 59-209; 34 Stat. 225; 43 CFR 3; 1906; Antiquities Act of 1906; Provides protection for archeological resources by protecting all historic and prehistoric sites on federal lands. Prohibits excavation or destruction of such antiquities without the permission (Antiquities Permit) of the secretary of the department which has the jurisdiction over those lands.

16 USC 461 to 467; 1997-Supp; Historic Sites, Buildings and Antiquities Act (HAS); Establishes national policy to preserve for public use historic sites, buildings and objects of national significance: the Secretary of the Interior operates through the National Park Service to implement this national policy.

16 USC 469 to 469c-1; 1997-Supp; Archaeological and Historic Preservation Act of 1974 (AHPA); Directs federal agencies to give notice to the Secretary of the Interior before starting construction of a dam or other project that will alter the terrain and destroy scientific, historical or archeological data, so that the Secretary may undertake preservation.

16 USC 470aa-470mm, Public Law 96-95; 1997-Supp; Archaeological Resources Protection Act of 1979 (ARPA); Establishes permit requirements for archaeological investigations and ensures protection and preservation of archaeological sites on federal property.

16 USC 470 to 470w-6-16 USC 470f, 470h-2; 1997-Supp; National Historic Preservation Act (NHPA); Requires federal agencies to (1) allow the Advisory Council on Historic Preservation to comment before taking action on properties eligible for the National Register and (2) preserve such properties in accordance with statutory and regulatory provisions.

25 USC 3001 - 3013), (Public Law 101-601; 1997-Supp; Native American Graves Protection and Repatriation Act of 1991 (NAGPRA); Federal agencies must obtain a permit under the Archeological Resources Protection Act before excavating Native American artifacts. Federal agencies must inventory and preserve such artifacts found on land within their stewardship.

42 USC 1996; 1994; American Indian Religious Freedom Act (AIRFA); Federal agencies should do what they can to ensure that American Indians have access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites in the practice of their traditional religions.

32 CFR Part 200; 1996; Protection of Archaeological Resources: Uniform Regulations; Provides that no person may excavate or remove any archaeological resource located on public lands or Indian lands unless such activity is conducted pursuant to a permit issued under this Part or is exempted under this Part.

36 CFR Part 60; 1996; Nominations to National Register of Historic Places; Details how the federal agency Preservation Officer is to nominate properties to the Advisory Council for consideration to be included on the National Register.

36 CFR Part 800; 1995; Protection of Historic and Cultural Properties; Sets out the Section 106 process for complying with Sections 106 and 110 of the NHPA: the agency official, in consultation with the State Historic Preservation Officer (SHPO), identifies and evaluates affected historic properties for the Advisory Council.

Executive Order 11593, 16 USC 470; 13-May-71; Protection and Enhancement of the Cultural Environment; Instructs federal agencies to identify and nominate historic properties to the National Register, as well as avoid damage to Historic properties eligible for National Register.

Executive Order 13007; 24-May-96; Directs federal agencies to provide access to and ceremonial use of sacred Indian sites by Indian religious practitioners as well as promote the physical integrity of sacred sites.

DoD Directive 4710.1; Archaeological and Historic Resources Management (AHRM); Establishes policy requirements for archaeological and cultural resource protection and management for all military lands and reservations.

Air Force Policy Directive 32-70; 20-Jul-94; Environmental Quality; Develops and implements the Air Force Environmental Quality Program composed of cleanup, compliance, conservation, and pollution prevention. Implements National Historic Preservation Act, Executive Order 11593, and DoD Directive 470.1.

Air Force Instruction 32-7065; 13-Jun-94; Cultural Resource Management; Directs Air Force bases to prepare cultural resources management plans (CRMP) to comply with historic preservation requirements, Native American considerations; and archeological resource protection requirements, as part of the Base Comprehensive Plan.

Air Force Policy Letter; 4-Jan-82; Establishes Air Force policy to comply with historic preservation and other federal environmental laws and directives.

APPENDIX C
MANAGEMENT PRACTICES

PROPOSED BEST MANAGEMENT PRACTICES TA C-74 Complex - Baseline Level of Activity

Ground Operations:

- A restriction of a maximum of 140 dB noise level leaving the Eglin Reservation boundary. An approximate calculation is 600 times the cube root of the NEW equals the distance in feet to the reservation boundary.
- No detonation can produce a seismic shock of more than 1 inch/sec peak particle velocity when reaching any structure. An approximate calculation is 60 times the square root of the NEW equals distance in feet to the structure.
- All inert weapons, which includes practice bombs with spotting charge, on or near the surface are recovered, removed and destroyed.
- Live fire is restricted to test areas. Blank ammunition use and pyrotechnics may be permitted according to test directive (described in individual test directives).
- Areas in which small arms with blank ammunition are used must be policed to pick up debris. Blank cartridges are turned in to be recycled (described in individual test directives).
- The use of all pyrotechnic devices will be under the supervision of qualified personnel (described in individual test directives).
- Pyrotechnic devices that dud will not be disturbed, but will be flagged. Explosive Ordnance Disposal (EOD) will be notified for dud disposal (described in individual test directives).
- Military activities should not disturb wildlife food plots (U.S. Army Corps of Engineers, 1996).
- Military activities should not be conducted within areas designated as forestry research plots or restoration sites unless the Natural Resources Branch has given specific written authorization (U.S. Army Corps of Engineers, 1996).
- Coordinate planned use of pyrotechnics, explosives, or powerful munitions in the vicinity of forestry research or restoration areas (sea turtle nesting/relocation sites) with Natural Resource Management (U.S. Army Corps of Engineers, 1996).
- Clean-up of debris is mandatory (as described in individual test directives).
- Cultural Resource discoveries must be reported immediately to AAC/EMH (as directed in individual test directives).
- Follow Regulations on Debris and Hazardous Materials for Cleanup: Cleanup of the test site debris and hazardous materials should be conducted according to regulations.
- Monitoring the Test Area: A monitoring plan should be developed to answer specific questions regarding the impact of the proposed testing. The area of the test site should be monitored for all possible areas of impact. The monitoring should include, but not be limited to, chemical analysis of soils, groundwater monitoring, surface water monitoring, and endangered species surveys.
- Report violations of any recreation rules to the Natural Resources Branch or the security police (U.S. Army Corps of Engineers, 1996).
- Ensure that all military activities are in compliance with the hunting, trapping, and fishing regulations established by the Natural Resources Branch and the Florida Fish and Wildlife Conservation Commission (FFWCC), unless specific authorization is granted by the Natural Resources Branch and the FFWCC (U.S. Army Corps of Engineers, 1996).

- Wheeled vehicles will keep to existing trails/roads (described in individual test directives) unless there is special authority to use nonexistent trails/roads.
- Any archaeological artifacts discovered shall be left in place and the location reported immediately to AAC/EMH (described in individual test directives).
- All trenches must be filled immediately after use.
- Tree cutting is limited to sand pine, slash pine, live oak (for tree thinning only), and scrub oak. Longleaf pines may not be cut down for any reason.
- Digging will be kept to a minimum—no holes deeper than three feet will be dug, especially within 150 meters of any stream.
- Native American artifacts of any kind (e.g., arrowheads and pottery) will be promptly reported to the Environmental Management Directorate at Eglin AFB so that the area will be marked.
- Coordinate all military activities that are within or near stands of mature longleaf pine and scheduled during red-cockaded woodpecker nesting season (late April-July) with the Natural Resources Branch (U.S. Army Corps of Engineers, 1996)
- Adhere to the specific action guide regarding forest fire danger ratings.
- Do not drive nails or other objects into trees for any reason unless there is special authorization to do so (U.S. Army Corps of Engineers, 1996).

Ordnance

- Live fire is restricted to test ranges. Blank ammunition use and pyrotechnics may be permitted in the Interstitial area according to test directive (described in individual test directives).
- Areas in which small arms with blank ammunition are used must be policed to pick up debris. Blank cartridges are turned in to be recycled (described in individual test directives).
- Do not use explosives or munitions within or near stands of mature longleaf pines (U.S. Army Corps of Engineers, 1996).

APPENDIX D

TA C-74 COMPLEX AFFECTED ENVIRONMENT SUPPORTING INFORMATION

SENSITIVE PLANT SPECIES WITHIN ONE KILOMETER OF THE TA-C74 COMPLEX

Table D-1. State Listed Plant Species Associated with TA C-74

<i>Endangered State Species</i>	
Sensitive Species	Habitat
Panhandle Lilly (<i>Lilium iridollae</i>)	Streamside baygalls throughout Eglin, including flatwoods
<i>Threatened State Species</i>	
Sensitive Species	Habitat
Pineland Wild Indigo (<i>Baptisia calycosa</i> var <i>villosa</i>)	Found in areas with an open canopy and sandy soils
Baltzell's Sedge (<i>Carex baltzelli</i>)	Occurs on moist, shaded, undisturbed slopes of steephead ravines
Bog Buttons (<i>Lachnocaulon dignum</i>)	Found where lateral groundwater seepage slopes are undisturbed, including bogs, baygalls, wet flatwoods, and wet prairies
Pineland Hoary-Pea (<i>Tephrosia mohrii</i>)	Eglin's open canopy Sandhills and upland pine forest
Sweet Pitcher Plant (<i>Sarracenia rubra</i>)	Wet flatwoods, wet prairies, and baygalls
Naked-stemmed Panic Grass (<i>Panicum nudicaule</i>)	Seepage slopes and bogs

Panhandle Lily

The panhandle lily is a perennial herb that is found in black mucky soils and peaty sands, on savannas and borders of shrub-bogs, and on the banks of blackwater creeks. The range of the species is limited and there are usually few individuals in one place. Factors influencing its status as a state-endangered species include drainage and field collecting.

Pineland Wild Indigo

The pineland wild indigo is a herbaceous pea plant that can be found in the Sandhills and Sand Pine associations with an open canopy and sandy soils. The species distribution is limited to Santa Rosa, Okaloosa, and Walton counties (U.S. Air Force, 1995).

Baltzell's Sedge

The Baltzell's sedge occurs on moist, shaded, undisturbed slopes of steephead ravines. The species occurs in the upland mixed and hardwood forest communities of the Sandhills (U.S. Air Force, 1995).

Bog Button

The bog button is an aquatic herb that grows in wet pine flatwoods, savannas, the margins of lakes and ponds, and other frequently flooded areas (U.S. Air Force, 1995).

Pineland Hoary-Pea

The pineland hoary-pea is a small herbaceous plant that is common where fire and other disturbance occurs. It prefers the habitat provided by the upland pine forest community within the Sandhills. The species distribution is limited to Santa Rosa, Okaloosa, and Walton counties (U.S. Air Force, 1995).

Sweet Pitcher Plant

In the Florida Panhandle, the sweet pitcher plant is primarily limited in distribution to Eglin and occurs almost entirely within the Yellow River floodplain and its tributaries. The clear, swift-flowing streams of Eglin are a favored habitat for this species although it is also found in acid bogs and depressions of the Flatwoods. It will form large clumps of individuals along streams (Ward, 1978).

Naked-stemmed Panic Grass

Naked-stemmed panic grass is found within swampy areas, in fire-maintained wet, sticky, organic soils associated with seepage slopes and bogs (U.S. Air Force, 1995).

SENSITIVE ANIMAL SPECIES ASSOCIATED WITH THE TA C-74 COMPLEX***Southeastern American Kestrel***

Southeastern American kestrel nests are frequently located along the forest edge and may be used for several years. The kestrels prefer to nest in snags and tight-fitting live tree cavities created by other birds (DeGraaf et al., 1991). The birds most frequently locate their nests in abandoned red-cockaded woodpecker and other woodpecker holes in longleaf pines 12 to 35 feet above the ground. Natural cavities and snags in turkey oaks and live oaks may also be used as nesting sites (Hoffman and Collopy, 1987).

The southeastern American kestrel subspecies has been extirpated over most of its former range and the current range is not described in the literature (Loftin, 1992). The former breeding range extended from Louisiana, Mississippi, central Alabama, and southern Georgia to southern Florida. Their former winter range extended from their breeding range south to the Gulf coast of Louisiana and to Key West, Florida (American Ornithologists Union, 1957).

The southeastern American kestrel is a small raptor that preys upon insects during the summer and also feeds on small rodents, birds, and reptiles that are common in open grasslands. Over 30 species of birds and about 30 species of mammals are listed as prey (Mueller, 1987). Generally it lays its eggs in early to mid-April (Bent, 1962). The birds search for prey from high perches

along the forest edge or hover over open areas with short, sparse vegetation (DeGraaf et al., 1991).

The kestrels occupy nearly all Grassland/Shrubland, Sandhills, and other forested community types. Habitat requirements include an adequate prey base, perch sites, and nesting sites. They mostly inhabit open forests and clearing edges with snags. The thick understory and midstory in Sandhills communities that are cut or are not burned may have an adverse effect on kestrel populations. Prescribed burning can be beneficial since it enhances habitat and increases the prey base (Hoffman and Collopy, 1987).

The Sandhills association is a preferred habitat in Florida with the pine-oak woodlands providing quality nesting and foraging sites (Bohall-Wood and Collopy, 1986). During a nesting survey, kestrel densities were higher in Sandhill longleaf pine-scrub oak than in hardwood hammock communities (Hoffman and Collopy, 1987). The decline in breeding pairs is correlated to a decrease in scattered, mature pine trees and snags in open habitats. Populations in north-central Florida have been reduced primarily due to logging operations. Since the 1940s, the population of southeastern American kestrels has decreased by 80 percent because of the reductions in longleaf pine flatwoods that once dominated the north-central Florida area (Smallwood and Collopy, 1993).

The kestrels are quite tolerant of human activity around their nests. They are frequently flushed or caught at the nest without desertion. In Ohio, kestrels use centers of human activity more than other raptors (Fischer et al., 1984).

Gopher Tortoise

The gopher tortoise is found primarily within the longleaf pine of the Sandhills, as well as the sand pine scrub and live oak hammocks of the Sand Pine and Grassland/Shrubland associations (U.S. Air Force, 1995).

The life of the gopher tortoise revolves around a burrow constructed by digging with its shovel-like feet. The burrow is frequently constructed in areas with low-growing plants, sandy, well-drained soils in open, sunny areas with bare patches of ground. These burrows can be up to 40 feet (12 meters) in length and 10 feet (3 meters) in depth. Gopher tortoise burrows are essential to the ecosystem of dry, sandy uplands. These burrows not only provide shelter for the gopher tortoise, but also for many other species of animals including such sensitive species as the indigo snake, pine snake, and gopher frog. The burrows remain at fairly constant temperature and humidity throughout the year, acting as a refuge from cold, heat, and dryness. They also act as a refuge from periodic fires that occur in this dry habitat.

The tortoise primarily eats grasses, leaves, fruits, seeds, and insects. The foods most frequently found in their diets are grasses (*Poaceae spp.*) and legume fruits (*Fabaceae spp.*).

Female tortoises lay 3 to 15 eggs in the sand in front of their burrows during late April and May. These eggs incubate for up to 100 days. Predators, such as raccoons, coyotes, and snakes, destroy more than 80 percent of gopher tortoise nests, resulting in a very low hatching success rate (Pucket and Franz, 1991).

A 1989 report indicated 60 vertebrate and 302 invertebrate species had been recorded in gopher tortoise burrows. On Eglin, dusky gopher frogs and eastern indigo snakes use this critical habitat for cover. The gopher tortoise is found in pine and oak woodlands in the Sandhills ecological association, but can also be found in the Sand Pine and Grassland/Shrubland associations. Many inactive burrows are found on Eglin; the number of active burrows is considerably less. The rising number of inactive burrows has led to concerns about a population decline of the species due to poaching and loss of fire-dependent habitat (U.S. Air Force, 1995).

Dusky Gopher Frog

The distribution of the gopher frog in Florida is closely tied to that of the gopher tortoise. Gopher frogs may use gopher tortoise burrows or other types of holes, such as old stumps or old field mouse burrows, for habitat. Native, xeric, upland sandhill habitats such as those surrounding TA C-74 provide the most suitable habitat for the gopher frog, which coincidentally supports the majority of gopher tortoises. Gopher frogs require seasonally flooded grassy ponds and cypress heads lacking fish populations for breeding and may not venture more than two kilometers from these areas. Thus, their occurrence on TA C-74 is probably dependent on the presence of the pond located to the northeast of the sled track, which may be used for breeding (Moler, 1987).

The gopher frog is generally nocturnal, with a diet mainly consisting of invertebrates and other amphibians (including toads). Gopher frog breeding in north Florida usually occurs from February through April. The females lay a mass of 3,000 to 7,000 eggs, which are attached to the vegetation in and around the breeding pond. The tadpoles transform in three to five months, maturing in their second year and reaching a maximum size of ~4.25 inches in length from snout-to-vent over a span of four to six years (Moler, 1987).

Eastern Indigo Snake

The eastern indigo snake is the longest North American snake, reaching a length of over eight feet. Listed as threatened by both the federal and state governments, it has a wide distribution and is found in the Sandhills and Swamp ecological associations surrounding TA C-74. It is closely associated with the gopher tortoise, often using gopher tortoise burrows as a winter resting place and foraging in wetter areas during the summer months. Eastern indigo snake sightings throughout the Eglin Range have been documented.

The eastern indigo snake feeds on vertebrates small enough for it to overtake, including fish, other reptiles, amphibians, and small mammals and birds. These snakes are diurnal, foraging during the day and resting at night. Preferred foraging areas include wetland fringes. Breeding takes place between November and April, with between 5 and 10 eggs laid in May or June (Moler, 1987).

Okaloosa Darter

The Okaloosa darter is found in six small Choctawhatchee Bay Basin tributaries located in the Sandhills ecological association surrounding TA C-74. Specifically, Rocky Creek, which runs through TA C-74, is considered Okaloosa darter habitat. The species is both federally and state listed as endangered.

The darter's diet consists primarily of immature aquatic insect larvae. Spawning occurs from March to October, with the greatest amount of activity taking place during April. The spawning occurs in beds of clean, current swept macrophytes (large aquatic plants). Each spawning act results in the release of a single egg. Darters do not provide parental care. Little is known of the development of the darter afterwards.

Okaloosa darter habitat is sensitive to a variety of disturbances. Erosion can increase siltation and imperil the darter's habitat (thus the erosion control project currently under way at TA C-74). Its range has also been reduced by habitat modification and encroachment by the brown darter. Delisting the darter is not likely in the near future due to the extremely limited range of the darter and its vulnerability to habitat alteration and catastrophic events. In order to protect the Okaloosa darter, the quantity and quality of water in the streams must be protected. Principal factors in the initial listing of the darter were the amount of its habitat degraded by road and dam construction, as well as siltation from land clearing (Jelks, 1981).

Florida Black Bear

The Florida black bear has been sighted throughout Eglin. The bear population on Eglin is Florida's fifth largest population of the subspecies. The exact locations of the bears are sensitive information because of the threat of poaching. A four-year study has begun on Eglin, the goal of which is to determine the relative density and distribution of the subspecies; determine seasonal feeding habitats and preferred habitat; and determine the effects of controlled burning and other human activities.

Bears inhabit swampy areas, flatwoods, stream riparian areas, and the pine-oak forests of the Sandhills. They prefer wooded and shrubby areas but will use meadows, clear-cuts, burned areas, and riparian areas, and use forested areas as travel corridors. During winter the bears may hibernate in tree cavities, under logs and rocks, in banks, caves, or culverts and in shallow depressions (Hamilton and Marchinton, 1980). Black bears eat a variety of foods relying most heavily on grasses, herbs, fruits, and mast. They also feed on carrion and insects (Jonkel, 1978).

The key habitat requirements of black bears are food, water, cover, and denning sites, spatially arranged across sufficiently large, relatively remote blocks of land. Remoteness is an important spatial feature of black bear habitat. This is generally accepted as a contiguous forested tract of more than 2,500 acres or a tract with .5 kilometer or less of road per square kilometer (Pelton, 1986). The home ranges of the black bear vary with habitat types, sex and age, season, environmental conditions, and population density, while providing the essentials for food, water, cover, space, denning sites, and contacts with potential mates. Home ranges vary from 4,151 to 105,660 acres for males and 1,360 to 26,044 acres for females (Hellgren and Vaughan, 1989).

Bears are adaptable and opportunistic. They can survive in proximity to humans if afforded areas of retreat that ensure little chance of close contact or visual encounters with humans. Heavy understory such as canebrakes (*Arundinaria gigantea*) and palmetto (*Sabal minor*) are examples of such escape cover. High-quality cover for bedding and escape is of great importance as forests become smaller and more fragmented, and as human encroachment and disturbance of bear habitat increases (Rogers and Allen, 1987). Travel corridors may facilitate bear movements through highly fragmented forest habitats (Noss, 1987).

The primary threat to bear populations is the destruction, modification, fragmentation, and/or curtailment of its habitat or home range. The Florida black bear is presently a candidate for federal listing.

Red-cockaded Woodpecker

The red-cockaded woodpecker (RCW) inhabits the interstitial areas of the Eglin reservation. No active RCW nest trees have been recorded within the TA C-62 boundaries; the closest active cluster of active RCWs is 3,283 feet to the west of the test area.

On Eglin, the RCW typically inhabits mature, open stands of longleaf pine. The RCW does not migrate and maintains year-round territories near nesting and roosting trees (Hooper et al., 1980). Studies by DeLotelle et al. (1987) in central Florida found that RCWs foraged primarily in longleaf pine and pondcypress stands with dense ground cover of broomsedge bluestem (*Andropogon virginicus*). They do not tolerate dense hardwood stocking in the midstory. The birds will abandon nest cavities when the understory reaches the height of the cavity entrance.

An RCW colony typically encompasses about 10 acres with most cavity trees most likely within a 1,500-foot diameter circle. The RCW has shown some preference for mature longleaf pine over other pine species as a cavity tree with the average age of longleaf pines in which new cavities have been excavated being 95 years. Cavity excavation may take several years and may be utilized by generations of birds for more than 50 years (Jackson et al., 1979).

The woodpeckers primarily feed on spiders, ants, cockroaches, centipedes, and insect eggs and larvae that are excavated from trees. Dead, dying, and lightning-damaged trees that are infested with insects are a preferred feeding source. The birds also feed on the fruits of black cherry (*Prunus serotina*), southern bayberry (*Myrica cerifera*), and black tupelo (*Nyssa sylvatica*) (Baker, 1974).

Florida Pine Snake

The Florida pine snake inhabits dry areas, characteristic of the Grassland/Shrubland associations, and has adapted itself to digging into loosely packed sand. They have been observed in rodent and gopher tortoise burrows (U.S. Air Force, 1995).

APPENDIX E

PHOTOGRAPHS OF TA C-74 FACILITIES



Sled Track: North to South, with observation tower



Sled Track: South to North, with RUT



Arena Test Area



Target Construction Area



Sled Track Target Impact Area



Sled Track Target Impact Area



Test Control Facilities



Erosion Control



Pond and Wetland Area South of Sled Track Target Area



Retention Pond East of Sled Track Target Area



Retention Pond South of Sled Track Target Area



Downrange Impact Area



Downrange Access Road and Erosion Control Project



Downrange Erosion Control Project



Okaloosa Darter Stream (north side of culvert)



Okaloosa Darter Stream (south side of culvert)



BMPs for Sedimentation Control near Okaloosa Darter Stream (west side of stream)



BMPs for Sedimentation Control near Okaloosa Darter Stream (east side of stream)



Gully and Rill Erosion at TA C-74



Downrange Impact Area Erosion Control Project (west side of stream)

APPENDIX F

FLORIDA STATE CLEARINGHOUSE CORRESPONDENCE



Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard, MS 47
Tallahassee, Florida 32399-3000

David B. Struhs
Secretary

August 6, 2002

Ms. Elizabeth B. Vanta
Chief, Environmental Analysis Branch
Department of the Air Force
501 DeLeon Street, STE 101
Eglin Air Force Base, Florida 32542-5133

RE: Department of the Air Force – Draft Programmatic Environmental Assessment – Test Area C-74 Complex – Eglin Air Force Base, Walton County, Florida
SAI: FL200206112177C

Dear Commander:

The Florida State Clearinghouse, pursuant to Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated the review of the above-referenced environmental assessment (EA).

The Department of State (DOS) indicates that the Air Force is required to conduct a cultural resources survey to identify any significant archaeological and/or historic sites which may be located within the project area and to avoid or mitigate any impacts to sites identified in the survey. The Air Force is advised to contact the DOS in order to coordinate the survey. Please refer to the enclosed DOS comments.

Based on the information contained in the referenced EA and the comments provided by our reviewing agencies, as summarized above and enclosed, the state has determined that, at this stage, the above-referenced project is consistent with the Florida Coastal Management Program. All subsequent environmental documents prepared for this project must be reviewed to determine the project's continued consistency with the FCMP. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews.

Thank you for the opportunity to review this project. If you have any questions regarding this letter, please contact Ms. Rosalyn Kilcollins at (850) 922-5438.

Sincerely,

A handwritten signature in cursive script that reads "Sally B. Mann".

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/rk
Enclosures

Cc: Janet Snyder Matthews, DOS

**NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT
Project Review Form**

TO: State Clearinghouse
Department of Environmental Protection
3900 Commonwealth Boulevard, MS 47
Tallahassee, FL 32399-3000

DATE: June 28, 2002

SUBJECT: Project Review: Intergovernmental Coordination
Title: Dept. of the Air Force-Draft Programmatic Environmental Assessment
(PEA) for the Test Area C-74 Complex-Eglin Air Force Base-Santa
Rosa, Okaloosa and Walton Counties, FL
SAI #: FL200206112177C

The District has reviewed the subject application and attachments in accordance with its responsibilities and authority under the provisions of Chapter 373, Florida Statutes. As a result review, the District has the following responses:

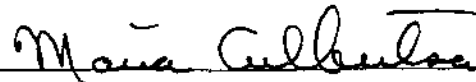
ACTION

- No Comment.
- Supports the project.
- Objects to the project; explanation attached.
- Has no objection to the project; explanation optional.
- Cannot evaluate the project; explanation attached.
- Project requires a permit from the District under_____.

DEGREE OF REVIEW

- Documentation was reviewed.
- Field investigation was performed.
- Discussed and/or contacted appropriate office about project.
- Additional documentation/research is required.
- Comments attached.

SIGNED



Duncan Jay Cairns
Chief, Bur. Env. & Res. Plng.

COUNTY: STATE

DATE: 6/11/02

COMMENTS DUE DATE: 7/11/02

CLEARANCE DUE DATE: 8/10/02

Message:

SAI#: FL200206112177C

STATE AGENCIES

WATER MNGMNT. DISTRICTS

OPB POLICY UNITS

COMMUNITY AFFAIRS
FISH and WILDLIFE COMMISSION
STATE
TRANSPORTATION
ENVIRONMENTAL PROTECTION

X NORTHWEST FLORIDA WMD

ENVIRONMENTAL POLICY UNIT

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.
- Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.
- Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

Department of the Air Force - Draft Programmatic Environmental Assessment (PEA) for the Test Area C-74 Complex - Eglin Air Force Base - Santa Rosa, Okaloosa and Walton Counties, Florida. On CD.

To: Florida State Clearinghouse
AGENCY CONTACT AND COORDINATOR (SCH)
2555 SHUMARD OAK BLVD
TALLAHASSEE, FLORIDA 32399-2100
(850) 414-6580 (SC 994-6580)
(850) 414-0479

EO. 12372/NEPA

Federal Consistency

- No Comment
- Comment Attached
- Not Applicable

- No Comment/Consistent
- Consistent/Comments Attached
- Inconsistent/Comments Attached
- Not Applicable

NO COMMENT

From:

Division/Bureau: NFWWMD
Resource Management Div.
Reviewer: Duncan J. Cairns
Date: 27 JUNE 02
Date:

COUNTY: STATE

DATE: 6/11/02

COMMENTS DUE DATE: 7/11/02

CLEARANCE DUE DATE: 8/10/02

Message:

SAI#: FL200206112177C

STATE AGENCIES

WATER MNGMNT. DISTRICTS

OPB POLICY UNITS

COMMUNITY AFFAIRS
 FISH and WILDLIFE COMMISSION
 STATE
 X TRANSPORTATION
 ENVIRONMENTAL PROTECTION

NORTHWEST FLORIDA WMD

ENVIRONMENTAL POLICY UNIT

RECEIVED
 JUN 28 2002
 OIP/OLGA

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

Project Description:

Department of the Air Force - Draft Programmatic Environmental Assessment (PEA) for the Test Area C-74 Complex - Eglin Air Force Base - Santa Rosa, Okaloosa and Walton Counties, Florida. On CD.

- Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.
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- Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

To: Florida State Clearinghouse

EO. 12372/NEPA

Federal Consistency

AGENCY CONTACT AND COORDINATOR (SCH)

2555 SHUMARD OAK BLVD

TALLAHASSEE, FLORIDA 32399-2100

(850) 414-6580 (SC 994-6580)

(850) 414-0479

- No Comment
- Comment Attached
- Not Applicable

- No Comment/Consistent
- Consistent/Comments Attached
- Inconsistent/Comments Attached
- Not Applicable

From:

Division/Bureau:

FDOT/AVIATION OFFICE
RICHARD C. NULL
 Date: *6/25/02*

Reviewer:

Date:

COUNTY: STATE

DATE: 6/11/02

COMMENTS DUE DATE: 7/11/02

Message:

CLEARANCE DUE DATE: 8/10/02

SAI#: FL200206112177C

STATE AGENCIES

WATER MNGMNT. DISTRICTS

OPB POLICY UNITS

COMMUNITY AFFAIRS
 FISH and WILDLIFE COMMISSION
 STATE
 X TRANSPORTATION
 ENVIRONMENTAL PROTECTION

NORTHWEST FLORIDA WMD

ENVIRONMENTAL POLICY UNIT

Post-it* Fax Note	7671	Date	6/26/02	# of pages	1
To	CINDY CRANICK	From	RICHARD NULL		
By	DOA CENTERS/HOUSE	Co.	FDOT/AVIATION		
Phone #	922-5438	Phone #	414-4375		
Fax #	922-5380	Fax #	922-4742		

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.
- Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.
- Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

Department of the Air Force - Draft Programmatic Environmental Assessment (PEA) for the Test Area C-74 Complex - Eglin Air Force Base - Santa Rosa, Okaloosa and Walton Counties, Florida. On CD.

To: Florida State Clearinghouse
 AGENCY CONTACT AND COORDINATOR (SCH)
 2555 SHUMARD OAK BLVD
 TALLAHASSEE, FLORIDA 32399-2100
 (850) 414-6580 (SC 994-8580)
 (850) 414-0479

EO. 12372/NEPA

Federal Consistency

- No Comment
- Comment Attached
- Not Applicable

- No Comment/Consistent
- Consistent/Comments Attached
- Inconsistent/Comments Attached
- Not Applicable

From:

Division/Bureau:

Reviewer:

Date:

EDOT/AVIATION OFFICE
 RICHARD C. NULL
 6/25/02



WEST FLORIDA REGIONAL PLANNING COUNCIL

Post Office Box 9759 • 3435 North 12th Avenue • Pensacola, Florida 32513-9759
 Phone (850) 595-8910 • S/C 695-8910 • (800) 226-8914 • Fax (850) 595-8967

Lel Czeck
 Executive Director

Robert F. Barnard
 Chairman

Cody Taylor
 Vice-Chairman

FAX TRANSMITTAL(S) Total # of Pages (including cover): 2

TO: STATE CLEARINGHOUSE ■ FAX: (850) 414-0479

DATE: July 10, 2002

FROM: *JNL*
 Jerrie Nelson Lewis, Intergovernmental Review Coordinator
 Extension 226
 lewisj@wfrpc.dst.fl.us

SUBJECT: State Clearinghouse Review(s) Fax Transmittals:

SAI #	Project Description	RPC #
FL200205302098C	Century CDBG Grant for 15 units.	E1023-06-05-2002
FL200206112177C	Dept of Air Force – Draft Programmatic Environmental Assessment (PEA) for the Test Area C-74 Complex – Eglin AFB – Santa Rosa, Okaloosa, & Walton counties (on CD only)	MJ629-06-20-2002

<input checked="" type="checkbox"/>	No Comments – Generally consistent with the WFSRPP
<input type="checkbox"/>	Comments Attached

If you have any questions, please call.



- email Governor Job Bush
- Gov. Bush's E-Newsletter

STATE CLEARINGHOUSE

[Home](#) > [My In-Box](#) > [Search Project](#) > **Add Agency Comments**

User: VANESSA HOLMES, , Clearinghouse

[Home](#)

[My In-Box](#)

[New Project](#)

[Search Project](#)

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[Help](#)

[Brochure](#)

[Manual](#)

Project Information

Project: FL200206112177C

Description: Department of the Air Force - Draft Programmatic Environmental Assessment (PEA) for the Test Area C-74 Complex - Eglin Air Force Base - Santa Rosa, Okaloosa and Walton Counties, Florida. On CD.

Keywords: USAF - DPEA for Test Area C-74 - SR, Okaloosa, Wai

Program:

Review Comments

2/12

Agency: ENVIRONMENTAL PROTECTION

Date: (mm/dd/yyyy)

Description:

Comment Type: Draft Final

APPENDIX G

**STATE HISTORIC PRESERVATION OFFICE
CORRESPONDENCE**

DIVISIONS OF FLORIDA DEPARTMENT OF STATE
Office of the Secretary
Office of International Relations
Division of Elections
Division of Corporations
Division of Cultural Affairs
Division of Historical Resources
Division of Library and Information Services
Division of Licensing
Division of Administrative Services



MEMBER OF THE FLORIDA CABINET
State Board of Education
Trustees of the Internal Improvement Trust Fund
Administration Commission
Florida Land and Water Adjudicatory Commission
Siting Board
Division of Bond Finance
Department of Revenue
Department of Law Enforcement
Department of Highway Safety and Motor Vehicles
Department of Veterans Affairs

FLORIDA DEPARTMENT OF STATE
Katherine Harris
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Cindy Cranick
Florida State Clearinghouse Coordinator
Florida Department of Environmental Protection
3900 Commonwealth Boulevard, Mail Station 47
Tallahassee, Florida 32399-3000

July 5, 2002

RE: DHR No. 2002-05830
Received by DHR: June 13, 2002
SAI #: 200206112177C
Draft Programmatic Environmental Assessment for Test Area C-74 Complex
Eglin Air Force Base, Walton County

Dear Ms. Cranick:

Our office received and reviewed the above referenced project in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992, and 36 *C.F.R., Part 800: Protection of Historic Properties*, Chapter 267, *Florida Statutes*, Florida's Coastal Management Program, and implementing state regulations, for possible impact to historic properties listed, or eligible for listing, in the *National Register of Historic Places*, or otherwise of historical, architectural or archaeological value. The State Historic Preservation Officer is to advise and assist state and federal agencies when identifying historic properties, assessing effects upon them, and considering alternatives to avoid or minimize adverse effects.

Based on the information provided in the referenced permit application and the Florida Master Site File, we note that archaeological site 8WL1485 is located within the project parcel. We concur with the Site File report conclusion that site 8WL1485 does not meet eligibility criteria for the *National Register*. Therefore, it is the opinion of this office that the proposed undertaking will have no effect on historic properties listed or eligible for listing in the *National Register of Historic Places*, or otherwise of historical or architectural value.

Although there are no other archaeological or historic sites currently recorded within the C-74 Complex, we concur that there is a high probability that additional cultural resources are present within the Complex.

500 S. Bronough Street • Tallahassee, FL 32399-0250 • <http://www.flheritage.com>

Director's Office
(850) 245-6300 • FAX: 245-6435

Archaeological Research
(850) 245-6444 • FAX: 245-6436

Historic Preservation
(850) 245-6333 • FAX: 245-6437

Historical Resources
(850) 245-6400 • FAX: 245-6433

Palm Beach Regional Office
(561) 279-1475 • FAX: 279-1476

St. Augustine Regional Office
(904) 825-5045 • FAX: 825-5044

Tampa Regional Office
(813) 272-3843 • FAX: 272-2340

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JUL 17 2002

OIP/OLGA


Ms. Cranick
July 5, 2002
Page 2

We recommend that the Eglin Base Historic Preservation Office (BHPO) coordinate an area cultural resource survey with this office. We look forward to coordinating with the Eglin BHPO to identify and avoid impacts to historic properties that may be located within the C-74 Complex. Conditioned upon completion of this coordination, the project will be consistent with the historic preservation laws of Florida's Coastal Management Program.

If there are any questions concerning our comments or recommendations, please contact Sarah Jalving, Historic Sites Specialist, by electronic mail at sjalving@mail.dos.state.fl.us or at 850-245-6333 or SunCom 205-6333. Thank you for your interest in protecting Florida's historic properties.

Sincerely,

 Frederick P. Gaska, Deputy SHPO

 Janet Snyder Matthews, Ph.D., Director, and
State Historic Preservation Officer

Response to Florida Division of Historical Resources Comments

The comments submitted by the Florida Division of Historical Resources have been incorporated into Section 1.6 of the Final Programmatic Environmental Assessment.

APPENDIX H

PUBLIC NOTIFICATION AND COMMENTS

PUBLIC NOTIFICATION

In compliance with the National Environmental Policy Act, Eglin Air Force Base announces the availability of draft Environmental Assessment (EA) and draft Finding of No Significant Impact (FONSI) for RCS 00-798, "Programmatic Environmental Assessment (PEA) For the Test Area C-74 Complex," and RCS 99-147, "Programmatic Environmental Assessment (PEA) For the Test Area C-64," for public review and comment.

The Proposed Action of RCS 00-798, "Programmatic Environmental Assessment For the Test Area C-74 Complex," is for the 46th Test Wing Commander to establish an authorized level of activity at these test areas based on an anticipated increased use. The Proposed Action includes adding a 200% increase in all mission activities to support surge requirements for contingencies, adding Best Management Practices to minimize potential environmental impacts, and to authorize a baseline level of activity on the test areas.

The Proposed Action of RCS 99-147, "Programmatic Environmental Assessment For the Test Area C-64," is for the 46th Test Wing Commander to establish an authorized level of activity at this test area based on an anticipated increased use. The Proposed Action includes adding a 200% increase in all mission activities to support surge requirements for contingencies.

Your comments on these draft PEAs and draft FONSI are requested. Letters or other written or oral comments provided may be published in the final PEA. As required by law, comments will be addressed in the final PEA and made available to the public. Any personal information provided will be used only to identify your desire to make a statement during the public comment period or to fulfill requests for copies of the final PEA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of the final PEA. However, only the names of those individuals making comments and specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the final PEA.

Copies of the Draft Environmental Assessments and Draft Findings of No Significant Impact (FONSI) may be reviewed at the Crestview Library, 1304 N. Ferndon Blvd., Crestview, Fla., and the Defuniak/Walton Library, 3 Circle Dr., Defuniak Springs, Fla. Copies will be available for review from Aug. 30 through Sept. 13, 2002. Comments must be received by Sept. 16, 2002 to be considered.

For more information, or to comment on these proposed actions, contact:
Mr. Mike Spaits, AAC/EM-PAV, 501 De Leon St., Suite 101, Eglin AFB, FL 32542-5133,
Or, email: spaitsm@eglin.af.mil. Tel: (850) 882-2878 ext. 333, Fax.: (850) 882-3761

MEMO

24 September 2002

FROM: AAC/EM-PAV

TO: EMSP

SUBJECT: PUBLIC NOTICE RCS 00-798, "Programmatic Environmental Assessment (PEA) For the Test Area C-74 Complex," and RCS 99-147, "Programmatic Environmental Assessment (PEA) For the Test Area C-64," Eglin AFB, Florida

A public notice was published in the *Northwest Florida Daily News* on Aug. 30th, 2002 to disclose completion of the Draft EA, selection of the preferred alternative, and request comments during the 15-day pre-decisional comment period.

The 15-day comment period ended on Sept. 13th, with the comments required to this office not later than Sept. 16th, 2002.

No comments were received during this period.

//SIGNED//

Mike Spaits

Public Information Specialist

APPENDIX I

USFWS BIOLOGICAL OPINION



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR ARMAMENT CENTER (AFMC)
EGLIN AIR FORCE BASE, FLORIDA

MEMORANDUM FOR 46TW/OGMT

17 Jul 02

ATTENTION: Dennis Schneider

FROM: AAC/EMSN

SUBJECT: Test Area C-74 Biological Opinion

1. A biological assessment (BA) was submitted to the U.S. Fish and Wildlife Service (USFWS) on 19 Nov 01 for review of this project. The BA addressed the potential impacts to six sensitive species, including the Endangered Species Act protected Eastern indigo snake (*Drymarchon corais couperi*), Red-cockaded woodpecker (*Picoides borealis*), and the Okaloosa darter (*Etheostoma okaloosae*). They have completed their review and have issued the attached biological opinion. They have supported the Eglin Natural Resources Branch (NRB) conclusion that the proposed action is not likely to adversely affect the Red-cockaded woodpecker and Eastern indigo snake. However, the action may affect the Okaloosa darter. The following is a summary of the biological opinion from the USFWS:

2. The BA for mission activities in Test Area C-74 concludes that retrieval of test items that happen to land in or near Rocky Creek, even with the proposed conservation measures (BMP's), could kill or injure darters or render water quality in the short term unsuitable to the species. Test item retrieval from the stream or its riparian zone using conventional methods involves some amount of vegetation clearing and soil disturbance and could result in some amount of erosion and bank destabilization.

3. The measures described below are non-discretionary and must be undertaken by Eglin for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If Eglin fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Eglin must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement [50 CFR §402.14(I)(3)].

4. The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Okaloosa darters:

a. The NRB will document any damage that occurs to Rocky Creek and its riparian zone (15 m from the stream bank), in order to better understand the risk of take posed by mission activities.

b. The 46 TW will restore the damaged riparian zone and stream banks to pre-test conditions as soon as possible following a test in order to limit any longer-term adverse effects on darters and their habitat.

c. The NRB will monitor the effectiveness of the restoration.

d. The NRB will ensure that the terms and conditions are accomplished as detailed in this incidental take statement.

5. In order to be exempt from the prohibitions of section 9 of the ESA, Eglin must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

6. Within 18 months after the final BO is delivered, the NRB shall provide a brief report to the USFWS that documents the incidents in which test items landed in Rocky Creek or within 15 meters of the creek during the first 12 months. The report should include:

a. Photographs of the impact sites immediately following test item retrieval.

b. A description of the retrieval and restoration methods used.

c. An evaluation of the success of the restoration.

d. Photographs of the impact sites following restoration.

The report is required one time only, i.e., it is not an annual requirement; however, its purpose is to establish whether the information used in this BO to estimate the extent of take incidental to mission activities is accurate and whether the proposed conservation measures are effective. If the report indicates otherwise, reinitiation of consultation may be required.


7. The USFWS believes that no more than six Okaloosa darters per year will be incidentally taken as a result of mission activities in TA C-74. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking, and review with the USFWS the need for possible modification of the reasonable and prudent measures.

8. All personnel performing the test should familiarize themselves with all requirements of the attached biological opinion and biological assessment. They should pay particular attention to the terms and conditions as described above, as well as the conservation measures/conservation recommendations. The terms and conditions are non-discretionary, while the conservation recommendations are suggested actions to help prevent or reduce impacts.

9. This concludes formal consultation on the action outlined in this BO. As provided in 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if the following applies:

- a. The amount or extent of incidental take is exceeded.
- b. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion.
- c. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion.
- d. A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

10. I have enclosed the BO that is dated 10 Jul 02. If you have any questions or would like to convene a meeting to discuss your responsibilities in the BO or any of the proposed activities, please do not hesitate to contact either Mr. Bob Miller or myself at (850) 882-4164.


RICHARD W. MCWHITE, GM-13
Chief, Natural Resources Branch

Attachment:
Biological Opinion, 10 Jul 02

cc:
AAC/EMSP

Field Office
1601 Balboa Avenue
Panama City, Florida 32405

Tel: (850) 769-0552
Fax: (850) 763-2177

July 10, 2002

Mr. Rick McWhite
Chief, Natural Resources Branch
AAC/EMSN
501 DeLeon Street, Suite 101
Eglin AFB, Florida 32542-5133

Re: FWS Log No. 4-P-02-182
Mission Activities in Eglin
Test Area C-74
Eglin AFB, Florida

Dear Mr. McWhite:

This letter transmits the Fish and Wildlife Service's (Service) biological opinion (BO) of mission activities within Test Area (TA) C-74, Eglin Air Force Base, Florida, in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) Your letter dated November 19, 2001, requesting formal consultation was received on November 26, 2001. Our BO is based on information provided in the biological assessment (BA) that accompanied your letter, discussions with experts in the field, and other sources of information. A complete administrative record of this consultation is on file at the Service's Panama City, Florida field office.

Your BA addressed potential impacts to six sensitive species, including the ESA-protected Eastern indigo snake (*Drymarchon corais couperi*), red-cockaded woodpecker (*Picoides borealis*), and the Okaloosa darter (*Etheostoma okaloosae*), all listed as endangered. Of these, only the darter is known to occur within TA C-74; therefore, the Service concurs with your finding that mission activities within TA C-74 would not affect the indigo snake or the

woodpecker.

CONSULTATION HISTORY

November 26, 2001 The Service received a letter from Carl Petrick, Acting Chief, Natural Resources Branch, Eglin Air Force Base, requesting formal consultation and a BA about the effects of mission activities in TA C-74 on ESA-protected species.

January, 2002 Because of workload demands and scheduling concerns, Eglin and the Service agreed to give highest priority to the consultation for Eglin's Integrated Natural Resources Management Plan. Consultation for mission activities in TA C-74 and other pending consultations were postponed.

June 3, 2002 Eglin Natural Resources staff and Service staff discussed the status of various on-going consultations, including TA C-74 mission activities. Service biologist Jerry Ziewitz asked whether military security concerns might preclude or limit the possibilities for documenting future occurrences of darter habitat impacts resulting from mission activities in TA C-74 and of any restoration activities following such impacts. Rick McWhite indicated that Eglin might not allow the release of photographs of habitat impacts while some test items remain in sight; however, photography and most other means of documenting impacts and restoration should be possible.

July 2, 2002 Eglin biologist Bob Miller called Service biologist Jerry Ziewitz with comments on the draft BO. Miller corrected one aspect of the proposed action description (length of the sled track) and Ziewitz clarified that the report required under the terms and conditions of the incidental take statement was a one-time obligation and not an annual condition. Miller indicated that Eglin found the terms and conditions acceptable. Ziewitz asked whether Eglin would appreciate adding the various tasks assigned to Eglin in the Okaloosa darter recovery plan to the list of conservation recommendations attached to the BO. Miller said, it would be helpful.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Section 5 of the BA describes mission activities within TA C-74, which contains a 610-meter-long Kinetic Energy Munitions Test Facility sled track, a down-range impact/retrieval area, and various other munitions and ballistics facilities. Land cover in the 331-ha impact/retrieval area

consists of maintained grassland, a 1.6-ha pond, and 34 ha of riparian/wetland habitat. A typical test event in TA C-74 involves strapping a test item onto a carrier sled, usually an inert or live bomb, which is then propelled along the track towards a target, usually consisting of concrete blocks. Live bombs detonate upon target impact, but 98 percent of the inert items pass through the target and continue down range, sometimes for hundreds of meters. The test items are retrieved and taken to TA C-74A for analysis. Eglin estimates that it would conduct about 50 test events per year under its preferred alternative. About 60 percent of the tests would involve inert test items and of these, about half (15 per year) are likely to land and be recovered from within 15 m of Rocky Creek, which runs through TA C-74.

Conservation Measures

The BA states that Eglin will use appropriate Best Management Practices (BMPs) when recovering test items from Rocky Creek and its riparian zone, including:

- ☐ Using the least intrusive method available for test item retrieval.
- ☐ Removing the test item along the same path that it entered the area to reduce habitat disturbance.
- ☐ Avoiding use of heavy equipment within the stream and along the stream banks.
- ☐ Repairing any damage to stream banks and erosion control measures along the stream.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/Critical Habitat Description

The Okaloosa darter, *Etheostoma okaloosae*, is a small percid fish (maximum size 49 millimeters Standard Length) with a well-developed humeral spot, a series of five to eight rows of small spots along the sides of the body, and a first anal spine longer than the second. General body coloration varies from red-brown to green-yellow dorsally, and lighter ventrally, although breeding males have a bright orange submarginal stripe on the first dorsal fin (Burkhead *et al.* 1992). The brown darter, *Etheostoma edwini*, is similar in size, but the blotched patterns on the sides are not organized into rows and breeding males have bright red spots on the body and fins. The Service listed the Okaloosa darter as endangered on June 4, 1973 (38 FR 14678). No critical habitat has been designated for this species.

Life History

The areas inhabited by the Okaloosa darter are typically the margins of flowing streams where detritus, root mats, and vegetation are present. Densities average about one darter in every 2.7 meters of stream length (Burkhead *et al.* 1994). Okaloosa darters have not been collected in areas where there is no current nor have they been collected in the open, sandy areas in the middle of stream channels. Brown darters also occupy similar stream margins; however, they are capable of living in areas of little to no flow (Burkhead *et al.* 1994). Okaloosa darters feed

primarily on fly (Diptera), mayfly (Ephemeroptera), and caddis fly (Trichoptera) larvae (Ogilvie 1980). The breeding season extends from late March through October, although it usually peaks in April. Spawning pairs have been videographed attaching one or two eggs to vegetation, and they also have been observed attaching eggs to woody debris and root mats (Burkhead *et al.* 1994; Collette and Yerger 1962). Ogilvie (1980) found a mean of 76 ova and 29 mature ova in 201 female Okaloosa darters. These numbers may under-represent annual fecundity as the prolonged spawning season is an indication of fractional spawning (i.e., eggs develop and mature throughout the spawning season). Estimates of longevity range from two to three years (Burkhead *et al.* 1992; Mettee and Crittenden 1979; Ogilvie 1980).

Status/Distribution

Okaloosa darters have been found only in the tributaries and main channels of Toms, Turkey, Mill, Swift, East Turkey, and Rocky Creeks, which drain into two bayous of Choctawhatchee Bay. Approximately 90 percent of the 457-square kilometer (176 square miles) watershed drainage area is under the management of Eglin AFB. The remainder of the watershed is in the urban complex of Niceville and Valparaiso (Fischer *et al.* 1994).

The Okaloosa darter was initially listed because of its extremely limited range and potential problems resulting from erosion, water impoundment, and competition with brown darters. Since the listing in 1973, population levels in several stream sections have either decreased or disappeared altogether. In Swift Creek, downstream of College Pond, no Okaloosa darters have been observed since 1987. Mill Creek has lost much of its Okaloosa darter habitat to erosion, culverts that restrict flow and cause bed aggradation, and beaver ponds associated with culverts. Populations appear stable in the upper reaches of the Boggy and Rocky Bayou stream systems since monitoring began in 1995.

Eglin AFB has maintained its system of unpaved roads by mining clay and sand from 144 pits of various sizes (Eglin 1993). Thirty-nine of these pits were located within or immediately adjacent to Okaloosa darter drainages and were sources of extreme erosion that covered stream vegetation with sediment (USFWS 1998). The roads themselves have also been sources of sediment altering darter habitat. Sediment runoff from unpaved roads and erosion associated with road crossings is likely the single-greatest remaining and continuing impact on Okaloosa darter habitat on the base. Sediment accumulating in darter streams smothers the aquatic vegetation and woody debris that these fish use as habitat and reduces channel capacity. Loss of channel capacity leads to greater bank erosion, channel widening, increased temperatures, and other alterations adverse to native aquatic species, including the darter.

Sand-filtered groundwater, the primary source for Okaloosa darter streams, is susceptible to depletion as the amount withdrawn from the sand-gravel aquifer increases (Barr *et al.* 1985). Increases in impermeable surfaces in the urban areas cause increased surface runoff with associated fluxes in water temperature and chemistry. Finally, the potential for catastrophic spills of toxic substances increases as traffic across Okaloosa darter streams expands in volume and extent.

The Service revised its Recovery Plan for the Okaloosa darter in 1998. The plan calls for the Service to consider re-classification from endangered to threatened status using five criteria: 1) habitat protection status, 2) habitat restoration progress, 3) population size and structure, 4) population range, and 5) foreseeable threats. Natural resources management on Eglin has made substantial progress on tasks related to these criteria, especially in the area of habitat restoration.

Eglin has actively supported the surveys necessary to monitor trends in darter population size, structure, and range. Almost all sites monitored on the base are relatively stable or increasing (H. Jelks, Okaloosa darter status report, memo dated November 8, 2001). The few monitored sites that show declines in recent years are either: 1) in the upper-most reaches of the drainage where drought has diminished stream flow so much that habitat availability is minimal and sampling efficiency is poor; 2) off base; or 3) near the bases' border with the cities of Niceville and Valparaiso. In the latter two cases, the declines are most likely attributable to habitat alterations resulting from roads, urban development, or beaver impoundments. Beaver colonization of the downstream-portions of several darter streams near Eglin's interface with urban areas is apparently increasing, probably due to long-term fire-exclusion and a resulting increase in hardwood abundance (H. Jelks, Okaloosa darter status report, memo dated November 8, 2001). Darters have declined in these beaver-impounded areas, and beavers remain a foreseeable threat to darter recovery.

Year 2001 population sampling completed in September shows stable or increasing numbers of fish at most of the established 27 monitoring sites, despite continuing regional drought conditions. However, these data show for the first time decreases at six monitoring sites to levels below the recovery plan thresholds for assessing population stability (H. Jelks, Okaloosa darter status report, memo dated November 8, 2001). The recovery plan defines stability as (1) Okaloosa darter numbers remain above 1.75 standard deviations below the cumulative long-term average at each of the monitoring sites, (2) the long-term trend in the average counts at each monitoring site is increasing or neutral, and (3) the range that the species inhabits is not decreased by more than a 500-meter stream reach within any of the six stream systems.

ENVIRONMENTAL BASELINE

Status of the Species Within the Action Area

Rocky Creek lies entirely within the boundaries of Eglin Air Force Base. TA C-74 is located in the headwaters of the Rocky Bayou Basin, which is the northeastern periphery of the Okaloosa darter's range. Since the first sampling for darters occurred in the mid-1970s, Okaloosa darters have been found consistently in Rocky Creek at several sites within 3 km downstream of TA C-74. In the 2001 population survey, a mean of 15, 12, and 33 darters were counted in 20-meter transects at the three monitoring sites 17, 18, and 19, respectively, that are closest to, but downstream of, TA C-74. This represents an average density of 1.0 fish per meter, which is higher than the average density of 1 darter per 2.7 meters (0.4 fish per meter) reported by

Burkhead *et al.* (1994). Darters were not found at a site upstream of TA C-74, where the stream is extremely small, in surveys conducted in 1977 and 1993 (USFWS 1998).

Our only record of Okaloosa darters within TA C-74 comes from a single sampling in August of 2001, when a Service and a U.S. Geological Survey biologist briefly seined the stream while looking at the effects of one particular test item that had crashed through the riparian zone but had not yet been recovered for analysis. They seined approximately 30 m of the stream and collected two Okaloosa darters (Theresa Thom and Howard Jelks, personal communication), which establishes that the species occurs in this reach, but is not sufficient data for a reliable density estimate without further sampling using standard methods. As a site approaching the upstream limits of the species' distribution, it is likely that darter densities in the action area lie between the 1.0 fish per meter at the downstream stream sites and no fish present at the upstream site. For the purposes of this BO, the Service assumes that the site is comparable to the range-wide average density reported by Burkhead *et al.* (1994) (0.4 fish per meter).

EFFECTS OF THE ACTION

The BA for mission activities in TA C-74 concludes that retrieval of test items that happen to land in or near Rocky Creek, even with the proposed conservation measures (BMPs), could kill or injure darters or render water-quality in the short term unsuitable to the species. Test item retrieval from the stream or its riparian zone using conventional methods involves some amount of vegetation clearing and soil disturbance and could result in some amount of erosion and bank destabilization. Excessive sediment inputs to streams elsewhere on Eglin in the past have covered the aquatic vegetation and woody debris that darters use as habitat (USFWS 1998). Excessive sediment inputs increases the width/depth ratio of the channel (i.e., the channel becomes shallower) and increases hydraulic stress in the near-bank region, which results in a cycle of bank erosion and sediment deposition (Rosgen 1996). The water in wider, shallower channels becomes warmer and less suitable as darter habitat.

Mission activities in TA C-74 potentially affect about 600 m of Rocky Creek, which represents less than one percent of the species' range on Eglin AFB (about 400 stream km). However, unrepaired damage to the channel and its riparian zone could lead to erosion that affects darter habitat well downstream of TA C-74. Frequent impacts, possibly 15 events per year as noted in the BA, to this upstream-most segment of the darter's range could have significant cumulative effects to the Rocky Creek darter population, depending on the severity of the habitat damage and the timeliness and effectiveness of subsequent restoration efforts. However, Eglin proposes to promptly restore any significant riparian zone damage, which should preclude any long-term effects of erosion on darters and their habitat. The direct and immediate effects of a test event would probably be limited to about a 1-meter length of the stream, based on observations of the area of one test item impact in August of 2001 (Theresa Thom, personal communication).

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are

reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Although the effects of mission activities in TA C-74 may extend downstream in Rocky Creek, the entire length of Rocky Creek is within Eglin Air Force Base. Therefore, no non-federal actions are reasonably certain to occur in the action area.

CONCLUSION

After reviewing the current status of the Okaloosa darter, the environmental baseline for the action area, the effects of the mission activities, and the cumulative effects, it is the Service's biological opinion that the activities, as proposed, are not likely to jeopardize the continued existence of the Okaloosa darter. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering [50 CFS §17.3]. Incidental take is defined as take that is incidental to, and not the purpose of, an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by Eglin so that they become binding conditions of any grant or permit issued by Eglin, as appropriate, for the exemption in section 7(o)(2) to apply. Eglin has a continuing duty to regulate the activity covered by this incidental take statement. If Eglin: (1) fails to assume and implement the terms and conditions or, (2) fails to require any contracted group to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Eglin must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates that six Okaloosa darters per year could be taken as a result of mission

activities in TA C-74. The incidental take is expected to be in the form of injury and mortality. It is unlikely, however, that Eglin will be able to detect take, since any individuals affected would be almost impossible to find and safety precludes on-site monitoring during a test. Our estimate is based on: 1) up to 15 test items per year may crash into Rocky Creek; 2) an assumed population density of 0.4 fish per meter (Burkhead *et al.* 1994); and 3) observations of the impact area of one test item, which suggest that each impact/retrieval event could affect a 1-m segment of the stream. Injury or mortality would occur either from the direct impact of the test item, the occasional necessary operation of heavy equipment within the stream to retrieve the test item, or smothering by sediment dislodged from banks during the test item impact or during retrieval operations. Because Eglin proposes to repair any damage to stream banks and erosion control measures along the stream, we do not anticipate take resulting from longer-term erosion and degradation of darter habitat caused by test-item impact or retrieval.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of Okaloosa darters:

1. Document any damage that occurs to Rocky Creek and its riparian zone (15 m from the stream bank) in order to better understand the risk of take posed by mission activities.
2. Restore the damaged riparian zone and stream banks to pre-test conditions as soon as possible following a test in order to limit any longer-term adverse effects on darters and their habitat.
3. Monitor the effectiveness of the restoration.
4. Ensure that the terms and conditions are accomplished as detailed in this incidental take statement.

In order to be exempt from the prohibitions of section 9 of the ESA, Eglin must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Terms and Conditions

Within 18 months after the final BO is delivered, Eglin shall provide a brief report to the Service that documents the incidents in which test items landed in Rocky Creek or within 15 meters of

the creek during the first 12 months. The report should include: a) photographs of the impact sites immediately following test item retrieval; b) a description of the retrieval and restoration methods used; c) an evaluation of the success of the restoration; and d) photographs of the impact sites following restoration. The report is required one time only, i.e., it is not an annual requirement; however, its purpose is to establish whether the information used in this BO to estimate the extent of take incidental to mission activities is accurate and whether the proposed conservation measures are effective. If the report indicates otherwise, reinitiation of consultation may be required.

The Service believes that no more than six Okaloosa darters per year will be incidentally taken as a result of mission activities in TA C-74. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking, and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the Act by conducting conservation programs for the benefit of endangered and threatened species. Towards this end, conservation recommendations are discretionary activities that an action agency may undertake to minimize or avoid the adverse effects of a proposed action, help implement recovery plans, or develop information useful for the conservation of listed species.

The Service recommends that Eglin:

Consider using a crane to retrieve test items from the stream or riparian zone as an alternative "least intrusive method available," which would avoid much vegetation clearing and other heavy equipment in or near the stream.

In addition, Eglin is listed as the lead agency for completing several tasks described in the Okaloosa darter recovery plan. These tasks are reiterated here as a courtesy:

Task Number	Task Description
1.1.1.1	Continue the restoration of clay pits and road crossings throughout Okaloosa darter watersheds.
1.1.1.2	Continue road access control program that reduces erosion and the number of sites where contaminants or nonindigenous species might be introduced to stream

systems.

- 1.1.1.3 Widen riparian buffers in open ranges of Eglin AFB to the normal hill crest so that mission visibility will not be impaired, and darter habitat will be improved.
- 1.1.1.4 Apply best management practices to road construction and maintenance.
- 1.2.1 Stabilize headwater banks on the golf course.
- 1.2.2 Remove impediments to flow such as sediment beds, beaver dams, and clogged culverts.
- 1.2.3 Minimize the use of pesticides, herbicides, and other contaminants on the golf course that impact Mill Creek darters by developing and implementing a chemical use plan.
- 1.2.4 Restore open channel stream habitat between State Routes 190 and 20 by converting underground piped and beaver-ponded segments into free-flowing streams.
- 1.3.1 Evaluate Eglin AFB ponds for ecological restoration.
- 1.3.2 Evaluate and modify the spillway of College Pond on Swift Creek to improve water quality below the dam.
- 1.4 Incorporate Okaloosa darter habitat conservation and restoration measures in the Eglin AFB Natural Resources Management Plan.
- 1.5 Prepare an Okaloosa darter habitat catastrophe response plan.
- 2.1 Incorporate water quality and quantity conservation into natural resource management plans for Eglin AFB to benefit Okaloosa darters and stream ecosystems.
- 3.1.2 Establish new darter monitoring stations at sites where habitat has been restored.
- 3.1.3 Link darter habitat conditions to the population monitoring by using a geographical information system (GIS) to document changes in land use, water quality and quantity, fire periodicity, vegetation cover, restoration of erosional sites, and natural fluvial processes.
- 3.2.1 Investigate the load of nutrients and contaminants from the Eglin golf course by studying chemical use needs and using indicator aquatic insect surveys.

- 3.2.2 Inventory pollutants on Eglin AFB that affect darter streams to determine toxicity potential and consider alternatives.
- 4.2 Summarize best management practices for golf course operation that are important to the survival and recovery of the Okaloosa darter in Mill Creek.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the Biological Assessment for mission activities in TA C-74. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information shows that mission activities may affect listed species in a manner or to an extent not considered in this opinion; (3) the mission activities are subsequently modified in a manner that causes an effect to the listed species not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate the cooperation of your staff in preparing this Biological Opinion. We look forward to working closely with you in implementing its provisions and in implementing recovery actions for the Okaloosa darter.

Sincerely yours,

Gail A. Carmody
Field Supervisor

cc:
USFWS, Atlanta, GA (Joe Johnston)
USFWS, Niceville, FL (Jeff Herod)
USGS, Gainesville, FL (Howard Jelks)

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