Environmental Assessment

Base General Plan

Schriever AFB, Colorado

September 2007

Report Documentation Page

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14. ABSTRACT

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. This EA assesses the potential environmental impacts of implementing the Base General Plan at Schriever AFB, which calls for improving infrastructure and constructing facilities. The Proposed Action would have short-term, but not significant impacts on air quality from construction. The Proposed Action would conform to the State Implementation Plan and would be exempt from further conformity review. Short-term disturbance to geological resources would occur during construction; impacts would not be significant. Impacts to surface water from stormwater runoff would not be significant as a result of project design. No significant impacts were identified for biological resources. Construction equipment and associated traffic would generate short-term increases in noise during normal working hours. Noise increases would be below thresholds for significance. No issues pertaining to environmental justice were identified. There would be no significant impacts to cultural resource, visual resources, socioeconomics, solid waste, or hazardous materials and wastes. In addition to the Proposed Action, alternatives were analyzed in the EA for taking no action and for constructing facilities at a more rapid pace than the General Plan indicates. No impacts were associated with the No Action Alternative, and no significant impacts would be expected for the Accelerated Construction Alternative.

15. SUBJECT TERMS

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FINDING OF NO SIGNIFICANT IMPACT

Base General Plan, Schriever Air Force Base, Colorado

INTRODUCTION

The United States Air Force proposes to implement the Base General Plan at Schriever AFB, including construction of facilities. Pursuant to Section 102(2)(c) of the *National Environmental Policy Act* (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations (40 CFR Sec 1500-1508) implementing procedural provisions of NEPA, and Air Force regulations for the Environmental Impact Analysis Process (32 CFR 989), the Department of Defense (DoD) gives notice that an environmental assessment (EA) has been prepared for implementing the proposed Base General Plan for Schriever AFB, attached and incorporated by reference. This document serves as a Finding of No Significant Impact (FONSI).

THE PROPOSED ACTION AND ALTERNATIVE ACTIONS

The following paragraphs describe the No Action Alternative, the Proposed Action, and an Accelerated Construction Alternative.

Alternative 1: No Action

Under the No Action Alternative, the Air Force would not implement the Base General Plan at Schriever AFB. However, certain activities that are included in the plan would be implemented, since they were assessed and selected under previous NEPA documents.

Alternative 2: Proposed Action

The proposed action is for Schriever AFB to implement construction across the installation, as described in the Base General Plan. Activities would be implemented in general timeframes of one to five years, six to ten years, and more than ten years.

Alternative 3: Accelerated Construction

The EA analyzed an alternative to the Proposed Action in which some facilities would be constructed at a more rapid pace than the timeline described in the Base General Plan.

ENVIRONMENTAL EFFECTS

The environmental effects of the No Action Alternative, Proposed Action, and Accelerated Construction Alternative are summarized below.

Summary of Environmental Impact Analysis Results

Resource	*No Action Alternative*	*Proposed Action*	*Accelerated Construction Alternative*
Cultural Resources	No impact.	No impact.	No impact.
Solid and Hazardous Wastes	No impact.	No significant impact.	No significant impact.
Human Health and Safety	No impact.	No impact.	No impact.
Socio-economics	No impact.	No significant impact.	No significant impact.
Visual Resources	No impact.	No impact.	No impact.
Air Quality	No change in current level of emissions.	ST* but not significant impacts from construction and operation of the proposed facilities, conforms to the SIP*, base would remain below thresholds for PSD* review; impacts not significant.	ST but not significant impacts from construction and operation of the proposed facilities, conforms to the SIP, base would remain below thresholds for PSD review; impacts not significant.
Geological Resources	No impact.	ST but not significant disturbance to soils; no LT* impact. ST but not significant impact to underlying geological layers; no LT impact.	ST but not significant disturbance to soils; no LT* impact. ST but not significant impact to underlying geological layers; no LT impact.
Water Resources	No impact.	Stormwater drainage patterns would be considered and addressed in design of specific projects. No impacts to groundwater or surface water.	Stormwater drainage patterns would be considered and addressed in design of specific projects. No impacts to groundwater or surface water.
Biological Resources	No impact.	ST but not significant impact to vegetation from construction; no LT impact. ST but not significant impact to wildlife from habitat disturbance; no LT impact. No impacts to T&E* species.	ST but not significant impact to vegetation from construction; no LT impact. ST but not significant impact to wildlife from habitat disturbance; no LT impact. No impacts to T&E* species.
Noise	No impact.	ST construction noise may cause annoyance, not a significant impact; no LT impact.	ST construction noise may cause annoyance, not a significant impact; no LT impact.
Environmental Justice	No impacts.	No impacts to minority populations, low-income populations, or children.	No impacts to minority populations, low-income populations, or children.

*ST = short term
LT = long term
SIP = state implementation plan
PSD = prevention of significant deterioration
T&E = threatened and endangered species

There would be no significant cumulative impacts.

Finding of No Significant Impact

Based on the attached EA, conducted in accordance with the CEQ and Air Force regulations implementing NEPA, an assessment of the identified environmental effects has been prepared for the proposed Base General Plan at Schriever AFB. I find that the action will have no significant impact on the quality of the human environment; thus, an Environmental Impact Statement is not warranted.

TERESA A.H. DJURIC
Colonel, USAF
Commander

FEB 14 2008
Date

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COVER SHEET

Agency: U.S. Air Force

Title: Base General Plan, Schriever Air Force Base, Colorado.

Date: September 2007

Contact: Public Affairs Office, 210 Falcon Parkway, Suite 2102, Schriever AFB, CO 80912, (719) 567-5040.

Designation: Final Environmental Assessment (EA) and Finding of No Significant Impact (FONSI)

Abstract: This EA has been prepared in accordance with the *National Environmental Policy Act* (NEPA) of 1969, as amended. This EA assesses the potential environmental impacts of implementing the Base General Plan at Schriever AFB, which calls for improving infrastructure and constructing facilities. The Proposed Action would have short-term, but not significant, impacts on air quality from construction. The Proposed Action would conform to the State Implementation Plan and would be exempt from further conformity review. Short-term disturbance to geological resources would occur during construction; impacts would not be significant. Impacts to surface water from stormwater runoff would not be significant as a result of project design. No significant impacts were identified for biological resources. Construction equipment and associated traffic would generate short-term increases in noise during normal working hours. Noise increases would be below thresholds for significance. No issues pertaining to environmental justice were identified. There would be no significant impacts to cultural resource, visual resources, socioeconomics, solid waste, or hazardous materials and wastes. In addition to the Proposed Action, alternatives were analyzed in the EA for taking no action and for constructing facilities at a more rapid pace than the General Plan indicates. No impacts were associated with the No Action Alternative, and no significant impacts would be expected for the Accelerated Construction Alternative.

The Draft EA was available for public review for 30 days. No comments were received.

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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	microgram per cubic meter
AAFES	Army & Air Force Exchange Service
AAM	annual arithmetic mean
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFI	Air Force Instruction
APEN	Air Pollutant Emission Notice
CAA	*Clean Air Act*
CAAQS	Colorado Ambient Air Quality Standards
CCR	Colorado Code of Regulations
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
dB	decibel
dBA	A-weighted decibel
DoD	Department of Defense
EA	environmental assessment
EIAP	Environmental Impact Analysis Process
FB	Facilities Board
FONSI	Finding of No Significant Impact
HAP	hazardous air pollutant
L_{eq}	equivalent sound level
$L_{eq\ (8)}$	equivalent sound level averaged over 8 hours
$L_{eq\ (24)}$	equivalent sound level averaged over 24 hours
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
PM_{10}	particulate matter smaller than 10 microns in diameter

ppm	parts per million
PSD	Prevention of Significant Deterioration
RA	Restricted Area
SIDC	Space Innovation and Development Center
SIP	State Implementation Plan
SO_x	sulfur oxides
STEF	Space Test and Evaluation Facility
T&E	threatened and endangered species
U.S.	United States
U.S.C.	United States Code
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound

1. PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

The United States Air Force (USAF) proposes to construct facilities to support existing and future missions, provide base support, and improve the quality of life at Schriever Air Force Base (AFB) in accordance with the General Plan. Implementing the General Plan evaluated in this environmental assessment (EA) is generally intended to allow USAF units to carry out their assigned responsibilities in ways that fully satisfy mission requirements, foster safe operational practices, and protect human health and the environment.

The *National Environmental Policy Act* (NEPA) of 1969, as amended, requires Federal agencies to consider environmental consequences in their decision-making process. The President's Council on Environmental Quality (CEQ) issued regulations to implement NEPA that include provisions for both the content and procedural aspects of the required environmental analysis. The Air Force is preparing this EA through adherence to procedures set forth in the CEQ regulations (Title 40 Code of Federal Regulations (CFR) 1500-1508) and 32 CFR 989, 15 Jul 99, and amended 22 Apr 2003 (*Air Force Environmental Impact Analysis Process*). These Federal regulations establish both the administrative process and substantive scope of the environmental impact evaluation, designed to ensure deciding authorities have a proper understanding of the potential environmental consequences of a contemplated course of action. This EA provides an analysis of potential environmental consequences that could result from implementing the General Plan over the next five years.

The remainder of this chapter describes the purpose of and need for the action and the location of the project area. Chapter 2 of this EA details the Proposed Action and Alternatives, Chapter 3 summarizes the characteristics of the Affected Environment, Chapter 4 presents the analysis of potential Environmental Consequences, Chapter 5 summarizes interagency coordination, Chapter 6 lists the EA's preparers, Chapter 7 lists the agencies, organizations, and persons contacted, and Chapter 8 provides the references cited throughout the EA. Appendix A contains interagency review letters on the Draft EA, and Appendix B presents the detailed air emissions estimates.

1.2 PURPOSE OF AND NEED FOR ACTION

In accordance with the Schriever AFB General Plan and more recent planning decisions, the proposed construction projects are necessary to support future mission growth and minimize security risks (through enhanced force protection) and to improve environmental quality, recreation opportunities, aesthetics, and the safety and medical functions on-base.

Schriever AFB was originally established as Falcon Air Force Station in 1983. The original base was located in what is now the Restricted Area (RA). Much of the RA is now developed. One of the goals of the General Plan is to locate only classified missions within the RA of the base and transition non-mission functions out of the RA within an orderly framework for development.

The General Plan is a summary document of the base comprehensive plan and is prepared in response to *Air Force Instruction* (AFI) 32-7062*, Air Force Comprehensive*

Planning, and AFI 32-7062 Air Force Space Command Supplement 1. The plan provides the 50th Space Wing senior leadership with a synopsis of those factors affecting the development of Schriever AFB. Plans and programs for future construction must follow the guidelines established in the General Plan, and the Schriever AFB Facilities Board (FB) must approve any deviations after coordination with Air Force Space Command.

The planning process consists of five major steps:

- *Standards* - Comprehensive Plan, Component Plans, and Special Plans establish standards from which to evaluate facilities and infrastructure conditions.

- *Existing Conditions* - Applying standards to existing facilities and infrastructure to provide a baseline from which requirements are developed.

- *Needs and requirements* - Needs and requirements are captured, their environmental impacts are assessed, and projects are justified.

- *Prioritized List* - Projects are prioritized by the Schriever AFB FB.

- *Execution Plan* - The Schriever AFB Five Year Plan is a comprehensive document that aligns planning, programming, budgeting, and execution of facility requirements with long-range goals and objectives.

1.3 LOCATION OF SCHRIEVER AFB AND THE ALTERNATIVES

Schriever AFB is situated along the Rocky Mountain Front Range about ten miles east of Colorado Springs; it is 7.5 miles west of the town of Ellicott and approximately 10 miles east of Peterson AFB. The base consists of a secure area (640 acres) surrounded by a buffer two miles by three miles (a total of 3,840 acres). The base is accessed from Colorado Highway 94 via Enoch Road, or from Bradley Road via Curtis Road and Irwin Road. Schriever AFB is surrounded by grasslands and ranches in a sparsely populated setting. Figure 1-1 shows the general location of Schriever AFB.

The proposed locations for development under the General Plan are within the RA, and south, west, north, and northeast of the RA (see Figure 1-2). The proposed sites for development range from nearly flat to rolling hills. These sites currently support short grass prairie which was formerly used for cattle grazing. Areas to the south and east of the Proposed Action sites are open space with no current plans for development. The area to the north (off-base) is currently undeveloped, but could potentially see residential development. A developer has begun constructing a private housing development within one mile of the west gate.

1.4 PUBLIC REVIEW PROCESS

A notice announcing the availability of the Draft EA for public review was published in the Colorado Springs *Gazette*. No comments were received on the Draft EA.

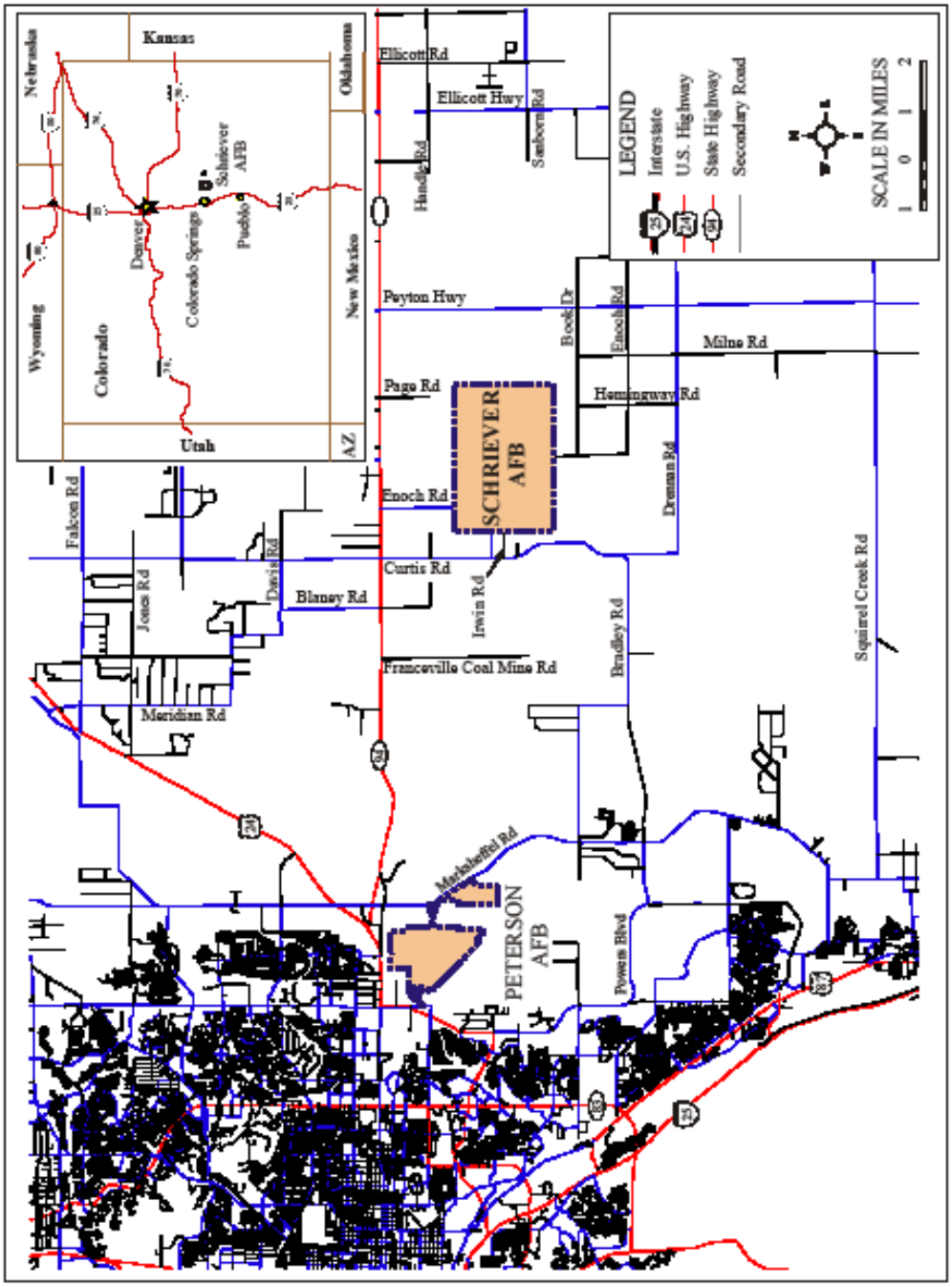

Figure 1-1 General Location of Schriever AFB

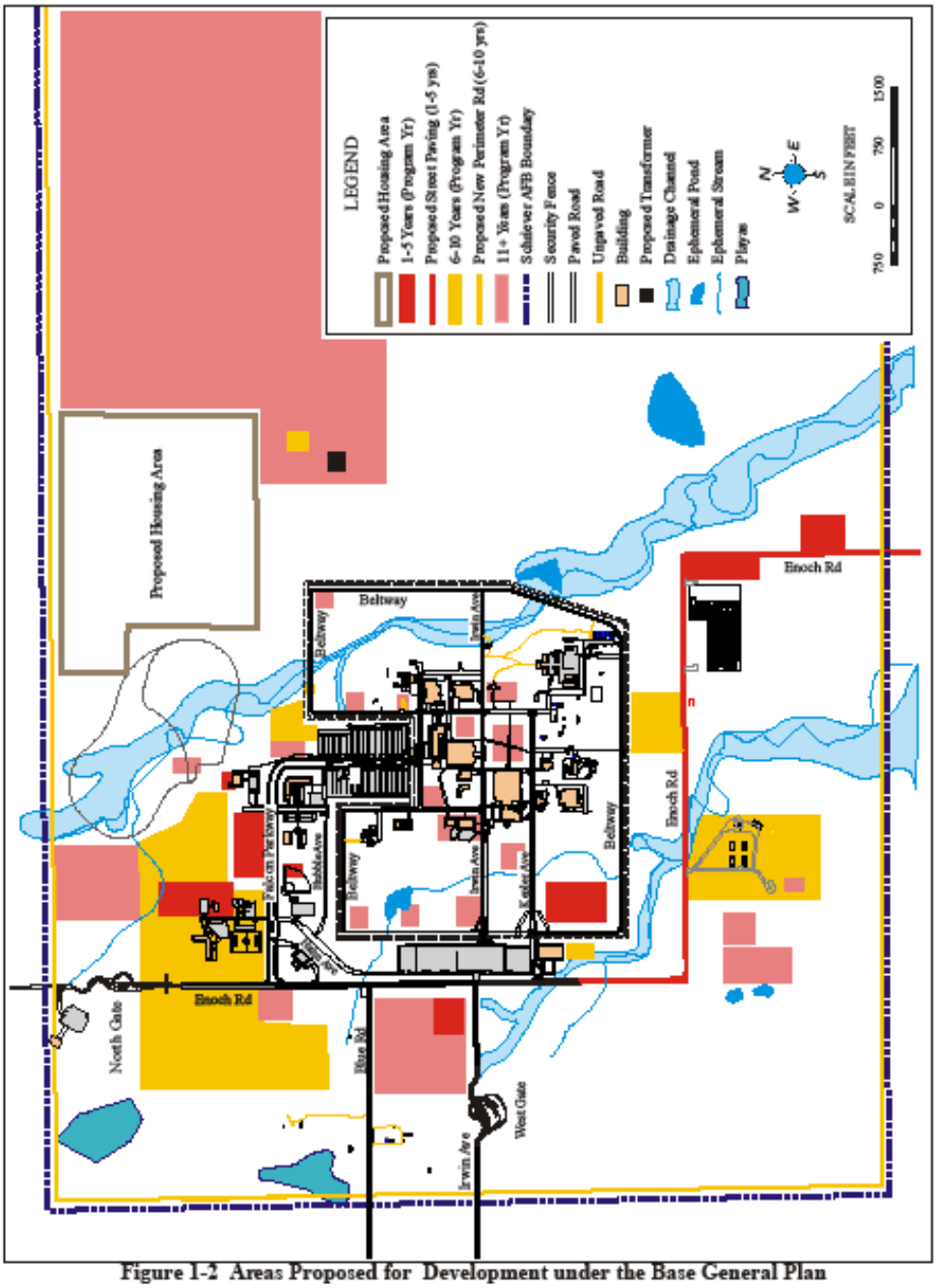

Figure 1-2 Areas Proposed for Development under the Base General Plan

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This section describes the No Action Alternative, the Proposed Action, and an Accelerated Construction Alternative.

2.1 ALTERNATIVE 1 — NO ACTION ALTERNATIVE

Under the No Action Alternative, new facilities for the base would not be constructed in accordance with the General Plan. The base would maintain existing facilities. However, this alternative would impair the base's ability to conduct current and future missions and to maintain and improve the quality of life for personnel at the base. Also, under a military family housing privatization initiative (previously evaluated in a separate EA), Schriever AFB will develop base housing in the near future; community facilities needed to support the proposed housing are part of the Proposed Action in this EA, but would not be provided under the No Action Alternative.

2.2 ALTERNATIVE 2 —PROPOSED ACTION

The Proposed Action is to construct facilities to ensure that adequate community support facilities exist at Schriever AFB, to support current and future mission requirements and population growth, to limit the RA to missions which require high levels of security, and to maintain appropriate force protection at the base.

In accordance with AFI 32-7062 and AFI 32-7062 Air Force Space Command Supplement 1, the General Plan outlines the planned development of the base over a period of 20 years. Much of the long range planning is subject to change, and the EA focuses on development in the next 5 years.

The Proposed Action is to improve infrastructure (utilities and roads) and construct facilities within the RA, south of the RA (in the vicinity of the current "800" area of buildings), west of the RA and Enoch Road, northwest of the RA (west of Enoch Road and the North Gate), north of the RA, and northeast of the RA. The following subsections describe the types of structures which could potentially be constructed in these areas, and the infrastructure requirements needed to develop facilities in these areas.

Within the RA

This area is substantially developed with mission and support facilities. The area is served by Irwin Avenue, Kepler Avenue, Beltway Road, and numerous access roads to facilities. Some of the western part of the RA is undeveloped grassland. The eastern part of the RA includes a drainageway which would limit development. The remainder of the RA contains buildings, parking lots, and other facilities.

The antenna farm for the Space Innovation and Development Center (SIDC) is proposed for the southwest corner of the RA, south of Kepler Avenue.

The southwest corner of the RA is currently served by all utilities.

South of the RA

This area is currently partially developed with industrial buildings (warehouses, recreational vehicle parking, and a fire training facility). The area is served by Enoch Road (gravel) and local gravel roads. Much of this area is undeveloped grassland.

Additional development in this area is projected to consist of industrial facilities (warehouses) to the west of the existing

buildings, training areas, and outdoor recreational uses to the east of the existing development in this area (see Figure 1-2).

There is currently electric and water supply in the area, but not natural gas. The area is served by sanitary sewers. Development in this area would be constrained by an ephemeral stream to the east of the existing buildings in this area (see Figure 1-2). Building height restrictions due to antenna look-angles range from 55 to 110 feet in this area. Development in this area would incorporate effective stormwater drainage. Design measures would be incorporated to reduce the velocity of flow before entering the nearby drainage.

West of the RA
This area is currently undeveloped grassland, with the exception of the West Gate and small industrial facilities in the vicinity of Blue Road (about 2,000 feet west of Enoch Road). The area is served by Irwin Avenue, Enoch Road, and Blue Road, all paved two-lane roads.

Projected development is anticipated to be primarily non-operational mission buildings, with supporting parking lots and access roads. The Space Innovation and Development Center (SIDC), to support the Space Warfare Center, is planned for this area (see Figure 1-2).

Some of the development, especially north of Blue Road is anticipated to consist of community commercial facilities.

Currently, there are electric, gas, and water lines east of Enoch Road. Leach fields are located near Blue Road.

Development constraints include drainageways south of Irwin Avenue and Enoch Road, a playa and small wetland north of Blue Road near the west boundary of the base, and a prairie dog community north of Irwin Avenue and west of Enoch Road (potentially including the burrowing owl, a protected species). Building height restrictions due to antenna look-angles range from 45 to 65 feet in this area. Development in this area would incorporate effective stormwater drainage.

Northwest of RA
This area is currently undeveloped grassland, with the exception of the North Gate. The area is served by Enoch Road, a paved two-lane road.

Projected development is anticipated to be primarily mission support (community) buildings, with supporting parking lots and access roads. Current plans are to extend Falcon Parkway to the western boundary of the base.

Currently, there are electric and gas lines west of Enoch Road, and a water line east of Enoch Road. Leach fields are located near Blue Road and to the east of Enoch Road and would be replaced by sanitary sewers when full development begins.

A playa near the northwest corner of the base would limit development in the area. Development in this area would incorporate effective stormwater drainage. Building height restrictions due to antenna look-angles range from 45 to 55 feet in this area.

North of RA
This area is partially developed with community facilities (child care, Army & Air Force Exchange Service (AAFES) service station, fitness center, running track). The land north of these facilities is undeveloped grassland. The area is served by Falcon Parkway and Hahn and Voyager Roads.

Projected development is anticipated to be additional community facilities and dormitories. Existing roads would be extended to the north to serve this area. Currently, there are electric, gas and water lines to existing development. These would be extended to serve additional development. There are sanitary sewer lines in the vicinity of development. These would also be extended as needed.

A stream with a drainage channel and steep topography near this drainage would limit development in this area. Development would incorporate effective stormwater drainage. Building height restrictions due to antenna look-angles range from 45 to 95 feet in this area.

Northeast of RA
This area is currently undeveloped grassland. There are no roads in this area.

This area is proposed to be developed as military family housing under the military family housing privatization initiative (this action was assessed in a separate EA). Under the current proposed action, a road would be developed just to the north of Schriever AFB and a separate entry control point would be constructed. Roads would also be developed to provide access to the housing. Support facilities for the housing would also be constructed in this area.

There are no utilities in this area. Under the proposed action, a private developer would extend utilities from offbase to support this area, with the exception of constructing a sanitary sewer line south from the housing area to the proposed Cherokee Metropolitan District sanitary sewer line on the south side of the base.

The only potential constraint to development in this area is the presence of black-tailed prairie dogs and the potential presence of the burrowing owl. Development in this area would incorporate effective stormwater drainage. Building height restrictions due to antenna look-angles range from 45 to 100 feet in this area.

2.3 ALTERNATIVE 3 — ACCELERATED CONSTRUCTION

An alternative to the Proposed Action is constructing facilities at a more rapid pace than the General Plan indicates. Community facilities would be needed to support the proposed military family housing northeast of the RA. For example, the proposed fire station near the proposed housing could potentially be constructed earlier than the currently projected 6 to 10 years. Other facilities – such as a base exchange or AAFES mini-mall, chapel and social services complex, or a library or theater – could also be constructed sooner than anticipated. This alternative would include the same facilities and infrastructure as the Proposed Action, but could potentially be constructed earlier than currently proposed.

2.4 COMPARISON OF ENVIRONMENTAL CONSEQUENCES

The potential impacts of the Proposed Action and alternatives were evaluated and are described in Chapter 4.

The intensity of an impact can be "significant" or "not significant", as defined by 40 CFR 1508.27. Table 2-1 summarizes the environmental consequences for each resource area under the No Action Alternative, Proposed Action, and Accelerated Construction Alternative.

Table 2-1 Summary of Environmental Consequences			
Resource	***No Action Alternative***	***Proposed Action***	***Accelerated Construction Alternative***
Cultural Resources	No impact.	No impact.	No impact.
Solid and Hazardous Wastes	No impact.	No significant impact.	No significant impact.
Human Health and Safety	No impact.	No impact.	No impact.
Socio-economics	No impact.	No significant impact.	No significant impact.
Visual Resources	No impact.	No impact.	No impact.
Air Quality	No change in current level of emissions.	ST* but not significant impacts from construction and operation of the proposed facilities, conforms to the SIP*, base would remain below thresholds for PSD* review; impacts not significant.	ST but not significant impacts from construction and operation of the proposed facilities, conforms to the SIP, base would remain below thresholds for PSD review; impacts not significant.
Geological Resources	No impact.	ST but not significant disturbance to soils; no LT* impact. ST but not significant impact to underlying geological layers; no LT impact.	ST but not significant disturbance to soils; no LT* impact. ST but not significant impact to underlying geological layers; no LT impact.
Water Resources	No impact.	Stormwater drainage patterns would be considered and addressed in design of specific projects. No impacts to groundwater or surface water.	Stormwater drainage patterns would be considered and addressed in design of specific projects. No impacts to groundwater or surface water.
Biological Resources	No impact.	ST but not significant impact to vegetation from construction; no LT impact. ST but not significant impact to wildlife from habitat disturbance; no LT impact. No impacts to T&E* species.	ST but not significant impact to vegetation from construction; no LT impact. ST but not significant impact to wildlife from habitat disturbance; no LT impact. No impacts to T&E* species.
Noise	No impact.	ST construction noise may cause annoyance, not a significant impact; no LT impact.	ST construction noise may cause annoyance, not a significant impact; no LT impact.
Environmental Justice	No impacts.	No impacts to minority populations, low-income populations, or children.	No impacts to minority populations, low-income populations, or children.

*ST = short term
LT = long term
SIP = state implementation plan
PSD = prevention of significant deterioration
T&E = threatened and endangered species

3. AFFECTED ENVIRONMENT

This chapter describes the existing condition of resources at Schriever AFB, laying the groundwork for the discussions in Chapter 4 of the potential for environmental impacts to each resource.

Cultural Resources
Cultural resources are archaeological and historical items or places considered important to a culture, community, tradition, religion, or science. Schriever AFB has been completely surveyed for historic and archaeological resources. Five separate surveys were conducted between 1982 and 1997, including Cold War historic sites. Since the surveys did not identify any sites within the boundaries of the base eligible for the National Register of Historic Places (USAF, 2004), cultural resources were not further analyzed in this EA. Should unidentified archaeological resources be discovered during construction activities, work would halt until the resources could be evaluated in terms of the National Register criteria (36 CFR 60.4), in consultation with the Colorado Historical Society.

Socioeconomics
Socioeconomics are defined as the basic attributes and resources associated with the human environment, particularly population, housing, and economic activity. There would be small beneficial impacts to local employment and income from construction of the proposed facilities. Overall impacts to the local economy would be small, but beneficial, and were not further analyzed.

Visual Resources
Visual resources are defined as the natural and manufactured features that constitute the aesthetic qualities of an area. These features form the overall impression that an observer receives of an area. The visual environment at Schriever AFB is characteristic of a military installation and the sites for proposed construction are near existing buildings in the main installation area. Constructing the planned facilities would be visually compatible with existing structures and would not significantly impact visual resources. Visual resources were not further analyzed.

Solid Waste
Solid wastes include all waste materials that are neither hazardous nor toxic, and which are normally disposed of by landfilling or incineration, or are recycled or recovered. There are no active landfills on base; solid waste is taken by a contractor to the Colorado Springs landfill (USAF, 2003). There is adequate existing and planned capacity to dispose of solid waste in El Paso County. The Proposed Action and Alternative 3 do not include any demolition of facilities. Solid waste generated during construction would be minimal and would be recycled to the extent practical under existing programs and any remaining waste would be disposed of at the Colorado Springs landfill. Impacts would not be significant, and solid waste was not further analyzed.

Hazardous Materials and Wastes
Hazardous materials are substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present a substantial danger to public health or the environment if released. The use or release of a hazardous material usually results in the generation of a hazardous waste. Only small amounts of hazardous materials (such as sealants) would be utilized in construction of the proposed facilities, and any hazardous waste generated would be disposed of in accordance with applicable regulations. No building demolition is part of the Proposed

Action or Alternatives; therefore, lead-based paint and asbestos are not an issue. Hazardous materials and wastes were not further analyzed.

Human Health and Safety
Construction activities could be associated with the potential for health risks due to hazardous materials that may become airborne; risks associated with temporary increases in heavy equipment; occupational risks associated with construction zones in general (including trip and fall hazards and noise hazards); and unauthorized entrance to construction areas (with associated potential for injury) by members of the public (particularly children). These safety risks would be short-term, ceasing after construction activities are completed. Additionally, these safety risks can be minimized through the use of water sprays, industry standard occupational protective measures (such as fall protection and hearing protection), and other standard construction management practices. Implementation of measures to restrict access to construction sites may deter children from entering such areas during work and non-work hours. Human health and safety impacts are expected to be negligible, and were not further analyzed in this EA.

The resources that were evaluated in detail in this EA are air, geology and soils, water, vegetation and wildlife, noise, and environmental justice.

3.1 AIR RESOURCES

This section discusses the climate and meteorology of the area, air quality standards, existing air pollutant sources, and regional air quality. The air quality of an area at any given time depends on the meteorological conditions (temperature, wind speed and direction, and temperature inversions), the amount and type of pollutants in the atmosphere, and the geographic setting of the area (in particular, features such as mountains or basins which inhibit the dispersion of pollutants). Pollutant concentrations are generally highest with a calm atmosphere or with a strong temperature inversion, where pollutants are trapped near the surface by warm air aloft. These conditions are more common in the autumn and winter.

3.1.1 Climate and Meteorology

Schriever AFB is located near the border of the Great Plains and the Front Range of the Rocky Mountains, which results in a moderate semi-arid climate. The average July temperature is 70° F and the average January temperature is 28° F. The area is subject to thunderstorms and heavy rainfall, which primarily occur from May through August. Mean precipitation is about 17.40 inches per year. Most rain occurs from March through September, with peak rainfall occurring in August (NWS, 2005). The most rainfall in a 24-hour period was 3.98 inches, which occurred in August 1999. Total annual potential evaporation is about 25 inches. Relative humidity ranges from about 55 percent in early morning to 35 percent in the early afternoon. Prevailing winds are predominantly from the north throughout the year. Wind speeds usually range from 7 to 10 knots (8 to 12 miles per hour), with the highest speeds occurring in the spring and the lowest in late summer and early fall. The maximum wind gust reported at the Colorado Springs Airport was 78 miles per hour in 1999 (NWS, 1997-2005; NCDC, 1998).

3.1.2 Air Quality Standards and Permit Requirements

The National Ambient Air Quality Standards (NAAQS), established by the U.S. Environmental Protection Agency (USEPA) and adopted by the Colorado Department of Public Health and Environment (CDPHE), define the maximum allowable concentrations of pollutants that may be reached but not exceeded within a given time period; see Table 3-1. These standards were selected to protect human health with a reasonable margin of safety. Section 110 of the *Clean Air Act* (CAA) requires states to develop air pollution regulations and control strategies to ensure that state air quality meets the NAAQS established by USEPA. These ambient standards are established under Section 109 of the CAA, and they currently address six criteria pollutants: carbon monoxide (CO), nitrogen dioxide, ozone, lead, particulate matter, and sulfur dioxide. Particulate matter has been further defined by size. There are standards for PM_{10} and particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$). Each state must submit these regulations and control strategies for approval and incorporation into the federally enforceable SIP. Exceeding the concentration levels within a given time period is a violation and constitutes a nonattainment of the pollutant standard.

Limits for other criteria pollutants apply only to permanent stationary sources installed during construction. These limits are specified for attainment or nonattainment areas (5 CCR 1001, Regulation 3, Part A, II.B.62.a) and are two tons per year of any pollutant in an attainment area.

Stationary sources of emissions are categorized as major or minor. A major source emits, or has the potential to emit, 100 tons per year of any air pollutant (40 CFR 52.21, 5 Colorado Code of Regulations (CCR) 1001, Regulation 3, Part A, Section I.B.23.b). A minor source emits or has the potential to emit less than 100 tons per year of any pollutant. Under Title V of the CAA, a major source must obtain an operating permit. Minor sources do not need an operating permit; however, if they emit two tons per year or more of a pollutant, they are required to submit an Air Pollutant Emission Notice (APEN).

Hazardous air pollutants (HAPs) are regulated under 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), and 40 CFR 63, NESHAP for Source Categories. A major source, defined as one emitting, or having the potential to emit, 10 tons per year of any single HAP or 25 tons per year total HAPs, requires a permit, and as specified in 40 CFR 63, the implementation of maximum achievable control technology. A minor source is defined as one emitting, or having the potential to emit, less than 10 tons per year of any single HAP or 25 tons per year total HAPs. Minor sources of HAPs whose emissions exceed the threshold defined in CCR 1001, Regulation 3, Appendix A are required to obtain an APEN; this threshold ranges from 50 to 5,000 pounds per year depending on the elevation of the release point above ground level, the distance from the source to the property boundary, the emission point as defined in Section II.B.4 of the regulation (a single point or a composite of multiple points), and the type of HAP (as classified in Appendix B of the regulation).

Particulate matter (PM_{10} and $PM_{2.5}$) is generated during ground disturbing activities and during combustion. El Paso County requires an air emissions permit and

Table 3-1
National Ambient Air Quality Standards (NAAQS)
and Colorado Ambient Air Quality Standards (CAAQS)

Pollutant	***Averaging Time***	***NAAQS µg/m³ (ppm)[a]***		***CAAQS***
		Primary[b]	***Secondary[c]***	
Ozone	1 hour 8 hours	235 (0.12) 157 (0.08)	Same Same	Same
CO	1 hour 8 hours	40,000 (35) 10,000 (9)	None None	Same
Nitrogen dioxide	AAM[d]	100 (0.053)	Same	Same
Sulfur dioxide	3 hours 24 hours AAM	None 365 (0.14) 80 (0.03)	1,300 (0.5) none none	700 µg/m³ 100 µg/m³ 15 µg/m³
PM_{10}	AAM 24 hours	50 150	Same Same	Same Same
$PM_{2.5}$	AAM 24 hours	65 15	Same Same	None
Lead	¼ year	1.5	Same	Same

[a] µg/m³ — micrograms per cubic meter; ppm — parts per million
[b] National Primary Standards establish the level of air quality necessary to protect the public health from any known or anticipated adverse effects of a pollutant, allowing a margin of safety to protect sensitive members of the population.
[c] National Secondary Standards establish the level of air quality necessary to protect the public welfare by preventing injury to agricultural crops and livestock, deterioration of materials and property, and adverse impacts on the environment.
[d] AAM — annual arithmetic mean
Source: 40 CFR 50; 5 CCR 1001, Regulation 14.

approval of an emission control plan that would limit fugitive dust emissions.

If this ground is disturbed for more than 6 months, or is 25 acres or more in size, a Colorado APEN is also required. The APEN would require specific measures to control fugitive dust to the extent technically feasible and economically reasonable. Specific measures are required for onsite unpaved roads (watering, chemical stabilizers, limiting vehicle speeds, or gravelling), controlling dust from disturbed areas (watering, chemical stabilizers, limiting vehicle speeds, revegetation, furrows, wind breaks, temporary compaction, or synthetic or natural covering, such as netting or mulching), and preventing mud and dirt from being carried out onto paved roads (gravel entryways, washing vehicle wheels, or street cleaning).

3.1.3 Regional Air Quality

Schriever AFB is located in the Colorado Springs Metropolitan Area, which lies within the San Isabel Intrastate Air Quality Control Region. The region is currently in attainment for all criteria pollutants, but has only been in attainment for CO since 1999 (CDPHE, 2003). As part of the redesignation as an attainment area, the Colorado Springs area is under a maintenance plan (last revised in 2003) until 2015 to demonstrate compliance with the CO standard. Under this maintenance plan, implemented under a SIP and approved by the USEPA, the Colorado Springs maintenance area has a mobile sources emissions budget of 270 tons per day of CO through 2009 and 531 tons per day from 2010 to 2015 (CDPHE, 2003).

The emission budget for construction non-road sources is 2.83 tons per day in 2007. The emission budget for point sources (emissions from vents and smokestacks, including natural gas combustion), is 3.34 tons per day in 2007 and 3.84 tons per day in 2010 (CDPHE, 2003).

According to the latest monitoring and trends report prepared by the Pikes Peak Area Council of Governments (PPACG, 2005), emissions of CO have declined since violations of the standard in 1988. Eight-hour average monitoring results are 4 ppm or less (compared to the eight-hour standard of 9.5 ppm). Emissions of other criteria pollutants are also well below standards, with the exception of ozone. The three-year average of the annual 4th-highest eight-hour average ozone level (this is the value used to determine compliance with standard) has remained at about 85% of the standard (0.088 ppm) (CDPHE, 2006).

3.1.4 Schriever AFB Air Emissions

Schriever AFB completed an Air Emissions Inventory for calendar year 2005 (USAF, 2006a). The installation-wide criteria pollutant totals (actual and potential emissions) are shown in Table 3-2. As defined in 40 CFR 52.21, the potential to emit is the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. For purposes of potential to emit calculations, operating hours for emergency equipment (such as emergency generators) are limited to 500 hours per year by the USEPA. Schriever AFB has chosen to limit its total actual and potential emissions to less than 100 tons under a synthetic minor operating permit (95 EP772, Modification 3), approved by the Colorado Air Pollution Control Division on April 19, 2005. This permit contains federally enforceable limits on emissions from stationary sources requiring an APEN (permitted sources). These permitted sources include 4 boilers

Table 3-2
2005 Air Pollutant Emissions at Schriever AFB
(values in tons per year)

	PM_{10}	$PM_{2.5}$	SO_x [1]	NO_x [1]	VOCs [1]	CO	HAPs
Actual Emissions							
Stationary, Permitted [2]	0.30	0.28	1.20	10.0	5.63	3.61	0.49
Stationary, Non-permitted	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Total Stationary	**0.72**	**0.70**	**1.32**	**15.03**	**7.36**	**17.62**	**0.62**
Potential to Emit							
Stationary, Permitted[1]	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Permit limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Stationary, Non-permitted	7.86	7.86	10.54	102.19	42.46	684.02	0.62
Total Stationary	**9.36**	**9.22**	**18.40**	**165.45**	**50.16**	**701.88**	**1.21**

[1] SO_x = sulfur oxides, NO_x = nitrogen oxides, VOCs = volatile organic compounds
[2] Permitted under Colorado Construction Permit finalized on April 19, 2005.
Sources: USAF, 2006a; CDPHE, 2005

and 13 diesel generators at the base. Many of the stationary sources at Schriever AFB do not require a permit to operate because the criteria pollutants they generate are below the threshold of 2 tons per year.

The base is not subject to the PSD review requirements of 40 CFR 52.21 and CCR Title 5, Chapter 1001, Regulation 3, Part B, Section IV.D.3 because the actual or potential emission of any criteria pollutant does not exceed 250 tons per year.

The main stationary sources of emissions at Schriever AFB are the seven large generators at the Central Utilities Plant, which combust diesel fuel. The largest source of potential CO emissions is small equipment (non-permitted sources). Schriever AFB is a minor source of HAPs, with actual emissions of 0.9 tons per year and the potential to emit 1.9 tons per year. HAPs emissions are below the thresholds for specific requirements under 40 CFR 61 and 63 for source categories.

Prescribed burning is used in some areas of the base to enhance habitat for native short grass prairie species of plants and animals, to reduce invasive weed species, and to maintain short grass cover for security specifications. Prescribed burning generates particulate matter, VOCs, NO_x, and CO for the duration of the burning, generally a few hours. Approximately 1,000 acres are expected to be burned over a decade. In some years, no burns will be prescribed in consideration of drought conditions, burn bans, or other factors.

3.2 GEOLOGICAL RESOURCES

Geological resources discussed in this section include physical features of the earth such as geology (surface and subsurface features), topography, and soils.

3.2.1 Geology

The project area is situated in the Colorado Piedmont section of the Great Plains Physiographic Province. The Southern Rocky Mountain Physiographic Province is located about 18 miles to the west. The Colorado Piedmont is a mature elevated plain, dissected by numerous streams. In the local area, this includes Chico and Black Squirrel Creeks and their tributaries.

The base is underlain by about 25 to 100 feet of Quaternary alluvium (primarily sand and gravel) from tributaries of the Arkansas River (EPCPD, 2003). These deposits are underlain by the Arapahoe Formation, which consists of a 200 foot-thick sequence of interbedded conglomerate, sandstone, siltstone, and shale. The deposits of the Laramie and Fox Hills Formations underlie the Arapahoe Formation. The Laramie Formation (500 to 600 feet thick) is composed of sandstone and shale. The sandstone is fine to medium texture, friable, and carbonaceous. The Fox Hills Formation, about 100 feet thick, consists of sandstone and siltstone interbedded with shale. Pierre Shale underlies the Laramie-Fox Hills Formation (USGS, 1984).

Deposits of sand and gravel are common in El Paso County. However, most of these are unsuited for commercial use and are rated as poor for fill material (USDA, 1981).

There are no major faults in the Colorado Springs vicinity; the nearest major faults are located about 75 to 100 miles from the area (USGS, 2002; USGS, 2004).

- The Northern Sangro de Cristo Fault, with a characteristic magnitude (the anticipated magnitude of an earthquake based on fault geology and stress in the fault) of 7.5, is

located about 90 miles southwest of the project area.

- The Sawatch Range Fault, with a characteristic magnitude of 7.2, is located about 100 miles southwest of the project area.

- The Poncha Pass Fault, with a characteristic magnitude of 6.9, is about 75 miles to the southwest.

- The Cheraw Fault, with a characteristic magnitude of 7.1, is located about 90 miles southeast of the project area.

The U.S. Geological Survey (USGS) calculates the probability of potential ground motion from faults and earthquake events in an area, compared to the motion of an object falling due to gravity. At Schriever AFB, there is a 10% chance that a peak acceleration of 3.5% of gravity would be exceeded in 50 years (USGS 2003). This would approximately equal a value of V to VI on the Modified Mercalli Scale for earthquake intensity. Earthquakes of this magnitude would typically cause breakage of windows or plaster or other slight damage. On average, this would equal magnitudes in the range of 4.0 to 4.4 on the Richter Scale (this is variable depending on the proximity of the earthquake to the site). Since 1973, there have been 10 earthquakes within 100 kilometers (62 miles) of the base, with magnitudes ranging from 2.2 to 4.0 (USGS, 2005; USGS, 2006a).

3.2.2 Topography

The topography at Schriever AFB consists of gently sloping plains to rolling hills, dissected by stream channels. Several depressions are scattered through out the northwest, southwest, north central, and south central areas of the base. Elevations range from about 6,380 feet near the northwest corner of the base to about 6,095 feet at the southeast corner of the base. Slopes are generally to the south and southeast (USAF, 2005a).

Restricted Area
Topography within the RA is characterized by a gently sloping plain dissected by several stream channels. Elevations range from about 6,290 feet to about 6,220 feet. Slopes are generally to the southeast at 4 to 6 percent, with the exception of two stream channels where slope orientation is variable and slope angles are steeper.

South of Restricted Area
Topography varies from gently to moderately sloping hills (2 to 6 percent slope) to steep slopes near drainageways (up to 20 percent slope). Elevations range from about 6,245 to 6,200 feet. Slopes are generally to the southeast and east, but vary near drainageways.

West of Restricted Area
The land generally slopes to the south and southeast at slopes of 2 to 6 percent. An ephemeral stream has cut a small drainageway at the southern end of this area, with somewhat steeper slopes near Enoch Road south of Irwin Avenue. Elevations are between 6,350 and 6,250 feet.

North and Northwest of Restricted Area
The topography in this area consists of gently to moderately sloping hills (slopes of 2 to 6 percent toward the east and southeast). A drainageway has cut a channel near the eastern end of this area, where slopes are between 10 and 20 percent. Elevations range from 6,380 feet near the northwest corner of the base to about 6,265 feet near the drainageway north of the RA.

Northeast of the Restricted Area
Slopes are generally to the east and southeast at 1 to 6 percent in this area of uplands and

rolling hills. Elevations range from 6,340 feet in the north central part of the base to 6,165 feet near the northeast corner of the base.

3.2.3 Soils

Soils at Schriever AFB were formed in arkosic (derived from quartz and feldspar-rich granite) sedimentary rocks derived from windblown and stream-deposited sediment. There are 11 soil series at the base, as defined by the U.S. Department of Agriculture (USDA, 2004); eight of these would be potentially affected by the proposed action (USDA, 2004). All of these soils are well drained to somewhat excessively drained. Water moves through these soils at a moderate to rapid rate. The depth to the water table (the upper limit where the soil or rock material is saturated with water) is six feet or greater in all of these soils. The following paragraphs describe the potentially affected soils, and Table 3-3 summarizes the physical properties of these soils.

- **Ascalon sandy loam, 1 to 3 percent slope**. This well drained soil, composed of mixed alluvium and wind-deposited material, is located on uplands. This soil is widespread at Schriever AFB, covering much of the western half of the base. These soils consist of sandy loam from 0 to 6 inches deep, sandy clay loam from 6 to 21 inches, sandy clay loam, loam and sandy loam from 21 to 27 inches, and fine sandy loam, sandy loam and loamy sand from 27 inches to a depth of 60 inches. The shrink-swell potential, a measure of potential changes in soil volume due to varying moisture conditions, is low to moderate. Permeability of the soil is moderate and runoff is slow. However, in brief heavy storms, runoff is greater, and due to the texture of the soils, overland flow can cause erosion in areas where vegetation is disturbed. Additional properties of this soil are shown in Table 3-3.

- **Ascalon sandy loam, 3 to 9 percent slope**. This soil is similar to Ascalon sandy loam, 1 to 3 percent slopes, with the exception of steeper slopes and slow to medium runoff.

- **Blakeland loamy sand, 1 to 9 percent slope.** This somewhat excessively drained soil, formed from alluvium and wind-deposited material, is located on uplands. It occurs in the northeast part of the base. These soils consist of loamy sand from 0 to 11 inches deep, and loamy sand, loamy coarse sand, and sand from 11 inches to 60 inches. The shrink-swell potential is low. Permeability of the soil is rapid and runoff is slow. However, in brief heavy storms, runoff is greater and, due to the texture of the soils, overland flow can cause erosion in areas where vegetation is disturbed. Additional properties of this soil are shown in Table 3-3.

- **Blendon sandy loam, 0 to 3 percent slope.** This well drained soil formed in alluvium and is located on alluvial fans and terraces. This soil occurs in a narrow strip near the eastern edge and north of the RA. This soil consists of sandy loam from 0 to 10 inches, sandy loam and fine sandy loam from 10 to 36 inches, and gravelly sandy loam from 36 to 60 inches. The shrink-swell potential is low. Permeability of the soil is moderately rapid and runoff is slow.

- **Bresser sandy loam, 0 to 3 percent slope.** This well drained soil formed in alluvium and is located on terraces and uplands. This soil occurs in the east and northeast parts of the base. It consists of sandy loam from 0 to 8 inches, sandy clay loam and clay loam from 8 to 27 inches,

Table 3-3
Soils in the Affected Area

Soil Series	Slope	Runoff	Wind erosion	Water erosion	Construction limits
2 Ascalon sandy loam	1-3 %	Slow	Moderate	Moderate	Moderate – low strength, shrink-swell[1], frost action[2]
3 Ascalon sandy loam	3-9 %	Slow to medium	Moderate	Moderate	Moderate – low strength, shrink-swell, frost action, slope
8 Blakeland loamy sand	1-9 %	Slow	Severe	Moderate	Slight to moderate – slope, severe limits for excavation – cave ins
10 Blendon sandy loam	0-3 %	Slow	Moderate	Moderate	Slight to moderate – low strength, frost action
11 Bresser sandy loam	0-3 %	Slow	Moderate	Slight to moderate	Slight
12 Bresser sandy loam	3-5 %	Slow	Moderate	Slight to moderate	Slight
28 Ellicott loamy coarse sand	0-5 %	Slow	Severe	Slight	Severe – flooding, cave ins
78 Sampson loam	0-3 %	Slow	Slight	Slight	Moderate – low strength, shrink-swell, frost action
97 Truckton sandy loam	3-9 %	Slow to medium	Moderate	Moderate	Slight to moderate – slope, frost action

[1] Shrink-swell is the potential change in soil volume due to varying moisture conditions.
[2] Frost action is the freezing and thawing of soil moisture; with moderate to high moisture content, they expand as they freeze and have low strength as they thaw.
The number preceding the soil series name is the U.S. Department of Agriculture (USDA) number designation for each soil.

and loamy sand and loamy coarse sand from 27 to 60 inches. The shrink-swell potential is low. Permeability of the soil is moderate and runoff is slow.

- **Bresser sandy loam, 3 to 5 percent slope.** This soil is similar to Bresser sandy loam, 0 to 3 percent slopes, with the exception of steeper slopes.

- **Ellicott loamy coarse sand, 0 to 5 percent slopes.** This somewhat excessively drained soil formed in alluvium and is located in floodplains and on terraces. This soil occurs in and near a drainageway in the south central part of the base. It consists of loamy coarse sand from 0 to 4 inches, and coarse sand and sandy loam from 4 to 60 inches. The shrink-swell potential is low. Permeability of the soil is moderate and runoff is slow. This soil periodically floods, briefly, between March and June.

- **Sampson loam**. This well-drained soil formed in alluvium and is located on terraces, alluvial fans, and small closed basins. It is located in the southwest part of the base. This soil consists of loam from 0 to 15 inches, clay loam, loam, and sandy clay loam from 15 to 34 inches, and loam, sandy loam, and sandy clay loam from 34 to 60 inches. The shrink-swell potential is moderate. Permeability of the soil is moderate and runoff is slow.

- **Truckton sandy loam.** This well drained soil formed in alluvium and is located in upland areas. It is located in the north-central and northeast parts of the base. This soil consists of sandy loam from 0 to 24 inches, and coarse sandy loam and loamy coarse sand from 24 to 60 inches. The shrink-swell potential is low. Permeability of the soil is moderate and runoff is slow.

Development of buildings and facilities at Schriever AFB has resulted in increasing amounts of impermeable surface which has increased the potential for erosion within and near developed areas.

3.3 WATER RESOURCES

None of the streams on Schriever AFB are waters of the United States (USAF, 2005b).

Water resources include surface and groundwater sources, quantity, and quality. The hydrologic cycle results in the transport of water into various media such as the air, the ground surface, and subsurface. Natural and human-induced factors determine the quality of water resources. Water resources discussed in this section include groundwater, surface water (including storm water runoff), floodplains, and wetlands.

3.3.1 Groundwater

The principal unconfined aquifer in the general vicinity of Schriever AFB is in the alluvial sediments of the Chico and Black Squirrel Creeks. However, according to the El Paso County Planning Department, the area directly underlying Schriever AFB includes minor or no water-bearing formations (EPCPD, 2003). The proposed sites to be developed under the Base General Plan are underlain by about 25 to 100 feet of Quaternary alluvium (primarily sand and gravel) from tributaries of the Arkansas River (EPCPD, 2003; USGS, 1984, USGS, 1995a). Groundwater was not encountered in soil borings at a depth of 15 feet (USAF, 2006b). The depth to groundwater at the base is not known; however, the depth to groundwater in the vicinity is about 40 to 50 feet (USGS, 2006b; CDWR, 2006). Groundwater in this alluvial aquifer flows to

the south towards Chico Creek and east towards Black Squirrel Creek.

Schriever AFB is near the southern edge of the Denver Aquifer system (USGS, 1984; EPCPD, 2003). The aquifer system underlies an area of about 7,000 square miles that extends from Greeley south to near Colorado Springs and from the Front Range east to near Limon. This aquifer system is composed of four aquifers (Dawson, Denver, Arapahoe, and Laramie-Fox Hills) in five geologic formations and is up to 3,000 feet thick. These formations are deepest in the central part of the aquifer, and shallow near the edges, outcropping in concentric circles at the edges of the Denver Basin. At the outer edge of the system lies the Laramie-Fox Hills Aquifer, which underlies Schriever AFB. The Arapahoe Aquifer also underlies Schriever AFB. The Denver Aquifer underlies about 32 acres of the northern edge of Schriever AFB and the Dawson Aquifer is about nine miles to the north (EPCPD, 2003; USGS, 1995b).

The deposits of the Laramie and Fox Hills Formations underlie the Arapahoe Formation. The Laramie Formation (about 500 feet thick) is composed of sandstone and shale. The sandstone is fine to medium, friable, and carbonaceous. The Fox Hills Formation is composed of sandstone and siltstone interbedded with shale. Pierre Shale underlies the Laramie-Fox Hills Formation (USGS, 1984; USGS 1995b).The Arapahoe Formation underlies the alluvial sediment, and consists of a 200 foot-thick sequence of interbedded conglomerate, sandstone, siltstone, and shale in the vicinity of Schriever AFB.

The Laramie-Fox Hills Aquifer varies between 50 and 300 feet in thickness and is about 300 feet deep in the vicinity of Schriever AFB (USGS, 1984; USGS, 1995b). Water yields in the Laramie-Fox Hills Aquifer are low, and therefore have not been used extensively as water supplies. Water taken from some areas of the Laramie-Fox Hills Aquifer can be of marginal value due to oxygen deficient conditions which give rise to hydrogen sulfide and methane gases (USGS, 1995b). Water in the Arapahoe Aquifer generally is a sodium bicarbonate or sodium sulfate type. The dissolved-solids concentrations of the water generally range from 200 to 400 milligrams per liter in the vicinity of Schriever AFB.

The Denver Basin is recharged principally by the downward percolation of only a small part of the area's precipitation (USGS, 1995b). Groundwater flow in both the Arapahoe Aquifer and the Laramie-Fox Hills Aquifer is toward the north-northeast.

Most water wells in the vicinity of Schriever AFB obtain water from the alluvial aquifers. Some wells draw water from the Arapahoe and Laramie-Fox Aquifers. There are about 41 water wells (off-base) within a mile of Schriever AFB and 17 on-base wells. Most of these wells were used for stock watering and domestic supply. Four of these wells were used for monitoring water quality (CDWR, 2006). Schriever AFB has no subsurface water rights; therefore any wells within the proposed project area will not be pumped. Schriever AFB obtains its water supply from Cherokee Metropolitan District, which owns the12 wells east of the base that draw water from the alluvial aquifer of the Black Squirrel Creek.

3.3.2 Surface Water

Schriever AFB is located in a semi-arid environment, which is typified by a limited number of perennial streams (those with water flows above the stream bed year

round) and an abundance of intermittent (none of which are on-base) and ephemeral streams. Intermittent streams are characterized by a water flow above the stream bed in some portions of the stream or during some months of the year, where the water table is above the level of the stream bed. Ephemeral streams are not connected with the water table, but flow only during or after precipitation or snowmelt. The water level in ephemeral streams often rises quickly and causes substantial erosion or deposition of sediment.

Schriever AFB lies within the Chico Creek Watershed (USGS hydrologic unit catalog 11020004), which drains into the Arkansas River (located about 35 miles to the south of the project area). Chico Creek, an intermittent stream, heads about 1.7 miles southwest of the base and flows into the Arkansas River. Black Squirrel Creek, an intermittent stream, heads about 15 miles northwest of the base, flows about 6 miles east of the base, and flows into Chico Creek about 25 miles south of the base. Two on-base streams flow from north to south through the RA and then south of Schriever AFB (see Figure 1-2). Another stream, a tributary of the West Fork of the Black Squirrel Creek, heads about 2 miles north of Schriever AFB and flows just inside the northeast corner of the base before joining Black Squirrel Creek southeast of the base. These streams have cut channels as deep as 15 feet from the surrounding land. They flow about 7 miles south of the base where they discharge into the ground near Chico Creek (EPCPD, 2003; USGS, 1975a; USGS, 1975b).

There are several ephemeral tributaries to Black Squirrel Creek in the area. The unnamed tributary has a low flow of zero. Schriever AFB is the sole known point source contributor to the particular unnamed tributary.

There are storm water drainage ditches along Enoch Road and Irwin Avenue west of the restricted area. These ditches drain to a drainage channel about 750 feet south of the intersection of Irwin Avenue and Enoch Road. This drainage channel drains into an ephemeral stream.

Schriever AFB had sewage lagoon ponds south of the restricted area east of Sputnik Street. These lagoons were closed in 2003. Sampling performed at the time of closure indicated cadmium, molybdenum, benzene, and selenium over regulatory limits in the sewage sludge and below the liner. The sludge and soil were disposed of in a hazardous waste landfill and the area was regraded. One pond remains to collect outflow from chillers (Trenchik, 2006).

There are two playas (seasonal lakes) in the northwest part of the base. Two small ephemeral lakes are located in the southeastern corner of the base (USGS, 1975). There are also two ephemeral lakes east of the restricted area.

Thunderstorms can result in stream flows of several thousand cubic feet per second in these channels, causing temporary flooding of these waterways. The stream bed and banks are susceptible to erosion as they consist of sand with little or no vegetation, particularly the Ellicott loamy coarse sand found at the westernmost of the two streams south of the RA. Culverts have been constructed in these drainages in the improved and semi-improved land areas. Energy dissipation structures (such as concrete aprons and riprap) have been constructed at culvert openings and discharge points to minimize erosion. In addition, five erosion control dams have

been constructed north of the secure area (USAF, 2005a). Streams on and in the vicinity of Schriever AFB, including Chico Creek and Black Squirrel Creek, meet all water quality standards (USEPA, 2006).

3.3.3 Floodplains

Schriever AFB includes about 8.5 acres that are situated within the delineated 100-year floodplain for the West Fork of the Black Squirrel Creek, in the northeast corner of the installation. Another floodplain (of an intermittent tributary of Chico Creek) is about ½ mile southwest of the base. No construction is proposed within drainageways of streams. Development near streams would incorporate effective stormwater drainage, including design measures to reduce the velocity of flow before entering the nearby drainage. These floodplains would not be impacted by the proposed action or alternatives, and are not further discussed.

3.4 BIOLOGICAL RESOURCES

Biological resources consist of an area's vegetation and wildlife, and the habitats (including wetlands) in which they occur. This section is divided into discussions of vegetation, wildlife, and threatened, endangered, and sensitive species.

3.4.1Vegetation

Native vegetation on Schriever AFB is consistent with a shortgrass prairie ecosystem, and is dominated by blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), three-awned grass (*Aristida purpurea*), dropseed (*Sporobolus cryptandrus*), and needle-and-thread grass (*Stipa comata*) (USAF, 2005c). Heavy grazing in the past is reflected in the species composition (USAF, 2005c). Discrete stands of trees are located along a draw south of Enoch Road near the industrial warehouse area, around three former farmsteads, and near a windmill southeast of the restricted area. Trees south of Enoch Road are mature cottonwood (*Populus sargentii*). Around the farmstead and windmill, trees are primarily box elder (*Acer negundo*) and hawthorn (*Crataegus* sp.) (USAF, 2005c).

Playas (natural depressions) on the base (see Section 3.3 and Figure 1-2 for locations) primarily support saltgrass (*Distichlis spicata*), two spikerushes (*Eleocharis palustrus* and *E. aciculais*), and a native sedge (*Carex* sp.) (USAF, 2005c). Currently, three wetlands remain on Schriever AFB, two of which are near, but not within, the areas of the proposed action (see Figure 1-2 in Section 1) (USAF, 2001). These two small wetlands are located within the two playas in the northwest corner of the base. Within the northern playa, less than 1 acre of wetland remains. Within the southern playa, approximately 900 square feet of wetland remain.

Man-made ecosystems are also present on base, including landscaped areas around buildings and the urban forest. Landscaped areas at Schriever AFB consist of irrigated turf grasses, native grass plantings, and native and ornamental shrubs and trees. The landscaped areas include the base entryway, Falcon Parkway, medians within the parking areas, and recreational areas. A Xeriscape and Water Conservation Plan seeks to reduce the amount of acres of land that are irrigated. More than 90% of the trees are located within the restricted zone of the base and have been planted since the base was constructed in 1985. Other trees are planted along Falcon Parkway and within the median dividers in the parking lots. The tree composition is approximately 45%

coniferous trees and 55% deciduous trees (USAF, 2005c).

During a survey conducted in 2004 (USAF, 2005c), seven species of state and federally listed noxious weeds were identified on Schriever AFB: Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*), puncturevine (*Tribulus terrestris*), and Russian olive (*Elaeagnus angustifolia*). Six other invasive species also were found during the field surveys, including cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola kali*), kochia (*Kochia scoparia*), tumble mustard (*Sisymbrium altissimum*), yellow sweetclover (*Melilotus officinalis*), and goatsbeard (*Tragopogon dubius*).

3.4.2 Wildlife

Schriever AFB is home to 22 bird species, 12 species of mammals, and 1 reptile species typical of the shortgrass prairie, summarized in Table 3-4.

3.4.3 Threatened, Endangered, and Sensitive Species

There are no federally listed threatened or endangered species known to be in residence at Schriever AFB (USAF, 2005c).

The western burrowing owl (*Athene cunicularia)* is protected under the *Migratory Bird Treaty Act*; it is also a state-listed threatened species. It is a small, brown, long-legged ground-dwelling bird that uses abandoned rodent burrows, usually from a prairie dog. Their range extends from Canada's southern prairie provinces throughout the western U.S., including southern California and Texas. Burrowing owls are resident in central and southern Florida. In Colorado, burrowing owls are a migratory species, and can be found almost anywhere there are prairie dog burrows from late March or early April through October (CDOW, 2006a). During winter, Colorado's burrowing owls migrate to Mexico and Central America (CDOW, 2006a). Populations of burrowing owls have been monitored annually at Schriever AFB since 2001 (USAF, 2005c). In 2006, two nesting pairs were observed: one pair about 1,500 feet south of the West Gate, and one pair in the southeastern area of the base (approximately 1/2 mile from the nearest proposed construction).

The presence of the black-tailed prairie dog (*Cynomys ludovicianus)* (a Colorado listed species of special concern) has been identified on Schriever AFB. Black-tailed prairie dogs are reddish cinnamon in summer and more reddish in the winter; they are chubby and have sharp teeth and black-tipped tails, weigh one to three pounds as adults, and are 14 to 17 inches long (CDOW, 2006b). Black-tailed prairie dog communities, called "towns," can vary greatly in size, from colonies with as few as 10 individuals to as many as several hundred.

The population of black-tailed prairie dogs on Schriever AFB is controlled under a management plan to prevent the existing population from expanding into the restricted area, where they may pose a problem for maintaining the security systems, and to decrease the potential for exposure to humans in case of a sylvatic plague (the wild form of bubonic plague) outbreak among the animals (USAF, 2005d). The plan assigns one of three management levels to each area of the base: to maintain the area as a prairie dog habitat, to maintain the area as a buffer between

Table 3-4. Wildlife Species on Schriever AFB

BIRDS

Common Name	Scientific Name
Mallard	*Anas platyrhynchos*
Western burrowing owl	*Athene cunicularia*
Great-horned owl	*Bubo virginianus*
Swainson's hawk	*Buteo swainsoni*
Lark bunting	*Calamospiza melanocorys*
Scaled quail	*Callipepla squamata*
Killdeer	*Charadrius vociferus*
Common nighthawk	*Chordeiles minor*
American crow	*Corvus brachyrhynchos*
Yellow-rumped warbler	*Dendroica coronata*
Horned lark	*Eremophila alpestris*
American kestrel	*Falco sparverius*
Barn swallow	*Hirundo rustica*
Loggerhead shrike	*Lanius ludovicianus*
Northern mockingbird	*Mimus polyglottos*
Brown-headed cowbird	*Molothrus ater*
House sparrow	*Passer domesticus*
Western meadowlark	*Sturnella neglecta*
European starling	*Sturnus vulgaris*
American robin	*Turdus migratorius*
Western kingbird	*Tyrannus verticalis*
Mourning dove	*Zenaida macroura*

REPTILES

Common Name	Scientific Name
Lesser earless lizard	*Holbrookia maculata*

MAMMALS

Common Name	Scientific Name
Pronghorn	*Antilocapra americana*
Coyote	*Canis latrans*
Black-tailed prairie dog	*Cynomys ludovicianus*
Ord's kangaroo rat	*Dipodomys ordii*
Black-tailed jackrabbit	*Lepus californicus*
Meadow vole	*Microtus pennsylvanicus*
Deer mouse	*Peromyscus maniculatus*
Raccoon	*Procyon lotor*
Western harvest mouse	*Reithrodontomys megalotis*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
Desert cottontail	*Sylvilagus audubonii*
Pocket gopher	*Thomomys* sp.

Source: USAF, 2005c.

active colonies and those areas where prairie dogs are not desired, or to maintain the area free from prairie dogs. The areas proposed for development under the General Plan include areas assigned to all three of these management approaches.

Threatened or endangered species and species of concern that may use the base as migrants or have potential to occur there include the bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk (*Buteo regalis*), Mexican spotted owl (*Strix occidentalis lucida*), mountain plover (*Charadrius montanus*), Preble's meadow jumping mouse (*Zapus hudsonius preblei)*, lynx (*Lynx canadensis*), and swift fox (*Vulpes velox*) (USAF, 2005c).

One globally rare plant species, the plains ragweed, has been identified at Schriever AFB in a 40-acre area east of the restricted area, outside of the areas planned for development under the proposed action. This species is known only to exist on the Great Plains of Colorado, occurring in playas on the prairie or artificial habitats similar to playas.

3.5 NOISE

Noise is defined as any unwanted sound that interferes with normal activities or in some way reduces the quality of the environment. Ambient noise levels vary greatly in magnitude and character from one location to another, depending on the normal activities conducted in the area.

3.5.1 Existing Noise Conditions

Current noise on Schriever AFB consists primarily of vehicle traffic on base and from Highway 94 (located approximately 1.5 miles north of the proposed housing area), with occasional noises from agricultural operations and small aircraft. Noise levels in the undeveloped areas are low and are consistent with a rural setting.

3.5.2 Noise Descriptors

A decibel (dB) is the physical unit commonly used to describe instantaneous sound levels. Sound measurement is further refined by using an "A-weighted" decibel (dBA) scale, which emphasizes the audio frequency response curve audible to the human ear. Thus, the dBA measurement more closely describes how a person perceives sound. Table 3-5 provides approximate sound levels for various types of construction equipment.

Construction equipment noise impacts to nearby receptors during a typical day are normally measured over a time period, using the equivalent sound level (L_{eq}). L_{eq} averaged over 8 hours is denoted by $L_{eq\ (8)}$ and is calculated using the dBA levels of noise events averaged over time, taking into account the usage factor of various types of equipment. There are two basic considerations for protecting the community from increased noise from short-term sources. To protect human health, noise levels must not exceed limits identified with potential loss of hearing. An L_{eq} of 75 dB sustained over 8 hours for 250 days or more per year can cause hearing loss to a general population over a prolonged time period (about 40 years) (WHO,1995; USEPA, 1974). The other consideration for protecting the public is noise interference with activity, or annoyance. The L_{eq} is normally averaged over 24 hours ($L_{eq\ (24)}$) to assess annoyance. The level of annoyance or interference depends upon the setting in which the increased noise takes place, for both indoor and outdoor activities. Thresholds for various uses vary from 45 $L_{eq\ (24)}$ within hospitals, educational facilities,

Table 3-5 Approximate Sound Levels (dBA) of Construction Equipment						
	Sound Levels (dBA) at Various Distances (feet)					
Averaging Time	**50**	**100**	**200**	**400**	**800**	**1,600**
8 hours	88.5	82.5	76.5	70.5	64.5	58.5
24 hours	82.0	76.0	70.0	64.0	58.0	52.0
L_{eq} for 8 and 24 hours, using an average source of 90 dB at 50 feet from a typical mix of construction equipment, generating a maximum noise level 70 percent of an eight hour period. The 24-hour average is averaged over one year, assuming 250 workdays. Noise attenuation of 6 dBA for each doubling of distance assumes flat terrain with no trees or buildings. Trees and buildings would increase the attenuation, reducing noise levels at various distances. Assumes a background noise level of 55 dBA for a typical urban area (USEPA, 1974).						

residences, and other locations based on a quiet use to 55 $L_{eq\,(24)}$ for outdoor exposure in recreational, commercial, and industrial areas (USEPA, 1974).

3.6 ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that each Federal agency identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. To evaluate these potential effects, demographic data on minority populations and low-income populations are provided in this section.

The terms "low-income" and "minority" are defined according to guidance published by the Air Force Center for Environmental Excellence (AFCEE). Under this guidance, "low-income" is defined as persons below the poverty level. "Minority" means persons designated in census data as Black (African-American); American Indian, Eskimo, or Aleut (Native American); Asian or Pacific Islander (now two separate designations in the 2000 Census); Other; or of Hispanic origin (AFCEE, 1997). The 1997 AFCEE Guidance did not address the new census category, "Two or more races;" for this analysis, that category is also considered as a minority. According to the U.S. Bureau of Census definition (USBC, 2001), the Hispanic origin designation is separate from the ethnic (racial) designation, as "people who identify their origin as Spanish, Hispanic, or Latino may be of any race." Within this document, to eliminate double-counting, the Hispanic population is differentiated from ethnic (racial) minority populations.

Environmental justice also takes into consideration Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which requires that each Federal agency identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on children, who are more at risk because of developing body systems, comparatively higher consumption-to-weight ratios, behaviors that may expose them to more risks and hazards than adults, and less ability than adults to protect themselves from harm.

The 2004 American Community Survey (USBC, 2005) reported demographic characteristics for El Paso County, the State of Colorado, and the United States, as summarized in Table 3-6. A slightly greater proportion of El Paso County's population consists of pre-school or school-aged children compared to the state-wide and national population, while minority (non-white) residents comprise a higher proportion than the national population, but less than the non-white population percent statewide, due mainly to significantly higher Black / African-American population compared to the Colorado census results. The Hispanic / Latino population in the County is lower by more than a third compared to the state-wide proportion.

The median income of households in El Paso County was $47,836, compared to state and national medians of $48,198 and $44,684, respectively (USBC, 2005).

Table 3-6. Demographic Characteristics of County, State, and Nation			
	El Paso County	**State of Colorado**	**U.S.**
Total population	539,225	4,498,611	285,691,501
Age (years)			
<5	44,397 (8.2%)	337,719 (7.5%)	20,008,152 (7.0%)
5 to 14	82,310 (15.3%)	644,897 (14.3%)	40,743,721 (14.3%)
15 to 19	38,524 (7.1%)	293,076 (6.5%)	19,077,645 (6.7%)
20 to 64	325,375 (60.3%)	2,792,381 (62.1%)	171,656,682 (60.1%)
>64	48,619 (9.0%)	431,078 (9.6%)	34,205,301 (12.0%)
Median age (years)	33.5	34.5	36.2
One race	520,690 (96.6%)	4,394,381 (97.7%)	280,285,784 (98.1%)
White	436,106 (80.9%)	3,755,623 (83.5%)	216,036,244 (75.6%)
Black or African American	36,427 (6.8%)	178,731 (4.0%)	34,772,381 (12.2%)
Native American and Alaska Native	3,719 (0.7%)	30,148 (0.7%)	2,151,322 (0.8%)
Asian	13,784 (2.6%)	113,570 (2.5%)	12,097,281 (4.2%)
Native Hawaiian and other Pacific Islander	1,506 (0.3%)	7,529 (0.2%)	403,832 (0.1%)
Other	29,148 (5.4%)	308,780 (6.9%)	14,824,724 (5.2%)
Two or more races	18,535 (3.4%)	104,230 (2.3%)	5,405,717 (1.9%)
Hispanic or Latino	67,740 (12.6%)	862,631 (19.2%)	40,459,196 (14.2%)

Source: USBC, 2005.

4. ENVIRONMENTAL CONSEQUENCES

This chapter discusses the potential for significant impacts to the human environment as a result of implementing any of the three Alternatives. As defined in 40 CFR Section 1508.14, the human environment is interpreted to include natural and physical resources, and the relationship of people with those resources. Accordingly, this analysis has focused on identifying types of impacts and estimating their potential significance. This chapter discusses the effects that the Alternatives could generate on the environmental resource areas described in Chapter 3.

The concept of "significance" used in this assessment includes consideration of both the context and the intensity or severity of the impact, as defined by 40 CFR 1508.27. Severity of an impact could be based on the magnitude of change, the likelihood of change, the potential for violation of laws or regulations, the context of the impact (both spatial and temporal), and the resilience of the resource. Significant impacts are effects that are most substantial and should receive the greatest attention in decision making. Impacts that are not significant include those that result in little or no effect to the existing environment and cannot be easily detected. If a resource would not be affected by a proposed activity, a finding of no impact was declared. If a resource would be improved by a proposed activity, a beneficial impact was noted.

This chapter is organized by resource element in the same order as introduced in Chapter 3. This chapter provides a discussion of the analysis methods and the potential impacts of the Alternatives. The chapter concludes with an evaluation of the relationships between short-term uses of the environment and long-term productivity, cumulative impacts, and irreversible and irretrievable commitments of resources.

4.1 AIR RESOURCES

The Proposed Action (Alternative 2) would have short-term, but not significant, impacts on air quality generated by construction and operation of the proposed facilities. The Proposed Action conforms to the SIP and is exempt from further conformity review. Schriever AFB would remain below the thresholds for PSD review requirements. The base would continue to be a minor source of HAPs. Impacts from the Accelerated Construction Alternative (Alternatives 3) would be greater than the Proposed Action, but still not significant. Air quality would not change under the No Action Alternative (Alternative 1).

4.1.1 Analysis Methods

The analysis was based on a review of existing air quality in the region, the latest air emissions inventory for Schriever AFB, projections of emissions from the proposed activities, a review of the Federal and Colorado regulations for air quality, and the use of air emission factors from the USEPA and USAF.

4.1.2 Potential Impacts of Alternative 1 – No Action Alternative

Emissions of criteria pollutants and HAPs would remain the same under the No Action Alternative. Impacts from the No Action Alternative would not be significant.

4.1.3 Potential Impacts of Alternative 2 - Proposed Action

Construction of the proposed facilities, as outlined in the Base General Plan, would

generate emissions of criteria pollutants from grading, construction equipment, trucks driving on paved and unpaved roads, and worker vehicles. Approximately 200 acres of soil would be disturbed during construction. This includes about 150 acres for the proposed military housing (previously analyzed in a separate EA but included here to account for cumulative impacts), about 9 acres for the proposed antenna field for the SIDC, about 5 acres for training areas, about 7 acres for an administrative facility, and about 16 acres for recreational facilities. About 15 acres would be disturbed to pave Enoch Road south of Irwin Avenue. Fugitive dust emissions (including $PM_{2.5}$ and PM_{10}) would be generated from demolition, grading and fill operations, and truck trips on paved and unpaved roads during construction. An air emissions permit would be required from El Paso County for disturbing more than one acre of ground (for each of the proposed projects); the County also requires an approved emission control plan. A Colorado APEN would likely be needed unless ground disturbance is limited to less than 25 acres at a time and is limited to less than six months in duration (the time of disturbance is only counted for days when particulate emissions are uncontrolled). This APEN, if applicable, would require the implementation of fugitive dust control measures from onsite unpaved roads, disturbed soil, and mud and dirt on paved roads adjacent to the site. These measures would include application of water and chemical stabilizers, revegetation, temporary furrows, and synthetic or natural coverings (netting or mulching) to disturbed areas as needed, to reduce fugitive dust (a source of $PM_{2.5}$ and PM_{10}) levels by 80 percent from uncontrolled levels. The majority of construction emissions would be generated by operating construction equipment and worker vehicle trips. Estimated emissions from construction are shown in Table 4-1. Best management practices (such as application of water or chemical stabilizers to disturbed areas, as needed, and revegetating sites as soon as possible) would be implemented to control fugitive dust (a source of PM_{10}). Construction and operation of the proposed military housing area was assessed in an EA finalized in May 2006. Impacts to air quality were not anticipated to be significant. In accordance with 40 CFR 1502.21, this EA is incorporated by reference. Construction of the antenna farm, training areas, recreational and administrative facilities, and road paving would not be significant with the implementation of permit requirements and best management practices.

The Proposed Action includes installing and operating about four emergency generators for backup power for the SIDC and an estimated two generators for the proposed Joint Operations Facility. Other projects developed under the Proposed Action are not anticipated to require generators. Emergency generators are considered stationary sources, subject to APEN requirements and Standards of Performance for New Stationary Sources. These generators would likely be similar to those at Building 700 or 712. The design rating of the generators would be approximately 3.5 to 5.0 million British thermal units per hour. These generators would likely need an APEN and would be added to the construction permit for the base. Estimated actual emissions from these generators are shown in Table 4-2. The total estimated actual emissions from permitted stationary sources at the base would remain within permit limits. The potential to emit from permitted stationary sources could exceed current permit limits, unless the permit limit is changed or the potential fuel usage from permitted sources is reduced.

Table 4-1 Air Pollutant Generation from Construction (tons per year)							
	CO	**VOCs**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**HAPs**
Proposed Action							
Construction emissions	9.13	0.82	5.73	1.21	3.90	0.87	0.11
Alternative 3							
Construction emissions	18.84	1.55	12.66	2.71	4.70	0.97	0.23
See Appendix B for detailed calculations and methods.							

Table 4-2
Estimated Stationary Emissions from the Proposed Action (values in tons per year)

	PM_{10}	$PM_{2.5}$	SO_x	NO_x	VOCs	CO	HAPs
Actual Emissions							
Existing Permitted Sources	0.30	0.28	1.20	10.00	5.63	3.61	0.49
Proposed Generators[1]	0.04	0.03	0.00	1.75	0.04	0.10	0.001
Total Permitted Sources[2]	**0.34**	**0.31**	**1.21**	**11.75**	**5.67**	**3.71**	**0.49**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Proposed Basewide Natural Gas[3]	0.07	0.07	0.01	0.92	0.05	0.59	0.02
Total Non-Permitted Sources	**0.49**	**0.49**	**0.12**	**5.96**	**1.78**	**14.60**	**0.15**
Total Stationary Sources	**0.82**	**0.80**	**1.33**	**17.71**	**7.45**	**18.31**	**0.64**
Estimated Increase in Emissions	*0.11*	*0.10*	*0.01*	*2.68*	*0.10*	*0.69*	*0.02*
Potential to Emit							
Existing Permitted Sources	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Proposed Generators[1]	0.32	0.27	0.03	15.97	0.41	1.22	0.008
Total Permitted Sources[2]	**1.82**	**1.63**	**7.89**	**79.23**	**8.11**	**19.08**	**0.59**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	7.86	7.86	10.54	102.19	42.46	684.02	0.62
Proposed Basewide Natural Gas[3]	0.14	0.14	0.01	1.85	0.10	1.17	0.036
Total Non-Permitted Sources	**8.01**	**8.01**	**10.55**	**104.04**	**42.56**	**685.19**	**0.65**
Total Stationary Sources	**9.83**	**9.64**	**18.45**	**183.27**	**50.67**	**704.27**	**1.25**
Estimated Increase in Emissions	*0.47*	*0.42*	*0.04*	*17.82*	*0.52*	*2.40*	*0.04*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center and 2 generators at the proposed Joint Operations Facility. Actual emissions would depend on the number and types of generators actually installed.

[2] Total with estimated six additional generators. Currently, there are 4 boilers and 13 generators permitted under Colorado Construction Permit 95EP772, initial approval to Modification 3 issued on April 19, 2005.

[3] Estimated for proposed military housing and proposed buildings. See Appendix B for detailed analysis of emissions.

Some numbers do not add due to rounding.

Boilers for space heating at the proposed buildings would be installed and operated as part of the projects. Due to the amount of emissions generated from these boilers, they would be exempt from APEN permit requirements.

Emissions of CO would increase by about 0.7 tons per year under the proposed action. Emissions of NO_x would increase by about 2.2 tons per year. The total actual emissions of CO from stationary sources at the base would increase to an estimated 14.6 tons per year with the addition of the proposed generators and boilers, with lesser amounts of other criteria pollutants. The potential to emit NO_x would increase by about 17.8 tons per year and the potential to emit CO would increase by about 2.4 tons per year. The estimated potential to emit CO and NO_x from permitted and non-permitted sources at the base would still exceed 100 tons per year (the threshold of a major source) unless the potential to emit was reduced to below 100 tons per year through smokestack testing at the Central Utilities Plant, or further reducing the potential to emit from existing permitted and non-permitted sources.

Estimated emissions would not cause the NAAQS or CAAQS to be exceeded, due to the amount of criteria pollutants generated (see Tables 4-1 and 4-2), the relatively large area in which the emissions would occur, and the dispersive meteorological conditions (winds average between 8 and 12 miles per hour) in which the emissions would be generated. Therefore, the focus of the analysis centers on conformity with the SIP for the CO maintenance area.

Schriever AFB, as part of the Colorado Springs Metropolitan Area, is located within a maintenance area for CO. Emissions would be regionally significant if they exceeded 10 percent of the inventory for any affected pollutant (in this case, CO). SIP budgets that are applicable to the proposed action include nonroad sources (including construction equipment), point sources (smokestacks and vents), and mobile sources (including on-road vehicles). Emissions from the proposed action would not exceed regional significance thresholds (see Table 4-3).

Conformity thresholds, as defined in 40 CFR 51, Subpart W, are used to determine conformity with a SIP. The threshold for CO is 100 tons per year. An exceedance of this threshold would result in non-conformity with the SIP. Estimated emissions from the Proposed Action are about 9 tons per year during construction and about 2.4 tons per year once facilities are constructed. This is less than the conformity threshold and would conform to the SIP, and is not significant. The air quality impacts of the Proposed Action are not regionally significant and the total direct and indirect emissions would be below the 100 tons per year *de minimis* threshold for CO. Therefore, this project is exempt from further conformity analysis pursuant to 40 CFR 93.153.

Construction equipment and the proposed emergency generators and boilers would generate small amounts of HAPs (see Tables 4-1 and 4-2). Actual emissions and the potential to emit HAPs from stationary sources would remain below the thresholds of a major source. These emissions would not be significant.

Appendix B presents detailed calculations of air emissions. Because the activities would not exceed or contribute to an exceedance of air quality standards and would conform to the SIP, the impacts would not be significant. No other air pollutants of note would be generated from the project.

Table 4-3
Regional Significance for CO of the Proposed Action (tons per year)

	Nonroad Emissions[1]	Point Sources[2]	Mobile[3]
Actual	2.85	0.68	6.28
Potential to Emit	N/A	2.40	N/A
Regionally significant threshold	103.30	121.91	9,855.00

[1] Includes construction equipment, emissions from construction activities over a period of six years
[2] From vents and smokestacks. Includes boilers and furnaces.
[3] Short-term emissions from construction (primarily from workers commuting). Long-term emissions would decrease from community housing being located on base and as other community facilities are constructed.
Source: Regional significance thresholds from CDPHE, 2003.
Regional significance and conformity thresholds per 40 CFR 51, Subpart W

The Proposed Action would have unavoidable short-term and long-term impacts on air quality. Exhaust emissions from construction equipment would be generated, and fugitive dust would be generated during construction activities. These emissions would not be significant, given the short duration of time for the activities. Other emissions from construction would be unavoidable, but not significant. Long-term emissions from the proposed generators and boilers would be generated, but these emissions would not be significant.

4.1.4 Potential Impacts of Alternative 3 – Accelerated Construction

Impacts from this Alternative would be similar to those described under Alternative 2. Impacts from construction would be higher since additional buildings, roads, and parking constructed would be constructed in a shorter time frame. Impacts from operation (emergency generators and boilers) would be higher than those described in Alternative 2 due to additional generators and space heating; see Table 4-4. The alternative would conform to the SIP and would not be regionally significant (see Table 4-5). Impacts to air quality would not be significant.

4.2 GEOLOGICAL RESOURCES

Geological resources are limited, non-renewable earth resources whose characteristics can easily be degraded by physical disturbances. The proposed action would disturb approximately 200 acres (including development of the housing area) over the next five years. Approximately 250 additional acres would be developed over the next five years under Alternative 3 (accelerated construction) and, if the golf course is developed in this time frame, another 495 acres would be disturbed. Impacts would not be significant. Geological resources would not be impacted under the No Action Alternative.

4.2.1 Analysis Methods

The geological resources within the proposed project area were studied to determine the potential impacts from implementing any of the three alternatives. Geological studies, the soil survey and geodatabase for the El Paso County area, previous EAs, topographic contours from Schriever AFB, and USGS topographical maps were reviewed to characterize the existing environment. Construction activities that could influence geological resources were evaluated to predict the type and magnitude of potential impacts. For example, soils would be disturbed by grading, excavating, and compacting during construction activities. The predicted post-construction environment was compared to the existing environment and the change was evaluated to determine if significant changes in any existing conditions would occur.

4.2.2 Potential Impacts of Alternative 1 - No Action Alternative

The proposed facilities would not be constructed under the No Action Alternative; therefore, geological resources would not be affected.

4.2.3 Potential Impacts of Alternative 2 - Proposed Action

The Proposed Action would primarily occur within the base boundaries, but a corridor along the northern boundary of the base could be disturbed by the proposed military housing. About 200 acres would be affected over the next five years by the Proposed Action. The Proposed Action would require an APEN from the State of Colorado if 25 or

Table 4-4
Estimated Stationary Emissions from the Alternative 3 (values in tons per year)

	PM_{10}	$PM_{2.5}$	SO_x	NO_x	VOCs	CO	HAPs
Actual Emissions							
Existing Permitted Sources	0.30	0.28	1.20	10.00	5.63	3.61	0.49
Proposed Generators[1]	0.10	0.08	0.01	5.08	0.14	0.99	0.002
Total Permitted Sources[2]	**0.39**	**0.36**	**1.21**	**15.08**	**5.77**	**4.59**	**0.49**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Proposed Basewide Natural Gas[3]	0.21	0.21	0.02	2.76	0.15	2.13	0.053
Total Non-Permitted Sources	**0.63**	**0.63**	**0.13**	**7.79**	**1.88**	**16.14**	**0.18**
Total Stationary Sources	**1.02**	**0.99**	**1.35**	**22.87**	**7.65**	**20.74**	**0.67**
Estimated Increase in Emissions	*0.31*	*0.29*	*0.03*	*7.84*	*0.29*	*3.12*	*0.06*
Potential to Emit							
Existing Permitted Sources	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Proposed Generators[1]	0.38	0.32	0.03	19.26	0.50	2.10	0.010
Total Permitted Sources[2]	**1.88**	**1.68**	**7.90**	**82.52**	**8.20**	**19.95**	**0.60**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	7.86	7.86	10.54	102.19	42.46	684.02	0.62
Proposed Basewide Natural Gas[3]	0.42	0.42	0.03	5.52	0.31	4.26	0.11
Total Non-Permitted Sources	**8.29**	**8.29**	**10.58**	**107.71**	**42.76**	**688.27**	**0.72**
Total Stationary Sources	**10.17**	**9.97**	**18.47**	**190.23**	**50.97**	**708.23**	**1.32**
Estimated Increase in Emissions	*0.81*	*0.74*	*0.07*	*24.78*	*0.81*	*6.35*	*0.12*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center, 2 generators at the proposed Joint Operations Facility and 2 generators at the proposed medical facility. Actual emissions would depend on the number and types of generators actually installed.

[2] Total with estimated eight additional generators. Currently, there are 4 boilers and 13 generators permitted under Colorado Construction Permit 95EP772, initial approval to Modification 3 issued on April 19, 2005.

[3] Estimated for proposed military housing and proposed buildings. See Appendix B for detailed analysis of emissions.

Some numbers do not add due to rounding.

Table 4-5
Regional Significance for CO of Alternative 3 (tons per year)

	Nonroad Emissions[1]	Point Sources[2]	Mobile[3]
Actual	8.78	2.28	10.06
Potential to Emit	N/A	6.35	N/A
Regionally significant threshold	103.30	121.91	9,855.00

[1] Includes construction equipment, emissions are from construction activities over a period of six years
[2] From vents and smokestacks. Includes boilers and furnaces.
[3] Short-term emissions from construction (primarily from workers commuting). Long-term emissions would decrease from community housing being located on base and as other community facilities are constructed.
Source: Regional significance thresholds from CDPHE, 2003.

more acres on Schriever AFB would be disturbed, or if any area would be disturbed for more than 6 months at a time during the duration of proposed construction under the Base General Plan. If an APEN is required at any given time, further measures to control wind erosion and fugitive dust would also be implemented. These controls could include daily watering or chemical stabilization of exposed surfaces, maintaining existing vegetation as much as possible, and revegetating sites as soon as possible, limiting vehicle speeds, or gravelling temporary roads, wind breaks, temporary compaction, or synthetic or natural covering, such as netting or mulching. Impacts to geological resources would not be significant. In accordance with permit requirements and best management practices, topsoil would be restored and vegetation would be reestablished to reduce the potential for erosion. Long-term soil productivity would be significantly impacted. Further permit requirements and potential impacts to hydrogeology and groundwater are discussed in Section 4.3.

As discussed in Section 3.2, there are no major faults in the project area. The area is located in Zone 1 for potential earthquake damage with slight damage anticipated from any seismic event. No special design would be required. Impacts from seismicity would not be significant.

The following subsections detail the impacts on geological resources in each affected area of the base.

Restricted Area

An area of about 8.6 acres would be disturbed during construction of an antenna field for the Space Innovation and Development Center southeast of Kepler Avenue and Beltway (near the southwest corner of the RA (see Figure 1-2). Any excavations would be limited in area and depth. This disturbance would be short term, and impacts would not be significant.

The antenna field would be constructed in an area ranging from about 6,240 to 6,260 feet in elevation. Slopes generally range from about 1 to 3 percent in this area, but are as much as 10 percent in the southern part of the area. Drainage would be maintained for storm water drainage. The topography at the site would undergo minor changes, but impacts would not be significant.

About 8.6 acres of Ascalon soils would be disturbed by grading, excavation, and compaction from equipment during construction of the proposed antenna field. Installation of utilities (communications and power) would disturb about 800 linear feet. Assuming a 10-foot wide corridor is disturbed, about 0.2 acres would be impacted. The affected areas would be regraded after this disturbance.

Disturbance of these soils during construction activities would expose the soil to potential erosion by wind and water. If the soil was left disturbed for extended periods of time, erosion could be substantial, as most of these soils have a moderate risk of erosion by wind and water. Due to the limited area impacted and the length of construction, impacts to soils would not be significant. Best management practices (such as daily watering as needed, chemical stabilization, maintaining existing vegetation as much as possible, and revegetating sites as soon as possible) would be implemented to reduce the risk of wind erosion.

Engineering studies would be conducted to determine the suitability of the soils to support construction of the proposed infrastructure. As discussed in Section 3.2.2,

the Soil Survey for El Paso County indicates that there are moderate limits for construction due to a moderate shrink-swell potential, frost action, low strength of soils, and slope. A combination of design and soil modification (changing physical properties, such as soil texture) can be used to overcome these limits. Impacts to soils from construction would not be significant.

Long-term soil productivity in affected areas would not be significantly impacted. Topsoil would be restored to disturbed areas and vegetation would be reestablished, maintaining soil productivity.

South of the RA

Construction of proposed facilities and paving of Enoch Road south of the RA to the base boundary would disturb about 15 acres. Excavations would likely be limited to the soil layers and impacts to underlying sediments would not be significant. Elevations in the affected areas range from about 6,265 to 6,160 feet. Slopes are generally less than 5 percent, but range up to 15 percent in areas near drainages. Siting of the proposed facilities would avoid drainage areas, but paving Enoch Road would impact the drainageway of a stream draining the west part of the RA and the south central area of the base (see Figure 1-2). Storm water drainage would be maintained, and impacts from construction to topography would be minor, and not significant.

The Proposed Action would disturb about 15 acres of Ascalon soils. These soils have moderate limits for construction due to a moderate shrink-swell potential, frost action, low strength of soils, and slope. Site-specific engineering studies would be conducted to determine the suitability of the soils to support construction. Utilities are already in the vicinity of the proposed facilities. A substantial extension of utilities would not be required. Impacts would not be significant.

West of the RA

Construction of facilities west of the RA would disturb about 7 acres. Excavations for building could be as deep as 15 to 20 feet. An area of alluvial sediments (primarily sand and gravel) below the soil would be impacted. This disturbance would be short term, and impacts would not be significant. Elevations in the affected areas range from about 6,270 to 6,300 feet. Slopes are between 1 and 3 percent. Storm water drainage would be maintained and impacts to topography would not be significant.

The Proposed Action would disturb about 7 acres of Ascalon soils. These soils have moderate limits for construction due to a moderate shrink-swell potential, frost action, low strength of soils, and slope. Site-specific engineering studies would be conducted to determine the suitability of the soils to support construction. Installation of utilities would disturb a total of about 5,500 linear feet. Assuming a 10-foot wide corridor is disturbed, about 1.3 acres would be impacted. The affected areas would be regraded after this disturbance. Impacts would not be significant.

North and Northwest of RA

Construction of facilities west of the RA would disturb about 16 acres. Excavations for buildings could be as deep as 10 to 15 feet. An area of alluvial sediments (primarily sand and gravel) below the soil would be impacted. This disturbance would be short term, and impacts would not be significant. Elevations in the affected areas range from about 6,295 to 6,315 feet. Slopes of affected areas are between 1 and 4 percent, but an area with slopes of 6 to 8 percent is just to the east of impacted areas. Storm water drainage would be maintained

and impacts to topography would not be significant.

The Proposed Action would disturb about 16 acres of Ascalon soils. These soils have moderate limits for construction due to a moderate shrink-swell potential, frost action, low strength of soils, and slope. Site-specific engineering studies would be conducted to determine the suitability of the soils to support construction.

All utilities are adjacent or near to the proposed action sites. A substantial extension of utilities would not be required. About 0.3 acres would be disturbed, and impacts would not be significant.

Housing Area
Development of the housing area (previously evaluated in a separate EA) would result in about 150 acres in the proposed housing area being disturbed during grading, installation of utility lines, and construction of housing. The grading and construction activities would take place in areas with slight to moderate slopes, with a moderate to severe risk of erosion. Soils impacted include Bresser sandy loams and Truckton sandy loams.

The EA that analyzed the impacts of constructing military housing at Schriever AFB determined that there would not be any significant impacts to geology, topography, or soils. The findings of this EA are incorporated by reference (USAF, 2006).

4.2.4 Potential Impacts of Alternative 3 - Proposed Action

This alternative would include the Proposed Action and additional areas currently scheduled for 6 to 10 years out.

As under the Proposed Action, Alternative 3 would require an APEN from the State of Colorado if 25 or more acres on Schriever AFB would be disturbed for more than 6 months at a time during the duration of construction under the Base General Plan. If an APEN is required at any given time, further measures to control wind erosion and fugitive dust would also be implemented. These controls could include daily watering or chemical stabilization of exposed surfaces, maintaining existing vegetation as much as possible, and revegetating sites as soon as possible, limiting vehicle speeds, or gravelling temporary roads, wind breaks, temporary compaction, or synthetic or natural covering, such as netting or mulching. Impacts to geological resources would not be significant. In accordance with permit requirements and best management practices, topsoil would be restored and vegetation would be reestablished to reduce the potential for erosion. Long-term soil productivity would be significantly impacted. Further permit requirements and potential impacts to hydrogeology and groundwater are discussed in Section 4.3.

The following subsections detail the impacts in each affected area of the base.

Restricted Area
Under this alternative, one project under the Proposed Action (SIDC antenna field) and an additional 0.4 acres would be developed in the RA. The additional development would occur in an area of about 5 percent slope. A stream is just to the east of this site. Little or no excavation would be required. The affected area is Blendon sandy loam soil, with a moderate potential for wind and water erosion. This soil has slight to moderate limits for construction due to low strength and frost action. Utilities would need to be extended about 1,000 feet through Ascalon and Truckton soils. Impacts

would not be significant, and best management practices would be implemented to control potential erosion.

South of the RA
In addition to the proposed action, another 54 acres would potentially be impacted by construction of facilities. Slopes at these sites are generally one to three percent, but there are limited areas of 15 to 20 percent slope near the drainageway (see Figure 1-2). Areas of steeper slope should be avoided to the extent possible. All of the impacted areas are Ascalon soils. This construction would occur in Ascalon soils, discussed above, and impacts would not be significant.

West of the RA
In addition to the Proposed Action, about 1.5 acres would be impacted by construction of a facility between Enoch Road and Beltway. Slopes range from about 3 to 20 percent. Much of this site is currently in a drainageway. Depending on the final design for this area, up to 12,000 cubic yards of fill material would be required for this area. The site would be graded and the stormwater drainage would be reestablished. The area affected is Ascalon soil. Impacts to soils would not be significant.

North and Northwest of RA
An additional 140 acres would be disturbed from construction of facilities and the extension of Falcon Parkway. Slopes in this area are generally 1 to 5 percent. No substantial changes to topography are anticipated. All of the additional affected acreage is Ascalon soil. Some of these areas to be developed are adjacent to steeper slopes near drainageways. Best management practices would be implemented to control erosion, and impacts would not be significant.

Housing Area
An additional 3 acres would be developed in areas with a 5 to 6 percent slope. The affected area is Ascalon soils. Impacts to soils would not be significant.

Perimeter Road
Under Alternative 3, a new perimeter road would be constructed. Assuming a 50-foot corridor would be impacted by construction, about 61 acres would be impacted. The slope of impacted areas varies from nearly level (less than 1 percent) to as much as 20 percent in drainageways. Soils impacted include Ascalon, Blakeland, Blendon, Bresser, Ellicott, Sampson, and Truckton. These soils have slight to moderate limitations for construction. Site-specific engineering studies would be done as needed and the soil would be modified if needed.

4.3 WATER RESOURCES

Constructing the proposed facilities under either the Proposed Action or the Accelerated Construction Alternative would not disturb the unconfined surficial aquifer. Impacts to groundwater would not be significant. There would not be any long-term impacts to water resources from water usage or storm water flow. If the No Action Alternative was selected, there would be no impact to water resources.

4.3.1 Analysis Methods

To establish the potential impacts of the alternatives, documents on the hydrology and hydrogeology of the area were reviewed. Maps showing topography, watersheds, and base drainage were examined. The review focused on the proximity of the proposed activities to surface waters, hydrogeology in the project area, and water quality in the local area.

Federal Emergency Management Agency Flood Insurance Rate Maps were reviewed to identify floodplains in the project areas. The assessment of potential impacts focused on the potential for impacting water quality, stormwater flow, and physical changes impacting aquifers and surface water.

4.3.2 Potential Impacts of Alternative 1 - No Action Alternative

Under the No Action Alternative, there would be no impact to groundwater, surface water, or floodplains.

4.3.3 Potential Impacts of Alternative 2 - Proposed Action

About 200 acres would be graded for construction of proposed facilities (including about 150 acres for the proposed housing area, evaluated in a previous EA). An area of alluvial sediments (primarily sand and gravel) would be impacted. The unconfined alluvial aquifer, at depths of 25 to 100 feet, would not be directly impacted. Disturbance from the excavation would be short term, and impacts would not be significant. A spill or leak of fuel or lubricants is not likely during excavation, but if one occurs, it would be cleaned up immediately in accordance with the Schriever AFB Spill Response Plan, to prevent contamination of the aquifer. Given the small amount of oil and fluids used by construction equipment, impacts to the water quality of aquifers underlying the base would not be significant. Wells obtaining stock and domestic water in the vicinity of the base would not be impacted by the Proposed Action.

Construction of the proposed facilities would increase impermeable surfaces by about 35 acres (not including the housing area, evaluated in a separate EA), slightly decreasing the recharge area of the unconfined surficial aquifer. This site also overlies the perennially saturated Laramie-Fox Hills and Arapahoe Aquifers. This would negligibly impact recharge of these aquifers. Impacts to the aquifer system would not be significant.

Disturbed areas would be vulnerable to wind and water erosion during grading of the site and construction. Particulate matter would be transported and deposited by wind in the local area. Deposition of particulate matter and siltation of streams would not be significant due to the dispersive wind conditions and small amounts of particulate matter that would be generated by the construction activities (see Section 4.1). Soil disturbed during construction would be watered as needed to control wind erosion. Water erosion could occur on steeper slopes near storm water drainage channels at the edges of the site (see Figure 1-2), but would not be significant due to best management practices to prevent an increase in sediment yield and flow velocity from pre-construction conditions. This would include such practices as installing and maintaining silt fences near drainage channels, limiting the area disturbed to the extent practical, installing a sediment basin as needed, and stabilizing soil as soon as practical. Native vegetation would be reestablished as soon as practical after construction of the facilities. Impacts to water quality from construction would be minimal, temporary, and would not be significant.

Construction of additional impermeable surfaces would slightly increase the amount and potential velocity of stormwater flow from rain events, but impacts to the existing stormwater system would not be significant. In accordance with best management practices, an adequately designed storm water flow system would need to be

incorporated in the construction of proposed facilities to prevent an increase in sediment yield and flow velocity from pre-construction conditions (this could include a sediment basin or a velocity dissipation structure). Post-construction impacts to water quality would be minimal and would not be significant.

The proposed construction would not impact any floodplains.

No long-term impacts are anticipated to result from the Proposed Action. Water usage on Schriever AFB would not substantially increase. No significant impacts to water resources would occur as a result of the Proposed Action.

4.3.4 Potential Impacts of Alternative 3 – Accelerated Construction

Impacts on water resources associated with Alternative 3 would be similar to those of the Proposed Action. Although construction would occur on a shorter schedule, best management practices would minimize any potential for surface water impacts from erosion or siltation. Although the area of impermeable surface on the base would be increased in the 1- to 5-year time frame, compared to the increase associated with the Proposed Action, impacts would remain in the negligible range as a result of a small relative area of the aquifers that would be affected and the inclusion of adequate storm water flow systems.

4.4 BIOLOGICAL RESOURCES

No populations of common wildlife species, critical habitat, threatened or endangered species, or wetlands would be affected by the Proposed Action and (assuming best management practices are followed) no increases in noxious weed populations are expected. Therefore, impacts to biological resources would not be significant. Impacts to biological resources from Alternative 3 would be similar to those described under the Proposed Action. Under the No Action Alternative, there would be no change in the biological environment of the project area.

4.4.1 Analysis Methods

The assessment of potential impacts to biological resources focused on the proposed location of the facilities and the existing habitat in these areas. Relevant plans and reports were reviewed, along with past NEPA documents, to provide data on existing biological resources in the project area.

4.4.2 Potential Impacts of Alternative 1 – No Action Alternative

Management of Schriever AFB's natural resources by the Air Force has been conducted in accordance with policies summarized in the base's Integrated Natural Resources Management Plan (USAF 2005c). Under the No Action Alternative, management of these resources would continue as in the past, and no impacts to the effective management of biological resources would occur.

4.4.3 Potential Impacts of Alternative 2 – Proposed Action

The existing vegetation on the areas proposed for development mainly consists of grazing-altered shortgrass prairie, with the exception of approximately 9 acres within the RA. Under the proposed action, native vegetation would be largely removed on approximately 200 of the base's 3,840 acres within the next five years, to be replaced with surfaces consistent with office buildings and community developments:

landscape/bedding plants, ornamental shrubs, buildings and related structures, parking areas, and paved roads and walkways. This would affect less than 5% of the base's land area, and is not considered to be a significant effect. To protect developed areas from the potential hazard of grassland fire in adjacent undeveloped areas, Schriever AFB would develop and maintain defensible space and suppress grassland fires around new development in accordance with the base's Wildland Fire Management Plan (USAF 2005e), a component plan of the Integrated Natural Resources Management Plan (USAF 2005c). The plains ragweed (a globally rare species) does not occur within or in proximity to the areas proposed for development.

Schriever AFB's playas and wetlands are not within the areas planned for development under the proposed action.

Schriever AFB's Invasive Species Control Plan (a component plan of the Integrated Natural Resources Management Plan) provides species-specific operational direction for managing noxious and invasive plant species on the base (USAF 2005f). Construction in areas of native vegetation often creates an opportunity for undesired plants to invade the disturbed area. The potential for this adverse impact can be completely or largely negated by strict adherence to the Invasive Species Control Plan, including careful monitoring and aggressive control of invasives, and re-seeding disturbed sites with competitive and native species.

Starting at the time of initial construction in any area, local wildlife will tend to avoid the human and mechanical activity, and their presence in the area will shift to adjacent and nearby undisturbed areas. Area disturbance activities will need to be scheduled so as not to interfere with the nesting season of the western burrowing owl (approximately 1 April through 31 October). Informal consultation and/or coordination between Schriever AFB, the U.S. Fish and Wildlife Service, and the Colorado Division of Wildlife regarding the western burrowing owl and the black-tailed prairie dog will continue. No significant adverse effects on wildlife are expected as a result of the proposed action.

4.4.4 Potential Impacts of Alternative 3 – Accelerated Construction

Under this alternative action, base development outside of the Restricted Area within five years would occur on approximately 245 acres in addition to the approximately 200 acres under the Proposed Action, slightly more than doubling the acreage on which native vegetation would be replaced with development in the near term (5 years), but with the same long-term effect.

Schriever AFB's wetlands are not within the areas planned for development under the accelerated construction alternative. However, the edge of the northernmost playa, containing a wetland <1 acre in size, is approximately 200 feet from an area proposed for community commercial activities northwest of the RA. This wetland is fenced. Erosion control measures (see Section 4.3.3) would prevent any impacts to this wetland during construction or use of the new developments. The proposed new perimeter road would cross the more southern of the two playas that are northwest of the RA; this playa extends to the property boundary. Design and construction of the road would preserve the playa to the extent feasible. Control measures would be implemented to minimize erosion that could affect the small (900-square-foot) wetland

within this playa. The road would also run adjacent to the edge of the northern playa; erosion control, road design, and construction methods would also minimize any impacts to this playa and the wetland (<1 acre) it contains.

The nature of potential effects to other biological resources would be essentially the same as those of the Proposed Action, and these would not be expected to be significant, even given the increased acreage affected.

4.5 NOISE

4.5.1 Analysis Methods

The analysis of noise impacts was based on estimated noise levels generated from the Proposed Action and Alternatives and a comparison with noise levels that prevent hearing loss and cause activity interference or annoyance.

4.5.2 Potential Impacts of Alternative 1 – No Action Alternative

Noise levels would remain at current levels and no impacts would occur from the No Action Alternative.

4.5.3 Potential Impacts of Alternative 2 - Proposed Action

Overall, noise would increase in the proposed development locations. The addition of various facilities would increase long-term noise levels on the base; however these noise increases are not expected to cause disruption to current area occupants or activities. Overall, the addition of mission, support, industrial, training, community commercial, outdoor recreation, dormitory and other facilities would increase the volume of traffic in areas that are currently unoccupied. As a result, noise created by area traffic would increase in the Schriever AFB area. New industrial facilities (warehouses) would correspond with additional receiving capacity and thus more truck traffic on the base.

Construction activity would occur intermittently several months at a time for several years at various locations on base. During construction activities, noise would increase due to operation of heavy equipment, increases in traffic from waste hauling activities, and other construction-related sources. These noises would be short-term, ceasing to continue after construction activities are completed. Construction activities could be scheduled to limit these noises to daylight hours.

Given the types of equipment likely to be used in constructing the roads and facilities (bulldozers, dump trucks, and similar equipment) and the noise levels of the equipment (see Table 3-5), typical noise emissions at 50 feet from multiple pieces of construction equipment would be approximately 90 dBA (U.S. Army, 1978). Assuming a usage factor of 50 percent (on average, any piece of equipment would be used at a maximum operating capacity 50 percent of the time), noise averaged over 8 hours would be about 88.5 dBA at 50 feet; noise averaged over 24 hours would be about 82 dBA at 50 feet. Noise exposure levels would attenuate about 6 dB for every doubling of distance (assuming flat terrain and no trees or buildings). Therefore, construction noise could cause temporary annoyance to current area occupants outdoors within 1,600 feet of construction. The threshold for annoyance as a result of outdoor exposure of 55 $L_{eq\,(24)}$ could be exceeded within 1,600 feet. Within buildings, the noise levels would be attenuated by an additional 20 to 25 dBA and therefore annoyance to those indoors is

only predicted within 50 to 100 feet of construction activity.

The construction contractor would ensure that Air Force personnel are protected from excessive noise exposure and all equipment utilized by the construction contractor that produces noise levels in excess of 84 dBA would be identified by the contractor. Occupational noise exposure to workers would be kept below the Occupational Safety and Health Administration standard of 85 $L_{eq\,(8)}$, averaged over eight hours.

4.5.4 Potential Impacts of Alternative 3 – Accelerated Construction

The long-term increase in noise associated with additional facilities and traffic would be the same for Alternatives 2 and 3, causing temporary annoyance during construction to nearby base personnel, but no risk or long-term disruption.

4.6 ENVIRONMENTAL JUSTICE

Activities related to the Proposed Action were evaluated to determine if they would disproportionately impact a minority population or low-income population, or children. None of the impacts from construction of the proposed facilities would be significant, and they would not disproportionately impact a minority population or low-income population, or children. No significant environmental justice impacts were identified from the Proposed Action.

4.6.1 Analysis Methods

The analyses contained in the preceding sections of Chapter 4 (potential impacts to air, water quality, soils, biological resources, and noise) were analyzed to determine if off-base populations could be impacted by significant changes to the environment. Demographic and income data was obtained from the U.S. Bureau of Census to characterize the population in the area near Schriever AFB.

4.6.2 Potential Impacts of Alternative 1 - No Action Alternative

Under the No Action Alternative, no impacts to the affected environment were identified. Therefore, there would be no change in current conditions affecting low-income populations, minority populations, and children.

4.6.3 Potential Impacts of Alternative 2 - Proposed Action

Construction and operation of the proposed facilities would result in increased emissions of criteria pollutants, noise generated by construction equipment, and limited disturbance of soil, alluvial sediments, and surface water on Schriever AFB. None of these impacts would be significant. Emissions of criteria pollutants and HAPs would not exceed the NAAQS or CAAQS. Noise generated during construction and from occasional operation of the emergency generators would be near background levels at sensitive receptor locations on-base and at or below background levels off-base. Soil, sediment, and surface water disturbance would be limited to areas on base. Because no significant impacts were identified to result from the Proposed Action, no disproportionate impacts to minority populations, low-income populations, or children would occur.

4.6.4 Potential Impacts of Alternative 3 – Accelerated Construction

No significant impacts would occur from the accelerated construction of the proposed

facilities. Because no significant impacts were identified to result from Alternative 3, no disproportionate impacts to minority populations, low-income populations, or children would occur.

4.7 COMPATIBILITY OF THE PROPOSED ACTION WITH OBJECTIVES OF FEDERAL, STATE, AND LOCAL LAND USE PLANS, POLICIES, AND CONTROLS

The Proposed Action would be compatible with the existing federal, Colorado, and El Paso County land use plans, policies, and controls.

4.8 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The definitions of short-term and long-term are based on the scope of the Proposed Action. Short-term use of the environment, as it relates to the Proposed Action, would encompass the construction period. Long-term productivity would occur after the construction period has ended. During construction soil would be excavated and there would be associated particulate emissions. Excavation and construction would not have a significant environmental effect and impacts would be minimized through best management practices. Areas of disturbed soil would be revegetated and storm water flow velocity to drainage channels would not change from pre-construction conditions (in accordance with National Pollutant Discharge Elimination System (NPDES) requirements). The proposed facilities would have a long useful life and therefore, high long-term productivity.

4.9 CUMULATIVE IMPACTS

Cumulative impacts are those changes to the physical and biological environments that would result from the Proposed Action in combination with reasonably foreseeable future actions. Significant cumulative impacts could result from impacts that are not significant individually, but when considered together with other impacts, are collectively significant.

Cumulative impacts associated with construction and operation of the proposed facilities include the increase in air emissions from stationary and mobile sources, soil disturbance, and impacts to water resources. Emission of criteria pollutants has been increasing at Schriever AFB over the last several years as more development has occurred and additional stationary sources, such as emergency generators and boilers have been installed. However, air quality in El Paso County has been improving for several years. Pollutant levels are lower than Federal and State standards (PPACG, 2005; PPACG, 2003). The use of construction-related vehicles and their short-term impacts on air quality is unavoidable. The short-term increases in air emissions and the impacts predicted for other resource areas would not be significant when considered cumulatively with other previous, ongoing, or reasonably foreseeable activities at Schriever AFB or El Paso County.

Under the Proposed Action, about 38 acres (in addition to those associated with the housing development) would be converted from grassland to impermeable surface (building and pavement areas) over the next five years, in addition to the development of nearby lands by private developers. Only about 15 percent of Schriever AFB has been developed; about 3,200 acres are

undeveloped. The development proposed under the Base General Plan represents about 1.2 percent of undeveloped land on the base. Cumulative impacts from on-base land development would not be significant. The proposed development would potentially generate increased stormwater flow from impermeable surfaces. Other past development has generated increased flows and significant erosion along drainage channels in the RA (USAF, 2003). Much of this development took place before NPDES permit requirements limited discharge from new construction to pre-construction sediment yield and storm water flow velocity levels. As needed, modifications to the existing drainage system would be incorporated, which would stabilize storm water flow and reduce the potential for erosion and sedimentation (USAF, 2003). NPDES permit requirements would be implemented for these projects, and post-construction storm water flow would not significantly impact the existing drainage system. Permit requirements are expected to also minimize the potential for cumulative impacts from an increase in impermeable surfaces overall in the area as a result of nearby off-base private development.

Any future Federal actions that may have potentially significant cumulative impacts to the environment would be assessed in separate NEPA documents.

4.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The irreversible and irretrievable commitment of resources would most likely involve the commitment of building materials, energy, fuel, and labor. The irretrievable resources to be committed are typical for the scale of the proposed projects. Implementation of best construction management practices, standard equipment maintenance schedules, and use of energy conservation and recycling measures during the facilities construction would minimize the use of irretrievable resources. None of these materials are considered rare and the long-term commitment of these resources would not have a substantial effect on their future availability.

5. REGULATORY REVIEW AND PERMIT REQUIREMENTS

This section lists a brief summary of Federal and state laws and regulations that may be applicable to the Proposed Action or Alternatives and addresses regulatory review and permitting requirements.

5.1 FEDERAL AND STATE LAWS AND REGULATIONS

Environmental Policy
The *National Environmental Policy Act* of 1969 [42 United States Code (U.S.C.) Sec. 4321, *et seq*.] (NEPA) establishes national policy, sets goals, and promotes efforts, which will prevent or eliminate damage to the environment and biosphere. The NEPA process is intended to help public officials make decisions that are based on an understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. The process is also intended to provide information regarding the analyses of proposed major Federal actions that may significantly affect the environment to the public. The President's CEQ regulations [40 CFR 1500-1508] implement the procedural provisions of NEPA.

32 CFR 989, *Environmental Impact Analysis Process* (EIAP), implements the Air Force EIAP and provides procedures for environmental impact analysis.

Executive Order 11514, *Protection and Enhancement of Environmental Quality*, as amended by Executive Order 11991, sets the policy for directing the Federal Government in providing leadership in protecting and enhancing the quality of the nation's environment.

Air Quality
The *Clean Air Act* [42 U.S.C. Sec. 7401, *et seq*., as amended] (CAA) establishes as Federal policy the protection and enhancement of the quality of the Nation's air resources to protect human health and the environment. The CAA sets national primary and secondary ambient air quality standards as a framework for air pollution control.

The *Colorado Air Pollution Prevention and Control Act* [Article 7 of the Title 25, *Colorado Revised Statutes*, 1973, as amended] establishes provisions to achieve and maintain levels of air quality that will protect human health and safety, and to require the use of all available practicable methods to reduce, prevent, and control air pollution for the protection of the health, safety, and general welfare of the people of the State of Colorado.

AFI 32-7040, *Air Quality Compliance*, instructs the Air Force on compliance with the CAA, and Federal, state, and local regulations.

Water Quality
The *Clean Water Act* [33 U.S.C. Sec. 1251, *et seq*., as amended] establishes Federal limits, through the NPDES, on the amounts of specific pollutants that are discharged to surface waters in order to restore and maintain the chemical, physical, and biological integrity of the water. A NPDES permit, or modification to an existing permit, would be required for any change from the present parameters in the quality or quantity of wastewater discharge and/or storm water runoff.

AFI 32-7041, *Water Quality Compliance*, instructs the Air Force on how to assess, attain, and sustain compliance with the

Clean Water Act and Federal, state, and local environmental regulations.

The *Colorado Water Quality Control Act* [Title 25] establishes provisions for the control and prohibition of air and water pollution within the state. In addition, the CDPHE is responsible for administering the permitting program created under the act. No stationary installation that is reasonably expected to be a source of water pollution may be operated, maintained, constructed, expanded, or modified without an appropriate permit issued by the department.

Executive Order 11988, *Floodplain Management*, requires Federal agencies to evaluate the potential effects of actions on floodplains and to avoid adverse floodplain impacts wherever possible.

Wetlands

Executive Order 11990, *Protection of Wetlands*, requires Federal agencies to take action to avoid, to the extent practicable, the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. The intent of Executive Order 11990 is to avoid direct or indirect construction in wetlands if a feasible alternative is available. All Federal and Federally supported activities and projects must comply with Executive Order 11990.

AFI 32-7064, *Integrated Natural Resource Management*, Section 3, provides the Air Force with guidance for no net loss of wetlands on Air Force installations.

Biological Resources

The *Endangered Species Act* [16 U.S.C. Sec. 1531-1543] requires Federal agencies that authorize, fund, or carry out actions to avoid jeopardizing the continued existence of threatened or endangered species and to avoid destroying or adversely modifying their critical habitat. Federal agencies must evaluate the effects of their actions on threatened or endangered species of fish, wildlife, and plants, and their critical habitats, and take steps to conserve and protect these species. All potentially adverse impacts to federally threatened and endangered species must be avoided or mitigated.

The *Migratory Bird Treaty Act* [16 U.S.C. Sec. 703-711] imposes substantive obligations on Federal agencies to protect migratory birds and their habitats.

AFI 32-7064, *Integrated Natural Resource Management*, provides the Air Force with guidance on compliance with the *Endangered Species Act* and Federal, state, and local environmental regulations.

AFI 32-1053 *Pest Management*, provides the Air Force with guidance on managing noxious weeds.

Cultural Resources

The *National Historic Preservation Act* of 1966 [16 U.S.C. Sec. 470, *et seq*., as amended] requires Federal agencies to determine the effect of their actions on cultural resources and take certain steps to ensure these resources are located, identified, evaluated, and preserved.

The *Archaeological Resources Protection Act* [16 U.S.C. Sec. 470a-11, as amended] protects archaeological resources on Federal lands. If archaeological resources are discovered that may be disturbed during site activities, the Act requires permits for excavating and removing the resource.

AFI 32-7065, *Cultural Resource Management*, provides the Air Force with guidance on compliance with the *National Historic Preservation Act*, the *Archaeological Resources Protection Act*,

and applicable Federal, state, and local regulations.

Solid Waste

AFI 32-7042*, Solid and Hazardous Waste Compliance*, provides guidance to the Air Force on compliance with the *Resource Conservation and Recovery Act* and applicable Federal, state, and local regulations.

Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, directs Federal agencies to identify and address any disproportionately high and adverse human or environmental impacts of Federal actions on minority or low-income populations.

Environmental justice also takes into consideration Executive Order 13045, Protection of Children from *Environmental Health Risks and Safety Risks*, which was signed by the President on April 21, 1997. This Executive Order requires that each Federal agency identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on children, who are more at risk because of developing body systems, comparatively higher consumption-to-weight ratios, behaviors that may expose them to more risks and hazards than adults, and less ability than adults to protect themselves from harm.

5.2 PERMIT REQUIREMENTS

The permit requirements identified for resource categories analyzed as part of this EA are identified below.

El Paso County Emission Permit. For all land disturbance greater than one acre, an El Paso County Emission Permit must be obtained and an emission control plan must be approved.

Colorado Air Pollutant Emission Notice (APEN). A Colorado APEN submitted to the CDPHE would be required for PM_{10} emissions from construction. Depending on the size of the six backup generators installed at some of the proposed buildings, these could also require an APEN (see Section 4.1.2). Note that any land development action disturbing less than 25 acres and lasting less than 6 months in duration is exempt from APEN and construction permit requirements.

Hazardous Air Pollutant (HAP) Permit. Only negligible amounts of HAPs would be generated and they would be well below the thresholds required for permits.

Prevention of Significant Deterioration (PSD) Requirements. Schriever AFB is not subject to the PSD review requirements of 40 CFR 52.21 and Code of Colorado Regulations, Title 5, Chapter 1001, Regulation 3, Part B, Section IV.D.3 because the actual or potential emission of any criteria pollutant does not exceed 250 tons per year. Additional emissions from generators and boilers would not exceed this threshold.

Construction General Permit. A Construction General Permit from USEPA Region VIII would be required for any activities disturbing more than one acre of land. The permit outlines provisions construction operators must follow to comply with the requirements of NPDES regulations. Site-specific Stormwater Pollution Prevention Plans may need to be developed. A separate NPDES permit is

required for each construction project on the base, in accordance with the requirements of Section 402 of the *Clean Water Act* (projects impacting one or more acres where storm water runoff would potentially impact waters of the U.S.).

Floodplain Requirements. Executive Order 11988, *Floodplain Management*, provides that if an agency of the Federal government proposes to conduct an activity of development in a 100-year floodplain area, it will consider alternatives to the action and modify its actions, to the extent feasible, to avoid adverse effects or potential harm. Floodplains in the vicinity of Schriever AFB would not be disturbed.

6. LIST OF PREPARERS

This EA was prepared under contract by Labat Environmental, Inc. The following personnel were involved in the preparation and review of this report:

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7. AGENCIES CONTACTED

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8. REFERENCES

AFCEE — see U.S. Air Force Center for Environmental Excellence

CDOW — see Colorado Division of Wildlife

CDPHE — see Colorado Department of Public Health and Environment

CDWR— see Colorado Division of Water Resources

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APPENDIX A
INTERAGENCY REVIEW COMMENT LETTERS

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September 19, 2007

50 CES/CEV (AFSPC)
Melissa R. Trenchik
Environmental Biologist/EIAP Manager
500 O'Malley Ave, Suite 19
Schriever AFB, CO 80912-5019

Re: Updated Integrated Cultural Resources Management Plan, Schriever AFB . (CHS #50868)

Dear Ms. Trenchik,

Thank you for your correspondence dated August 28, 2007and received by our office on August 31, 2007 regarding the review of the above-mentioned project under Section 106 of the National Historic Preservation Act (Section 106). After review of the provided information, we concur with the finding of *no historic properties affected* under Section 106 for the proposed project of implementing the Base General Plan.

We request being involved in the consultation process with the local government, which as stipulated in 36 CFR 800.3 is required to be notified of the undertaking, and with other consulting parties. Additional information provided by the local government or consulting parties might cause our office to re-evaluate our eligibility and potential effect findings.

Please note that our compliance letter does not end the 30-day review period provided to other consulting parties. If we may be of further assistance, please contact Amy Pallante, our Section 106 Compliance Coordinator, at (303) 866-4678.

Sincerely,

for Georgianna Contiguglia
State Historic Preservation Officer

COLORADO HISTORICAL SOCIETY
1300 Broadway Denver Colorado 80203 Tel 303/866-3395 Fax 303/866-2711 www.coloradohistory-oahp.org

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APPENDIX B

AIR EMISSIONS ESTIMATES FOR THE PROPOSED ACTION AND ALTERNATIVE 3

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B. Estimated Air Emissions from Proposed Construction and Operation Activities

This appendix presents calculations performed for estimating air emissions generated from activities related to the construction and operation of facilities under the Proposed Action and Alternative 3 for implementing the Base General Plan at Schriever AFB.

Estimated emissions from construction are presented in Tables B-1 through B-9 for the Proposed Action, and B-10 through B-18 for Alternative 3. Table B-19 presents existing stationary sources actual emissions and potential to emit. Estimated emissions from stationary sources are presented in Tables B-20 for the Proposed Action, and in Table B-21 for Alternative 3.

Table B-1. Proposed Action: Construction Emissions Summary [1]

	Emissions (tons)						
	CO	**VOC**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**HAPs**
Grading (fugitive dust)					20.97	2.94	
Trucks - paved roads					0.13	0.09	
Trucks - unpaved roads					1.77	0.78	
Construction equipment	10.30	2.21	31.34	7.01	0.04	1.36	0.66
Highway vehicles	0.07	0.02	0.03	0.00	0.00	0.00	
Worker vehicles	37.63	2.58	2.58	0.19	0.03	0.03	
Asphalt	6.81	0.14	0.43	0.08	0.46	0.03	0.00
Total Construction	54.81	4.95	34.37	7.27	23.40	5.23	0.66
tons/year	9.13	0.82	5.73	1.21	3.90	0.87	0.11
lb/year	109618	9895	68742	14549	46816	10459	1319
tons/day avg	0.04	0.00	0.02	0.00	0.02	0.00	0.00
lb/day avg	70	6	44	9	30	7	1

[1] See Tables B-2 through B-9 for emissions estimate calculations.

Table B-2. Proposed Action: PM Emissions from Grading (fugitive du

Calculation			Result	
PM emission rate = $\frac{1.0*s^{1.5}}{M^{1.4}}$		lb/hr [1]	9.397	lb/hr PM
where s = silt (%), M = moisture (%) [2,3]				
PM_{10} = PM * 0.75			7.05	lbs/hr PM_{10}
$PM_{2.5}$ = PM * 0.105			0.99	lbs/hr $PM_{2.5}$
Remainder of PM is greater than 10 microns				
Total grading hours =	5,952	hours [4]	41945.6	lbs PM_{10}
			5,872.39	lbs $PM_{2.5}$
Total grading emissions (tons) =			20.97	tons PM_{10}
			2.94	tons $PM_{2.5}$

[1] Sources: USEPA 1995, USEPA 1998a.

[2] Silt content averages 20% for affected soil types (USDA 2004).

[3] 5% soil moisture was assumed.

[4] 201 acres graded, at 1.2 eight-hour days per acre for site clearing and and 2.5 eight-hour days per acre for fill / site leveling; 744 eight-hour days, total.

Table B-3. Proposed Action: PM Emissions from Trucks Driving on Paved Roads

Equation	$EF = k(sL/2)^{0.65}(W/3)^{1.5}$
	where:
	EF = emission factor for normal conditions
	k = particle size multiplier for PM_{10} (0.016) or $PM_{2.5}$ (0.004)
	sL = silt loading (g/m^2); default value for normal conditions, low average daily traffic roads = 0.4
	W = mean vehicle weight (tons); assumed to be 10
PM_{10} emission factor	0.034 lb/mile
$PM_{2.5}$ emission factor	0.009 lb/mile

	Additional assumptions:
15	miles/round trip
3	trucks/hour
8	hours of activity
61	days
	Yield:
21960	Total vehicle miles travelled
265.58	Total PM_{10} emissions (lbs)
0.133	Total PM_{10} emissions (tons)
187.793	Total $PM_{2.5}$ emissions (lbs)
0.094	Total $PM_{2.5}$ emissions (tons)

[1] Emission factor formula from USEPA 2003a.

Table B-4. Proposed Action: PM Emissions from Trucks Driving on Unpaved Roads

Equation[1]:	$EF = k(s/12)^a(W/3)^b$	
	where:	
	EF = emission factor on unpaved roads (uncontrolled)	
	k = particle size multiplier for PM_{10} (1.5) or $PM_{2.5}$ (0.23)	
	s = silt (%); assumed to be 20%	
	W = mean vehicle weight (tons); assumed to be 15	
	a and b are empirical constants; a =0.9 and b = 0.45	
PM_{10} emission factor	4.084	lb/mile
$PM_{2.5}$ emission factor	0.626	lb/mile
	Additional assumptions:	
	2	Mile/round trip
	3	Trucks/hour
	8	Hours of activity
	52	Days
	Yield:	
	2496	Total vehicle miles travelled
	3543.456	Total PM_{10} emissions (lbs)
	1.77	Total PM_{10} emissions (tons)
	1562.902	Total $PM_{2.5}$ emissions (lbs)
	0.781	Total $PM_{2.5}$ emissions (tons)

[1] Source: USEPA 2003b.

Table B-5. Proposed Action: Emissions from Construction Equipment Operation

Equipment	Days	Hours/day	Pieces	CO	VOCs	NO_x	SO_x	PM_{10} [2]	$PM_{2.5}$ [2]
Grading and Excavating									
Scraper	300	8	2						
Emissions factor (grams/hr) [1]				382.67	50.43	1219.19	266.98	1.42	46.04
Emissions (grams)				1836794.9	242058.2	5852113.9	1281484.8	6834.6	220984.9
Emissions (lbs)				4045.80	533.17	12890.12	2822.65	15.05	486.75
Bulldozer	450	8	4						
Emissions factor (grams/hr) [1]				114.06	30.02	332.75	79.76	0.57	18.30
Emissions (grams)				1642475.5	432230.4	4791582.7	1148497.9	8150.6	263537.0
Emissions (lbs)				3617.8	952.0	10554.1	2529.7	18.0	580.5
Grader	450	8	2						
Emissions factor (grams/hr) [1]				164.11	46.07	545.61	125.25	0.69	22.34
Emissions (grams)				1181623.7	331683.8	3928380.5	901765.4	4975.3	160866.7
Emissions (lbs)				2602.7	730.6	8652.8	1986.3	11.0	354.3
Roller	90	8	2						
Emissions factor (grams/hr) [1]				101.29	26.66	295.50	76.16	0.50	16.25
Emissions (grams)				145861.6	38384.6	425521.2	109670.4	723.8	23403.7
Emissions (lbs)				321.3	84.5	937.3	241.6	1.6	51.5
Backhoe/loader	120	8	2						
Emissions factor (grams/hr) [1]				277.55	38.35	236.92	38.80	0.64	20.81
Emissions (grams)				532899.84	73624.32	454893.12	74500.80	1235.84	39958.72
Emissions (lbs)				1173.79	162.17	1001.97	164.10	2.72	88.01
Grading and Excavating Emissions			lbs	11761.36	2462.51	34036.32	7744.32	48.28	1561.13
			tons	5.88	1.23	17.02	3.87	0.02	0.78
Paving [3]									
Paving Equipment	61	8	1						
Emissions factor (grams/hr) [1]				102.21	26.90	298.18	69.17	0.51	16.40
Emissions (grams)				49878.7	13126.0	145510.9	33752.5	247.5	8003.1
Emissions (lbs)				109.87	28.91	320.51	74.34	0.55	17.63
Asphalt Paver	61	8	1						
Emissions factor (grams/hr) [1]				154.86	16.26	190.37	39.79	0.31	9.96
Emissions (grams)				75573.4	7933.1	92901.0	19415.3	150.3	4860.1
Emissions (lbs)				166.46	17.47	204.63	42.76	0.33	10.71
Dump Truck	61	8	9						
Emissions factor (grams/hr) [1]				316.91	41.76	1009.70	218.65	1.18	38.13
Emissions (grams)				1391887.6	183427.0	4434618.7	960294.5	5179.1	167458.1
Emissions (lbs)				3065.83	404.02	9767.88	2115.19	11.41	368.85
Roller	61	8	1						
Emissions factor (grams/hr) [1]				101.29	26.66	295.50	76.16	0.50	16.25
Emissions (grams)				49430.9	13008.1	144204.4	37166.1	245.3	7931.2
Emissions (lbs)				108.88	28.65	317.63	81.86	0.54	17.47
Paving Emissions			lbs	3451.04	479.06	10610.65	2314.16	12.82	414.65
			tons	1.73	0.24	5.31	1.16	0.01	0.21

Table B-5. Proposed Action: Emissions from Construction Equipment Operation (continued)

Equipment	Days	Hours/day	Pieces	CO	VOCs	NO_x	SO_x	PM_{10} [2]	$PM_{2.5}$ [2]
Building & Facility Construction									
Crane	450	8	2						
Emissions factor (grams/hr) [1]				73.85	30.53	393.88	91.58	0.38	12.42
Emissions (grams)				531738.00	219785.04	2835936.00	659355.12	2765.04	89402.88
Emissions (lbs)				1171.23	484.11	6246.56	1452.32	6.09	196.92
Generators	300	8	2						
Emissions factor (grams/hr) [1]				133.11	20.78	263.98	66.84	0.40	13.08
Emissions (grams)				638944.42	99750.82	1267104.96	320820.19	1941.10	62762.14
Emissions (lbs)				1407.37	219.72	2790.98	706.65	4.28	138.24
Air Compressors	450	8	2						
Emissions factor (grams/hr) [1]				33.70	23.59	232.50	40.10	0.29	9.48
Emissions (grams)				242611.20	169827.84	1674017.28	288707.33	2110.72	68246.53
Emissions (lbs)				534.39	374.07	3687.26	635.92	4.65	150.32
Concrete Truck [4]	70	8	2						
Emissions factor (grams/hr) [1]				316.91	41.76	1009.70	218.65	1.18	38.13
Emissions (grams)				354944.0	46775.6	1130868.1	244883.9	1320.7	42703.3
Emissions (lbs)				781.82	103.03	2490.90	539.39	2.91	94.06
Building & Facility Const.Emissions			lbs	3894.80	1180.92	15215.70	3334.29	17.92	579.55
			tons	1.95	0.59	7.61	1.67	0.01	0.29
Utilities Relocation									
Excavator	100	8	2						
Emissions factor (grams/hr) [1]				104.62	27.53	305.20	73.15	0.52	16.79
Emissions (grams)				167388.48	44049.60	488321.28	117046.08	830.65	26857.67
Emissions (lbs)				368.70	97.03	1075.60	257.81	1.83	59.16
Backhoe/loader	80	8	2						
Emissions factor (grams/hr) [1]				277.55	38.35	236.92	38.80	0.64	20.81
Emissions (grams)				355266.56	49082.88	303262.08	49667.20	823.89	26639.15
Emissions (lbs)				782.53	108.11	667.98	109.40	1.81	58.68
Bulldozer	80	8	2						
Emissions factor (grams/hr) [1]				114.06	30.02	332.75	79.76	0.57	18.30
Emissions (grams)				145997.8	38420.5	425918.5	102088.7	724.5	23425.5
Emissions (lbs)				321.58	84.63	938.15	224.86	1.60	51.60
Crane	20	8	1						
Emissions factor (grams/hr) [1]				73.85	30.53	393.88	91.58	0.38	12.42
Emissions (grams)				11816.40	4884.11	63020.80	14652.34	61.45	1986.73
Emissions (lbs)				26.03	10.76	138.81	32.27	0.14	4.38
Utilities Relocation Emissions			lbs	1498.83	300.52	2820.53	624.35	5.38	173.81
			tons	0.75	0.15	1.41	0.31	0.00	0.09
Total Emissions			lbs	20606.02	4423.02	62683.21	14017.11	84.41	2729.14
			tons	10.30	2.21	31.34	7.01	0.04	1.36

[1] Calculated with the following formula: emissions (grams/horsepower-hour) x horsepower x typical load factor
Emission rates and horsepower from USEPA 2006.
Assumes Tier 2 equipment (model years 2001 and newer).
Typical load factor from USAF 2002.

[2] Per USEPA 2004a, PM_{10} from construction equipment exhaust is calculated at 3% of total PM, and $PM_{2.5}$ is calculated at 97% of total PM.

[3] Asphalt paving assumes standard 6-inch thickness with density of 2 tons per cubic yard, 15 mile round trip for 15-ton dump trucks, and four 2-hour round trips each for 9 trucks per day loading, transporting, and unloading.

[4] For building floors; assumes 0.5-ft floor thickness, 9 cubic yards per truck, 2-hour round trip.

Table B-6. Proposed Action: HAPs from Construction Equipment

HAPs emissions = VOCs emissions x 29.83% [1]

VOCs emissions = 4423.02 lbs

HAPs emissions = 1319.39 lbs

= 0.66 tons

[1] From USAF 2002.

[2] From Table B-5.

Table B-7. Proposed Action: Estimated Emissions from Highway Travel by Water Trucks

		Vehicle Exhaust Component					
		CO	**Hydrocarbon**	**NO_x**	**SO_x** [1]	**PM_{10}**	**$PM_{2.5}$**
Number of trucks	1						
Distance (miles)	5						
Days	750						
Total Miles	3750						
Emissions factor (g/mile) [2]		17.9	4.7	6.5	0.512	0.124	0.114
Emissions factor (lb/mile)		0.039427	0.0103524	0.014317181	0.001127753	0.0002731	0.000251101
Estimated emissions (lb)		147.8524	38.821586	53.68942731	4.22907489	1.0242291	0.941629956
Esimated emissions (tons)		0.073926	0.0194108	0.026844714	0.002114537	0.0005121	0.000470815

[1] SO_x factor considered conservatively high, since it uses high sulfur fuel

[2] Emission factors from AFIERA Tables 4-41, 4-42, 4-43, and 4-50 (USAF 2002);
assumes average vehicle model year of 2000 for high altitude heavy duty diesel powered trucks

Table B-8. Proposed Action: Emissions from Worker Vehicles

			Vehicle Exhaust Component					
			CO	**VOCs**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Number of workers [1]	50							
Commute (miles) [2]	30							
Days [3]	1560							
Total Miles	2,340,000							
Emissions factor [4]		grams/mile	14.600	1.000	1.000	0.072	0.011	0.010
lbs/mi		lbs/mile	0.03216	0.00220	0.00220	0.00016	0.00002	0.00002
Total emissions		lbs	75251.10	5154.19	5154.19	371.10	56.70	51.54
		tons	37.63	2.58	2.58	0.19	0.028	0.026

[1] Assumed to average 50 per day for the life of the project.

[2] Assumed to average 30 miles.

[3] Number of work-days in the 6-year project, assumed to be 260 work days per year.

[4] From Tables 4-5, 4-6, 4-7, and 4-50 in USAF 2002 for calendar year 2007;
assumes average vehicle model year of 2003 for low altitude light duty gas vehicles.

Table B-9. Proposed Action: Emissions from Hot Mix Asphalt Plant (off-site)

		Emissions Component						
		CO	**VOCs**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**HAPs [1]**
Tons hot mix asphalt		34033.33						
Emission factor (lbs/ton asphalt) [2]		0.4	0.0082	0.025	0.0046	0.027	0.0016011	0.0077
Estimated emissions	lbs	13613.33	279.0733	850.83333	156.5533333	918.9	54.49077	2.15
	tons	6.806667	0.139537	0.4254167	0.078276667	0.45945	0.0272454	0.00000385

[1] HAPs emissions are calculated by mutiplying VOC emissions by emissions factor.

[2] Source: EPA 2004b

Table B-10. Alternative 3: Construction Emissions Summary [1]

	Emissions (tons)						
	CO	**VOC**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**HAPs**
Grading - fugitive dust					15.85	2.22	
Trucks - paved roads					0.61	0.09	
Trucks - unpaved roads					9.61	0.23	
Construction equipment	23.39	4.55	69.98	15.60	0.09	3.02	1.36
Highway vehicles	0.15	0.04	0.05	0.00	0.00	0.00	
Worker vehicles	60.20	4.12	4.12	0.30	0.05	0.04	
Asphalt	29.28	0.60	1.83	0.34	1.98	0.12	0.00
Total Construction	113.02	9.32	75.99	16.24	28.19	5.72	1.36
tons/year	18.84	1.55	12.66	2.71	4.70	0.95	0.23
lb/year	226034	18633	151972	32481	56383	11441	2717
tons/day avg	0.07	0.01	0.05	0.01	0.02	0.00	0.00
lb/day avg	145	12	97	21	36	7	2

[1] See Tables B-11 through B-18 for emissions estimate calculations.

Table B-11. Alternative 3: PM Emissions from Grading (fugitive dust)

Calculation			**Result**
PM emission rate = $\frac{1.0*s^{1.5}}{M^{1.4}}$		lb/hr [1]	9.397 lb/hr PM
where s = silt (%), M = moisture (%) [2,3]			
PM_{10} = PM * 0.75			7.05 lbs/hr PM_{10}
$PM_{2.5}$ = PM * 0.105			0.99 lbs/hr $PM_{2.5}$
Remainder of PM is greater than 10 microns			
Total grading hours =	4,499	hours [4]	31705.9 lbs PM_{10}
			4,438.82 lbs $PM_{2.5}$
Total grading emissions (tons) =			15.85 tons PM_{10}
			2.22 tons $PM_{2.5}$

[1] Sources: USEPA 1995, USEPA 1998a.

[2] Silt content averages 20% for affected soil types (USDA 2004).

[3] 5% soil moisture was assumed.

[4] 446 acres graded, at 1.2 eight-hour days per acre for site clearing and and 2.5 eight-hour days per acre for fill / site leveling; 744 eight-hour days, total.

Table B-12. Alternative 3: PM Emissions from Trucks Driving on Paved Roads

Equation	$EF = k(sL/2)^{0.65} (W/3)^{1.5}$	
	where:	
	EF = emission factor for normal conditions	
	k = particle size multiplier for PM_{10} (0.016) or $PM_{2.5}$ (0.004)	
	sL = silt loading (g/m^2); default value for normal conditions, low average daily traffic roads = 0.4	
	W = mean vehicle weight (tons); assumed to be 10	
PM_{10} emission factor	0.034	lb/mile
$PM_{2.5}$ emission factor	0.009	lb/mile
Additional assumptions:		
	15	miles/round trip
	6	trucks/hour
	8	hours of activity
	141	days
Yield:		
	101520	Total vehicle miles travelled
	1227.76	Total PM_{10} emissions (lbs)
	0.614	Total PM_{10} emissions (tons)
	187.793	Total $PM_{2.5}$ emissions (lbs)
	0.094	Total $PM_{2.5}$ emissions (tons)

[1] Emission factor formula from USEPA 2003a.

Table B-13. Alternative 3: PM Emissions from Trucks Driving on Unpaved Roads

Equation[1]:	$EF = k(s/12)^a(W/3)^b$	
	where:	
	EF = emission factor on unpaved roads (uncontrolled)	
	k = particle size multiplier for PM_{10} (1.5) or $PM_{2.5}$ (0.23)	
	s = silt (%); assumed to be 20%	
	W = mean vehicle weight (tons); assumed to be 15	
	a and b are empirical constants; a =0.9 and b = 0.45	
PM_{10} emission factor	4.084	lb/mile
$PM_{2.5}$ emission factor	0.626	lb/mile
	Additional assumptions:	
	2	Mile/round trip
	6	Trucks/hour
	8	Hours of activity
	141	Days
	Yield:	
	13536	Total vehicle miles travelled
	19216.44	Total PM_{10} emissions (lbs)
	9.61	Total PM_{10} emissions (tons)
	450.8371	Total $PM_{2.5}$ emissions (lbs)
	0.225	Total $PM_{2.5}$ emissions (tons)

[1] Source: USEPA 2003b.

Table B-14. Alternative 3: Emissions from Construction Equipment Operation

Equipment	Days	Hours/day	Pieces	CO	VOCs	NO_x	SO_x	PM_{10} [2]	$PM_{2.5}$ [2]
Grading and Excavating									
Scraper	300	8	4						
Emissions factor (grams/hr) [1]				382.67	50.43	1219.19	266.98	1.42	46.04
Emissions (grams)				3673589.8	484116.5	11704227.8	2562969.6	13669.2	441969.9
Emissions (lbs)				8091.61	1066.34	25780.24	5645.31	30.11	973.50
Bulldozer	450	8	8						
Emissions factor (grams/hr) [1]				114.06	30.02	332.75	79.76	0.57	18.30
Emissions (grams)				3284951.0	864460.8	9583165.4	2296995.8	16301.3	527074.1
Emissions (lbs)				7235.6	1904.1	21108.3	5059.5	35.9	1161.0
Grader	450	8	4						
Emissions factor (grams/hr) [1]				164.11	46.07	545.61	125.25	0.69	22.34
Emissions (grams)				2363247.4	663367.7	7856761.0	1803530.9	9950.5	321733.3
Emissions (lbs)				5205.4	1461.2	17305.6	3972.5	21.9	708.7
Roller	90	8	4						
Emissions factor (grams/hr) [1]				101.29	26.66	295.50	76.16	0.50	16.25
Emissions (grams)				291723.3	76769.3	851042.3	219340.8	1447.6	46807.3
Emissions (lbs)				642.6	169.1	1874.5	483.1	3.2	103.1
Backhoe/loader	120	8	4						
Emissions factor (grams/hr) [1]				277.55	38.35	236.92	38.80	0.64	20.81
Emissions (grams)				1065799.68	147248.64	909786.24	149001.60	2471.67	79917.45
Emissions (lbs)				2347.58	324.34	2003.93	328.20	5.44	176.03
Grading and Excavating Emissions			lbs	23522.71	4925.03	68072.65	15488.63	96.56	3122.25
			tons	11.76	2.46	34.04	7.74	0.05	1.56
Paving [3]									
Paving Equipment	132	8	3						
Emissions factor (grams/hr) [1]				102.21	26.90	298.18	69.17	0.51	16.40
Emissions (grams)				323802.9	85211.3	944627.9	219114.7	1606.8	51954.5
Emissions (lbs)				713.22	187.69	2080.68	482.63	3.54	114.44
Asphalt Paver	132	8	3						
Emissions factor (grams/hr) [1]				154.86	16.26	190.37	39.79	0.31	9.96
Emissions (grams)				490607.9	51500.3	603095.3	126040.1	975.8	31550.7
Emissions (lbs)				1080.63	113.44	1328.40	277.62	2.15	69.49
Dump Truck	132	8	19						
Emissions factor (grams/hr) [1]				316.91	41.76	1009.70	218.65	1.18	38.13
Emissions (grams)				6358568.5	837950.9	20258695.0	4386919.4	23659.8	764999.9
Emissions (lbs)				14005.66	1845.71	44622.68	9662.82	52.11	1685.02
Roller	132	8	3						
Emissions factor (grams/hr) [1]				101.29	26.66	295.50	76.16	0.50	16.25
Emissions (grams)				320895.6	84446.2	936146.5	241274.9	1592.4	51488.1
Emissions (lbs)				706.82	186.00	2062.00	531.44	3.51	113.41
Paving Emissions			lbs	16506.33	2332.84	50093.76	10954.51	61.31	1982.36
			tons	8.25	1.17	25.05	5.48	0.03	0.99

Table B-14. Alternative 3: Emissions from Construction Equipment Operation (continued)

Equipment	Days	Hours/day	Pieces	CO	VOCs	NO_x	SO_x	PM_{10} [2]	$PM_{2.5}$ [2]
Building & Facility Construction									
Crane	500	8	2						
Emissions factor (grams/hr) [1]				73.85	30.53	393.88	91.58	0.38	12.42
Emissions (grams)				590820.00	244205.60	3151040.00	732616.80	3072.26	99336.54
Emissions (lbs)				1301.37	537.90	6940.62	1613.69	6.77	218.80
Generators	300	8	2						
Emissions factor (grams/hr) [1]				133.11	20.78	263.98	66.84	0.40	13.08
Emissions (grams)				638944.42	99750.82	1267104.96	320820.19	1941.10	62762.14
Emissions (lbs)				1407.37	219.72	2790.98	706.65	4.28	138.24
Air Compressors	550	8	2						
Emissions factor (grams/hr) [1]				33.70	23.59	232.50	40.10	0.29	9.48
Emissions (grams)				296524.80	207567.36	2046021.12	352864.51	2579.77	83412.43
Emissions (lbs)				653.14	457.20	4506.65	777.23	5.68	183.73
Concrete Truck [4]	70	8	2						
Emissions factor (grams/hr) [1]				316.91	41.76	1009.70	218.65	1.18	38.13
Emissions (grams)				354944.0	46775.6	1130868.1	244883.9	1320.7	42703.3
Emissions (lbs)				781.82	103.03	2490.90	539.39	2.91	94.06
Building & Facility Const.Emissions			lbs	4143.69	1317.84	16729.15	3636.97	19.63	634.83
			tons	2.07	0.66	8.36	1.82	0.01	0.32
Utilities Relocation									
Excavator	120	8	3						
Emissions factor (grams/hr) [1]				104.62	27.53	305.20	73.15	0.52	16.79
Emissions (grams)				301299.26	79289.28	878978.30	210682.94	1495.17	48343.81
Emissions (lbs)				663.65	174.65	1936.08	464.06	3.29	106.48
Backhoe/loader	90	8	3						
Emissions factor (grams/hr) [1]				277.55	38.35	236.92	38.80	0.64	20.81
Emissions (grams)				599512.32	82827.36	511754.76	83813.40	1390.32	44953.56
Emissions (lbs)				1320.51	182.44	1127.21	184.61	3.06	99.02
Bulldozer	90	8	3						
Emissions factor (grams/hr) [1]				114.06	30.02	332.75	79.76	0.57	18.30
Emissions (grams)				246371.3	64834.6	718737.4	172274.7	1222.6	39530.6
Emissions (lbs)				542.67	142.81	1583.12	379.46	2.69	87.07
Crane	30	8	2						
Emissions factor (grams/hr) [1]				73.85	30.53	393.88	91.58	0.38	12.42
Emissions (grams)				35449.20	14652.34	189062.40	43957.01	184.34	5960.19
Emissions (lbs)				78.08	32.27	416.44	96.82	0.41	13.13
Utilities Relocation Emissions			lbs	2604.92	532.17	5062.85	1124.95	9.45	305.70
			tons	1.30	0.27	2.53	0.56	0.00	0.15
Total Emissions			lbs	46777.65	9107.87	139958.40	31205.07	186.96	6045.15
			tons	23.39	4.55	69.98	15.60	0.09	3.02

[1] Calculated with the following formula: emissions (grams/horsepower-hour) x horsepower x typical load factor
Emission rates and horsepower from USEPA 2006.
Assumes Tier 2 equipment (model years 2001 and newer).
Typical load factor from USAF 2002.

[2] Per USEPA 2004a, PM_{10} from construction equipment exhaust is calculated at 3% of total PM, and $PM_{2.5}$ is calculated at 97% of total PM.

[3] Asphalt paving assumes standard 6-inch thickness with density of 2 tons per cubic yard, 15 mile round trip for 15-ton dump trucks, and four 2-hour round trips each for 9 trucks per day loading, transporting, and unloading.

[4] For building floors; assumes 0.5-ft floor thickness, 9 cubic yards per truck, 2-hour round trip.

Table B-15. Alternative 3: HAPs from Construction Equipment

HAPs emissions = VOCs emissions x 29.83% [1]

VOCs emissions = 9107.87 lbs

HAPs emissions = 2716.88 lbs

= 1.36 tons

[1] From USAF 2002.

[2] From Table B-14.

Table B-16. Alternative 3: Estimated Emissions from Highway Travel by Water Trucks

		Vehicle Exhaust Component					
		CO	**Hydrocarbons**	**NO_x**	**SO_x [1]**	**PM_{10}**	**$PM_{2.5}$**
Number of trucks	2						
Distance (miles)	5						
Days	750						
Total Miles	7500						
Emissions factor (g/mile) [2]		17.9	4.7	6.5	0.512	0.124	0.114
Emissions factor (lb/mile)		0.039427	0.010352423	0.014317181	0.001127753	0.0002731	0.000251101
Estimated emissions (lb)		295.7048	77.64317181	107.3788546	8.45814978	2.0484581	1.883259912
Esimated emissions (tons)		0.147852	0.038821586	0.053689427	0.004229075	0.0010242	0.00094163

[1] SO_x factor considered conservatively high, since it uses high sulfur fuel

[2] Emission factors from AFIERA Tables 4-41, 4-42, 4-43, and 4-50 (USAF 2002);
assumes average vehicle model year of 2000 for high altitude heavy duty diesel powered trucks

Table B-17. Alternative 3: Emissions from Worker Vehicles

			Vehicle Exhaust Component					
			CO	**VOCs**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Number of workers [1]	80							
Commute (miles) [2]	30							
Days [3]	1560							
Total Miles	3,744,000							
Emissions factor [4]		grams/mile	14.600	1.000	1.000	0.072	0.011	0.010
lbs/mi		lbs/mile	0.03216	0.00220	0.00220	0.00016	0.00002	0.00002
Total emissions		lbs	120401.76	8246.70	8246.70	593.76	90.71	82.47
		tons	60.20	4.12	4.12	0.30	0.05	0.04

[1] Assumed to average 50 per day for the life of the project.

[2] Assumed to average 30 miles.

[3] Number of work-days in the 6-year project, assumed to be 260 work days per year.

[4] From Tables 4-5, 4-6, 4-7, and 4-50 in USAF 2002 for calendar year 2007;
assumes average vehicle model year of 2003 for low altitude light duty gas vehicles.

Table B-18. Alternative 3: Emissions from Hot Mix Asphalt Plant (off-site)

		Emissions Component						
		CO	**VOCs**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**HAPs [1]**
Tons hot mix asphalt		146397.2						
Emission factor (lbs/ton asphalt) [2]		0.4	0.0082	0.025	0.0046	0.027	0.0016011	0.0077
Estimated emissions	lbs	58558.89	1200.457	3659.930556	673.4272222	3952.725	234.39659	9.24
	tons	29.27944	0.600229	1.829965278	0.336713611	1.9763625	0.1171983	0.00000385

[1] HAPs emissions are calculated by mutiplying VOC emissions by emissions factor.

[2] Source: EPA 2004b

Table B-19: Existing Stationary Sources Actual Emissions and Potential to Emit

Emission Source	Permitted[a] Device (Y/N)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_x (tpy)	NO_x (tpy)	VOC (tpy)	CO (tpy)	HAPs (tpy)
Actual Emissions								
Internal combustion engines	Y	0.149	0.127	1.187	8.034	0.280	1.960	0.0069
External combustion	Y	0.150	0.150	0.017	1.963	0.108	1.646	0.0515
Mogas storage and dispensing	Y					5.239		0.4320
Government diesel fuel and storag	Y							
Internal combustion engines	N	0.103	0.103	0.093	1.507	0.632	11.288	0.0013
External combustion	N	0.259	0.259	0.020	3.239	0.187	2.646	0.0645
Cooling towers	N	0.003	0.003	0.003				
Storage tanks	N					0.005		
Woodworking	N	0.003	0.003					
Miscellaneous chemical usage	N					0.777		0.0590
Firefighter training	N	0.049	0.049		0.287	0.124	0.079	0.0036
Solvent parts washer	N					0.003		
Total Emissions from Permitted Sources		0.299	0.277	1.203	9.997	5.627	3.606	0.490
Permit Limits		*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Total Emissions from Non-Permitted Sources		0.417	0.417	0.117	5.033	1.728	14.013	0.128
Total Stationary Sources		0.716	0.694	1.320	15.030	7.355	17.619	0.619
Potential to Emit								
Internal combustion engines	Y	0.960	0.827	7.164	56.209	1.797	11.934	0.0133
External combustion	Y	0.536	0.536	0.699	7.050	0.378	5.922	0.1335
Mogas storage and dispensing	Y					5.525		0.4395
Government diesel fuel and storag	Y					0.001		
Internal combustion engines	N	5.751	5.751	5.174	82.344	37.713	673.096	0.0001
External combustion	N	1.899	1.899	5.365	18.699	0.959	10.605	0.3430
Cooling towers	N	0.004	0.004	0.004				
Storage tanks	N					0.007		
Woodworking	N	0.011	0.011					
Miscellaneous chemical usage	N					3.271		0.2610
Firefighter training	N	0.20	0.20		1.15	0.495	0.317	0.0145
Solvent parts washer	N					0.014	0.000	
Total Emissions from Permitted Sources		1.496	1.362	7.863	63.259	7.700	17.856	0.586
Permit Limits		*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Total Emissions from Non-Permitted Sources		7.862	7.862	10.544	102.192	42.458	684.018	0.619
Total Stationary Sources		9.36	9.22	18.41	165.45	50.16	701.87	1.20

Source USAF, 2006

Table B-20. Proposed Action: Stationary Sources Estimated Emissions

Additional emergency generators and increased space heating (natural gas combustion)

Proposed Space Innovation Development Center Building Generators [1]

Calendar Year	CY 2008	
Actual Fuel Usage[a]	8,127	gal/yr total
Actual Operating Hours[b]	135	hrs/yr total
Potential Fuel Usage[c]	67,760	gal/yr total
Potential Operating Hours[d]	1,126	hrs/yr total
Generator Output Rating	900.0	kW each
Engine Rating[e]	3.43	MMBtu/hr each
Horsepower[f]	1350	
Fuel Sulfur Content[g]	0.5%	
Fuel Heat Content[h]	137,000	btu/gal

Generators:

4 Cummins QST30-G3

[1] From Space Innovation and Development Center EA, March 2006

a Actual fuel usage estimated from estimated actual hours multiplied by fuel consumption rate (Cummins, 2005).

b Actual operating hour data estimated from Schriever AFB air emissions inventory (similar to Bldg 700).

c Potential fuel usage obtained from the Schriever AFB Synthetic Minor Construction Permit (April 2005) for Building 700 generators.

d Calculated from the Schriever AFB Synthetic Minor Construction Permit limits on potential fuel usage and the fuel. consumption rate per hour from the QST30-G3 Data Sheet.

e Engine rating from Schriever AFB Synthetic Minor Construction Permit.

f Horsepower obtained from Cummins Power Generation Data Sheet (Cummins, 2005)

g Sulfur content per fuel delivery contract requirements as stated in the Schriever AFB Synthetic Minor Construction Permit.

h Diesel fuel heat content from AP-42 Appendix A, 5th Edition (10/96), Table 3.4-1. (USEPA 1985)

Criteria Pollutant Emission Estimation

Pollutant	Emission Factor g/HP-hour[a]	Emission Factor (lb/mmbtu)[b]	Actual Emissions (tpy)[c]	Potential Emissions (tpy)
PM	0.08		0.02	0.13
PM_{10}		0.06	0.03	0.27
$PM_{2.5}$		0.05	0.03	0.22
SO_x		0.01	0.00	0.02
NO_x	7.58		1.52	12.69
VOC	0.19		0.04	0.32
CO	0.21		0.04	0.35
Total			**1.68**	**14.00**

a Emission factors for PM, Nox, VOC, and CO are from QST30 fact sheet (Cummins, 2005).

b Emission factors for PM10, PM2.5, and SOx are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel) only. These emission factors are from USEPA, 1996; USEPA, 2004c; and USAF, 1999.

c Emissions of PM, NOx, VOC, and CO = emission factor * horsepower * operating hours divided by 454 (grams per pound) divided by 2000lbs

c Emissions of PM10, PM2.5, and SOx = fuel usage (estimated from Bldg 700 generator) * emission factor * heat content of fuel (per million BTus) divided by 1 million divided by 2000 (pounds per ton)

HAP Emission Estimation[a]

HAP	CAS Number	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Acetaldehyde	75070	2.52E-05	0.00001	0.00012
Acrolein	107028	7.88E-06	0.00000	0.00004
Benzene	71432	7.76E-04	0.00043	0.00360
Formaldehyde	50000	7.89E-05	0.00004	0.00037
Mercury	7439976	3.01E-07	0.00000	0.00000
Naphthalene	91203	1.30E-04	0.00007	0.00060
Toluene	108883	2.81E-04	0.00016	0.00130
Xylene	1330207	1.93E-04	0.00011	0.00090
Total			**0.0008**	**0.0069**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only.

b Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.

c Emissions = fuel usage (estimated from Bldg 700 generator) * emission factor * heat content of fuel (per million BTus) divided by 1 million divided by 2000 (pounds per ton)

Table B-20. Proposed Action: Stationary Sources Estimated Emissions (continued)

Proposed Joint Operations Building Generators

Calendar Year	**CY 2003**	
Actual Fuel Usage[a]	1,061	gal/yr total
Actual Operating Hours[b]	135	hrs/yr total
Potential Fuel Usage[c]	15,000	gal/yr total
Potential Operating Hours[d]	413	hrs/yr total
Generator Output Rating	900.0	kW each
Engine Rating[c]	4.98	MMBtu/hr each
Fuel Sulfur Content[c]	0.5%	
Fuel Heat Content[e]	137,000	btu/gal

Generators:
2 Cummins QST30-G2
(typical example)

a Actual fuel usage estimated from estimated actual hours multiplied by fuel consumption rate (Cummins, 2005).
b Actual operating hour data estimated from Schriever AFB air emissions inventory (similar to Bldg 700).
c From the Schriever AFB Synthetic Minor Construction Permit (April 2005).
d Potential operating hours = Potential fuel usage x Fuel Heat Content/1000000/Engine Rating
e Diesel fuel heat content from USEPA, 1996, Table 3.4-1.

Criteria Pollutant Emission Estimation[a]

Pollutant	**Emission Factor (lb/mmbtu)**	**Actual Emissions (tpy)[b]**	**Potential Emissions (tpy)**
PM	0.07	0.01	0.07
PM_{10}	0.06	0.00	0.06
$PM_{2.5}$	0.05	0.00	0.05
SO_x	0.01	0.00	0.01
NO_x	3.20	0.23	3.29
VOC	0.09	0.01	0.09
CO	0.85	0.06	0.87
Total		**0.31**	**4.44**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only. Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

HAP Emission Estimation[a]

HAP	**CAS Number**	**Emission Factor (lb/mmbtu)**	**Actual Emissions (tpy)[b]**	**Potential Emissions (tpy)**
Acetaldehyde	75070	2.52E-05	0.0000	0.0000
Acrolein	107028	7.88E-06	0.0000	0.0000
Benzene	71432	7.76E-04	0.0001	0.0008
Formaldehyde	50000	7.89E-05	0.0000	0.0001
Mercury	7439976	3.01E-07	0.0000	0.0000
Naphthalene	91203	1.30E-04	0.0000	0.0001
Toluene	108883	2.81E-04	0.0000	0.0003
Xylene	1330207	1.93E-04	0.0000	0.0002
Total			**0.0001**	**0.0015**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only. Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

Natural Gas Consumption from Boilers for New Buildings

206,000 square feet
7.57 ft^3 natural gas per ft^2 per month, based on recent basewide usage
30 days per month
51980.67 consumption per day (ft^3)
51.98 consumption per day (1000 ft^3)
9,356,520 consumption per year (ft^3)
9.36 mmcf

Estimated Emissions from Boilers for New Buildings

	CO	**VOC**	**NOx**	**SOx**	**PM10**	**PM2.5**
Emission Factors (lbs/million ft^3)	84	5.5	100	0.6	7.6	7.6
Emission Factors (lbs/ 1,000 ft^3)	0.0840	0.0055	0.1000	0.0006	0.0076	0.0076
lbs/day	4.3664	0.2859	5.1981	0.0312	0.3951	0.3951
lbs/year	785.9477	51.4609	935.6520	5.6139	71.1096	71.1096
tons/year	0.393	0.026	0.468	0.003	0.036	0.036

Emission factors from Table 1.4-1 (CO, Nox) and Table 1.4-2 (VOC, SOx, and PM_{10}). Source: AP-42 Vol I Chapter 1.4 Natural Gas Combustion, July 1998 (USEPA 1998b)
CO and NOx emission factors for heating units less than 100 Million British thermal units for uncontrolled combustion from Table 1.4-1.
VOC, SOx, and PM10 emission factors are for general natural gas combustion (Table 1.4-2)
Estimated emissions are calculated on the basis of 180 days (6 months) operation of furnaces/boilers

Table B-20. Proposed Action: Stationary Sources Estimated Emissions (continued)

HAPs	CAS Number	Emission Factor (lb/mmcf)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Arsenic	7440382	0.00020	0.000001	0.000002
Benzene	71432	0.00210	0.000010	0.000020
Beryllium	7440417	0.00001	0.000000	0.000000
Cadmium	7440439	0.00110	0.000005	0.000010
Chromium	7440473	0.00140	0.000007	0.000013
Cobalt	7440484	0.00008	0.000000	0.000001
Dichlorobenzene (1,4 isomer)	25321226	0.00120	0.000006	0.000011
Formaldehyde	50000	0.07500	0.000351	0.000702
Hexane	110543	1.80000	0.008421	0.016842
Lead	7439921	0.00050	0.000002	0.000005
Manganese	7439965	0.00038	0.000002	0.000004
Mercury	7439976	0.00026	0.000001	0.000002
Naphthalene	91203	0.00061	0.000003	0.000006
Nickel	7440020	0.00210	0.000010	0.000020
POMc	None	0.00009	0.000000	0.000001
Selenium	7782492	0.00002	0.000000	0.000000
Toluene	108883	0.00340	0.000016	0.000032
Total			0.0088	0.0177

Emission factors from USEPA, 1998b, Table 1.4-3 and 1.4-4

Potential to Emit

CO	VOC	NOx	SOx	PM10
0.786	0.051	0.936	0.006	0.071

PTE based on continuous operation

Estimated Air Emissions from Operation of the Proposed Military Family Housing
Summary of emissions in tons per year from operation (stationary sources)

	CO	VOC	NOx	SOx	PM-10	HAPs
Natural gas consumption	**0.19**	**0.03**	**0.46**	**0.00**	**0.04**	**0.009**

Natural Gas Consumption from all usage

269	housing units
36.00	average consumption per year (1000 ft^3)
9684.00	total consumption from 269 housing units (1000 ft3)

Average Consumption of natural gas from USDOE, 2001.

Estimated Emissions from housing units

CO	VOC	NOx	SOx	PM10	
40.0	5.5	94.0	0.6	7.6	Emission Factors (lbs/million ft^3)
0.0400	0.0055	0.0940	0.0006	0.0076	Emission Factors (lbs/ 1,000 ft^3)
387.3600	53.2620	910.2960	5.8104	73.5984	lbs/year
0.194	0.027	0.455	0.003	0.0368	tons/year

Emission factors from AP-42 (USEPA 1998b), Table 1.4-1 (CO, Nox) and Table 1.4-2 (VOC, SOx, and PM10)

Potential to Emit from all housing units

CO	VOC	NOx	SOx	PM10	
774.72	106.52	1820.59	11.62	147.20	lbs/year
0.39	**0.05**	**0.91**	**0.01**	**0.07**	**tons/year**

Potential to emit based on doubling estimated emissions

Estimated Emissions of HAPs from Housing units

Inorganic HAPs	Organic HAPs	Total	
0.00606	1.881198	1.887258	Emission Factors (lbs/million ft^3)
0.00000606	0.001881198	0.001887258	Emission Factors (lbs/ 1,000 ft^3)
0.05869	18.21752	18.27621	lbs/year
0.00003	**0.00911**	**0.00914**	**tons/year**

Source: AP-42 Vol I Chapter 1.4 Natural Gas Combustion, July 1998 (USEPA 1998b)

Potential to Emit HAPs from Housing Units

Inorganic HAPs	Organic HAPs	Total	
0.11737	36.43504	36.55241	lbs/year
0.00006	**0.01822**	**0.01828**	**tons/year**

Potential to emit based on doubling estimated emissions

Table B-20. Proposed Action: Stationary Sources Estimated Emissions (continued)

Summary of Stationary Criteria Pollutant Emissions with Proposed Action
Stationary Sources - Actual Emissions

Source	Criteria Pollutants - Actual, in Tons per Year						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	0.30	0.28	1.20	10.00	5.63	3.61	0.49
Proposed Generators[1]	0.04	0.03	0.00	1.75	0.04	0.10	0.001
Total Permitted Sources	**0.34**	**0.31**	**1.21**	**11.75**	**5.67**	**3.71**	**0.49**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Proposed Basewide Natural Gas[2]	0.07	0.07	0.01	0.92	0.05	0.59	0.02
Total Non-Permitted Sources	**0.49**	**0.49**	**0.12**	**5.96**	**1.78**	**14.60**	**0.15**
Total Stationary Sources	**0.82**	**0.80**	**1.33**	**17.71**	**7.45**	**18.31**	**0.64**
Estimated Increase in Emissions	*0.11*	*0.10*	*0.01*	*2.68*	*0.10*	*0.69*	*0.02*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center and 2 generators at a proposed Joint Operations Facility
[2] Estimated using proposed military housing and estimated square footage of other facilities

Summary of Stationary Criteria Pollutant Emissions with Proposed Action
Stationary Sources - Potential to Emit

Source	Criteria Pollutants - Actual, in Tons per Year						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Proposed Generators[1]	0.32	0.27	0.03	15.97	0.41	1.22	0.008
Total Permitted Sources	**1.82**	**1.63**	**7.89**	**79.23**	**8.11**	**19.08**	**0.59**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	7.86	7.86	10.54	102.19	42.46	684.02	0.62
Proposed Basewide Natural Gas[2]	0.14	0.14	0.01	1.85	0.10	1.17	0.036
Total Non-permitted Sources	**8.01**	**8.01**	**10.55**	**104.04**	**42.56**	**685.19**	**0.65**
Total Stationary Sources	**9.83**	**9.64**	**18.45**	**183.27**	**50.67**	**704.27**	**1.25**
Estimated Increase in Emissions	*0.47*	*0.42*	*0.04*	*17.82*	*0.52*	*2.40*	*0.04*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center and 2 generators at a proposed Joint Operations Facility
[2] Estimated using proposed military housing and estimated square footage of other facilities

Table B-21. Alternative 3: Stationary Sources Estimated Emissions

Proposed Space Innovation Development Center Building Generators [1]

Calendar Year	CY 2008	
Actual Fuel Usage[a]	8,127	gal/yr total
Actual Operating Hours[b]	135	hrs/yr total
Potential Fuel Usage[c]	67,760	gal/yr total
Potential Operating Hours[d]	1,126	hrs/yr total
Generator Output Rating[e]	900.0	kW each
Engine Rating[f]	3.43	MMBtu/hr each
Horsepower[g]	1350	
Fuel Sulfur Content[h]	0.5%	
Fuel Heat Content[i]	137,000	btu/gal

Generators:
4 Cummins QST30-G3

[1] From Space Innovation and Development Center EA, March 2006
a Actual fuel usage estimated from estimated actual hours multiplied by fuel consumption rate (Cummins, 2005).
b Actual operating hour data estimated from Schriever AFB air emissions inventory (similar to Bldg 700).
c Potential fuel usage obtained from the Schriever AFB Synthetic Minor Construction Permit (April 2005) for Building 700 generators.
d Calculated from the Schriever AFB Synthetic Minor Construction Permit limits on potential fuel usage and the fuel consumption rate per hour from the QST30-G3 Data Sheet.
e Generator output rating was obtained from the Schriever AFB air emissions inventory..
f Engine rating from Schriever AFB Synthetic Minor Construction Permit.
g Horsepower obtained from Cummins Power Generation Data Sheet (Cummins, 2005)
h Sulfur content per fuel delivery contract requirements as stated in the Schriever AFB Synthetic Minor Construction Permit.
i Diesel fuel heat content from AP-42 Appendix A, 5th Edition (10/96), Table 3.4-1. (USEPA 1985).

Criteria Pollutant Emission Estimation

Pollutant	Emission Factor g/HP-hour[a]	Emission Factor (lb/mmbtu)[b]	Actual Emissions (tpy)[c]	Potential Emissions (tpy)
PM	0.08		0.02	0.13
PM_{10}		0.06	0.03	0.27
$PM_{2.5}$		0.05	0.03	0.22
SO_x		0.01	0.00	0.02
NO_x	7.58		1.52	12.69
VOC	0.19		0.04	0.32
CO	0.21		0.04	0.35
Total			**1.68**	**14.00**

a Emission factors for PM, Nox, VOC, and CO are from QST30 fact sheet (Cummins, 2005).
b Emission factors for PM10, PM2.5, and SOx are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel) only. These emission factors are from USEPA, 1996; USEPA, 2004c; and USAF, 1999a.
c Emissions of PM, NOx, VOC, and CO = emission factor * horsepower * operating hours divided by 454 (grams per pound) divided by 2000lbs
c Emissions of PM10, PM2.5, and SOx = fuel usage (estimated from Bldg 700 generator) * emission factor * heat content of fuel (per million BTus) divided by 1 million divided by 2000 (pounds per ton)

HAP Emission Estimation[a]

HAP	CAS Number	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Acetaldehyde	75070	2.52E-05	0.00001	0.00012
Acrolein	107028	7.88E-06	0.00000	0.00004
Benzene	71432	7.76E-04	0.00043	0.00360
Formaldehyde	50000	7.89E-05	0.00004	0.00037
Mercury	7439976	3.01E-07	0.00000	0.00000
Naphthalene	91203	1.30E-04	0.00007	0.00060
Toluene	108883	2.81E-04	0.00016	0.00130
Xylene	1330207	1.93E-04	0.00011	0.00090
Total			**0.0008**	**0.0069**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only. Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
c Emissions = fuel usage (estimated from Bldg 700 generator) * emission factor * heat content of fuel (per million BTus) divided by 1 million divided by 2000 (pounds per ton)

Table B-21. Alternative 3: Stationary Sources Estimated Emissions (continued)

Proposed Joint Operations Building Generators

Calendar Year	CY 2003	
Actual Fuel Usage[a]	8,127	gal/yr total
Actual Operating Hours[b]	135	hrs/yr total
Potential Fuel Usage[c]	15,000	gal/yr total
Potential Operating Hours[d]	413	hrs/yr total
Generator Output Rating	900.0	kW each
Engine Rating[e]	4.98	MMBtu/hr each
Fuel Sulfur Content[f]	0.5%	
Fuel Heat Content[g]	137,000	btu/gal

Generators:
2 Cummins QST30-G2
(typical example)

a Actual fuel usage estimated from estimated actual hours multiplied by fuel consumption rate (Cummins, 2005).
b Actual operating hour data obtained from Schriever AFB air emissions inventory.
c Potential fuel usage obtained from the Schriever AFB Synthetic Minor Construction Permit (April 2005).
d Potential operating hours = Potential fuel usage x Fuel Heat Content/1000000/Engine Rating
e Engine rating from the 2005 Schriever AFB Synthetic Minor Construction Permit.
f Sulfur content per fuel delivery contract requirements as stated in the Schriever AFB Synthetic Minor Construction Permit.
g Diesel fuel heat content from USEPA, 1996, Table 3.4-1.

Criteria Pollutant Emission Estimation[a]

Pollutant	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
PM	0.07	0.04	0.07
PM_{10}	0.06	0.03	0.06
$PM_{2.5}$	0.05	0.03	0.05
SO_x	0.01	0.00	0.01
NO_x	3.20	1.78	3.29
VOC	0.09	0.05	0.09
CO	0.85	0.47	0.87
Total		**2.40**	**4.44**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only. Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

HAP Emission Estimation[a]

HAP	CAS Number	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Acetaldehyde	75070	2.52E-05	0.0000	0.0000
Acrolein	107028	7.88E-06	0.0000	0.0000
Benzene	71432	7.76E-04	0.0004	0.0008
Formaldehyde	50000	7.89E-05	0.0000	0.0001
Mercury	7439976	3.01E-07	0.0000	0.0000
Naphthalene	91203	1.30E-04	0.0001	0.0001
Toluene	108883	2.81E-04	0.0002	0.0003
Xylene	1330207	1.93E-04	0.0001	0.0002
Total			**0.0008**	**0.0015**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only. Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

Proposed Medical Facility Generators

Calendar Year	CY 2003	
Actual Fuel Usage[a]	**1,061**	gal/yr total
Actual Operating Hours[b]	**135**	hrs/yr total
Potential Fuel Usage[c]	**15,000**	gal/yr total
Potential Operating Hours[d]	**413**	hrs/yr total
Generator Output Rating	**900.0**	kW each
Engine Rating[e]	**4.98**	MMBtu/hr each

Generators:
2 Cummins QST30-G2
(typical example)

Table B-21. Alternative 3: Stationary Sources Estimated Emissions (continued)

Criteria Pollutant Emission Estimation[a]

Pollutant	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
PM	0.07	0.04	0.07
PM_{10}	0.06	0.03	0.06
$PM_{2.5}$	0.05	0.03	0.05
SO_x	0.01	0.00	0.01
NO_x	3.20	1.78	3.29
VOC	0.09	0.05	0.09
CO	0.85	0.47	0.87
Total		**2.40**	**4.44**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only.
Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

HAP Emission Estimation[a]

HAP	CAS Number	Emission Factor (lb/mmbtu)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Acetaldehyde	75070	2.52E-05	0.0000	0.0000
Acrolein	107028	7.88E-06	0.0000	0.0000
Benzene	71432	7.76E-04	0.0004	0.0008
Formaldehyde	50000	7.89E-05	0.0000	0.0001
Mercury	7439976	3.01E-07	0.0000	0.0000
Naphthalene	91203	1.30E-04	0.0001	0.0001
Toluene	108883	2.81E-04	0.0002	0.0003
Xylene	1330207	1.93E-04	0.0001	0.0002
Total			**0.0008**	**0.0015**

a Emission factors are for internal combustion engines > 600 hp which burn fuel oil #2 (diesel fuel) only.
Emission factor from USEPA, 1996; USEPA, 2004c; and USAF, 1999.
b Emissions = Emission factor multiplied by fuel usage divided by 1,000,000 (BTus) divided by 2000 (lbs per ton).

Natural Gas Consumption from Boilers for New Buildings

1,014,125 square feet
7.57 ft^3 natural gas per ft^2 per month
30 days per month
255897.54 consumption per day (ft^3)
255.90 consumption per day (1000 ft^3)
46,061,558 consumption per year (ft^3)
46.06 mmcf

Consumption of natural gas estimated from current basewide usage

Estimated Emissions Boilers for New Buildings

	CO	VOC	NOx	SOx	PM10	PM2.5
Emission Factors (lbs/million ft^3)	84	5.5	100	0.6	7.6	7.6
Emission Factors (lbs/ 1,000 ft^3)	0.0840	0.0055	0.1000	0.0006	0.0076	0.0076
lbs/day	21.4954	1.4074	25.5898	0.1535	1.9448	1.9448
lbs/year	3869.1708	253.3386	4606.1558	27.6369	350.0678	350.0678
tons/year	1.935	0.127	2.303	0.014	0.175	0.175

Emission factors from Table 1.4-1 (CO, Nox) and Table 1.4-2 (VOC, SOx, and PM_{10})
Source: AP-42 Vol I Chapter 1.4 Natural Gas Combustion, July 1998 (USEPA 1998b)
CO and NOx emission factors for heating units less than 100 Million British thermal units for uncontrolled combustion from Table 1.4-1
VOC, SOx, and PM10 emission factors are for general natural gas combustion (Table 1.4-2)
Estimated emissions are calculated on the basis of 180 days (6 months) operation of furnaces/boilers

HAPs	CAS Number	Emission Factor (lb/mmcf)	Actual Emissions (tpy)[b]	Potential Emissions (tpy)
Arsenic	7440382	0.00020	0.000005	0.000009
Benzene	71432	0.00210	0.000048	0.000097

Table B-21. Alternative 3: Stationary Sources Estimated Emissions (continued)

Summary of Stationary Criteria Pollutant Emissions with Alternative 3
Stationary Sources - Actual Emissions

Source	Criteria Pollutants - Actual, in Tons per Year						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	0.30	0.28	1.20	10.00	5.63	3.61	0.49
Proposed Generators[1]	0.10	0.08	0.01	5.08	0.14	0.99	0.002
Total Permitted Sources	**0.39**	**0.36**	**1.21**	**15.08**	**5.77**	**4.59**	**0.49**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Proposed Basewide Natural Gas[2]	0.21	0.21	0.02	2.76	0.15	2.13	0.053
Total Unpermitted Sources	**0.63**	**0.63**	**0.13**	**7.79**	**1.88**	**16.14**	**0.18**
Total Stationary Sources	**1.02**	**0.99**	**1.35**	**22.87**	**7.65**	**20.74**	**0.67**
Estimated Increase in Emissions	*0.31*	*0.29*	*0.03*	*7.84*	*0.29*	*3.12*	*0.06*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center,2 generators at a proposed Joint Operations Facility, and 2 generators at the proposed medical facility

[2] Estimated using proposed military housing and estimated square footage of other facilities

Summary of Stationary Criteria Pollutant Emissions with Alternative 3
Stationary Sources - Potential to Emit

Source	Criteria Pollutants - Actual, in Tons per Year						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Proposed Generators[1]	0.38	0.32	0.03	19.26	0.50	2.10	0.010
Total Permitted Sources	**1.88**	**1.68**	**7.90**	**82.52**	**8.20**	**19.95**	**0.60**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	7.86	7.86	10.54	102.19	42.46	684.02	0.62
Proposed Basewide Natural Gas[2]	0.42	0.42	0.03	5.52	0.31	4.26	0.11
Total Non-Permitted Sources	**8.29**	**8.29**	**10.58**	**107.71**	**42.76**	**688.27**	**0.72**
Total Stationary Sources	**10.17**	**9.97**	**18.47**	**190.23**	**50.97**	**708.23**	**1.32**
Estimated Increase in Emissions	*0.81*	*0.74*	*0.07*	*24.78*	*0.81*	*6.35*	*0.12*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center, 2 generators at a proposed Joint Operations Facility, and 2 generators at the proposed medical facility.

[2] Estimated using proposed military housing and estimated square footage of other facilities

Table B-21. Alternative 3: Stationary Sources Estimated Emissions (continued)

Summary of Stationary Criteria Pollutant Emissions with Alternative 3
Stationary Sources - Actual Emissions

Source	**Criteria Pollutants - Actual, in Tons per Year**						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	0.30	0.28	1.20	10.00	5.63	3.61	0.49
Proposed Generators[1]	0.10	0.08	0.01	5.08	0.14	0.99	0.002
Total Permitted Sources	**0.39**	**0.36**	**1.21**	**15.08**	**5.77**	**4.59**	**0.49**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	0.42	0.42	0.12	5.03	1.73	14.01	0.13
Proposed Basewide Natural Gas[2]	0.21	0.21	0.02	2.76	0.15	2.13	0.053
Total Unpermitted Sources	**0.63**	**0.63**	**0.13**	**7.79**	**1.88**	**16.14**	**0.18**
Total Stationary Sources	**1.02**	**0.99**	**1.35**	**22.87**	**7.65**	**20.74**	**0.67**
Estimated Increase in Emissions	*0.31*	*0.29*	*0.03*	*7.84*	*0.29*	*3.12*	*0.06*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center,2 generators at a proposed Joint Operations Facility, and 2 generators at the proposed medical facility

[2] Estimated using proposed military housing and estimated square footage of other facilities

Summary of Stationary Criteria Pollutant Emissions with Alternative 3
Stationary Sources - Potential to Emit

Source	**Criteria Pollutants - Actual, in Tons per Year**						
	PM_{10}	**$PM_{2.5}$**	**SO_x**	**NO_x**	**VOC**	**CO**	**HAPs**
Existing Permitted Sources	1.50	1.36	7.86	63.26	7.70	17.86	0.59
Proposed Generators[1]	0.38	0.32	0.03	19.26	0.50	2.10	0.010
Total Permitted Sources	**1.88**	**1.68**	**7.90**	**82.52**	**8.20**	**19.95**	**0.60**
Permit Limits	*N/A*	*N/A*	*30.00*	*70.00*	*20.00*	*30.00*	*N/A*
Existing Non-Permitted Sources	7.86	7.86	10.54	102.19	42.46	684.02	0.62
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Total Stationary Sources	**10.17**	**9.97**	**18.47**	**190.23**	**50.97**	**708.23**	**1.32**
Estimated Increase in Emissions	*0.81*	*0.74*	*0.07*	*24.78*	*0.81*	*6.35*	*0.12*

[1] Estimated assuming 4 generators at the proposed Space Innovation and Development Center, 2 generators at a proposed Joint Operations Facility, and 2 generators at the proposed medical facility.

[2] Estimated using proposed military housing and estimated square footage of other facilities

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