DEPARTMENT OF DEFENSE

NATIONAL AIRSPACE SYSTEM

FINAL

PROGRAMMATIC ENVIRONMENTAL

ASSESSMENT

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EXECUTIVE SUMMARY

The Department of Defense (DoD) National Airspace System (NAS) Program proposes to replace radar approach control components at U.S. Air Force, U.S. Navy and Marine Corps, and U.S. Army airfields throughout the United States and its territories. DoD NAS is a component of the aviation system capital investment plan developed by the Federal Aviation Administration (FAA). Pursuant to the Program Management Directive, the DoD must provide services comparable to those provided by the FAA to civil aircraft in the airspace delegated to DoD. The DoD NAS Program would comprehensively upgrade the DoD's air traffic control system infrastructure by systematically replacing analog systems with state-of-the-art, digital technology. This modernization is necessary because the existing equipment is becoming economically insupportable and incapable of meeting new user requirements.

This assessment of the potential environmental impacts of the DoD NAS Program is subdivided into five sections: Purpose and Need For Action; Description of Proposed Action and Alternatives; Affected Environment; Environmental Consequences; and Mitigation. The replacements proposed by the DoD NAS Program would require the construction and operation of systems in various locations throughout the United States and its territories. Due to the broad, varying nature of potential sites and impacts, this environmental assessment provides a national assessment of the potentially affected environment and potential consequences of the proposed action. The environmental analysis and impact study focuses on the following resources and issues: geology, soils, water resources, air quality, biology, noise, infrastructure, visual resources, cultural resources, socioeconomics, pollution prevention, hazardous waste management, and human safety.

The environmental consequences of two alternatives, the DoD NAS alternative and the no action alternative, are presented in this environmental assessment. Construction and operation of the proposed DoD NAS alternative could result in minor, short-term construction period impacts, and the following minor long term impacts: loss of small areas (less than 3 acres) of vegetation and wildlife habitat due to the installation of the NAS antenna and associated access road and utility trenches; low-level risk of bird collisions; slight increased demand upon electric, telephone, water and sewer services; minor increased development; and slight increased use and generation of hazardous materials and wastes. However, all impacts would be minimized by screening potential sites following the siting process in the *National Airspace System Digital Airport Surveillance Radar Siting Plan* (Attachment A) and the use of appropriate construction practices. The no action alternative would involve no new construction, renovation or operations and therefore would result in no impact to environmental resources. However, selecting the no action alternative would require relying on uneconomical existing radar systems.

The contents of this environmental assessment will be used by the DoD to understand the consequences of the proposed project, to locate potential sites, and to encourage public input early in the decision process. If, at the completion of this environmental assessment, the decision is made to proceed with the project, the site-selection process would be initiated. Prior to construction, individual site-specific environmental documentation, tiered to this environmental assessment, would be completed as appropriate.

TABLE OF CONTENTS

LIST OF FIGURES AND ATTACHMENTS

LIST OF TABLES

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1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment (CEQ, 1978). NEPA establishes policy, sets goals, and provides the process for carrying out the policy and achieving the goals. NEPA procedures were established to ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The NEPA process is intended to help federal agencies make decisions that are based on understanding of environmental consequences and take actions that protect, restore, and enhance the environment.

The proposed action involves a Department of Defense (DoD) project that would be constructed on U.S. Air Force (USAF), U.S. Navy and Marine Corps (USN/USMC) and Army (USA) installations. Each of these organizations has internal regulations on their policies, responsibilities, and procedures for implementing NEPA (USAF, 1995; USN, 1990; USA, 1994). For the purposes of this project, however, the USAF has been identified as the lead federal agency. Therefore this environmental assessment has been prepared in accordance with USAF NEPA regulations (USAF, 1995). According to these regulations, the environmental assessment is a written analysis which serves to (1) provide analysis sufficient to determine whether to prepare an Environmental Impact Statement (EIS) or Finding of No Significant Impact (FONSI); and (2) aid federal agencies in complying with NEPA when no EIS is required.

If this environmental assessment determines that the proposed project would significantly degrade the environment, significantly threaten public health or safety, or generate significant public controversy, then an EIS would be completed. An EIS involves a comprehensive assessment of project impacts and alternatives and a high degree of public input. Alternatively, if this environmental assessment finds that the action would not have a significant impact on the environment (FONSI), then the action would not be the subject of an EIS. The environmental assessment is not intended to be a scientific document. The level and extent of detail and analysis in the environmental assessment is commensurate with the importance of the environmental issues involved and with the information needs of both the decision makers and the general public.

This environmental assessment evaluates the consequences of the proposed modernization of radar approach control systems at DoD airfields throughout the country (Figure 1-1 and 1-2). Such modernization would require the construction and operation of systems in various locations within the United States. Due to the broad, varying nature of potential sites and impacts, this environmental assessment provides a national assessment of the potentially affected environment and potential environmental consequences of the proposed action. The contents of this environmental assessment will be used by the DoD to understand the consequences of the proposed project, to locate potential sites, and to encourage public input early in the decision process. If, at the completion of this environmental assessment, the decision is made to proceed with the project, the site selection process would be initiated. Prior to construction, individual, site-specific NEPA documentation, tiered to this programmatic environmental assessment, would be completed to assist with site selection.

The remainder of this chapter will discuss the purpose and need for the action and provide an overview of the planned action. Additional facts on the potentially affected environment and potential impacts of the proposed project are discussed in the remainder of this environmental assessment.

1.2 PURPOSE OF THE ACTION

The purpose of the DoD National Airspace System (NAS) Program is to modernize military approach control systems in the United States and its territories. DoD NAS is a component of the aviation system capital investment plan developed by the Federal Aviation Administration (FAA). Pursuant to the Program Management Directive (USAF, 1994), the DoD must provide services comparable to those provided by the FAA to civil aircraft in the airspace delegated to DoD. This includes providing the following flight services to DoD airfields: flight following, separation, expeditious handling, radar approach control, and landing.

FIGURE 1-1. DoD NAS AIR FORCE AND NAVY/MARINE CORPS LOCATIONS

FIGURE 1-2. DoD NAS ARMY LOCATIONS

1.3 NEED FOR THE ACTION

The DoD NAS Program would comprehensively upgrade DoD's air traffic control system infrastructure by systematically replacing analog systems with state-of-the-art, digital technology. This modernization is necessary because the existing equipment is becoming economically insupportable and incapable of meeting user requirements. Modern systems take advantage of the significantly increased capabilities of digital technology now available in radars, computers, and data distribution networks. The existing systems were designed in the 1960s and fielded in the 1970s. A recent DoD study concluded that retention of the present DoD NAS equipment would cost more over its life cycle than would replacement with modern systems (USAF, 1992). The DoD NAS equipment upgrades are expected to have a life cycle of about 20 years.

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2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

There are three components of DoD NAS that would replace less technologically advanced facilities associated with existing radar approach control systems. These components are Digital Airport Surveillance Radars (DASR), DoD Advanced Automation Systems (DAAS), and Voice Communication Switching Systems (VCSS). Each component is described separately below. Each component can be acquired independently of the others, and the combination of components upgraded during the DoD NAS project would vary among locations. However, since this programmatic document evaluates impacts of the entire system, these components have been considered jointly. Specific configurations at each DoD NAS airfield will be evaluated in detail in the site-specific NEPA documents.

2.1 DoD NAS ALTERNATIVE -- PROPOSED ACTION

2.1.1 Digital Airport Surveillance Radar (DASR) Systems

DASR systems would detect and process aircraft position and weather conditions at the airport. DASR systems would consist of two subsystems: the primary radar and the integrated secondary surveillance radar. The purpose of the subsystems would be to accurately locate aircraft, in terms of range, azimuth, and altitude.

The primary radar would transmit electromagnetic waves in the form of radio frequency pulses which backscatter from the surface of aircraft. The radar would measure the time required for an echo to return and the direction of the signal in order to determine the aircraft range and azimuth, respectively. By comparing variations in returned signal parameters, such as phase differences between pulses, the radar could separate moving targets from stationary clutter, such as mountains and trees. The primary radar would also report 6 discrete weather precipitation levels (from mild to hazardous) via a processing channel dedicated to weather detection and reporting.

The secondary surveillance radar (also called the beacon radar) would be a cooperative system consisting of ground-based beacon interrogator/receiver systems and existing aircraft based transponders. The secondary radar would obtain additional information, such as identification code, barometric altitude, and emergency conditions, from an aircraft transponder. Various processing techniques would be used to decipher both overlapping responses from multiple aircraft (synchronous garble) and aircraft responses to other beacon systems (asynchronous interference). The beacon radar would also provide rapid identification of aircraft in distress.

The DASRs would provide highly accurate target data to USAF/USN/USMC Local Control Facilities (LCF), and Military Control Towers (MCT). The DASR would have clutter rejection, target accuracy, and probability of detection that are equal to or better than the existing Airport Surveillance Radar-9 (ASR-9).

The proposed action is to acquire and install commercially available DASR systems at DoD airfields. Acquisition of the DASR systems would include production, test, site survey, site design, site preparation, installation and logistics support at 28 USAF and 14 USN/USMC locations. DASR systems would vary between locations in order to accommodate site and user requirements. Acquisition strategy calls for a full and open competition for a radar system that meets DoD operational needs. The DASR systems contract award is planned for December 1995 with the first system delivered to the test site by November 1997.

The DoD NAS upgrade program is planned in two phases: pre-operational and operational. During the pre-operational phase, the DASR system would undergo DoD/FAA developmental and operational testing at selected field locations. The DoD would test to basic performance requirements and DoD interfaces, and would also field test each system to verify operational performance and suitability for air traffic control. When the DAAS and the VCSS are available, a system level follow-on test and evaluation would be conducted with an integrated DASR, DAAS and VCSS in a fully operational environment.

The program would be fully operational at the conclusion of the successful test program - after full rate production authorization. During the operational phase, the DASR contractor would deliver turnkey DASR installations at USAF sites. The USN/USMC intends to perform installation of the DASR systems using USN/USMC personnel. DASR facility construction is not expected to require new land acquisition or new leases as the facilities would be located on

DoD property. No temporary buildings would be required during the transition from existing to new equipment operation.

DASR facilities would consist of the following: primary and secondary radar electronics, rotating antenna(s), tower, and optional radome; interconnecting cabling; an uninterruptable power supply; an emergency generator; power conditioning; buildings; electronic equipment grounding systems; a fuel storage system; foundations for a DASR shelter and antenna; an unpaved access road; fences; and security systems. Facilities construction would vary depending upon location, but would typically include installation of the following: an approximately 800 square foot concrete pad foundation for an equipment shelter and antenna; approximately 1/2 mile of trenching for utilities; a 1/4 mile unpaved access road; a fuel storage tank for the emergency generator; and approximately 1/2 acre of miscellaneous site improvements (minor regrading and reseeding for erosion control). Once the new DASR system is operational, the old system would be dismantled, structures would be razed, and the ground would be reclaimed in accordance with the local site authority's desires.

2.1.2 DoD Advanced Automation System (DAAS)

The DoD plans to accomplish identification, tracking and sequencing of aircraft by implementing the DAAS, both in the radar approach control facility and the control tower. The operator console, the interface between the controller and the automation system would provide a display of aircraft call signs, identification codes, flight paths and altitudes. The DAAS would include two components, the LCF and the MCT.

The LCF equipment would be located within a facility typically within a 5-mile radius of the runway. The LCF would house individuals monitoring air traffic via view screens and providing control services for aircraft approach and take-off. The LCF could be configured as a large or medium facility with a collocated tower, or a small facility consisting of a tower with collocated ground control approach services. In large LCFs, two or more approach controls would typically be consolidated into a single facility. Small and medium LCFs would usually consist of single approach controls or would provide ground control approach services. The LCF would provide independent surveillance processing, tracking, separation assurance processing, and other terminal air traffic control functions. While the LCF performs its own surveillance processing and tracking, it is also dependent on the FAA's existing air route traffic control centers for some additional processing. These centers are already in place.

MCTs would house both ground and air traffic controllers and would also coordinate arriving and departing aircraft. MCTs would house a high-contrast, high-resolution surveillance display system that receives data from LCFs. The MCT would have two modes of operation: normal and emergency. In the normal mode, the LCF would process flight data from multiple external systems and combine them with internal digital site maps, compass rose, and range marks to form a composite air traffic control presentation for the MCT's surveillance displays. Data entry inputs and functional selection capabilities would be provided by a keyboard and trackball. In the emergency mode, the MCTs themselves would provide minimal air traffic control data needed for their surveillance displays (aircraft reports, digital site maps, compass rose, range marks) in order to maintain aircraft separation.

New facility construction at the large LCFs could require an approximately 5,000 square foot addition to two sites, along with required site improvements. New common consoles would be fit into existing building volume and floor space. DAAS at each small/medium LCF would include the following: renovating the existing building; upgrading the electronic equipment grounding system; building an addition to existing MCTs for equipment; altering interiors to accommodate both a common console maintenance area and an on-site training room within each LCF; and altering existing building utility systems.

The MCT would be equipped with a combination of existing service-unique flight data and airfield system control equipment as well as a small subset of the DAAS for surveillance data display and limited processing. The primary systems of the MCT would be the DAAS, which provides data to MCT surveillance display and data processing, and a suite of existing equipment. DAAS equipment would be installed in MCTs at approximately 25 locations.

2.1.3 Voice Communications Switching System (VCSS)

Voice communication is a basic requirement in the air traffic control process. Voice switches control all functions needed for air traffic control voice communications. These include air-to-ground communications with pilots, and ground-to-ground voice communications between controllers within either the same facility or adjacent facilities. The DoD NAS VCSS would support three types of communication: radio, intercom, and telephone. They would be composed of five major physical components: controller position, maintenance position, supervisory position, administrative position, and power supply and distribution equipment.

For the DoD NAS upgrades, the DoD plans to procure the Enhanced Terminal Voice Switch System (ETVS), a commercially available voice switch which the FAA is procuring for air traffic communications in both towers and radar approach control facilities. The DoD would replace the present voice switch (OJ-314) with the ETVS. The ETVS would consist of five configurations, including 8 to 150 operator positions and 24 to 475 air-ground and ground-ground interfaces. The actual configuration to be used at a particular facility would be dependant upon the size of the facility.

No new facility construction would be required for the installation of the ETVS, as all necessary equipment would be installed within the LCF and MCT facilities. At some sites, up to 15,600 feet of cable might have to be installed below ground or pole mounted between the LCF and MCT. The amount of trenching required would vary depending upon site-specific conditions and requirements.

2.2 NO ACTION ALTERNATIVE

Digital Airport Surveillance Radar System (DASR). The alternative of no action would leave the present radar systems in place. The existing system installations are over 20 years old, at the end of their useful life cycle, difficult to maintain due to the decreasing availability of spare parts, and incapable of meeting user requirements for target detection and weather reporting. This analog equipment lacks the inter-operability necessary to work with modern digital systems, and has higher operation and maintenance costs. The DoD NAS Milestone I Cost and Operational Effectiveness Report (USAF, 1992) determined that modifications to extend the life of the existing system and improve its performance were not cost effective.

DoD Advance Automation System (DAAS). The alternative of no action would retain all existing DoD systems. Retaining the existing systems would not meet user requirements and would result in high operational costs. Maintenance of the existing 1970 vintage equipment through the year 2017 would require unacceptably higher operation cost due to the age of the equipment and the scarcity of replacement parts.

Voice Communications Switching Systems (VCSS). The current DoD Voice Switch would be retained under the no action alternative. The OJ-314 Voice Switch currently in the DoD inventory was engineered in the 1960s. The system is a solid state, analog, mechanical switch system that has limited capabilities. The system is no longer supportable as the manufacturer no longer supplies many of the line replacement units used in the system. Current media technology requires a voice switch that is digital. Not procuring ETVS would result in not meeting the current connectivity requirements between the FAA and DoD sites.

2.3 ALTERNATIVES CONSIDERED AND NOT SELECTED FOR ANALYSIS

An alternative to full implementation of DoD NAS would involve upgrading the existing DAAS equipment to meet user requirements. Two major upgrades would be required. The first would upgrade the current analog system to a digital system. The second would replace those components which are obsolete or insupportable. This alternative would result in higher costs over the 20-year life of the project as compared to the proposed action. Furthermore, there would be a risk that the new equipment would not satisfactorily integrate with the existing modules. For these reasons this alternative was not selected for detailed analysis.

2.4 COMPARISON OF THE PROPOSED AND NO ACTION ALTERNATIVES

Construction of the proposed DoD NAS alternative could result in the following minor short-term impacts: slight increases in soil erosion, surface water runoff, dust, emissions from vehicles, noise levels; demand upon electric, telephone, water and sewer service, and use and generation of hazardous materials and wastes. In addition, implementation of the proposed alternative could result in the following minor long-term impacts: loss of small areas of vegetation and habitat; low-level risk of bird collisions; and slight increased use and generation of hazardous materials and wastes.

Since the no action alternative would leave existing radar systems and air traffic control equipment in place, no new construction, renovation, or operations would be required. Therefore, the no action alternative would result in few of the impacts associated with the proposed action. However, selecting the no action alternative would require relying on uneconomical existing radar systems, resulting in unacceptably higher operation cost over time.

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3.0 AFFECTED ENVIRONMENT

This section describes the existing environment potentially affected by DoD NAS. Since DoD NAS installations are proposed for locations throughout the nation, this chapter provides general, regional information about environmental resources in the United States that could be affected by DoD NAS installations.

3.1 GEOLOGY AND SOILS

The geologic resources of the United States include all consolidated earth materials (i.e. rocks), regardless of depth. The soil resources of the United States are comprised of all unconsolidated earth materials, regardless of depth. Relevant aspects of these resources include significant landforms; hazardous areas (volcanoes, earthquakes, etc.); economic mineral deposits, including oil; agricultural viability; and fossil remains.

Data on geologic and soil resources are available at the federal level from the Bureau of Land Management, Bureau of Reclamation, Minerals Management Service, Environmental Protection Agency, Forest Service, Geological Survey, and the Natural Resources Conservation Service (formerly the Soil Conservation Service). Typically, sources of data at the state level include the departments of agriculture, environmental protection, forestry, geologic survey, and soil and water conservation offices.

Geologic and soil resources within the United States may be divided into nine regions, based on geologic history and geomorphology (Figure 3-1) (Snead, 1980):

- Appalachian Region (New England, New York, Pennsylvania, West Virginia, and parts of Ohio, Virginia, Kentucky, Tennessee, North and South Carolina, Georgia, and Alabama)
- Atlantic and Gulf Coastal Plains (New Jersey south through Florida; Florida west through Texas)
- Interior Lowlands (Michigan west through North Dakota and south through Missouri)
- Great Plains (North Dakota/Montana south through Texas)
- Rocky Mountains(Montana/Idaho south through New Mexico)

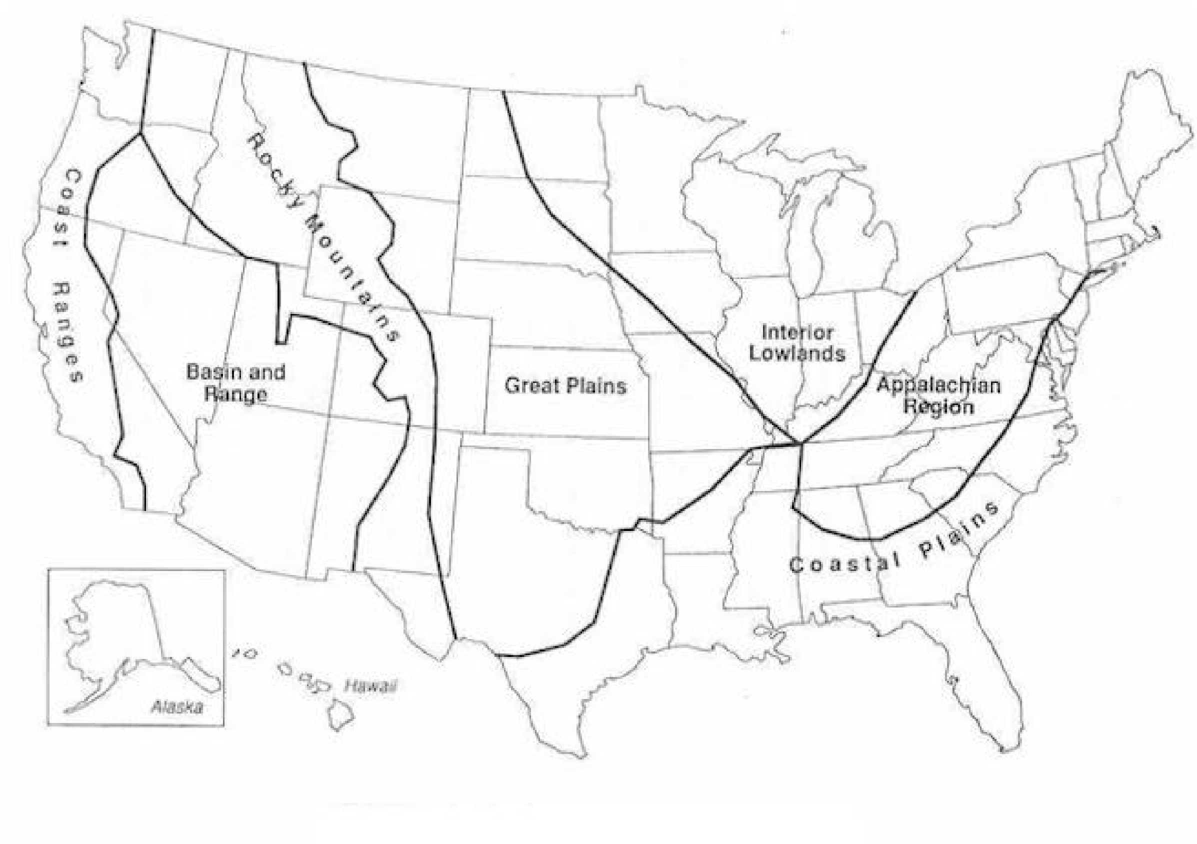

FIGURE 3-1. GEOMORPHOLOGICAL REGIONS

- Basin and Range Region (Oregon southeast through Arizona)
- Coast Ranges (Washington south through California)
- Alaska
- Hawaiian Islands

This analysis describes each region in general terms, emphasizing possible geologic and soil constraints to DoD NAS construction. Potential hazards, including seismic and volcanic activity, flooding, and soil erosion, are briefly described. Due to the numerous variations in each of these large geomorphologic regions, the information on each region contains only broad generalizations. Geologic and soil resources that are especially site-specific, such as mineral, fossil, and agricultural resources are analyzed independently of geomorphologic region.

3.1.1 Appalachian Region

This region is often subdivided into (1) the Piedmont, along the eastern face of the Appalachian mountains; (2) the Blue Ridge, covering the higher parts of the range from Virginia south to Alabama and Georgia; (3) the Valley and Ridge region, mainly in Pennsylvania, Virginia, and West Virginia, but extending south to Alabama; (4) the Appalachian Plateau region lying to the west of the Ridge and Valley and Blue Ridge regions; (5) the New England region; and (6) the Adirondacks. In general, the area consists of the roots of old mountain ranges formed millions of years ago. At one time these mountain ranges were much higher, but have since been eroded down. Many thermal springs are located along the West Virginia/Virginia border.

Soils in the New England region generally are Orthods (one of 47 taxonomic suborders), which generally are freely drained soils that contain accumulations of iron, humus, and aluminum. In areas of Maine, the Orthods developed in thick deposits of till. In much of southern New England, the soils developed in thick deposits of glacial drift and in lake or marine sediments. Soils in the Piedmont and Blue Ridge region generally belong to the taxonomic suborder Udults. These soils are mainly freely drained and have very little organic matter. The soils developed from weathered rocks. Soils in the Valley and Ridge, Appalachian Plateau, and the Adirondack regions primarily belong to the suborder Ochrepts. Some of these soils, which developed mainly in glacial deposits, contain hard packed layers which slow percolation of water and restrict root development (SCS, 1975).

Historic evidence does not indicate a very severe earthquake risk for any part of the Appalachian region. Therefore, the seismic hazard is minor. Flooding often causes severe problems within the Appalachian Region. Areas near rivers and adjacent floodplains can be impacted by flooding. Therefore, the potential for flooding is moderate.

3.1.2 Atlantic and Gulf Coastal Plains

This area typically consists of relatively flat plains, with gentle slopes, along the Atlantic Ocean and Gulf of Mexico. Soils in this area are primarily Ultisols (one of ten taxonomic orders of soils). These soils, which are usually found in areas where groundwater is very close to the surface during part of each year, are formed mainly in alluvium and marine deposits and are intensely weathered soils (SCS, 1975; Aber and Melillo, 1991). The soil profiles of Ultisols may include varying amounts of organic matter accumulations, but are characterized by a horizon of clay accumulation (Birkeland, 1984).

Seismic activity in this region is minor. The coast of Louisiana contains an area of mud volcanoes. Although not true volcanoes, mud volcanoes are high-pressure gas seepages that discharge water, mud, sand, fragments of rocks, and occasionally oil.

Flooding often causes problems within the Coastal Plains, partly because of its low relief, but also because much of the surface water flow in the United States crosses the region. Intense frontal and tropical storms produce large amounts of rainfall in short periods of time. Coupled with low relief, the heavy rainfalls result in widespread and severe flooding. Tropical storms may be accompanied by rises in sea level and severe wave conditions which cause widespread flooding, erosion of coastal areas, and other damages. Therefore, the potential for flooding is considered significant is some low-lying areas and areas adjacent to major river systems and the coast.

3.1.3 Interior Lowlands

This area consists of the old, stable core of the continent which has experienced little rock deformation over the last 65 million years. The soils in this area are primarily Spodosols, which are a suborder of Orthods (described previously in Section 3.1.1), and Boralfs. In this region, Boralfs which are freely drained, developed in glacial drift and consist mostly of silt and clay (SCS, 1975).

Since this area is one of the least seismically active areas in North America, the seismic hazard is minor. Along the shores of the Great Lakes, shoreline erosion, from wave action attacking soft glacial deposits, can be significant. However, only a minor risk occurs along the shores which are formed of harder rock formations. Due to the low relief of the area, flood hazards are widespread, particularly in the low-lying areas east of the Mississippi Valley where rainfall and associated runoff are high. Severe weather is characteristic of this region because low relief allows vigorous interaction of cold Canadian air masses with warm, moist air from the Gulf of Mexico. As a result, severe thunderstorms, tornadoes, and localized flooding are common. Therefore, the potential for flooding is considered significant in localized areas.

3.1.4 Great Plains

This area also is comprised of the old, stable core of the continent which has experienced little rock deformation. Most of the soils in this region belong to the order Mollisols, which developed mainly from unconsolidated material and are very high in surface organic content (SCS, 1975).

This area is not very seismically active, with the exception of the New Madrid fault in Missouri (A fault is a slipping of blocks of the earth's crust along great ruptures or cracks). The New Madrid earthquakes of 1811 and 1812 were among the most severe in American history and were felt over most of the country east of the Rocky Mountains. Although the cause of these earthquakes is still not completely understood, the seismic hazard in this region is considered minor, due to the lack of recent activity.

Due to low relief, the area is frequently flooded. Severe weather (thunderstorms, tornadoes, etc.) is also common in this region. Therefore, the potential for flooding is considered significant in localized areas.

3.1.5 Rocky Mountains

This area is dominated by mountain ranges and associated valleys. Geothermal springs and geysers are also located in portions of this region. Soils in the area are very diverse and include Mollisols, Boralfs, and Argids. Mollisols are characterized by a high surface organic matter content, while Boralfs occur in areas with cold temperature regimes and are characterized by a soil horizon of clay accumulation (Birkeland, 1984). Argid soils typically have a low soil moisture content and occur in arid climates (SCS, 1975; Birkeland, 1984).

Seismic and faulting activity in this region is only moderate, although significant earthquakes have occurred in the Yellowstone Park area. Recent fault features suggest the possibility of renewed activity in this area. Although faults are prominent in many of the Rocky Mountain ranges, most of them do not appear to have been active during the past ten thousand years. Therefore, the seismic hazard in this region is minor.

Flooding is a recurring problem in this area. Unusually heavy rains or unseasonably warm weather early in the spring may cause more runoff and flooding than normal. Sites in narrow mountain canyons are especially vulnerable, but any location close to a drainage channel is subject to occasional significant flooding. Therefore, the potential for flooding is significant in limited areas of this region.

3.1.6 Basin and Range Region

Geologic features produced by faulting dominate the topography of this region. Thermal springs and geysers are also common. Soils in this region are predominantly Mollisols and Argids, which are described above in Section 3.1.5.

Faulting and seismic risk are significant within the region. These hazards are site-specific and can be minimized by proper siting and design. Flooding is usually limited to the low-lying portions of the basins. Rain can fall in short but intense thunderstorms with significant associated flash-flood conditions. Significant erosion and high-water conditions are also possible in limited areas adjacent to stream and rivers. Therefore, flooding is considered a significant risk in limited areas of this region.

3.1.7 Coast Ranges

This region is geologically complex. Elongated north-south mountain ranges and valleys are prominent features. Soils include Ultisols, Inceptisols, Xeralfs, and Orthents. Ultisols are described above in Section 3.1.2. Inceptisols are usually found on steep mountain slopes and are characterized by little soil development. Xeralfs are reddish soils that are dry for extended periods in summer. Orthents are usually found on recent erosional surfaces, and show even less evidence of soil development than do Inceptisols (SCS, 1975; Birkeland, 1984).

The area contains one of the most active mountain building belts in the continental United States. It is broken by hundreds of active faults, particularly in California. The San Andreas, the largest of these fault systems, extends over 600 miles from southern to northwestern California. Oregon and Washington are less seismically active than California. The seismic hazard in this region is considered significant.

Since there is a close correlation between fault zones and volcanoes, it is not surprising that there are many volcanic cones in this region. Because volcanoes are found along cracks or fissures in the earth's crust, severe earthquakes are often associated with volcanic eruptions. Volcanoes in the region include Mounts Shasta, Pitt, Jefferson, Hood, Rainier, St. Helens, Baker, and Lassen. The Coastal Range Region also contains a few mud volcanoes (California) and many thermal springs.

Flooding and erosion are a widespread problem in this region, due to steep topography and occasional high rainfall intensities. Narrow canyons and limited lowland areas along streams through the region are at risk. Summer and fall fires in forests and chaparral aggravate the problem and are often followed by destructive mud flows. Therefore, flooding is a significant risk in these areas.

3.1.8 Alaska

Alaska includes a variety of terrains and geologic features. A large portion of the state is mountainous. The coast ranges of the Alaska-Yukon region contain much glacial ice and the largest glaciers of continental North America. Alaska also contains many thermal springs. Inceptisols are the most prevalent soil type in both interior Alaska and the Aleutian Island chain. As described above, Inceptisols are soils present in areas of frequent disturbance and show little soil development (Birkeland, 1984). Much of Alaska contains permafrost which is ground that has been frozen for many years. The undulating layers of permafrost are of different thicknesses; they lie from a few inches to several feet below the surface of the ground. Permafrost is usually covered by a layer of soil, called the active layer, that generally is quite moist and varies in temperature with the seasons. This soil layer, which belongs to the suborder Aquepts of the order Inceptisols, is very sensitive to disturbance and is easily damaged.

Southeastern and southern Alaska have experienced major earthquakes due to the presence of faults. Seismic activity in the remainder of the state is moderate. Therefore, the seismic hazard in southern Alaska is considered significant. Volcanic activity is another potential hazard in southern Alaska. For example, Mounts Redoubt and Spurr have both erupted within the last decade. In Alaska, areas near rivers and adjacent floodplains can be impacted by flooding. Therefore, the potential for flooding is moderate.

3.1.9 Hawaiian Islands

The Hawaiian Islands contain many volcanic cones, and the island of Hawaii contains a few thermal springs. Except for the island of Hawaii, soils in this region are Inceptisols, which show little soil development (Birkeland, 1984). Portions of the island of Hawaii contain Ultisols, which are heavily weathered soils characterized by a horizon of clay accumulation (Birkeland, 1984). However, little soil has developed on the lava flows, ash, and cinders from Mauna Loa and Mauna Kea (SCS, 1975).

Due to the associated seismic activity, the seismic hazard is considered to be significant. Areas near rivers and adjacent floodplains can be impacted by flooding. Therefore, the potential for flooding is moderate.

3.1.10 Mineral Deposits, Agricultural Resources, and Fossil Remains

Mineral deposits are widely distributed throughout the United States. Mineral resources may be broadly defined as rock and rock-derived materials that are concentrated in the crust of the earth and for which some use has been found. Mineral resources include fossil fuels, construction and building materials, metals, gemstones, and nonmetallic raw materials (such as talc and asbestos). Construction and building materials, including granite, limestone, marble, and clay, as well as large deposits of coal, are found throughout the United States. Oil and gas reserves, and associated salt domes, are abundant in Texas, Oklahoma, California, and Louisiana, with smaller reserves elsewhere. Large deposits of gold, silver, and copper are found in the southwestern states, while large deposits of zinc and iron are found in New York, Pennsylvania, and New Jersey. Large iron deposits are also found in Minnesota, Michigan, and Alabama.

Agricultural resources include approximately 600 million acres (45 percent of the land in the United States) which are suitable for cultivation and another 190 million acres which are marginal (Brady, 1984). Approximately 340 million acres of this land are designated as prime farmland by the Natural Resources Conservation Service. In general, prime farmland meets a set of technical criteria including soil water capacity or availability of irrigation, temperature regime, pH, depth of water table, flood and erosion potential, permeability, and percentage of rock fragments.

Fossil remains are abundant throughout the United States, with the exception of New England, where few fossil-containing rocks can be found. Fossils of approximately 1,000 taxonomic genera occur within North America (Thompson, 1982). The majority of these resources are found where bedrock is exposed on the surface, typically where erosion has removed the soil profile or in mountainous terrains.

3.2 WATER RESOURCES

The water resources of the United States include surface and ground water. This section focuses on the chemical, biological, and physical factors, including erosion and sedimentation, that influence water quality and quantity. Aquatic habitats, including wetlands, are discussed in the biology portion of the environmental assessment (Section 3.4).

The analysis of water resources within the United States is divided into four areas of concern: (1) general location of groundwater, surface waterbodies, and drainage networks; (2) drinking water supplies; (3) increased erosion and sedimentation; and (4) surface water runoff. This analysis describes each area of concern in general terms, emphasizing possible constraints to DoD NAS construction. Since most of these concerns are site-specific, the analysis focuses on identifying characteristics that could typically result in significant impacts to water resources. Data on water resources and impacts are available at the federal level from the Bureau of Standards, Environmental Protection Agency, Fish and Wildlife Service, Forest Service, Geological Survey, and the Natural Resources Conservation Service (formerly the Soil Conservation Service). Typically, sources of data at the state level include the departments concerned with environmental protection, forestry, geologic survey, soil, and water.

3.2.1 Ground and Surface Water and Drainage Networks

Groundwater is found beneath the surface of the earth. Sources of groundwater include rainfall; surface waters such as lakes, rivers, wetlands, and stormwater retention ponds; and wastewater treatment systems such as cesspools and septic tank drain fields. These waters penetrate and move through the soils to the water table. Most states east of the Rocky Mountains contain large areas of groundwater. States west of and including the Rocky Mountains contain scattered areas of groundwater (van der Leeden, 1991).

Surface waters include rivers, streams, wetlands, and lakes. Through drainage networks (i.e. streams discharging to rivers, etc.), surface waters drain the land, but not uniformly or consistently. Drainage basins are geographic areas that contribute surface water to a particular stream or river network. Generally, topographical features, such as mountains, divide one drainage basin from another. The United States can be divided into several major drainage (i.e. river) basins. Most of these basins drain to the Atlantic or Pacific Oceans or the Gulf of Mexico.

However, a few basins (i.e. the Salt Lake watershed in Utah) are "internal" and do not drain to the oceans. The Mississippi River basin is the third largest drainage system in the world; draining 1.2 million square miles (over 50% of the continental United States) (Snead, 1980).

Areas of high stream flow are found where there is considerable rainfall and where sufficient geologic time has elapsed for streams to develop elaborate tributary systems, such as mountainous regions and humid hill lands. The hill lands of the eastern United States offer excellent examples of intricate stream patterns. Areas of low stream flow include the arid and semiarid portions of the United States. These areas have high evaporation rates, slight and irregular rainfall, and relatively infrequent stream channels. However, areas of low stream flow are not wholly confined to dry regions. Sandy flats near coastlines and extremely porous limestone areas may lack permanent surface streams, despite a humid climate. In areas of poor drainage, lakes and wetlands, rather than streams, form a large part of the land surface. Wetlands are also numerous along flat coastal plains in the Eastern United States. Deltas of large rivers also are poorly drained.

The largest number of lakes in the United States are concentrated in glaciated areas. Across the northern portion of the United States, there are literally thousands of lakes of many sizes and depths. The southern boundary of glacial lakes roughly follows a line from Nantucket Island, Massachusetts, along Long Island, across southern New York State and around the Great Lakes into northern Iowa and the Dakotas. The Great Lakes were shaped by glaciers, as were the Finger Lakes in New York. In the western United States, particularly in the high Sierra Nevadas of California and the Rocky Mountains, rock basins formed by glaciers are currently occupied by lakes. Smaller glacial lakes can be found in the Cascades, Wasatch, and Grand Teton Ranges.

Areas of limestone rock also often have many lakes. For example, lakes abound in the Lakeland-Orlando-Gainsville, Florida region, in basins of soluble limestone. Lakes are also found in volcanic regions, where irregular distribution of volcanoes tend to form depressions. Lakes sometimes form in large joints or cracks in massive rocks. The most common pattern is rectangular basins formed by two or more joint systems intersecting at approximately right angles. Such structurally formed lakes, including Lake Placid in New York, can be found in the

Adirondack Mountains. Other large structurally formed lakes, such as Lake Tahoe, occur in long trench-like depressions, known as rift valleys. Large lakes are also found in enclosed desert basins. Most of these lakes are remnants of former, much larger, very old (over a million years old) lakes.

Thousands of large artificial lakes, used as storage basins and recreation centers, exist in the United States. Nearly every major river has a dam with a human-made lake behind it. As a result, large bodies of water now exist in remote semi-arid and arid regions which previously had no lakes.

3.2.2 Drinking Water Supplies

In addition to surface water supplies, much of the nation's drinking water is supplied by groundwater aquifers. An aquifer can be defined as a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs. Most aquifers can be considered as underground reservoirs that receive recharge from rainfall. Generally, aquifers are laterally extensive and may be overlain or underlain by a confining bed, defined as a relatively impermeable material. These systems are subject to contamination from sites above or below the ground surface. Properties of the porous media and subsurface geology govern both the rate and direction of groundwater flow in any aquifer system. The accidental spill of contaminants into an aquifer or the pumping of the aquifer for water supply may alter groundwater quality or hydraulic flow patterns.

Groundwater is an important source of water supply for municipalities, agriculture, and industry. Western and Midwestern areas of the United States are generally much more dependent on groundwater than other areas of the country. Many of these states depend on groundwater for over 50% of their water needs. However, every state in the nation depends on groundwater to supply a portion of drinking water needs.

3.2.3 Erosion and Sedimentation

The universal soil loss equation (USLE) is the standard method for estimating loss of sediment (Novotny & Chesters, 1981). Since the site-specific information required to apply the USLE would not be available until specific sites are analyzed, this evaluation identifies conditions potentially contributing to significant erosion and sedimentation problems.

Every year in the United States, land is lost to riverbank, beach, and estuary erosion. Areas within the following regions of the United States experience significant erosion and land losses through erosion (van der Leeden, 1991): South Atlantic Ocean-Gulf of Mexico; Mississippi River; Texas-Gulf of Mexico; Rio Grande River; Columbia River-North Pacific Ocean; California; and Alaska.

The effect of land-use change on the drainage basin and its streams may be quite dramatic. Streams in naturally vegetated areas usually are stable, that is, without excessive erosion or deposition. Converting vegetated land to pavement or other uses generally increases the runoff and sediment yield (erosion) of the land. As a result, the streams become muddy and may not be able to transport all of the sediment delivered to the channels. Therefore, the channels would aggrade (partially fill with sediment), possibly increasing the magnitude and frequency of flooding and adversely impacting the stream flora and fauna (Keller, 1982).

3.2.4 Surface Water Runoff

When rainfall or snow melt exceeds the infiltration and evaporation rates at the surface, excess water begins to accumulate as surface storage on vegetation and in small topographic depressions. As the depth of surface detention increases, overland flow (runoff) may occur. The flow quickly concentrates into small rivulets or channels, which then flow into larger streams. Rainfall that infiltrates the soil and moves laterally through upper soil zones until it enters a stream channel is known as interflow. Some precipitation may percolate to the water table, usually many feet below the ground surface, and contribute to a stream as baseflow if the water table intersects the stream channel.

Prior to human settlement, soils generally were protected from erosion by vegetative interception of rainfall. The vegetation and soils intercepted large amounts of rainfall and released it slowly to waterways. The clearing of vegetation; draining and filling of wetlands, streams, and ponds; and construction of buildings, roads, parking lots, pastures, and farm fields has irrevocably altered drainage patterns. Once areas are cleared, the increase in compacted and impervious surfaces increases the volume and flow rates of surface runoff and decreases groundwater recharge. This causes stream bank erosion and habitat destruction. Sediment from cleared areas and eroded stream banks is deposited downstream. Summer base flows are greatly reduced because of a lack of interflow (Bedient and Huber, 1988). These impacts adversely effect aquatic life.

Land dominated by impervious surfaces and hydraulically altered drainage systems (i.e. storm sewer systems) respond much more quickly to rainfall than undeveloped land of equivalent area, slope, and soils. The runoff volume from a developed area is larger because there is less pervious area available for infiltration. Since most DoD NAS structures would be constructed on or near airfields, it is likely that the existing site conditions would include substantial impervious areas and altered drainage systems. Therefore, the existing volume and flow rates of surface water runoff from these sites are likely to be high.

3.3 AIR QUALITY

The air quality in an area is defined as the concentration of pollutants present within the air mass of a region in either parts per million (ppm) or µg/m3. Typically, the U.S. Environmental Protection Agency (EPA) delineates regional air masses on the basis of counties (40 CFR 81 § 81.11). The ambient concentrations of pollutants are compared with EPA established National Ambient Air Quality Standards (NAAQS). Pollutant concentrations equal to or below the EPA NAAQS are indicative of relatively good air quality, while comparatively poorer air quality characterizes areas with pollutant levels above NAAQS. The regulated air pollutants of concern consist of the following: sulfur dioxide (SO_2); carbon monoxide (CO); ozone (O_3); nitrogen dioxide (NO_2); lead (Pb); and particulate matter composed of particles of *"an aerodynamic diameter less than or equal to a nominal 10 micrometers*" (40 CFR 50 § 50.6).

The primary factor affecting the air quality of an area is the emissions output within the air basin. The pollutant concentrations in source emissions, and the rate at which point sources produce these emissions determine the raw input of pollutants to the air mass in a given area. This input can subsequently be modified by a variety of climatic and meteorological factors, including: temperature, precipitation, wind direction, wind speed, humidity, atmospheric stability and mixing height. These factors determine whether pollutants remain within an air basin, or are instead dispersed outside of the area.

3.3.1 Regulatory Standards

Both state air pollution control agencies and the U.S. EPA establish procedures for achieving acceptable ambient air levels of regulated pollutants throughout the country. The EPA has established and periodically updates NAAQS for SO_2, CO, Pb, O_3, NO_2 and PM-10. In the past the EPA also promulgated standards for Total Suspended Particles (TSP). The TSP standard, however, was replaced with the PM-10 standard in 1987. The EPA establishes two types of NAAQS (Table 3.3-1). Primary standards are aimed at protecting public health, while secondary standards are established to protect public welfare. Protection of public welfare includes guarding against negative public effects that may result from air pollution, such as visibility impairment and vegetation and crop damage (EPA, 1993).

Each standard is measured over a specified averaging time which is either a short-term period or a long-term period (Table 3.3-1). Generally, the short-term, hourly standards are not to be exceeded more than once per year (see Table 3.3-1) and the long-term, annual standards are never to be exceeded. EPA identifies air basins or counties as "non-attainment" for one or more

TABLE 3.3-1. NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Primary Standard	Secondary Standard
Sulfur dioxide (SO2)		
annual arithmetic mean[4]	80 $\mu g/m^3$ (0.03 ppm1)[2]	No secondary standard
maximum 24-hour average[5]	365 $\mu g/m^3$ (0.14 ppm)[2]	No secondary standard
maximum 3-hour average[5]	No primary standard	1300 $\mu g/m^3$ (0.50 ppm)[2]
Particulate Matter (PM-10[a])		

24-hour average[5] annual arithmetic mean[4]	150 $\mu g/m^3$ 50 $\mu g/m^3$	Same as primary standard Same as primary standard
Carbon Monoxide (CO) 8 hour average[5] 1 hour average[5]	 9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)	 No secondary standard No secondary standard
Ozone (O3) 1 hour average[5]	 0.12 ppm (235 $\mu g/m^3$)	 Same as primary standard
Nitrogen Dioxide (NO_2) annual arithmetic mean[4]	 0.053 ppm (100 $\mu g/m^3$)	 Same as primary standard
Lead (Pb) 3 months max. arithmetic mean[4]	 1.5 $\mu g/m^3$	 Same as primary standard

[a]"*particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers*" (40 CFR 50 § 50.6)
[1]ppm=parts per million
[2]approximate equivalent value in either $\mu g/m^3$, mg/m^3 or ppm
[4]not to be exceeded
[5]not to be exceeded more than once a year
Source: EPA, 1993

of the six regulated pollutants if the air concentrations of the pollutant exceed the short or long-term average NAAQS for that pollutant. Each state must develop an implementation plan which identifies how the EPA's NAAQS will be attained and subsequently maintained within non-attainment air basins (40 CFR 51 § 51.110). The states' implementation plans are subject to approval by the U.S. EPA.

In addition to establishing NAAQS, the EPA also promulgates Prevention of Significant Deterioration (PSD) regulations that apply to permanent stationary sources of pollutants emitting in excess of 100 tons of pollutants per year (40 CFR 52 § 52.21). The PSD regulations define the maximum increase in ambient pollutant levels that are permissible within 3 types of geographical areas. Permanent stationary sources that are subject to PSD must ensure that their emissions do not exceed the permissible levels of increase. Class I areas are national parks and wildernesses in which pristine air quality and exceptional visibility are desirable. Minimal increases in pollutant levels are permitted in these areas. The majority of the United States is considered Class II, in which less stringent limits of pollutant increases are enforced. Class III is reserved for areas of particularly intensive industrial development, in which the greatest level of pollutant increases are permitted. There are currently no Class III areas designated within the United States (40 CFR 52 § 52.21).

3.3.2 Regional Concentrations of Air Pollutants

The U.S. EPA monitors ambient air quality within counties and air basins throughout the country, and periodically publishes reports relating the current status of air concentrations of pollutants in EPA regions across the U.S. The EPA reports the second highest daily maximum pollutant concentration rather than the highest value (EPA, 1993), presumably in an attempt to discount spurious, extreme air monitor readings. The following discussion is heavily based on the most recent EPA report (EPA, 1993) and summarizes the most recent nationwide levels of each of the regulated pollutants. The discussion below also includes a description of the effect of the regulated pollutants on visibility impairment in regions across the country.

Carbon Monoxide. Of the CO emissions in the United States, approximately 80% result from transportation, with motor vehicles representing the largest transportation source. Other sources which emit CO include wood burning stoves, incinerators and industrial sources. Recent improvements in both CO ambient air levels and emissions have occurred despite an increase in vehicle miles travelled in the U.S. (EPA, 1993).

In 1992, the composite averages of the second highest 8-hour average CO concentrations ranged between 4 and 7.8 ppm across the country. The lowest CO levels were evident in EPA Region VII, which includes Iowa, Kansas and Nebraska, while the highest CO concentrations were recorded in Region VIII (Montana, North Dakota, South Dakota and Utah) and Region X (Alaska, Washington, Idaho and Oregon). There are currently 41 EPA designated non-attainment areas for CO, 40 of which are classified as moderate. The Los Angeles area is currently designated as serious non-attainment for CO. Designated non-attainment areas for CO are required to use oxygenated fuel during the winter to reduce CO emissions (EPA, 1993).

Lead. Historically, transportation sources were the largest contributors of lead emissions. However, the introduction of unleaded gasoline in 1975 and a reduction in the amount of lead in leaded gasoline has diminished the importance of transportation as a lead source. More recently, lead smelters, battery plants and solid waste sites have become the largest contributors to lead emissions (EPA, 1993).

There are currently 13 designated non-attainment areas for lead. These non-attainment areas are distributed throughout the United States and typically surround lead point sources such as lead smelters and battery plants. Eight additional areas are currently undesignated in regard to lead as a result of insufficient data. In 1992, the composite averages of the maximum quarterly lead concentration were below 0.08 $\mu g/m^3$ within each of the EPA regions across the country (EPA, 1993).

Nitrogen Dioxide. Both stationary sources of fuel combustion, such as electric utility and industrial boilers, and transportation contribute to NO_2 emissions. In 1992, these two sources contributed 51% and 45% of the nationwide NO_2 emissions, respectively (EPA, 1993).

Los Angeles is currently the only officially designated non-attainment area for NO_2, however all EPA monitoring stations across the country reported NO_2 air concentrations below the NAAQS in 1992. The 1992 composite annual NO_2 averages ranged between 0.005 ppm and 0.027 ppm across the nation. The 1992 NO_2 levels were substantially lower in EPA Region VIII, which includes Montana, North Dakota, South Dakota, Wyoming, Colorado and Utah, and were highest in Region II, which includes New York, New Jersey and Puerto Rico (EPA, 1993).

Ozone. Ground-level ozone is a major component of smog, and differs from the atmospheric ozone that plays a beneficial role in moderating the earth's climate. Unlike the other EPA regulated pollutants, ozone is not an emission, but is instead formed as a result of the chemical reaction of nitrogen oxides (NOx) and volatile organic compounds (VOCs), which are emitted from a variety of sources. The sources of nitrogen oxides are discussed above, while VOCs are typically produced by automobiles, chemical manufacturing and dry cleaners. Meteorological factors are particularly important in regard to ozone formation and air concentrations. High temperatures, clear skies, light winds and limited vertical mixing represent the optimal conditions for ozone formation. Consequently, the ozone season generally lasts between May and October throughout most of the country, but may continue throughout the year in southern and southeastern states (EPA, 1993).

There are currently 94 areas designated by EPA as non-attainment for ozone. Of these areas, 39 are designated as marginal, 31 as moderate, 14 as serious, 9 as severe, and 1 (Los Angeles) as extreme. In 1992, the composite average of the second highest daily 1-hour ozone concentration ranged between 0.08 ppm and 0.12 ppm at EPA monitoring sites across the nation. The highest 1992 ozone levels were evident in EPA Region IX, which includes California, Nevada, Arizona and New Mexico. Ozone levels were similar in other regions across the country (EPA, 1993).

PM-10. Particulate matter includes dust, dirt, soot, and smoke. In 1987, the EPA replaced the standard for total suspended particles (TSP) with a NAAQS for PM-10, or particulate matter with "an aerodynamic diameter less than or equal to a nominal 10 micrometers" (40 CFR 50 § 50.6). The PM-10 standard is aimed at focussing attention on smaller air particles which are more likely to cause adverse health effects. Fugitive dust sources such as agricultural tilling, construction, and unpaved roads are the primary PM-10 sources (EPA, 1993).

The annual PM-10 mean in 1992 ranged between 20 $\mu g/m^3$ and 35 $\mu g/m^3$ across the nation, and was highest in EPA Region IX (California, Nevada, Arizona and Hawaii) and lowest in EPA Region I (Maine, Vermont, New Hampshire, Massachusetts, Rhode Island and Connecticut). The remaining EPA regions exhibited similar ambient PM-10 levels. The data which are the basis for the EPA analysis, however, were predominantly gathered at TSP modelling sites and therefore may not be entirely representative of PM-10 levels since TSP sources are not the most important sources of PM-10 (EPA, 1993). In 1991, the EPA designated 70 areas in the United States as non-attainment for PM-10.

Sulfur Dioxide. The primary sources of SO_2 are stationary sites of coal and oil combustion, such as electric utilities, power plants, steel mills, refineries, pulp and paper mills, and nonferrous smelters. EPA air monitoring stations are typically located in unpopulated areas whereas SO_2 point sources are primarily situated in populated areas. Almost all EPA monitors record ambient air levels of SO_2 which meet NAAQS. Consequently, dispersion models are used to predict areas affected by point sources of SO_2. There are currently 46 non-attainment areas designated by the EPA for SO_2 (EPA, 1993). The 1992 composite annual SO_2 average ranged between 0.002 ppm and 0.011 ppm across the nation, and was highest in EPA Region III and lowest in Region IX (Hawaii, California, Nevada and Arizona).

Visibility. All of the six regulated pollutants discussed above can contribute to visibility degradation, which detracts from scenic views. Visibility impairment results primarily from aerosols, which are a mixture of gases and suspended particles that cause light to be either scattered or absorbed. Sulfates are the largest single contributor to visibility degradation in Hawaii and in all states east of New Mexico. Organic carbon is the second largest contributor, accounting for approximately 16% of the visibility reduction in these areas. Sulfates and organic carbon account for roughly equal amounts of the visibility impairment experienced in the western states and in Alaska. Nitrates are a substantial source of visibility impairment only in California. Light absorbing carbon and soil dust also contribute to visibility degradation across the country (EPA, 1993).

The best visibility in the United States generally occurs in the rural mountain desert areas of the southwestern states, where visibility often exceeds 80 miles. In comparison, the visibility in the area east of the Mississippi River and south of the Great Lakes averages only 12 miles. The Great Basin, Colorado plateau, portions of the central Rockies, the Great Plains, and Alaska also generally experience good visibility. The western United States has six times better visibility in winter, and ten times better visibility in summer as compared to the east (EPA, 1993).

3.3.3 DoD NAS Locations

The proposed DoD NAS sites are distributed throughout the country (Figures 1-1 and 1-2) and therefore are located within areas of both good and poor relative visibility. Tables 3.3-2 and 3.3-3 list the proposed DoD NAS sites that would be located within regions designated by the EPA as non-attainment for one or more pollutants. The DoD NAS sites listed in Tables 3.3-2 and

3.3-3 have ambient air levels of pollutants which exceed the EPA NAAQS, and therefore experience slightly degraded existing air quality. The remainder of the DoD NAS sites are characterized by ambient air quality which is equal or better than the NAAQS. Fort Sill in Comanche County, Oklahoma is directly adjacent to the Wichita Mountains National Wildlife Refuge, which is within an area designated as Class I by the EPA. Although some of the other DoD NAS sites are within 60 miles of Class I areas (Tables 3.3-2 and 3.3-3), none except Fort Sill are adjacent to Class I areas

TABLE 3.3-2. U.S. NAVY AND U.S. MARINE CORPS AND U.S. AIR FORCE DoD NAS SITES WITHIN NON-ATTAINMENT AREAS OR NEAR1 CLASS I AREAS

DoD Site	State/ Terr.	County/Area	Non-attainment Status	Nearby Class I[2] Area
Eareckson AFS[3]	AK	Aleutian Islands	Attainment	Within Bering Sea
Luke AFB[3]	AZ	Maricopa County	Moderate: CO, O_3 and PM-10	None
Yuma MCAS[3]	AZ	Yuma County	Moderate: PM-10	None
Los Alamitos	CA	Orange County	Serious: CO and PM-10 Extreme: O_3 Just outside non-attainment area for NO_2	San Gabriel and Cucamonga Wildernesses are approximately 30 and 40 miles north, respectively
Travis AFB	CA	Sacramento Air Basin	Serious: O_3 Moderate: CO and PM-10	None
Lemoore NAS[3]	CA	Kings County	Serious: O_3 Moderate: PM-10	None
High Desert	CA	Kern County	Serious: O_3 Moderate: PM-10	Cucamonga and San Gabriel Wildernesses are approximately 50 and 20 miles south, respectively
China Lake NAWC	CA	San Bernadino and Inyo Counties	Severe: O_3 Serious: PM-10	Sequoia and Kings Canyon National Parks are 40 and 60 miles north, respectively

TABLE 3.3-2. U.S. NAVY AND U.S. MARINE CORPS AND U.S. AIR FORCE DoD NAS SITES WITHIN NON-ATTAINMENT AREAS OR NEAR[1] CLASS I AREAS

DoD Site	State/ Terr.	County/Area	Non-attainment Status	Nearby Class I[2] Area
March AFB	CA	Riverside County	Extreme: O_3 Serious: CO and PM-10	San Gorgonio and San Jacinto Wildernesses are each approximately 30 miles east; Joshua Tree Wilderness is approximately 50 miles east; Cucamonga and San Gabriel Wildernesses are approximately 30 and 40 miles north, respectively
Homestead AFB	FL	Dade County	Moderate: O_3	Everglades National Park is approximately 10 miles west
Andersen AFB	Guam	None	Within 3.5 km radius of Piti and Tanguisson power plants, SO_2 does not meet primary standard	None
Mountain Home AFB	ID	Elmore County	Attainment	Sawtooth Wilderness Area is approximately 45 miles north
Indian Springs AFAF3	NV	Clark County	Las Vegas Planning Area, Hydrographic Area 212 is moderate non-attainment for CO and serious non-attainment for PM-10	None

TABLE 3.3-2. U.S. NAVY AND U.S. MARINE CORPS AND U.S. AIR FORCE DoD NAS SITES WITHIN NON-ATTAINMENT AREAS OR NEAR[1] CLASS I AREAS

DoD Site	State/ Terr.	County/Area	Non-attainment Status	Nearby Class I[2] Area
Nellis AFB	NV	Clark County	Las Vegas Planning Area, Hydrographic Area 212 is moderate non-attainment for CO and serious non-attainment for PM-10	None
Altus AFB	OK	Jackson County	Attainment	Wichita Mountains National Wildlife Refuge is approx. 30 miles east
Ellsworth AFB	SD	Meade County	TSP does not meet primary standard; no PM-10 classification	Badlands and Wind Cave National Parks within approximately 45 mile radius
Oceana NAS	VA	Northampton County	Marginal: O_3	None
Roosevelt Roads NAS	PR	Unknown	Guaynabo County is moderate non-attainment for PM-10	None

[1] For the purposes of this discussion, "near" is defined as within an approximately 60 mile radius of the DoD NAS site
[2] Based on Class I areas identified in 40 CFR 81 § 81.400 to § 81.437
[3] AFS=Air Force Station; AFB=Air Force Base; AFAF=Air Force Auxiliary Field; MCAS=Marine Corps Air Station; NAS=Naval Air Station; NAWC=Naval Air Warfare Center

TABLE 3.3-3. U.S. ARMY SITES WITHIN NON-ATTAINMENT AREAS OR NEAR[1] CLASS I AREAS

DoD Site	State/ Terr.	County/Area	Non-attainment Status	Nearby Class I[2] Area
Redstone Arsenal	AL	Madison County	Attainment	Sipsey Wilderness is approximately 40 miles southwest of site
Fort Wainwright	AK	Outside Fairbanks	Moderate: CO	None
Pinal Park	AZ	Pinal County	Just outside non-attainment areas for PM-10 and SO_2	Galiuro and Saguaro Wildernesses within 30 miles of Pinal Park
Fort Carson	AZ	El Paso and Pueblo Counties	Just outside moderate non-attainment area for CO	Great Sand Dunes National Monument is approximately 60 miles to the southwest
The Pentagon	Washington, D.C.	None	Moderate: CO Serious: O_3	None
Fort Benning	GA	Chattahoochee & Muscoogee Counties	Within 2.3 km of lead smelter in Muscoogee County is non-attainment for lead	None
Fort Knox	KY	Hardin and Bullett Counties	Attainment, but just outside moderate non-attainment for O_3	None
Fort Drum	NY	Jefferson & Lewis Counties	Marginal: O_3	None

TABLE 3.3-3. U.S. ARMY SITES WITHIN NON-ATTAINMENT AREAS OR NEAR[1] CLASS I AREAS

DoD Site	State/ Terr.	County/Area	Non-attainment Status	Nearby Class I[2] Area
Fort Sill	OK	Comanche County	Attainment	Directly adjacent to Wichita Mountains National Wildlife Refuge
Indiantown Gap	PA	Lebanon County	Marginal: O_3	None
Fort Bliss	TX	El Paso County Pinal County	Serious: O_3 Just outside city of El Paso moderate non-attainment area for CO	Guadalupe Mountains National Park is 60 miles to the west
	NM	Otero and Don Ana Counties	Part of Don Ana County is moderate non-attainment for PM-10	Carlsbad Caverns National Park and Gila Wilderness are within a 60 mile radius of site
Fort Eustis	VA	James City County	Marginal: O_3	Site is located on James River; James River Face National Wildlife Refuge is Class I
Fort Belvoir	VA	Fairfax County	Serious: O_3	None
Fort Lewis	WA	Pierce County	Marginal: O_3 Site is on edge of moderate non-attainment zone for PM-10 and just outside moderate non-attainment zone for CO	Mt. Rainier National Park is approximately 25 miles east of site

[1] For the purposes of this discussion, "near" is defined as within an approximately 60 mile radius of the DoD NAS site
[2] Based on Class I areas identified in 40 CFR 81 §81.400 to § 81.437

3.4 BIOLOGY

The biological resources of the United States consist of all plants and animals and the habitats in which they occur. They include both terrestrial and aquatic ecosystems. Protected biological resources include species under consideration for listing (candidate species) or listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or by individual states.

The biological resources of the United States may be divided into the following seven major terrestrial biomes (large climatic regions): tundra, taiga, temperate deciduous forest, grassland, desert, scrub forest, and tropical forest (Keeton, 1986; Figure 3-2). These biomes are a result of complex interactions of temperature, wind, humidity, latitude, altitude, and topography. Each biome is characterized by different types of plants and animals. The variability of biological resources geographically and over time precludes conducting a detailed analysis of specific resources until potential sites are chosen. Therefore, this analysis describes the biological resources, including potentially sensitive areas, of each large biome in general terms. Two types of biological resources that are particularly sensitive and ubiquitous, aquatic ecosystems and threatened, endangered, and candidate species, are analyzed independently of biome.

Data on biological resources and impacts are typically available at the federal level from the Army Corps of Engineers, Bureau of Land Management, Bureau of Reclamation, Environmental Protection Agency, Fish and Wildlife Service, Forest Service, National Biological Survey, National Marine Fisheries Service, and the Natural Resources Conservation Service (formerly the Soil Conservation Service). Typically, sources of data at the state level include the departments concerned with environmental protection, forestry, geologic survey, and soil and water conservation offices.

3.4.1 Tundra

The northern and western portions of Alaska (approximately sixty percent) consist of tundra. Soils in this area are generally permanently frozen, although the top soil layer thaws in the

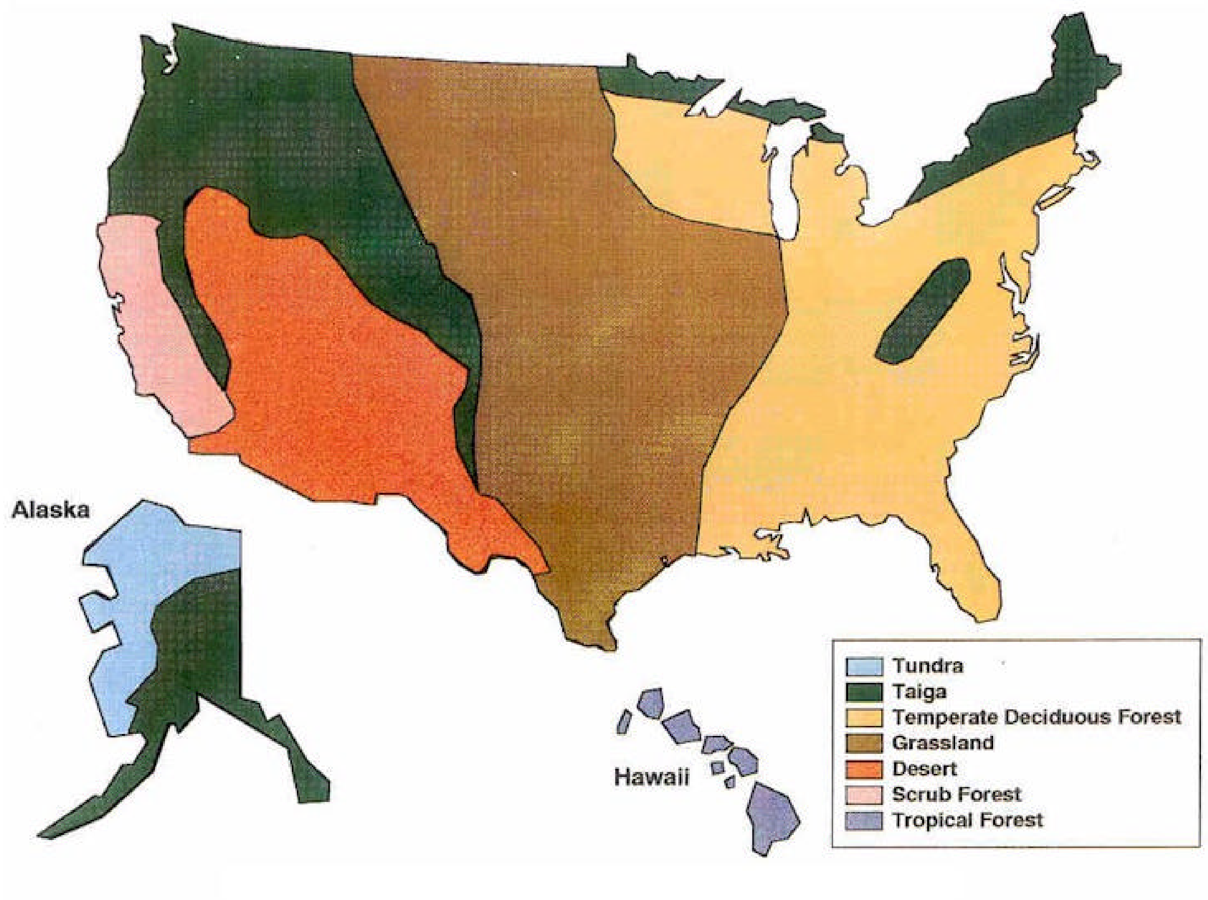

FIGURE 3-2. THE MAJOR BIOMES OF THE UNITED STATES

summer and refreezes in the winter (see Section 3.1.8). The land has the appearance of a gently rolling plain, with many lakes, ponds, and bogs in the depressions. There are a few trees, such as sitka alder (*Alnus sinuata*), on the tundra, but they are small, widely scattered, and not dominant, except locally. Much of the ground is covered by mosses, lichens, and grasses. There are numerous small perennial herbs, which are able to withstand frequent freezing and which grow rapidly during the brief cool summers, often carpeting the tundra with brightly colored flowers.

Caribou (*Rangifer tarandus*), arctic fox (*Alopex lagopus*), arctic hare (*Lepus arcticus*), and lemming (*Lemmus trimucronatus*) are among the principal mammals; polar bear *(Thalarctos maritimus*) being common on tundra near the coast. Vast numbers of birds, particularly shorebirds such as sandpipers (*Calidris sp*.), plovers (*Pluvialis sp*.), etc.) and waterfowl (ducks, geese, etc.), nest on the tundra in summer. Tundra in northern and coastal Alaska provides summer breeding habitat for tundra swans (*Cygnus columbianus*). However, most birds migrate south for the winter. The willow ptarmigan (*Lagopus*) is one of the permanent avian residents of the tundra. Insects, particularly flies and mosquitoes, are abundant. Though the number of individual organisms on the tundra is often very large, the number of species is quite limited.

3.4.2 Taiga

The taiga, which is south of the tundra, predominates in eastern Alaska; on the upper slopes of the Coast Ranges in Washington, Oregon, and northern and eastern California; on the upper slopes of the Rocky Mountains in Idaho, western Montana, Wyoming, Colorado, and small portions of the southwest; the northern portions of states bordering Canada, including a significant portion of Maine; and a relatively small area along the upper slopes of the Appalachian Mountains. Taiga, also called boreal forest, is dominated by coniferous (evergreen) trees and, like tundra, is dotted with lakes, ponds, and bogs and experiences very cold winters. However, taiga summers are longer and somewhat warmer than tundra summers. As a result, taiga subsoil thaws and vegetation grows abundantly in summer. In Alaska, the northern reaches of the taiga may contain areas of discontinuous permafrost.

The number of species living in the taiga is larger than on the tundra, but considerably smaller than in biomes farther south. Though conifers (including spruce (*Picea sp*.), fir (*Abies sp*.), and tamarack (*Larix laricina*)) are the most characteristic larger plants in the taiga, some deciduous trees, such as paper birch (*Betula pendula*), are also common. Moose (*Alces alces*), black bear (*Ursus americanus*), grey wolf (*Canis sp*.), lynx (*Lynx canadensis*), wolverine (*Gulo luscus*), marten (*Martes americana*), porcupine (*Erethizon dorsatum*) and many smaller rodents are present in the taiga. Water-birds, such as common loons (*Gavia immer*), grebes (*Podiceps sp*.), and scoters (*Melanitta sp*.) are abundant in summer. Permanent avian residents include spruce grouse (*Canachites canadensis*), boreal owls (*Aegolius funereus*), and three-toed woodpeckers (*Picoides tridactylus* and *Picoides arcticus*). The taiga of eastern Alaska provides summer breeding habitat for trumpeter swans (*Cygnus buccinator*).

3.4.3 Temperate Deciduous Forest

Most of the states east of the Mississippi are in the temperate deciduous forest biome. Rainfall is abundant in these areas and the summers are relatively long and warm. Vegetative communities are dominated by broad-leaved deciduous trees such as oaks (*Quercus sp*.), maples (*Acer sp*.), and poplars (*Populus sp*.). In the autumn, leaves change color and fall off the trees. This biome characteristically includes many more plant species than the taiga to the north. Among the common mammals in the biome are ground squirrels (*Citellus sp*.), deer (*Odocoileus sp*.), foxes (*Vulpes sp*.), and bears (*Ursus sp*.). Deciduous forest provides habitat for many birds including an abundance of migratory insectivorous birds such as whip-poor-wills (*Caprimulgus vociferus*) and warblers (*Parulidae*). Many birds, such as wild turkeys (*Meleagris gallopavo*), cooper's hawks (*Accipiter cooperii*), and cardinals (*Cardinalis cardinalis*), permanently reside in temperate deciduous forests.

3.4.4 Grassland

The central portion of the United States, generally from the Rocky Mountains to the Mississippi River consists of grasslands. These are areas with annual warm-cold cycles and either relatively low total annual rainfall (10-12 inches) or uneven seasonal occurrence of rainfall. As a result, conditions are inhospitable for forests, but suitable for grasses and other herbaceous plants. Common grasses include bluestem (*Andropogon sp*.), quack grass (*Agropyrom repens*), and panic grass (*Panicum sp*.). As rainfall decreases from east to west, the stature of the vegetation decreases successively through tall, mixed and short grass prairies. Shrubs or trees, such as willows (*Salix sp*.) and bur oak (*Quercus macrocarpa*), are scattered throughout portions of the grasslands and often associated with riparian areas.

Grasslands contain vast numbers of large and conspicuous herbivores, such as bison *(Bison bison*) and pronghorn antelope (*Antilocapra americana*). Burrowing rodents or rodent-like animals, such as prairie dogs (*Cynomys ludovicianus*) and badgers (*Taxidea taxus*), are often common. Grassland marshes, particularly the prairie potholes of the northern great plains, are extremely productive waterfowl habitats. Grasslands also provide valuable grazing land for livestock.

3.4.5 Desert

Most of the southwestern United States is part of the desert biome. Since rainfall is often less than 10 inches per year, not even grasses can survive as the dominant vegetation. These arid regions are subject to the most extreme temperature fluctuations of any biome. During the day they are exposed to intense sunlight, and the temperature of both air and soil may rise very high (130^{o}F or higher for air temperature and 185^{o}F or higher for surface temperature). In the absence of the moderating influence of abundant vegetation and water vapor in the air, heat is rapidly lost at night.

Deserts in the United States contain areas of bare soil and scattered drought-resistant shrubs or small trees such as Joshua tree (*Yucca brevifolia*), creosote bush (*Larrea tridentata*), and mesquite (*Prosopis glandulosa*), and succulent plants such as saguaro cactus (Carnegiea gigantea) that can store much water in their tissues. In addition, there are often many small rapid-growing annual herbs with seeds that will germinate only after a rain. Once they germinate, these young plants shoot up, flower, set seed, and die, all within a few days.

Most desert animals are active primarily at night or during the brief periods in early morning and late afternoon when the heat is not so intense. During the day they remain in cool underground burrows or in cavities in plants or, in the case of some spiders and insects, in the shade of the plants. Desert animals include rodents, such as kangaroo rats (*Dipodomys sp*.), snakes such as western diamondback rattlesnakes (*Crotalus atrox*), lizards such as gila monsters (*Heloderma suspectum*), arachnids and insects. A few birds, such as the gilded flicker (*Colaptes chrysoides*) and Gambel's quail (*Lophortyx gambelii*), also live in the desert. Most desert animals possess numerous physiological and behavioral adaptations for life in their hostile environment.

Aquatic and moist habitats are important to wildlife in desert regions. Desert springs and streams contain a large number of endemic (geographically restricted in distribution) fish species, many of which are protected under federal or state regulations. The springs, playas, and marshes of western Nevada and eastern California harbor a high concentration of federally listed threatened, endangered, and candidate plant and animal species.

3.4.6 Scrub Forest

The major scrub forests of the United States are the chaparral and coastal sage scrub communities of western California. The plant communities of scrub ecosystems are dominated by shrubs and/or multi-stemmed trees that are typically less than 16 feet in height. Riparian or wetland scrub associations are widespread, but scrub is more characteristic of regions of moderate aridity (i.e. 10 to 30 inches of rainfall per year) and seasonal drought, often on slopes and rock or other poor soils. Examples of scrub vegetation include coyote brush (*Baccharis pilularis*) and sage (*Salvia clevelandii*).

Coastal sage scrub is somewhat more open and generally occurs below chaparral, although the two often intermingle. Both types of communities are subject to periodic fires, with ensuing succession. Chaparral provides habitat for mammals such as mule deer (*Odocoileus hemionus*), and sonoma chipmunks (*Eutamias sonomae*), snakes such as striped racers (*Masticophis lateralis*), and birds such as scrub jays (*Aphelocoma coerulescens*).

3.4.7 Tropical Forest

Hawaii, Guam, and Puerto Rico contain tropical forests. Warm temperatures combined with abundant and fairly uniform rainfall create these dense forests which contain vertically stratified communities. Different levels beneath the high tree canopy contain plant species adapted to ever diminishing amounts of sun. On the forest floor, few plants are effective at photosynthesis, although any break in the canopy encourages exuberant growth of tree saplings and other plants. Competition for light is intense but the abundant rains make adaptations, that are never seen under drier conditions, possible. Many types of vines grow upwards toward the sunlight. Mosses, orchids, lichens, and bromeliads grow on tree branches and obtain minerals from falling leaves, debris, and the wastes of animals living in the canopy. Many insects, spiders, amphibians, birds, and mammals, such as spider monkeys spend most of their lives at a single level in the canopy. The number and types of organisms living in or on a single tree in a tropical forest often exceed the number and types of organisms living in an entire temperate forest. In addition, due to the geographic isolation of islands, Hawaii, Guam and Puerto Rico contain significant numbers of species that are found nowhere else.

3.4.8 Aquatic Ecosystems

Many of the nation's biological resources are found in aquatic environments. Like terrestrial ecosystems, aquatic ecosystems also vary in type with varying physical conditions. Thus the plants and animals in lakes differ from those in the flowing waters of rivers and streams, and even those in a single stream differ from one another, depending on whether they are in rapids or in water flowing slowly and calmly over a smooth bottom.

The system adopted by the USFWS (Tiner, 1984) provides a basis for defining and classifying aquatic ecosystems. Deepwater habitats are defined as permanently flooded, and include inland lakes and streams and sub-tidal marine habitats. Wetlands include marshes, swamps, bogs, playas, and periodically flooded areas. In general, wetlands are transitional ecosystems between terrestrial and deepwater habitats. Riparian ecosystems, broadly defined, encompass all terrestrial areas of relatively high soil moisture that occur adjacent to rivers and streams.

Wetlands of the United States may be divided into two broad categories: estuarine/coastal wetlands which are subject to tidal influxes of seawater; and palustrine wetlands which are interior freshwater wetlands. Functions provided by wetlands include improving water quality, reducing flood and storm damages, providing fish and wildlife habitat, and providing opportunities for recreation and aesthetic appreciation. Wetlands are one of the most productive ecosystems in the world. Most fish feed on wetland produced food and use wetlands as nursery grounds. In addition, wetlands are of prime importance to waterfowl, which feed, nest, and raise young in diverse wetland habitats.

Riparian areas also provide habitat for a wide variety of species. In arid to semi-arid regions, riparian zones often support the only significant woodland or forest habitats and harbor a large number of wildlife species in comparison to the surrounding uplands. Riparian corridors permit the extension of species into drier regions than they would otherwise occupy. Finally, riparian vegetation regulates many of the physical and chemical characteristics of small streams, along with supplying much of their primary nutrients in the form of leaf litter. Riparian vegetation stabilizes stream and riverbank habitats, and in small streams, reduces solar radiation and water temperature in the stream bed. The biological resources of riparian areas and wetlands are extremely sensitive to changes in water level, neighboring vegetation, and sedimentation.

3.4.9 Threatened, Endangered, and Candidate Species

Species listed as threatened or endangered, and species that are candidates for listing under the Endangered Species Act of 1973 occur throughout the United States, although within a relatively small proportion of the total area. Although a complete listing by states is published annually in the Federal Register, the field and regional offices of the USFWS are the primary sources of information regarding the occurrence of listed species in particular areas.

As of October 1, 1993, a total of 363 plant species and 368 animal species were listed as threatened or endangered in the continental United States, Alaska, and Hawaii. Guam and Puerto Rico also contain many threatened and endangered species. In addition to protecting well known and charismatic endangered species, such as bald eagles, alligators, and spotted owls, the Endangered Species Act also protects little known plants (i.e. small whorled pogonia (*Isotria medeoloides*)) and animals (i.e. American burying beetle (*Nicrophorus americanus*)).

3.5 NOISE

Sound is created by a pressure disturbance that results from the vibration of molecules in a liquid medium. Each vibrating molecule collides with adjacent molecules which results in the creation of a wave of vibration that is perceived as sound when it reaches the human ear (USAF, 1978). Sound waves can travel through a wide array of media, such as air, water, wood, and steel (Yerges, 1969). Sound is a pervasive element of the human and animal environments, but becomes noise when it is unwanted and does not convey useful information. We are subjected to continuous background noises on a daily basis either at work or at home. However, noise becomes an annoyance or disturbance when it exceeds this typical background level.

The energy expanse of typical noises is extremely large, ranging from 1 unit of relative sound intensity, or the threshold of hearing, to 100,000,000,000,000 units, which is the approximate threshold of pain (Yerges, 1969). Because of this wide range of sound energy, noise is typically measured in decibels (dB), which is a logarithmic scale that condenses a wide range of sounds. On this scale, an increase of 3 dB represents a doubling of sound energy, but this difference in sound is barely perceptible by the human ear. An increase in sound energy by 10 dB is approximately equivalent to a doubling in perceived loudness (USAF, 1978).

The frequency range of human hearing extends from roughly 20 Hertz (Hz) to approximately 10,000 to 15,000 Hz. The human ear is most sensitive to high frequencies of 1,000 Hz and above, and less sensitive to mid and low frequencies of 125 Hz and below (USAF, 1978). Consequently, an "A-weighted" scale, termed dBA, which places more emphasis on high frequencies than on low frequencies is typically used to express sound. The dBA scale has been found to accurately represent the relative "loudness" of a noise as perceived by the human ear (USAF, 1978). A variety of typical dBA levels are shown in Table 3.5-1.

TABLE 3.5-1. TYPICAL dBA SOUND LEVELS

dBA	Description
0	Threshold for Hearing
10	Barely Audible Noise
20	Broadcasting Studio
30	Soft Whisper

40	Residential Area at Night
50	Quiet Conversation (10 ft)
60	Large Store
70	Vacuum Cleaner (10 ft) Freeway Traffic (250 ft)
80	Inside Sport Car at High Speed Freight Train (50 ft)
90	Subway Train (90 ft) Jack Hammer (50 ft)
100	Inside Propeller plane Electric Furnace Area
110	Riveting Machine
120	Maximum Vocal Effort Jet Engine (200 ft)
130	Limit of Amplified Speech
140	Jet Engine (75 ft)

Sources: Yerges, 1969 and USAF, 1993b

The dBA scale measures the noise from a single event. However, for planning purposes, the cumulative amount of noise over a given time period represents the noise environment experienced at a particular location. In addition, nighttime noise (between 10 pm and 7 am) contributes disproportionately to the noise environment at a given location because people are typically resting at night and background noise levels are lower at night (USAF, 1978). There are two commonly used sound measurements which accommodate these two critical aspects of the noise environment. The Equivalent Sound Level (Leq) measurement averages the dBA sound levels experienced at a particular location over a specified time period to represent the typical noise experienced at that location. Similarly, the Day/Night Sound Level (Ldn) averages sound levels over a 24-hour time period. However, the Ldn measurement adds 10 dB to nighttime noise levels to represent the relatively greater contribution of nighttime sounds to the noise environment.

An important characteristic of sound is that sound energy levels decrease as distance from the sound source increases. Typically, doubling the distance between a sound source and sound receiver results in four times less sound energy at the receiver than at the point of origin (USAF, 1978). This represents a noise reduction of approximately 6 dB. The noise attenuation of a line-source of noise, such as a highway, is less than that of a point-source, such as a piece of machinery. There are two reasons that noise attenuates with distance. First, a sound wave spreads out as it emanates from its origin, resulting in a more diffuse wave at the receiving location. Second, the atmosphere absorbs some sound energy, particularly at higher frequencies (USAF, 1978). Other factors that may influence the attenuation of sound with distance include: wind, temperature, humidity, terrain, and infrastructure (USAF, 1978).

The ambient noise level in a particular community or location varies depending on the relative amount of development in the area and the population density in the area (USAF, 1978). Table 3.5-2 shows the typical background noise levels characterizing a variety of communities ranging from rural to urban. In general, the proposed DoD NAS sites would range from suburban to urban locations. Very few of the sites would likely be characterized by rural background noise levels because of the numerous operation activities which typically take place on a military installation in the vicinity of an airstrip. The one exception is that in certain locations, the DASR component of the DoD NAS system might be located as far as one mile away from the airstrip at a DoD NAS site. At these sites, it is possible that the DASR would be located in an environment with a rural background noise level (Table 3.5-2), although noise from nearby aircraft might be present. Sites with rural background noise levels would be identified in the site-specific environmental document. At the majority of the proposed DoD NAS sites, the background noise level would most likely be dominated by the existing radar, which typically generates 80 dB during normal operation, and 95 dB with the beacon radar operating (noise levels generally measured at 50 feet from source). The existing emergency generator associated with the existing radar at each DoD NAS site also generates 145 dB of noise inside its shelter during its periodic operation, and therefore contributes additional background noise when in use.

TABLE 3.5-2. TYPICAL DAY/NIGHT (Ldn) BACKGROUND NOISE LEVELS IN VARIOUS COMMUNITY TYPES

Community Type	Ldn (dBA)
Rural	40-48
Small Town/Quiet Suburban	45-55
Suburban/Low Density Urban	52-60
Urban	57-67
Dense Urban with Heavy Traffic	64-74
Downtown in Major City	72-80
0.5 to 1.0 Mile from Airport	78-85

Source: USAF, 1978

3.6 INFRASTRUCTURE

Infrastructure addresses the key services required for airfield operation and thus for support of the new radars and automation systems. For this analysis, infrastructure includes water and wastewater distribution and collection systems, respectively; utilities (electricity and telephone); fuel supply; and transportation (roadways). In addition, the community services of police and fire protection are also addressed. Regulations governing the extension of utilities on the various airfields would vary with location and are expected to be governed by airfield operational rules, local utility standards, and local and state building codes.

Information on local police staffing was obtained by region from the U.S. Department of Commerce, Bureau of the Census. Existing infrastructure varies from airfield to airfield, and such variation was not considered in this document. Site-specific infrastructure will be addressed in the site-specific environmental documentation as appropriate.

Military airfields often have their own power station or at a minimum have an auxiliary power source, such as emergency generation. Electric service may be supplemented by utility companies; however, in some areas a local government entity (such as town, city, or special district) may provide service. Users can include residential, institutional, commercial and industrial entities. Telephone service is typically provided by regional telephone companies. Fuel supply for heat or for emergency generators may be provided by local gas or oil companies or wholesale distributors.

Water supply may be provided through a community or regional distribution system or through on-site wells. Wastewater can be discharged to a regional or community wastewater treatment plant, or to an on-site package treatment plant or subsurface disposal system.

Each airfield usually maintains its own security and fire protection force, which may or may not be supplemented by local police and fire personnel. In some locations the military and the local community may establish a Memorandum of Understanding, where there is reciprocal support of fire and police personnel as needed. In some rural areas, local police and fire workers may be volunteer, making such an agreement of greater importance. Table 3.6-1 illustrates the full time equivalent police employment in the major geographic regions across the country. The employment figures, which are per 10,000 population, are fairly consistent throughout the country.

TABLE 3.6-1. POLICE EMPLOYMENT IN MAJOR GEOGRAPHIC AREAS

United States	#/10,000 capita
Northeast	32.0
New England	27.8
Middle Atlantic	33.5
Midwest	26.2
East North Central	27.1
West North Central	24.2
South	27.4
South Atlantic	29.2
East South Central	23.6
West South Central	26.5
West	27.3
Mountain	28.0
Pacific[1]	27.1
Guam	NA[2]

[1]Includes Alaska and Hawaii
[2]Information not available at this time
Source: U.S. Bureau of the Census, 1993a

Each airfield has an internal roadway system with required checkpoints, as necessary, to maintain airfield security. Off-site roadway networks vary depending upon specific airfield location. Access may be either by urban or rural roadway. Table 3.6-2 shows the total primary, urban and rural mileage of the Federal Aid Highway system, by major geographic area. As can be seen from the Table, there is significant variability in the types of roadways that provide the majority of service to the various regions of the country.

TABLE 3.6-2. FEDERAL AID HIGHWAY MILEAGE

Region	Primary Miles[1]	Urban Miles[2]	Rural Miles[3]
Northeast			
New England	1996	1929	1496
Middle Atlantic	8958	7052	5330
Midwest			
East North Central	10233	5424	12921
West North Central	8946	1562	14869
South			
South Atlantic	5785	2225	6257
East South Central	7344	2430	9006
West South Central	10394	3651	14800
West			
Mountain	5268	1056	3316
Pacific[4]	6542	4943	5717
Guam	NA[5]	NA[5]	NA[5]

[1] Network of main roads important to interstate, statewide, and regional travel.
[2] Roads located in areas of 5,000 or more persons and consisting of major urban roads, except those on the primary system.
[3] Rural roads of a local nature, such as those that connect county seats and population centers not served by primary system.
[4] Includes Alaska and Hawaii
[5] Information not available at this time
Source: U.S. Federal Highway Administration, 1993.

3.7 VISUAL RESOURCES

Visual Resources are defined as the physical features of a landscape which affect the viewer's perception of the vista. Both natural and human-made features of a landscape contribute to the impression made upon viewers, including features such as mountains, rivers, plains, buildings, power lines and roads (USAF, 1983). There are four general landscape settings that can be identified within the United States (U.S.), which are distinguished based upon the relative dominance of natural and artificial features. These landscape types consist of natural, rural, urban and transitional settings (USAF, 1987).

Natural landscapes are those in which there is a paucity of human influence, and the viewshed is instead dominated by physiographic landforms and pristine natural scenes, such as mountain profiles, forests, lakes and wide-open plains. Expansive natural landscapes are generally more abundant in the western U.S. than in the eastern U.S. Jagged, barren mountain silhouettes characterize much of western views, including the Rocky Mountain and Cascade Mountain Ranges. In contrast, forested mountain chains, such as the Appalachian Mountains, and rolling landscapes are more typical of eastern natural landscapes. In the southwestern U.S. across Utah, Arizona and New Mexico, wide-open eroded landscapes, or badlands, dominate the natural scenes. Natural landscapes are relatively less abundant in the central U.S. where large expanses of agriculture dominate the landscape. However, expansive plains dominate natural views where they occur. Of the natural landscapes present within the U.S., eastern viewsheds generally offer the most limited relative views due to the horizon complexity that is created by dense stands of vegetation. The comparatively open, barren horizons of the central and western states provide more expansive viewsheds (USAF, 1987).

Small towns and villages, sparsely distributed homes, agricultural fields, silos, barns and ranging livestock characterize typical rural landscapes throughout the U.S. (USAF, 1987). Rural landscapes are most prevalent in the central U.S., although these types of landscapes are common throughout the country except in heavily industrialized areas. In the central U.S., the topography of rural areas is generally flat, expansive and rolling and the view is frequently dominated by a field supporting a single agricultural crop. In contrast, rural areas in the Pacific northwest, Appalachian Mountain area, and mountainous states of the eastern interior U.S. are typically characterized by mountainous, rugged terrain which is heavily forested. Views in these rural landscapes are generally restricted due to the dense vegetation (USAF, 1987).

Urban landscapes are dominated by human activity and infrastructure. Commercial business buildings, factories, highways, airports, railroads, various utilities, and communications towers typify urban environments (USAF, 1987). Densely populated residential areas, shopping centers and parks are also common features of urban environments. Urban landscapes are generally bordered by suburban areas which are predominately residential in nature. Views within urban landscapes are generally restricted by buildings, utilities and other infrastructure (USAF, 1987).

Transitional landscapes occur between any of the above three landscape types and contain elements characteristic of one or more of the natural, rural or urban viewshed categories (USAF, 1987). Transitional landscapes are very common since the vast majority of areas are unlikely to fit completely within one of the three specific landscape types identified above.

Features typifying an urban landscape are those most likely to dominate the proposed DoD NAS sites. The planned DoD NAS sites are located on existing military installations and near airstrips. These areas are characterized by human activity and infrastructure, and therefore existing visual resources in these areas are likely somewhat limited and dominated by buildings, aircraft, vehicles and communications facilities. Although natural landscapes might be present in the background of many of the proposed DoD NAS sites, elements of typical natural views are not likely to dominate the majority of the planned sites. The one exception is that the DASR component at some sites might be located as far as one mile from the airstrip on the military installation. In these cases, a natural landscape could characterize the existing natural resources in the vicinity of the radar.

3.8 CULTURAL RESOURCES

Cultural resources include prehistoric archaeologic and historic, architectural, and Native American resources. Prehistoric archaeological resources include the physical remnants of human activity that predate the advent of written records. They include archaeological sites, structures, artifacts, and other evidence of prehistoric human behavior.

Historic resources can be materials, properties, or locations that postdate the advent of written records. These resources can include archaeologic sites, structures, artifacts, documents, and other evidence of human behavior. They can also include locations of events that were important in history or that are associated with the lives of historically significant persons. It is important to note that resources must normally be greater than fifty years old to be considered as historic and eligible for the National Register of Historic Places (see discussion of applicable laws and regulations below). However, it is possible for some resources less than fifty years old to be eligible (National Park Service, 1982). Properties that are of exceptional importance to a community, state, region or the nation may be eligible. The criteria used to determine this are the following:

- association with events that have made a significant contribution to the broad patterns of our history
- association with the lives of persons significant in our past
- embodiment of the distinctive characteristics of a type, period, or method of construction, or representative of the work of a master, or possession of high artistic values, or, representative of a significant and distinguishable entity whose components may lack individual distinction
- likelihood of yielding information important to prehistory or history

Facilities on military airfields may be considered eligible for the National Register for two reasons: the role of the military system in history and the historical value of its individual facilities/structures.

Native American resources may be prehistoric sites and artifacts, areas of occupation and events, historic and current sacred areas, materials used to produce tools and other objects, hunting and gathering areas, and other resources that may be of importance to contemporary Native Americans.

The number of documented cultural resources is extensive. The National Register of Historic Places (begun in 1967) now includes 58,000 listings and incorporates 800,000 significant historic properties (Baer, 1995). Federal agencies, including DoD, annually survey over six million acres for archaeological resources, and identify approximately 30,000 sites. The Historic American Building Survey and Historic Engineering Records (HABS-HAER) have documented, through narrative, plans, and photographs, 25,000 historic structures. One of these was a Distant Early Warning (DEW) Line site located on the northern slope of Alaska, that was documented prior to facilities modifications, including the upgrade of radar and communications systems (USAF, 1993a).

3.8.1 Regulations

There are numerous federal statutes and associated regulations that govern the appropriate evaluation and treatment of cultural resources on lands administered or controlled by federal agencies or that could be potentially affected by proposed federal projects. Several of these are briefly discussed below.

Antiquities Act of 1906 (34 Stat. 225: 16 U.S.C. 431) provides for the protection of historic or prehistoric remains or any object of antiquity on federal lands; establishes criminal penalties for unauthorized destruction or appropriation of antiquities; and authorizes scientific investigation of antiquities on federal lands, subject to permit and regulations. Paleontological resources also are considered to be under the authority of this act.

Historic Sites Act of 1935 (49 Stat. 666; 16 U.S.C. 461-467) authorizes the establishment of national historic sites and the preservation of historic sites and archaeological properties of national significance; provides the basis for the designation of national historic landmarks; establishes criminal penalties for violation of regulations pursuant to the Act; and authorizes interagency, intergovernmental and interdisciplinary efforts for the preservation of cultural resources.

National Historic Preservation Act of 1966 (NHPA) (80 Stat. 915; 16 U.S.C. 470) declares historic preservation as a national policy and defines it as the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or culture, including the encouragement of preservation at state, local, and private levels. The law also directs the expansion of the National Register to include cultural resources of state and local significance, in addition to those of national significance; authorizes matching federal grants to states and the National Trust for the Historic Preservation for acquisition and rehabilitation of National Register properties; establishes an Advisory Council on Historic Preservation (ACHP); and in Section 106 of the Act provides direction for federal agencies in the event an undertaking affects a property eligible for or included in the National Register. These affects include both direct impacts and potential off-site visual impacts from the construction of facilities that can be viewed from an historic property. Section 106 of the National Historic Preservation Act is implemented by regulations issued by the ACHP (36 CFR Part 800 § 800.3 to § 800.9). These regulations are generally administered by the State Historic Preservation Officer (SHPO) of each state.

American Indian Religious Freedom Act of 1978 (92 Stat. 469: 42 U.S.C. 1966) establishes as U.S. policy the protection and preservation of American Indians and their inherent right to freely believe, express, and practice their traditional religions. It also directs federal agencies to consult with native traditional religious leaders to determine appropriate policy for protecting and preserving the religious and cultural rights and practices of American Indians.

Archaeological Resources Protection Act (ARPA) of 1979 (93 Stat. 721; 16 U.S.C 470) clarifies and defines archaeological resources; prohibits the removal, sale, receipt, and interstate transport of illegally obtained archaeological resources from public or Indian lands; provides substantial criminal and civil penalties for those who violate the terms of the Act; authorizes confidentiality of site-location information; and authorizes permit procedures to enable qualified individuals to study archaeological resources on public and Indian lands.

Other laws, regulations, and policies that apply to the treatment of cultural resources are the following:

- *Archaeological Resources Protection Act of 1979. Final Uniform Regulations*
- *(32 CFR 229, 1984)*
- *National Historic Landmarks Program (36 CFR 65)*
- *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (1983)*

3.8.2 DoD NAS Locations

There are numerous cultural resources in each of the major regions of the country. Historic resources can most easily be identified through literature searches; research at the SHPO, and at local archives and historic commissions, and field reconnaissance. Prehistoric resources are the most difficult to readily identify. The sensitivity of any geographic area for archaeological resources is based upon a number of factors including terrain, proximity to water bodies, extent of previous ground disturbance, and identified archaeological finds in the area.

Anthropologists and archaeologists have long recognized that the world's environments are very different and that this has required an evolution of lifestyles to fit the various resources and characteristics. For example, in the desert West, arid conditions precluded the bison, which were hunted as early as 19,000 BP, from lingering after the early Paleo-Indians moved on. This contrasted with the situation in the Plains, where climatic conditions allowed the bison to continue to populate the area resulting in an evolution of hunters (Jennings, 1978). In the southeast, deciduous hardwood forests and dense, swampy stream valleys supplied varied fauna and flora for both the hunter and collector. Archaeologists have documented numerous prehistoric settlements or camps in all parts of the country, as indicated below, and, therefore, the potential exists for these resources to be located in proximity to the DoD military airfields where the DASR facilities would be installed.

In Alaska, the earliest known artifact suggesting human occupation consists of broken bison bones found on the Seward peninsula which have been radiocarbon dated at 13,000 BC. The vast majority of early tool complexes found in Alaska, however, consist of stone rather than bone implements. Numerous types of blade artifacts dating from 9,0000 BC to 6,000 BC have been found in interior Alaska. By 4,000 BC, climatic warming had resulted in a northward migration of interior Alaska's boreal forests and caribou had become established as the major food source. Firm evidence of coastal occupation in Alaska also dates from 4,000 BC. Radiocarbon dating of finds in the Kodiak island chain suggest that the use of fishing implements manufactured by grinding and polishing arose in this area between 4,000 and 3,000 BC. Evidence of occupation of the Aleutian island chain dates from after 3,000 BC and includes stone implements manufactured by chipping rather than grinding. The subsistence lifestyle in the Aleutian islands was heavily dependent on the sea and included hunting a wide variety of fish and sea mammals. The data suggest that early occupation of the Aleutian islands occurred from interior and coastal Alaska rather than from Asia. Evidence of human occupation of the Bering Sea coast dates from between 2,000 and 1,000 BC and suggests a subsistence lifestyle balanced between hunting of land mammals and fishing of both interior and coastal waters.

Evidence of hunters was found on the northern Olympic peninsula. The find was dated by radiocarbon at about 10,000 BC (Dumond, 1978). Microblades dating from as early as 4500 BC were found at a site in south central Washington state. Unpublished excavations near the mouth of the Columbia River indicate that the Northwest Coast lifeway appeared there by the beginning of the Christian era.

Local traditions began to develop in California, the Great Basin and the Plateau by 7000 BC. The climate of California encouraged a diverse abundance of resources, and enabled the people to develop a sedentary lifestyle. Archaeologic finds of beads made of marine shells in California indicate that there was a systematic exchange of value between the sedentary peoples of California and the more nomadic peoples of the Great Plains and Plateau (Aikens, 1978).

Archaeological finds have indicated that occupation in the Great Plains occurred at least as early as 11,000 years ago by hunters of the last of the mammoths and of giant bison. In the western short-grass plains, hunting economies based on bison have been documented to be the mainstay of these early populations (Wedel, 1978). Further east, bison were supplemented by other animals, and by vegetable goods. In these areas, food-producing subsistence economies based on maize-bean-squash foods were developed. Subsequently trade relations developed between communities, and hunters and growers of goods began to exchange their products.

The earliest reported evidence of early populations in the Midwest comes from a shelter approximately 50 miles southwest of Pittsburgh. At this site, flint knives, flakes, a scraper and other tools of flint were discovered. These tools have a radiocarbon date of 17,000 BC (Griffin, 1978). Additional finds across the Great Lakes region show significant prehistoric activity in the Midwest throughout the early, middle and late archaic periods, as well as into the woodlands periods. Many of these finds centered on the Illinois and Ohio valleys.

In the Northeast, archaeologists have discovered resources that indicate native Americans were in the area at least 12,000 and possibly 16,000 years ago (Funk, 1978). The archaeologists records show that diverse cultural developments occurred after the Ice Age, culminating in the historic tribal groups encountered by the Europeans. It is interesting to note that in the Northeast, archaeologists have been frustrated by sites located within areas of shallow soils that have been plowed, thus resulting in disturbed and destroyed finds.

In the southeast, human occupancy is documented to have occurred as early as 10,000 BC (Muller, 1978). Hundreds of local archaeologic phases and complexes have been defined for the southeast region. Numerous sites across the Mississippi Valley, Texas, Arkansas, Tennessee, and Kentucky show the evolution of an American Indian culture.

In summary, there are prehistoric and historic resources in all parts of the country. The proximity of these resources to DoD airfields can be determined by research and by investigative field work during site-specific analyses, as necessary.

3.9 SOCIOECONOMICS

This socioeconomic section addresses the social and economic aspects of the human environment and includes demographic (population and employment), income, and housing information for major geographic regions throughout the country.

The financial condition of the local area is also considered as part of the socioeconomic analysis. The financial condition of a local government entity (town, city, county or special district) can be affected by increased demand for services, or increased revenue returned to the government entity. Baseline financial conditions are determined through a review of the average per capita revenue, outstanding debt, and expenditures by major region of the country. State and local laws would determine the amount of tax revenue (income, sales and fees) generated and returned to the local economy.

Information on demographics, income, and local housing availability are obtained from the U.S. Department of Commerce, Bureau of the Census (1990). Information on public finances was also obtained from the Bureau of the Census (1990).

Information on existing socioeconomic conditions is presented by major geographic area of the country. The data represent average figures for the areas covered, and it is recognized that specific differences will occur depending upon the exact location of each airfield. Table 3.9-1 summarizes the percent of the population living in urban as opposed to rural areas; the unemployment rate; the percent of housing vacancies, and the median household income. These indicators help to characterize the general socioeconomic conditions of the major regions of the country, in terms of labor (both skilled and unskilled) and housing availability. For example, some areas that exceed the national average for urbanized areas (Northeast and the West Regions) also have above average-unemployment rates. These areas may be more likely to benefit from the temporary increases in demand for construction workers. However, the majority of regions that exceed the national average for urbanized areas appear to have less than the national average for percentage of housing vacancies. This would indicate that housing outside of military installations during construction might be more difficult to obtain in some areas of the country than in others.

Table 3.9-2 summarizes regional financial information with respect to average per capita revenues, expenditures, and outstanding debt. Those areas that have low outstanding debt per capita (relative to the average for the country as a whole) while still maintaining a high average of per capita expenditures are in better financial condition than those that have both high per capita expenditures and outstanding debt. Certain areas of the country, such as the mountain and west north central regions, appear to be in better financial condition than the New England or the mid-Atlantic regions. According to these data, these latter regions may be less able to support extra fiscal burdens that might be caused by an influx of temporary or permanent population, or may benefit the most from additional taxes or revenues that the project might generate.

TABLE 3.9-1. DEMOGRAPHICS AND HOUSING DATA IN MAJOR GEOGRAPHICAL AREAS

Geographic Area	Population: Percent Urban	Unemployment Rate	Median Household Income	Percent Housing Vacancy
United States	75.2	7.4	30,056	10.1
Northeast	78.9	8.1	34,229	9.3
New England	74.4	8.0	34,138	11.3
Mid Atlantic	80.5	8.1	34,320	8.6
Midwest	71.7	6.5	28,059	8.9
East North Central	74.0	7.3	30,043	8.4

West North Central	66.3	4.8	26,075	10.0
South	68.6	7.2	25,342	11.8
South Atlantic	69.4	7.1	29,835	11.8
East South Central	56.2	7.0	22,769	9.0
West South Central	74.5	7.4	23,422	13.2
West	86.3	8.1	31,047	9.4
Mountain	79.7	6.4	27,199	14.2
Pacific[1]	88.6	8.6	34,894	7.5
Guam	38.2	27.3	31,178	NA[2]

[1] Includes Alaska and Hawaii
[2] Information not available at this time
Source: U.S. Bureau of the Census, 1993b.

TABLE 3.9-2. FINANCIAL INDICATORS BY GEOGRAPHIC AREA

Geographic Area	Revenue/Capita	Outstanding Debt/Capita	Expenditures/Capita
United States (average)	2,188	1,370	2,199
New England	2,462	3,383	2,615
Mid Atlantic	2,494	2,099	2,467
East North Central	2,091	1,172	2,083
West North Central	2,172	1,105	2,141
South Atlantic	2,149	1,491	2,177
East South Central	1,401	940	1,932
West South Central	1,946	1,221	1,902
Mountain	2,354	1,261	2,323
Pacific[1]	4,176	3,506	4,700
Guam	NA[2]	NA[2]	NA[2]

[1] Includes Alaska and Hawaii
[2] Information not available at this time
Source: U.S. Bureau of the Census, 1993c

3.10 POLLUTION PREVENTION AND HAZARDOUS WASTE MANAGEMENT

3.10.1 Pollution Prevention

Pollution prevention, as defined by the Pollution Prevention Act of 1990 (42 U.S.C. § 12101 et seq.), is source reduction whereby pollutants are reduced or eliminated through: increased efficiency in the use of raw materials, energy, water, or other resources; protection of natural resources by conservation; recycling; and affirmative procurement. Source reduction is further defined as any practice which (1) reduces the amount of any hazardous substance, pollutant, or contaminant entering the waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (2) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The strategic goal of the USAF pollution prevention program is to prevent future pollution by reducing hazardous material use and releases of pollutants into the environment to as near zero as feasible (SECAF/CSAF, 1993). As directed in USAF Instruction 32-7080, Pollution Prevention Program, Major Commands are responsible for establishing procedures to ensure installations develop and execute pollution prevention management plans to fulfill the Pollution Prevention Act, DoD, and USAF requirements as appropriate. Pollution prevention management plans are to contain management strategies for the following program elements: ozone depleting chemicals; United States Environmental Protection Agency (EPA) 17 industrial toxics; hazardous wastes; municipal solid waste; affirmative procurement of environmentally friendly products; energy conservation; and air and water pollutant reduction.

Pollution prevention policies and procedures for all USN/USMC shore activity operations in the United States are directed by Operational Naval Instruction (OPNAVINST) 5090.1B, Chapter 3, Pollution Prevention. The Instruction directs the USN/USMC to take action to prevent pollution by reducing hazardous materials use, and decreasing the release of pollutants into the environment to the minimum amounts achievable. Major Claimants are responsible for ensuring that every activity under their command develop and implement a Pollution Prevention Plan by the end of 1995. The Plan will address the actions required by the activity for reducing pollution from all sources and to all media.

Pollution prevention policies and procedures for facilities under USA jurisdiction are regulated by USA Regulation 200-1, Environmental Protection and Enhancement. The regulation includes non-point source abatement in all construction, installation operations, and land management plans and activities; and requires the establishment of a waste minimization program. Installation, activity, and unit Commanders are responsible for designing and executing the environmental program to achieve the USA's environmental goals and objectives.

3.10.2 Hazardous Substances and Wastes

Hazardous substances and wastes are solid, liquid or gaseous materials, or combinations thereof, which because of their quantity, concentration, or physical, chemical, or infectious characteristics may:

- cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

- pose a substantial present or potential hazard to human health, or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed (Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6901 *et seq*.).

Hazardous substances are defined by § 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 U.S.C. § 9601 *et seq*.) to include hazardous wastes subject to regulation under subtitle C of RCRA, toxic water pollutants regulated under § 307 of the Clean Water Act (33 U.S.C. § 1251 *et seq*.), hazardous air pollutants listed under § 112 of the Clean Air Act (42 U.S.C. § 7401 *et seq*.), imminently hazardous chemicals regulated under § 7 of the Toxic Substances Control Act (TSCA, 15 U.S.C. § 2601 *et seq*.), substances subject to § 311 of the Clean Water Act (governing oil and hazardous substance spills in navigable waters), and additional substances defined by the EPA. While the definition of "hazardous substance" encompasses just about any toxic substance, § 104 of CERCLA also provides jurisdiction over substances not listed in any of the categories of "hazardous substances" if it is a "*pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare*" (Percival *et al*., 1992).

The major federal statutes governing the management of hazardous materials are RCRA and CERCLA. The EPA and state agencies share the responsibility for regulating newly generated hazardous waste under RCRA. Subtitle C, Hazardous Waste Management, of RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. This cradle-to-grave control of hazardous waste requires a "manifest" to identify and track the generation and transportation of hazardous waste; and requires the owners/operators of facilities that treat, store, or dispose of hazardous waste to apply for and comply with permits issued by the EPA or an authorized state agency. The Federal Facilities Compliance Act (FFCA), an amendment to RCRA enacted by Congress in 1992, requires all federal facilities to fully comply with RCRA.

Although the jurisdiction of RCRA includes federal facilities, the FFCA provided clarification to EPA's enforcement capabilities against federal facilities.

Liability for the cleanup of releases of hazardous substances is imposed by CERCLA. CERCLA was substantially amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA, 42 U.S.C. § 11013 and 11028). The statute establishes standards to ensure the cleanup of releases of hazardous substances, and liability for all costs of the remedial action. Implementation of CERCLA is under the authority of the President of the United States; this authority has largely been transferred to the EPA by executive order. Presidential Executive Order #12856, "*Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements"* requires all federal facilities to fully comply with SARA.

Guidance for managing hazardous waste at USAF installations is provided by USAF Pamphlet 32-7043 (Draft), Hazardous Waste Management Guide, dated April 30, 1994. Final publication of the guidance is expected in April 1995. All USAF installations must develop and implement a comprehensive hazardous waste management plan which incorporates current DoD, USAF, EPA, Occupational Safety and Health Administration (OSHA), Department of Transportation (DOT), state, and local requirements regarding the management of hazardous waste as they relate to environmental protection, worker safety, and transportation during operations conducted at the installation. Elements which must be contained in the plan include: responsibilities, waste inventory, waste analysis plan, hazardous waste management procedures, reporting, training, contingency plan, preparedness and spill prevention, and pollution prevention.

Hazardous waste management requirements and responsibilities for USN/USMC shore facilities are directed by OPNAVINST 5090.1B, Chapter 12, Hazardous Waste Management Ashore. The Instruction directs that every USN/USMC shore activity that generates hazardous waste shall develop and use a hazardous waste management plan, or a hazardous waste management component in its Pollution Prevention Plan. Major Claimants shall ensure subordinate commands develop and use the management plans or components. The management plan or component shall include: identification of all applicable federal, state, and local regulations pertaining to the generation and management of hazardous waste; identification of training requirements; assignment of responsibilities and descriptions of all hazardous waste generation and management procedures; hazardous waste minimization plans and goals; and contingency plans and emergency response procedures.

Policies and procedures for managing hazardous materials and waste at USA facilities are directed by USA Regulation 200-1, Environmental Protection and Enhancement. Chapter 5, Hazardous Materials Management Program, directs USA components to pursue all reasonable actions to avoid or reduce the use of hazardous material and the generation of hazardous waste. Chapter 6, Solid Waste and Hazardous Waste Management Program, includes the USA's objective of minimizing the volume or quantity and toxicity of waste prior to disposal by emphasizing source reduction, recycling, and reuse.

3.10.3 Deactivation / Demolition

The last phase in the life cycle of electronics systems is deactivation. This may involve the rehabilitation or demolition of existing facilities; the opportunity exists for hazardous and non-hazardous materials controlled during the operational life of the existing system to become uncontrolled and inadvertent pollutants.

The historical background of the deactivated system could indicate the possibility of encountering or generating hazardous material and waste during facility rehabilitation/demolition. Facilities could contain materials currently defined as hazardous, although at the time of installation the materials and applications were in compliance with current regulations and standard construction practices.

Asbestos was used in many commercial products beginning in early 1900, and its use peaked in the period from World War II into the 1970's. Existing facilities constructed during this period could contain such asbestos-containing material as ceiling and floor tiles, insulation, and siding. Asbestos is regulated as a hazardous air pollutant under the Clean Air Act. TSCA, including the Asbestos Hazard Emergency Response Act (AHERA) of 1986, regulates the management of asbestos-containing material.

Polychlorinated biphenyls (PCBs) could be encountered if the facility involved the use or storage of transformers (PCB-contaminated insulating oil), elevators and auto lifts (PCB-contaminated hydraulic fluid), and fluorescent lighting (PCBs in lighting ballasts). The handling, use, storage, and disposal of PCB-contaminated items is regulated by TSCA.

Lead-containing materials could also be encountered during facility rehabilitation/demolition. Lead-based paint, primers, and coatings; lead pipe and solder; and lead shielded conductors could be present throughout existing buildings. Lead-containing materials are regulated by the EPA's 17 Industrial Toxics program.

Facilities rehabilitation and demolition could involve existing storage tanks (both underground and aboveground) and associated piping. Existing tanks were probably constructed and installed under less stringent regulations than are currently in place, and combined with age-induced corrosion and failures, the potential exists that the tanks have leaked or are leaking their contents into the ground or groundwater. Under Subtitle I of RCRA, EPA promulgates regulations for managing underground storage tanks (USTs), including notification requirements for new and existing USTs containing regulated substances. The cleanup of releases of hazardous substances is regulated by CERCLA; enforcement of CERCLA is largely regulated by the EPA.

In addition to possible spills from storage tanks, existing sites may contain areas of documented contamination from previous hazardous material release or disposal. Known areas of hazardous material release or contamination at military installations have been identified through the military environmental audit programs. The USAF's Environmental Compliance Assessment and Management Program (ECAMP) requires each USAF installation to receive an external environmental compliance assessment at least once every three years. Each installation must also conduct an internal assessment each calendar year, except in years when external assessments are conducted. The USN/USMC's Environmental Compliance Evaluation (ECE) audit program requires assessments at the same frequency as ECAMPs (Gent, 1995). The USA's Environmental Compliance Assessment System (ECAS) requires an external assessment every four years, and an internal assessment at each two year interval between external assessments (Holt, 1995). The environmental assessments identify the nature and extent of known releases and disposals of hazardous materials, and the status of cleanup activities.

3.11 HUMAN SAFETY

Many of the components of human safety have been discussed under other subsections of this section. One component of human safety that has not been addressed previously in this document concerns radio frequency radiation (RFR). Therefore, this section focuses on this aspect of human safety.

RFR, also referred to as radio waves, is electromagnetic waves at frequencies between approximately 3 kilohertz (kH_z) and 300 gigahertz (GH_z). People in the vicinity of the proposed DoD NAS sites are continually exposed to RFR from many currently existing and man-made sources, including existing aircraft surveillance radars.

Exposure to electromagnetic fields (EMFs) is often misunderstood. Acute effects arising from neural stimulation and tissue heating have long been recognized, and the goal of reducing health risks mediated by these mechanisms was the rationale for the original standard for safe exposure levels of EMFs promulgated by the American National Standards Institute (ANSI, 1982). Over the years the adopted threshold has decreased (IEEE Standards Department, 1991); the ANSI standard is voluntary, but is widely followed in industry and government (EPA, 1993b).

The news media often does not distinguish between RFR and ionizing radiation. This sometimes raises concerns, with no scientific basis, that RFR can give rise to the hazardous effects known to be caused by ionizing radiation. Ionizing radiation, such as ultraviolet light, x-rays and gamma rays, and emissions from radioactive materials, have frequencies millions and trillions of times higher than those of RFR. A "quantum" of any of these radiations has enough intrinsic energy to ionize (eject an election from) an atom or molecule. The resulting effects can be cumulative and irreversible and, thus, can profoundly affect the health of living organisms. For this reason, devices such as film badges are commonly used for monitoring cumulative exposure over time (total doses) of ionizing radiation.

In contrast to ionizing radiation, quanta of nonionizing radiation or electromagnetic radiation (such as RFR) have intrinsic energies far too small to ionize molecules within a body because their frequencies are vastly lower. Rather than producing changes in molecules (as in ionizing radiation), nonionizing/electromagnetic radiation simply agitates molecules making them vibrate and rotate faster (note that all molecules naturally vibrate and rotate), the equivalent of adding heat to the body. RFR is emitted by devices as commonplace as the hair dryer and electric shaver. The additional molecular agitation produced by the RFR ceases when exposure to RFR ends. The heat induced in a warm-blooded animal by exposure to RFR at relatively low incident power densities, normally can be compensated for through the body's temperature regulating capabilities. However, depending on the species, the heat produced at relatively high intensities may exceed the temperature regulating mechanisms of the animal, so compensation for such effects may be inadequate. Thus, exposure at high intensities could cause gross heating and subsequent thermal distress or irreversible thermal damage. Some researchers have reported bioeffects at RFR levels below those giving rise to gross heating. However, such reports are not universally accepted by the large majority of the research community.

Examples of commonly used RFR-generating devices include:

- TV/computers
- Radio broadcasting stations
- Citizen-band radios
- Ham radio transmitters
- Cellular telephones

The federal government regulates the use of these devices primarily through the Federal Communications Commission (FCC). These agencies restrict the operation of RFR devices to specific frequency bands and emission power levels.

Terms such as "safety standards" and "exposure standards" generally refer to, and are frequently used interchangeably with, specifications or guidelines on maximum exposure levels to RFR by the general public or workers. Such levels are usually expressed as maximum permissible exposure (MPE) limits, threshold limit values (TLVs), or maximum power densities or field intensities in specific frequency ranges for stated exposure durations.

Several groups, listed below, have established standards and guidelines for human exposure to RFR. They are:

- American National Standards Institute (ANSI)
- American Conference of Governmental Industrial Hygienists (ACGIH)
- Air Force Occupational Safety and Health
- International Nonionizing Radiation Committee of the International Radiation Protection Association
- Institute of Electrical and Electronics Engineers (IEEE)

These standards and guidelines were based on maximum values of "specific absorption rate" (SAR) that were found to be not harmful in experimental studies. SAR is the rate at which RFR energy is absorbed in any small region of the body. Since it is usually impractical to measure the SAR, the TLVs are expressed in units that are measurable, viz, squares of the electric and magnetic field strength, averaged over any 0.1-hour period. A conservative additional safety margin (either 10 or 50 times) is factored into the standard.

In 1988, the function of ANSI Subcommittee C95.VI was transferred to Subcommittee IV of Standards Coordinating Committee (SCC) 28, a new body under jurisdiction of the IEEE. In 1991, SCC issued new guidelines covering the frequency range 3kH_z to 300GH_z. Unlike previous guidelines, the SCC guidelines separately specified the maximum allowable RFR exposure in "uncontrolled environments" (accessible by the general population) and "controlled environments" (such as occupational exposure). Among the differences between the 1982 ANSI and the 1991 SCC standards are the newer limits for "uncontrolled environments" which have a safety reduction factor of 50 instead of 10 but are averaged over any 30-minute period instead of 6 minutes. The corresponding limits for "controlled environments" remained at a safety reduction factor of 10 averaged over 6 minutes. The maximum permissible exposures (MPEs) at the ASR/ATCBI radar sites according to the IEEE C95.1-1991 are listed in Table 3.11-1.

TABLE 3.11-1. MAXIMUM PERMISSIBLE EXPOSURES FOR THE ASR/ATCBI

FREQUENCY RANGE ACCORDING TO THE IEEE C95.1-1991 STANDARDS

Environment	Field	Frequency 3 MHz	Frequency 10 MHz	Time of Exposure
Uncontrolled	Electric (E)	275 V/M[1]	82 V/M	30 minutes
	Magnetic (H)	5.4 A/M[2]	1.6 A/M	6 minutes
Controlled	Electric (E)	614 V/M	184 V/M	6 minutes
	Magnetic (H)	5.4 A/M	1.6 A/M	6 minutes

[1] V/M = volts/meter
[2] A/M = amperes/meter

The uncontrolled environment figures are appropriate for areas accessible to the general population. Controlled environment values are for occupational exposure guidelines in which the entire body is exposed to the incident RFR energy or in which the cross section of the body is smaller than the cross section of the incident beam of energy.

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4.0 ENVIRONMENTAL CONSEQUENCES

This section of the environmental assessment identifies potential environmental consequences of both the DoD NAS Alternative and the No-Action Alternative. For the DoD NAS Alternative, the environmental consequences of the system as a whole are considered. Since the planned number and type of components to be installed at each site may change over time, this section does not distinguish between the consequences of the DASR, DAAS and VCSS components of DoD NAS. In general, the DASR component of DoD NAS would have the greatest impact on resources since DASR installation will require new siting and construction while DAAS and VCSS will mostly involve remodelling existing facilities and upgrading existing equipment. The USA sites would include only the DAAS and VCSS components of DoD NAS, and would therefore experience less impact than those discussed in this chapter. Site-specific environmental documentation would identify the relatively lesser impacts at individual DoD NAS sites where only the DAAS and/or the VCSS components would be installed.

Since most DoD NAS sites would be separated by more than one hundred miles and would be relatively small (approximately three acres or less for the facilities associated with the three components of NAS), significant nationwide cumulative impacts would not be likely. Therefore, nationwide cumulative impacts are not addressed in this section. Cumulative impacts of past, present, and future actions at each DoD NAS location would be addressed in site-specific environmental documentation.

Through implementation and adherence to the NAS DASR Siting Plan, impacts to sensitive and protected environmental resources will be avoided to the maximum extent practicable. The siting plan employs a three step screening process in which decreasingly restrictive categories of criteria (Table 4-1) are employed to identify potential DASR system sites while minimizing impacts to environmental resources. The sensitive resources that would be avoided during DoD NAS site selection are discussed below where appropriate. The NAS DASR Siting Plan is provided in Attachment A and describes the process by which the criteria are employed to identify potential DASR system sites.

TABLE 4.0-1. SCREENING LEVELS AND CRITERIA

EXCLUSIONARY	RESTRICTIVE	SELECTIVE
Occupied Existing Structures	Ecological/Wildlife Refuges, Preserves, Conservation Areas, and Sanctuaries	Visual Sensitivity
Railroads	Wild and Scenic Rivers	Accessibility to Roads
Highways	Prime and Unique Farmland	Soils
Runways and Taxiways	National, State, and Municipal Parks and Recreation Areas	Geology
Power Lines	Historical, Archaeological, and Cultural Sensitive Sites	Proximity to Power
Wilderness Areas	Wetlands	Proximity to Telephone Lines
National Natural Landmarks	Endangered and Threatened Species Habitat	Zoning
Sites Less than 1/2 acre	Non-airfield or Non-federal Land	Subsurface Rights
Additional Operational Criteria to be provided by DASR Systems Contractor	Designated Hazardous Waste Sites	Unique Habitat
	Capped Land Fill	Utilities
	Scenic Highways	Planned Use of Site
	Coastal Zones	Roadways
	Slope	Water Resources
	Floodplain	Recreational Use
		Bodies of Water

4.1 DoD NAS ALTERNATIVE - PROPOSED ACTION

4.1.1 Geology and Soils

This section evaluates geologic and soil impacts should the DoD NAS system be implemented. Specific impacts considered include geologic hazards; erosion; and loss or damage to mineral deposits, agricultural resources, and fossil remains. DoD NAS construction and operation may affect and be affected by geologic and soil resources. Major potential geologic and soil constraints to the project include seismic shaking, volcanic emissions, and unstable substrate. The project's potential geologic and soil impacts include erosion of disturbed soils, alteration of landforms, and loss or damage to geologic or soils resources.

Geologic Hazards. Seismic shaking, due to an earthquake or other earth movement, could have a short-term effect on DoD NAS facilities. Although the western half of the United States has the most frequent and powerful earthquakes, nearly the entire nation has had a seismic event that caused at least some damage to human-made structures. Therefore, the potential for seismic shaking impacts to DoD NAS sites exists throughout most of the country, but the risk is highest in areas in the western coastal range region.

Even large earthquakes should result in only minor damage to DoD NAS installations. In most earthquakes, the DAAS and DASR radar towers and associated structures might sway, but should remain intact. If the DoD NAS structures did collapse, the debris would remain within the site boundaries and therefore would not impact surrounding areas. In such situations the tower and structures would be reconstructed and repaired. Therefore, the potential impacts on DoD NAS facilities from seismic shaking are considered to be minor.

Flooding and/or high water conditions are usually restricted to low-lying areas and locations directly adjacent to rivers and other waterbodies. Flooding may be caused by seiches, stationary waves that often cause overflow from steep-sided lakes or other water basins. Seiches usually result from strong winds or earth movement (i.e. earthquakes and landslides). Dam failures could also cause flooding in downstream watersheds. Most of these flood-prone areas have been defined and depicted in a series of flood boundary maps published by the Federal Emergency Management Agency for the entire nation. The potential for significant flooding is high at specific locations within the nation. However, flooding impacts to DoD NAS installations should be minor as 100-year floodplains would be avoided during the site screening process. Avoiding floodplains would not only protect DoD NAS facilities, but also reduce downstream flood hazards. Finally, federal and state permission is usually required to build in floodplains; floodplain avoidance is mandatory in certain areas of the country.

Additional hazardous geologic and soil areas that should be avoided include: areas of extreme slope instability; locations prone to collapse; and active volcanoes. Since these areas would be avoided to the maximum extent possible during the site selection process, DoD NAS installations should not be impacted by geologic hazards.

Erosion. During construction (i.e. ground disturbance) of DoD NAS facilities, the potential for soil erosion exists. The clearing of vegetation and interruption of natural drainage courses increases the rate of erosion. The rate and amount of soil erosion should be minimized as much as possible since erosion typically results in sedimentation of streams and other waterbodies and adverse impacts to aquatic flora and fauna. Because the DoD NAS sites would avoid areas with steep terrain, their impact on the rate and severity of erosion would be minor and could be further minimized through the development of a drainage and erosion control plan. Best Management Practices (as specified in the Uniform Building Code (UBC), National Fire Protection Association (NFPA) publications, Building Officials and Code Administrators (BOCA) publications, and other national standards) require the use of erosion control devices such as hay bales and/or silt fences in erodible areas.

Mineral Deposits, Agricultural Resources, and Fossil Remains. Activities related to the recovery of mineral deposits, including oil, occur in widely spaced and diverse areas of the United States. The limited size (approximately 3 acres or less) and number of DoD NAS sites and the distance between the sites in relation to the total area of mineral activity in the nation indicate that loss of or damage to mineral resources would be minor. The small size of DoD NAS sites is unlikely to restrict access to mineral deposits, even at the site-specific level. Therefore, impacts on mineral resources would be minor.

The amount of agricultural land varies considerably from region to region. The small size and number of DoD NAS sites and the distance between the sites in relation to the total acreage of agricultural land in the country indicate that loss of or damage to agricultural lands, even at the local level, would be minor. In addition, areas of prime and unique farmland would be avoided to the maximum extent possible during the site selection process.

Fossil remains and scientifically important rock outcrops are common throughout the country. The majority of these important resources are found where bedrock is exposed on the surface, which typically occurs where erosion has removed the soil profile or in mountainous regions. Because the DoD NAS sites would avoid steep terrain, the potential impact on these resources is considered minor. Depending on the specific area involved, public land management agencies may require fossil surveys. In these cases, coordination with the land manager would assure compliance with such policies.

All significant geologic impacts are avoidable through adherence to Best Management Practices (specified by UBC, NFPA, BOCA and other national standards) and through proper siting and appropriate mitigation, as discussed further in the NAS DASR Siting Plan (Attachment A) and Section 5.0 - Mitigation. Construction of DoD NAS facilities could result in unavoidable minor short-term geologic impacts due to dust and minor erosion.

In summary, no significant geologic or soil impacts are expected to occur as a result of DoD NAS construction and operation.

4.1.2 Water Resources

The DoD NAS program has the potential to affect and be affected by water resources. The location of groundwater, surface waterbodies, and drainage networks, could constrain the location of DoD NAS installations. The project's potential water impacts include surface and ground water contamination (from fuel spills), including drinking water supplies; secondary erosion effects from removal of vegetation (increased stream sediment load is a related issue); and increased runoff from covering permeable areas (i.e. grasslands, forests) with impermeable structures (i.e. buildings, roads).

Water Contamination. The only potential source of contamination to water resources from DoD NAS installations would be the fuel storage systems. However, adequate containment structures would be built under and around the fuel storage systems to prevent significant impacts to water resources as a result of fuel spills. Fuel might also be spilled on the access road or on ground surfaces during transfer of fuel from tanker trucks to the storage systems. As long as the spill is small (less than 50 gallons), the fuel would evaporate or be degraded by microbial action rather than leaching into groundwater or being transported by surface water. Larger spills could adversely impact water supplies. However, all possible measures would be taken to prevent, contain, and clean up fuel spills in order to minimize impacts. In addition, the site selection process would avoid wetlands and floodplains as potential DoD NAS sites so that the risk of water contamination is further minimized. Consequently, the potential of contamination to water supplies from DoD NAS facilities is considered to be minor.

Erosion and Sedimentation. Rainfall intensity, soil erodibility, slope, vegetation, and erosion control measures all influence the rate of erosion. Clearing and grubbing DoD NAS sites would temporarily increase soil erosion. Erosion rates are particularly sensitive to the removal of vegetation. For example, the universal soil loss equation (Brady, 1984) predicts roughly ten-fold increases in erosion rates when well-vegetated areas are cleared. Grading and earthmoving also produce erosion-prone slopes. Increases in erosion rates are accompanied by the addition of sediment to down slope water resources (sedimentation).

The potential for erosion and resulting impacts to water resources at specific DoD NAS sites would be identified through consultation with local or regional offices of the Natural Resources Conservation Service. The following site features would noticeably increase soil erosion rates and potentially impact down slope water resources: average slopes greater than two percent; relatively erodible soils; and regional climates characterized by high-intensity rainfalls. However, erosion would be minimized by avoiding steep terrain when siting DoD NAS during the screening process. If a DoD NAS site were located upslope and near to surface waters important to aquatic life or to public water supplies, a moderate impact to water resources would be likely. Earthmoving within 100-year floodplains would also impact water resources. In addition, wetlands and 100-year floodplains would be avoided to the maximum extent possible during the site selection process.

To prevent sedimentation of waterbodies and adverse impacts to aquatic flora and fauna, DoD NAS sites would be selected and constructed such that the rate and amount of soil erosion would be minimized as much as possible. Because the DoD NAS sites would generally be located on relatively level terrain, their impact on the rate and severity of erosion would be minor and could be further minimized through siting and the development of a drainage and erosion control plan. Impacts would be short to long term depending primarily on the rate at which vegetation is re-established and local conditions.

Surface Water Runoff. Removal of vegetation and alteration of soil at potential DoD NAS sites could increase surface water runoff if the project were constructed in undisturbed (i.e. naturally vegetated) areas. However, constructing a DoD NAS facility on a highly disturbed site (i.e. natural vegetation and soils altered and/or eliminated) might reduce runoff. Increases in surface water runoff decrease groundwater recharge, cause stream bank erosion and habitat destruction, deposit sediment from cleared areas and eroded stream banks downstream, reduce summer base flows due to a lack of interflow, and, as a result, adversely impact aquatic life.

The impacts of DoD NAS construction and operation on surface water runoff would be minimized by locating DoD NAS sites outside of floodplains, wetlands, and terrain with steep slopes. Although earthmoving during construction might temporarily increase runoff, adherence to a drainage and erosion control plan would minimize impacts to water resources. Replacing a vegetated area with a DoD NAS system could permanently increase surface water runoff. However, due to the small size of the DoD NAS system and the implementation of Best Management Practices (specified by UBC, NFPA, BOCA and other national standards) the impacts would be minor and would not compromise the integrity of the area drainage network.

A number of methods may be employed to predict the impacts of DoD NAS installations on surface runoff. However, these methods must be used with caution since factors such as antecedent rainfall, soil moisture, variable infiltration, and variable runoff response with season make the development of rainfall-runoff relationships difficult. One of the simplest rainfall-runoff formulas is the rational method. This method is based on the assumption that a steady, uniform rainfall rate would produce maximum runoff (peak flow) when all parts of a watershed are contributing to outflow, a condition that is met after the time of concentration t_c has elapsed. The rational method predicts the peak flow of runoff as follows.

$$Q_p = CIA$$

where

Q_p = peak flow (cubic feet per second)

C = runoff coefficient, variable with land use

I = intensity of rainfall of chosen frequency for a duration equal to time of concentration t_c (in/hr)

t_c = time for rainfall at the most remote portion of the watershed to travel to outlet (min, hr)

A = area of watershed (acres)

The runoff coefficient C, which varies as a function of land use and slope, describes the proportion of the total rainfall that becomes runoff. The theoretical range for C is 0 (absorption of all rainfall) to 1 (no absorption). Typical vales of the coefficient generally range from between 0.1 for relatively flat, heavily vegetated, uneven terrain, to 0.9 for moderately steep, partially paved, smooth surfaces. When multiple land uses are found within the catchment, it is customary to use an area-weighted runoff coefficient.

The intensity I is obtained from Intensity-Duration-Frequency (IDF) curves for a specified period under the assumption that the duration equals the time of concentration. IDF curves are available from the National Weather Service.

Due to assumptions regarding the homogeneity of rainfall, the rational method should not be used on areas larger than one square mile without subdividing the overall area into subareas. Since actual rainfall is not homogeneous, the rational method becomes more conservative (i.e. it over predicts peak flows) as the area becomes larger. In addition, the accuracy of the rational method improves as the degree of urbanization increases (i.e. as imperviousness increases). Working within these constraints, the rational method may be used to yield a reasonable approximation of the peak flow from potential DoD NAS developments. Combining the estimated effects of DoD NAS installations on the runoff coefficient with historical data on rainfall intensities for various parts of the country, changes in runoff volume from creating an impervious DoD NAS area may be estimated. These analyses would be conducted as necessary during the site-specific investigations.

In summary, no significant impacts to water resources are expected to occur as a result of DoD NAS construction and operation. All significant impacts to water resources are avoidable through adherence to Best Management Practices (specified by UBC, NFPA, BOCA and other national standards) and through proper siting, as discussed in Section 5.0 - Mitigation, and the NAS DASR Siting Plan (Attachment A). Slight increases in surface water runoff and soil erosion may be unavoidable, particularly during construction.

4.1.3 Air Quality

Approximately 6 months of construction activity would be required to install the DASR, DAAS and VCSS components at each of the proposed DoD NAS sites. Construction activities would produce equipment emissions and dust that could temporarily affect the air quality in the vicinity of the proposed DoD NAS sites. Since air pollutant concentrations are somewhat dependent on local site conditions, the magnitude of the effect of DoD NAS construction on air quality would be determined during site-specific analyses. However, it is anticipated that the temporary vehicle emissions and dust produced during construction would have no significant impact on air quality.

The predicted emissions that would be produced by the DoD NAS construction equipment at each proposed site are summarized in Table 4.3-1. These short-term emissions are not expected to alter the concentrations of regulated air pollutants such that NAAQS are exceeded within air basins currently in attainment. However, the effect of the DoD NAS construction emissions on regional air quality is somewhat site dependent as local meteorological conditions and topography may determine the extent to which the construction emissions influence the air quality within the surrounding air basin. For example, emissions at DoD NAS sites which are surrounded by steep terrain would result in relatively greater pollutant air concentrations in the immediate vicinity of the DoD NAS site. In contrast, emissions would have a smaller impact on air quality at sites located in more open settings with higher wind velocities. In addition, the construction emissions would have a relatively more negative impact at DoD NAS sites located within non-attainment areas (see Tables 3.3-2 and 3.3-3) since these areas are currently experiencing degraded air quality. However, the additional, nominal emissions produced during DoD NAS construction activity would not significantly contribute to the air quality degradation in these areas.

Up to 19 tons of dust could be generated during construction activities at each DoD NAS site. At Nellis Air Force Base, approximately 1 ton of dust would be generated in addition to the above 19 tons as a result of the installation of the large LCF (small or medium LCFs would be installed at other DoD NAS sites. These dust production estimates are based on EPA's estimate that 1.2 tons of dust per acre per month of activity are generated during heavy construction projects involving building and road construction (EPA, 1985a). However, this approximate rate of dust production is based on the dust generated by projects such as shopping center and apartment building construction, which are much more intensive than the construction activities necessary for installing the DoD NAS. Thus, the above dust production figures greatly overestimate the quantity of fugitive dust produced during DoD NAS construction. The EPA rate of dust generation also assumes a moderate soil silt content of approximately 30% and a

TABLE 4.3-1. PREDICTED EMISSIONS FROM CONSTRUCTION EQUIPMENT AT EACH DoD NAS SITE[1]

Equipment	Estimated Hours of Use During 6 Mo.Construct. Period	Approximate Pounds of Pollutant Emitted					
		CO	Exhaust Hydro-carbons	NO2	Alde-hydes	SO2	PM-10
Track-type tractor	600	208	73	756	16	83	67
Wheeled tractor	200	718	38	254	6	54	82
Bulldozer2	510	915	98	2,125	33	178	84
Scraper	200	251	56	768	29	93	81
Motor Grader	600	91	24	428	7	52	37
Wheeled Loader	300	172	75	567	12	55	52
Track-type	300	60	29	248	3	23	17

loader							
Construction Trucks2	1,040	1,866	200	4,333	116	472	266
Roller	80	24	5	69	1	5	4
Hydraulic Excavator	500	338	76	845	16	72	70
Trencher	100	68	15	169	3	14	14
Concrete Paver	200	135	30	338	6	29	28
Crane2	140	94	21	237	4	20	19
TOTAL EMISSIONS/ 6 MO. PERIOD	4,770	4,940	740	11,137	252	1,150	821
AVERAGE EMISSIONS (pounds/hour)		1.03	0.15	2.32	0.05	0.24	0.17

[1] Approximate emissions estimates are based on EPA Emission Factor for Heavy-duty, Diesel-powered Construction Equipment reported in EPA, 1985b

[2] Includes hours for dismantling of existing ASR-9 system

semiarid climate (EPA, 1985a). Consequently, there would be a smaller quantity of dust generated at DoD NAS sites characterized by less silty soils and wetter climates, and more dust generated at sites having siltier soil and drier climates. However, the dust generated during DoD NAS construction would be temporary only and water application could be employed to suppress dust. Therefore, it is anticipated that dust would not adversely affect air quality in the vicinity of the DoD NAS sites.

Implementation of the DoD NAS project would also involve dismantling and removing the existing ASR-9 radar system. The demolition activities associated with the dismantling of the ASR-9 system would also produce vehicle emissions and dust that could temporarily affect ambient air quality in the vicinity of the proposed DoD NAS sites. The nominal emissions and dust generated during this phase of the DoD NAS project would be much less than that generated during construction and are not anticipated to cause an exceedance of NAAQS. Table 4.3-1 includes the emissions projected to result from the dismantling and demolition of the existing radars.

There are three primary sources of emissions that would be associated with the operation of a DoD NAS site. First, the 100 kW emergency diesel generator associated with the DASR would produce nominal emissions during its once/week testing and during power outages (Table 4.3-2). For the purposes of estimating emissions, it was assumed that testing would require approximately 2 hours of generator operation each week and that commercial power outages would require an additional 48 hours of generator use each year. The total quantity of roughly 1,130 pounds of pollutants produced by the emergency generator at each DoD NAS site would be far below the 100 tons of emissions which require review under the Prevention of Significant Deterioration (PSD) regulations. The generator emissions are therefore expected to have no significant impact on air quality.

Evaporative loss from the 250 gallons of diesel fuel proposed to be stored at each DoD NAS site would be an additional source of emissions during DoD NAS operation. However, the emissions produced by diesel fuel stored in above-ground tanks are expected to be minimal and therefore are anticipated to have no significant impact on local air quality. Finally, vehicle traffic on the unpaved DASR access road during routine operation and maintenance would generate fugitive dust. However, as stated above, water application could be employed to suppress dust generation so that no significant deterioration of local air quality occurs.

TABLE 4.3-2. PREDICTED EMISSIONS FROM EMERGENCY GENERATOR ASSOCIATED WITH EACH DASR[1]

POLLUTANT	QUANTITY PRODUCED (LBS/YEAR)
CO	169
NO_2	782
SO_2	50
Particulate Matter	56
Exhaust Hydrocarbons	62
Aldehydes	12

[1] Assumes following: 100 kW Onan-type diesel generator with a power rating of 166 brake horsepower (bhp) and a fuel consumption rate of 7.2 gallons of fuel per hour; based on EPA Emissions Factor for Diesel Generator (EPA, 1985a).

In summary, no significant air quality impacts are expected to result from DoD NAS construction and operation. Although construction vehicles would produce emissions, these would be temporary only and are therefore not expected to cause exceedances of air quality standards. The minimal quantity of emissions produced during DoD NAS operations would be far below the threshold level which requires regulatory review and are therefore not expected to have a significant impact on air quality. Dust suppressant practices would preclude air impacts from fugitive dust.

4.1.4 Biology

DoD NAS construction and operation has the potential to adversely affect biological resources in the vicinity of the proposed sites. Potential impacts include elimination, alteration, and degradation of vegetation, and associated habitat and animal populations. Potential sources of these impacts include airborne emissions, bird hazards, drainage modifications, and increased noise.

Vegetation and Associated Habitat and Animal Populations

Protected Species

Federal and state laws and regulations protect native plant and animal species that are rare, threatened, or endangered because these species are sensitive to reductions in population size and habitat area. To determine the susceptibility of a protected species known to occur on or adjacent to a potential DoD NAS site, it would be necessary to consider the capability of the species to persist in or to recolonize areas disturbed by construction. The use of a potential DoD NAS site or adjacent area by a protected animal species would necessitate the evaluation of the importance of the habitat to the species in question, the extent of disturbance or alteration of the habitat, and the values of the habitat. These evaluations, as well as evaluations of impacts to protected plants, would be made at the site-specific level in coordination with the U.S. Fish and Wildlife Service (USFWS) and with the appropriate state agency. However, no significant impacts to protected species are anticipated because endangered and threatened species habitat would be avoided during the identification of potential DoD NAS sites. In addition, the screening process would avoid ecological/wildlife refuges, preserves, conservation areas, and sanctuaries. Special consideration would also be given to unique habitat to prevent loss of these critical areas to the maximum extent possible. Short-term reductions (i.e. during construction) followed by recolonization and recovery would not be significant.

Plant Communities

Distinctive native plant communities, especially if they are of limited areal extent, may have particular scientific or aesthetic value. In many regions, intact native plant communities have become rare because of loss of habitat or the invasion of non-native species. Native plant communities can be assumed to be highly susceptible to degradation. Non-native opportunistic species are likely to colonize any disturbed project areas and to inhibit the recovery of native species. Soil compaction, loss of topsoil, and the addition of fill may render a site unsuitable for former resident plants. To prevent impacts to distinctive plant communities, the DoD NAS site screening process would avoid locating the project in ecological refuges, preserves, conservation areas, and sanctuaries. Some outstanding examples of native plant communities are recognized under the National Natural Landmarks Program of the National Park Service. These areas would also be avoided during the site selection process in order to prevent significant impacts to unique plant communities.

The degradation of a wetland or riparian plant community would constitute a long-term adverse impact. In general, the removal or loss of perennial vegetation or the disruption of the physical structure of the habitat such that its suitability for wetland plant species were reduced would constitute an adverse impact. However, no significant impacts to wetland or riparian plant communities are expected to occur as a result of DoD NAS construction and operation because wetlands and floodplains would be avoided to the maximum extent possible during DoD NAS site selection. Preliminary conclusions regarding impacts on wetlands or riparian areas would be verified at the site-specific level through coordination with the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, USFWS, relevant state departments, and any other managing agency.

Fish and Wildlife

The importance of wetlands and riparian areas to fish and wildlife and the sensitivity of these habitats to degradation following the removal of vegetation, suggests a high likelihood that long-term adverse impacts on fish or wildlife would accompany development in wetland or riparian areas. Since these areas would be avoided to the maximum extent possible during site selection, no indirect negative impacts to fish or wildlife are anticipated. Coordination with state and federal regulatory agencies regarding the sensitivity of the habitat and its importance to local fish and wildlife would be necessary during site-specific analyses.

The loss of a habitat or resource that is necessary for the persistence of one or more wildlife species within a region substantially larger than an individual DoD NAS site could result in potential long term significant impacts on wildlife. Unique nesting or feeding areas and isolated sources of water or cover are examples of critical resources. The fauna of relatively isolated patches of woodland or forest are also susceptible to local extinction in the event their habitat area is reduced. Avoidance of threatened and endangered species habitat and unique habitat during site selection would minimize possible impacts to these important resources.

Natural ecosystems generally provide higher quality wildlife habitat than cultivated areas which provide higher quality habitat than developed areas. In general, each step toward more intense land use further degrades the quality of wildlife habitat. Since it is likely that DoD NAS facilities would be sited in areas previously developed by humans, impacts to wildlife habitat should be minimal.

Effects on Habitat Value

The duration of DoD NAS related impacts would depend on land use considerations, restoration, or re-vegetation actions, and the rate of recovery by resident vegetation. Installation of DoD NAS facilities might result in the long term permanent loss of vegetation and wildlife habitat in a small area (less than three acres at each site, which is the approximate acreage required for the installation of the DASR antenna and associated access road and utility trenches). However, no significant habitat impacts are anticipated because sensitive, crucial areas of wildlife would be avoided during site selection, including: ecological/wildlife refuges, preserves, conservation areas and sanctuaries; wetlands and floodplains; endangered and threatened species habitat; wilderness areas; and other unique habitats. The NAS DASR Siting Plan (Attachment A) details the screening process that would avoid these important resource areas during the identification of potential sites. Furthermore, the small size of the sites and the anticipated proximity of the sites to developed areas would further minimize impacts to important wildlife habitat.

Construction of DoD NAS facilities might result in the short term temporary loss of wildlife habitat. Since desert vegetation typically requires longer periods of time to attain pre-disturbance cover, biomass, density, or species composition, these areas would experience greater habitat impacts than other plant community types. The recovery of grassland or other herbaceous community types would generally be assured within ten years of construction. The potential for recovery of scrub and forest plant communities would have to be considered on a site-specific basis. However, no significant habitat impacts are expected to result from DoD NAS construction due to the avoidance of critical areas, the small size of the facilities, and the anticipated proximity of the sites to developed areas.

Airborne Emissions. Airborne emissions produced during construction include fugitive dust and gaseous emissions (i.e. carbon monoxide and nitrogen oxide) from the exhausts of equipment and vehicles. For comparative purposes, a study on the effects of surface mining (Moore and Mills, 1977) revealed that neither fugitive dust nor gaseous emissions produced at most surface mine sites are widespread enough or at a concentration high enough to cause severe or even moderate impacts to wildlife or vegetation outside the immediate area of mining activity. Furthermore, any impacts on wildlife in the immediate area of large mines are very localized.

Airborne pollutants produced during construction of DoD NAS facilities would be substantially less than those expected from surface mining activities and would be temporary. Therefore, emission levels would be well below those known to cause adverse impacts to wildlife or vegetation, and the effects of such emissions would be short-term and minor. Air quality issues are further discussed in Section 4.1.3 - Air Quality.

Bird Hazards. The potential for injury or mortality of bird populations resulting from collision is common. Objects known to be detrimental to birds include towers, wires, transmission lines, tall buildings, lighthouses, and smoke stacks (Avery et al. 1980). When located in migration corridors and over or near water bodies, these obstacles become potentially more destructive (USFWS, 1978; Avery et al. 1980). Most bird collisions occur during conditions of poor visibility (e.g. mist, fog, or a very low ceiling of thick clouds) and adverse meteorological phenomena (e.g. high wind, rain, hail, or thunderstorms). Such conditions generally force birds to lower their flight level, which simultaneously decreases their ability to avoid human-made obstacles. Occasional disasters (i.e. mass mortality of birds) do occur under ideal weather conditions, but they are exceptional (Avery et al. 1977).

The majority of towers associated with avian collisions are over 300 feet tall (Avery et al. 1980). Therefore, the hazard associated with a DoD NAS radar (less than 100 feet tall) is much less than that of a typical TV or radio tower. As a result, the low height of DoD NAS radars reduces the risk of avian collision to a minor potential impact.

Drainage Modifications. A DoD NAS facility could result in a slight modification of existing drainage patterns; most likely increasing the amount of runoff received by downslope areas. Sedimentation in drainage networks, and associated wildlife habitats, might increase as a result of erosion from the clearing of vegetation during construction. The magnitude of this effect would depend on slope, soil type, rainfall patterns, and the efficacy of revegetation following construction, while the biological importance of the impact would depend on the downslope organisms and habitat affected. The consequences of increased sedimentation in aquatic habitats could include increased turbidity and resulting effects on photosynthesis and vision; increased scouring of biota and erosion of the stream channel; and increased nutrient inputs. Although the magnitude of these impacts would depend on site-specific conditions, no significant impacts are anticipated because steep terrain, wetlands, floodplains, and sensitive habitat would be avoided during site selection, as discussed above and detailed in the NAS DASR Siting Plan. In addition, Best Management Practices (specified by UBC, NFPA, BOCA and other national standards) and the development of a drainage and erosion control plan would prevent significant changes to the existing drainage patterns.

Increased Noise. The reactions of wildlife to noise are extremely difficult to define or predict. Auditory functions are species-dependent and often poorly understood, animals vary in the types of noise sources that affect them, and fieldwork is lacking in this area. Laboratory experiments using captive animals in restricted areas reveal that noise can produce a variety of physiological damage (Busnel, 1978). Primary effects include the masking of communication, stress response, and hearing loss. Secondary effects include abandonment of young, reduced reproductive success, and interference with feeding patterns.

Noise levels at DoD NAS installations would increase temporarily during construction. However, DoD NAS sites are likely to be located in environments where background noise includes human sources. Since wildlife in such areas may be somewhat adapted to human-produced noise, and the nature of such noise is temporary, the impact on wildlife should be insignificant. Noise increases attributable to DoD NAS are further discussed in Section 4.1.5 - Noise.

Biological Impacts. In summary, no significant biological impacts are expected to result from DoD NAS construction and operation. All significant biological impacts would be avoided through adhering to Best Management Practices (specified by UBC, NFPA, BOCA and other national standards), and by avoiding sensitive resources during the siting process. These two components of impact avoidance are discussed further in Section 5.0 - Mitigation, and the NAS DASR Siting Plan (Attachment A). DoD NAS development would potentially result in the following unavoidable, minor impacts: short term loss of vegetation and wildlife habitat; long term loss of some vegetation and habitat; increased air emissions and noise levels during construction; and a low-level risk of bird collisions.

4.1.5 Noise

The construction activity required for the installation of DoD NAS would result in a temporary increase in ambient noise levels in the vicinity of each of the proposed DoD NAS sites. Construction is anticipated to generally occur between 9 AM and 5 PM, Monday through Friday, at each DoD NAS site. Table 4.5-1 lists the construction equipment that is anticipated to be used during the installation of the DoD NAS, and also provides the noise ranges associated with each piece of equipment. The predicted, additive noise level that would result from the use of this equipment during five general construction stages is provided in Table 4.5-2. The predicted noise levels provided in Table 4.5-2 assume a typical industrial construction level of activity at each DoD NAS site during the installation process (Bolt et al., 1971). The noise intensity associated with this level of construction activity is based on the use of an assumed number and operation time of each piece of construction equipment (Table 4.5-2) during the five installation stages.

TABLE 4.5-1. TYPICAL NOISE LEVELS (dBA) OF ANTICIPATED DoD NAS CONSTRUCTION EQUIPMENT

Equipment	Approximate Range of Noise Level at 50 ft (dBA)
Compactors (Rollers)	73-75
Front Loaders	73-94
Backhoes	76-96

Tractors	80-94
Scrapers, Graders	80-93
Pavers	86-88
Trucks	82-94
Concrete Mixers	75-87
Concrete Pumps	81-83
Cranes (Movable)	76-87
Cranes (Derrick)	86-88
Pumps	69-71
Generators	71-82
Compressors	74-86
Pneumatic Wrenches	83-88
Jack Hammers & Rock Drills	81-97
Pile Drivers (Peaks)	95-105
Vibrator	69-81
Saws	72-81

Source: Bolt, Beranek and Newman, 1971.

TABLE 4.5-2. TYPICAL AVERAGE NOISE LEVEL (dBA) ANTICIPATED DURING CONSTRUCTION AT DoD NAS SITES

Construction Stage	Predicted Noise Level at each Stage at 50 ft	
	Assuming Suburban Background Noise of 50 dBA	Assuming Urban Background Noise of 70 dBA
Ground Clearing	84	87
Excavation	89	89
Foundations	77	78
Erection	84	85
Finishing	89	89

Source: Bolt, Beranek and Newman, 1971

A joint planning document prepared by the USAF, USN and USA (USAF et al., 1978) describes three basic categories of impacts that may result from elevated noise levels: physiological effects, behavioral effects and subjective effects. Physiological effects include both temporary impacts, such as simply being startled or taken aback by a sudden loud noise, and permanent impacts, such as irreversible hearing loss. Behavioral impacts include the effect of noise on speech, sleep and work patterns. The noise levels at which physiological and behavioral effects are usually experienced are reported in Table 4.5-3. Finally, subjective effects generally consist of personal annoyance or aggravation as a result of loud noises. Table 4.5-4 lists the typical noise levels at which a reaction is elicited from individuals in the surrounding area. However, the noise levels provided in Table 4.5-4 generally describe reactions to noise within communities that are characterized by quieter ambient conditions than those typifying most military communities (USAF et al., 1978).

TABLE 4.5-3. NOISE LEVELS CAUSING PHYSIOLOGICAL AND BEHAVIORAL EFFECTS[1]

Effect	Moderate Impact (dBA)	Appreciable Impact (dBA)
Hearing Damage Risk	70	90
Speech Interference	45	60
Sleep Interference	40	70
Task Interference	55	75
Physiological Stress	None Defined	90
Startle	None Defined	110

[1] Based on 8 hours of exposure

Source: Bolt, Beranek and Newman, 1971.

TABLE 4.5-4. TYPICAL REACTIONS TO AMBIENT NOISE LEVELS

Average Day/Night Noise Level (Ldn, dB)	Community Reaction
55	No Reaction
60	Sporadic Complaints
65	Widespread Complaints
75	Threats of Legal Action Appeals to Officials
80	Vigorous Community Action

Source: Bolt, Beranek and Newman, 1971

A variety of noise criteria exist which describe "acceptable" noise levels. The EPA has recommended 55 dBA as the noise level that is needed to protect outdoor activities, while Housing and Urban Development (HUD) includes this value on the boundary between "acceptable" and "discretionary - normally unacceptable" outdoor noise levels (USAF et al., 1978). The USAF/USA/USN noise planning document states that no special insulation is required for homes, schools, churches, hospitals, or nursing homes in communities experiencing an outdoor Ldn of 65 dBA. The USAF/USA/USN noise criterion for an acceptable outdoor working environment is 80 dBA for work which does not require frequent communications (USAF et al., 1978).

At the DoD NAS sites, the noisiest period of construction would be that involved with the excavation and finishing stages for the DASR. The predicted noise level at each of these stages would be approximately 89 dBA at a point 50 feet from the center of the construction site. Since there is a 6 dB reduction in noise level with doubling of distance from the source, the peak noise level is anticipated to be approximately 77 dBA at 200 feet, 65 dBA at 800 feet and 59 dBA at 1600 feet (Figure 4-1). Assuming that there are no centers of activity or residential areas within 1600 feet of the construction site, only sporadic noise complaints, if any, would occur (see Table 4.5-4). A noise level of 59 dBA at 1600 feet from the construction site would be low enough to prevent physiological noise effects (see Table 4.5-3), although moderate interference with speech and task performance could occur. However, the noise attenuation described above does not account for additional attenuation that could occur as a result of intervening buildings, vegetation or topographical features. In addition, a noise level of 59 dBA is likely not much different from the ambient noise environment characterizing a military base in the vicinity of the DoD NAS site as this noise level is typical of a suburban or low density urban environment (see Section 3.5). In fact, the construction period noise levels predicted are substantially below those currently characterizing the DoD NAS sites (see below). Furthermore, this noise level is below that at which the USAF recommends insulating sensitive buildings (65 dBA), and is only slightly above that promulgated by the EPA for protecting outdoor uses (55 dBA). Consequently, it is expected that the noise generated by DoD NAS construction would be low enough that no significant impacts would occur in areas of residential or community use.

[figure 4-1 noise diagram]

Implementation of the DoD NAS project would also involve dismantling and removing the existing ASR-9 radar system. The demolition activities associated with the dismantling of the ASR-9 system would also produce construction noise that could temporarily increase noise levels in the vicinity of the proposed DoD NAS sites. The noise generated during this phase of the DoD NAS project is anticipated to be approximately equivalent to that generated during the DoD NAS construction activities. As discussed above, this temporary increase in noise is not expected to significantly increase ambient noise levels.

Operation of the DoD NAS would also generate noise, but would not elevate the ambient noise level in the nearby area. The radar itself and the emergency back-up generator are both sources of operational noise. The proposed DASR is an upgraded version of the existing ASR-9 and would generate noise at levels similar to those currently produced by the ASR-9. The ASR-9 currently generates approximately 95 dBA of noise while the antenna and secondary radar are operating, and its associated generator generates approximately 145 dBA of noise inside its shelter. Equipment enclosures generally reduce noise levels by 10 to 50 dBA, depending on the type of shelter. Since the shelter used to enclose the NAS generator would likely be a limited access shelter, a moderate to high noise reduction level of approximately 30 dBA can be presumed (USAF, 1978; Bolt, Beranek, and Newman, 1971). Thus, the combined noise that would be produced by the enclosed generator and the NAS antenna is approximately 105 dBA at 50 feet from the NAS site (note that decibels add logarithmically, not algebraically). Employing the rule of attenuation with distance yields noise levels of approximately 99 dBA at 100 feet, 87 dBA at 400 feet, and 75 dBA at 1600 feet from the DASR site. These noise levels are above those recommended to prevent behavioral, physiological and subjective noise impacts. However, the noise levels generated by the DASR operation would be identical to those currently characterizing the proposed DoD NAS sites. Consequently, the operation of DoD NAS would not significantly increase existing noise levels.

In summary, construction and operation of the DoD NAS project would generate noise, but the anticipated noise levels would not significantly increase ambient noise levels. Adherence to Best Management Practices (specified by UBC, NFPA, BOCA and other national standards) during construction, which include the use of equipment mufflers, would minimize any noise generated from construction activities. During operation, the proposed NAS components would generate noise similar to that characterizing the existing system.

4.1.6 Infrastructure

The DoD NAS components would typically be installed within the property boundaries of the airfields. It is not expected that there would be any need for acquisition of new property. The infrastructure effects of the proposed project would occur as a result of physical extension or expansion of utility, water distribution and wastewater collection systems, and roadways on the airfield, and an increase in demand of some services during peak construction periods.

Electricity. The DASR system would operate from commercially available electrical power as its primary source and from an on-site engine generator as its secondary power source. In addition there would be need for electrical power to operate lighting and other devices. Electrical power would be obtained from the nearest adequate and available source as approved by the Government. The electrical service would comply with all the requirements of the National Electrical Code (NFPA 70) and the National Electrical Safety Code (ANSI C.2).

Commercial power provided to the DASR facility would be via a single user substation located within the facility perimeter fence. Cabling from the substation to the facility shelter would be via an underground conduit. Direct burial of the cable would not be allowed. The construction of the substation and the digging of the trench for the conduit would result in short-term disturbances. However, all construction would occur within the perimeter fence. A discussion of potential short and long-term effects of electromagnetic radiation is discussed in Section 4.1.11.

Telephone. Each shelter building would be constructed to provide an exterior wall mounted equipment box or cabinet attached to an appropriate location on the outside of the shelter for installation of telephone company equipment and termination of telephone cables. Telephone service would be provided between the government telephone system and the equipment shelter from the nearest adequate and available source as approved by the Government. This would require an extension of telephone line from the nearest on-airfield supply. There would be temporary construction impacts due to either placement of telephone poles and aboveground lines, or trenches to place underground conduits. Regardless of the method used, the temporary effects are not expected to be significant.

Water and Sewer Systems. There would be no increased demand upon long-term water supply and sewer service as a result of the upgraded DoD NAS system because the number of staff that would be required to operate the new facilities would be identical to the number of staff currently needed to operate the ASR-9 system. There would be a need to maintain adequate water pressure to fight fires at the new radar and equipment shelter both during construction and operation, however, existing fire fighting capacity already exists on each airfield. Fire detection systems would be installed in each DASR shelter, in accordance with DoD specifications. Additional fire fighting capacity is not anticipated to be needed.

Short-term demand upon water and sewer service is expected to be somewhat greater. Increased water demand would result from possible use of water to reduce dust impacts during construction, and increases due to domestic use by construction workers (an average of 10 to 12 workers for approximately six to nine months). The total number of construction workers is quite small, and in addition, the majority of the workers would be drawn from the local area, and thus there would not be a significant change in net water demand. If water demand on the airfield during a construction day is an issue, calcium chloride could be used in place of water to keep the dust down at the construction site. In addition, potable water could be transported from off-site in holding tanks to provide water during the construction period, as necessary.

Wastewater flow on the airfield would also increase temporarily during construction. The net increase in flow would be minimal, primarily because relatively few construction workers are required to be at the site, and the majority of these workers would be from the local area, and thus would not represent additional flow into the overall (airfield plus off-airfield) system during the average 24-hour period. The flow would be primarily sanitary flow and should not contain any toxic material that would be problematic in terms of treatment for either on-site or off-site disposal. If the additional flow would contain any components that would disrupt the operation of existing treatment facilities, the USAF would investigate use of pretreatment facilities, or holding tanks prior to shipment to an appropriate treatment facility.

Fire and Police. Existing fire and police forces on airfields are expected to provide adequate protection for long-term operation of the facility. There would be no increased demand for services because the number of permanent staff associated with operation of the new radar and automation facilities would be identical to the number of staff currently needed to operate the ASR-9 facility. In addition, the radar and equipment shelter would be enclosed by a perimeter fence, minimizing the traffic through the area and thus reducing the potential for security risks.

There would be a potential temporary increase in demand for fire and police protection during construction activity in order to preserve the security and safety of the site. However, due to the relatively low number of construction workers that would be accessing the site, it is not anticipated that maintaining security would require additional personnel. Also, because all construction work would occur on the airfield, no police details would be required on off-site roadways. In addition, the workers would be drawn from the local area, and would not represent an additional population within the community or require additional protection services.

Roads. Equipment and materials, as well as workers, would need to be transported over non-airfield road networks and on-airfield roads in order to construct, install, and operate the upgraded radar and automation facilities. Although there may be variability in the types of roads that currently provide access to the many DoD airfields, it is not expected that non-airfield roads would need to be significantly improved because each airfield already exists, and it is expected that these access roads to the airfield meet minimum requirements.

New access roads may be required on the airfield to access the new radar and equipment shelter. The access road, driveways, and parking lot would be designed in accordance with USAF Regulation, and would be based on axle or wheel loading for vehicles required for construction, installation, operation, and maintenance of the facility and the DASR system in all types of weather. The site layout would accommodate a minimum of three vehicles. All construction would occur so as to minimize erosion. All disturbed areas would be regraded and revegetated as discussed in Section 5.0 - Mitigation.

Infrastructure Impacts. In summary no significant impacts related to infrastructure are anticipated during operation of the facility, due primarily to the small size and staff of the facilities, and the anticipated presence of some existing utilities and services. There would be a need for new roads, and temporary demand for increased services construction. The extent of these increases would depend on the current level of services and the available capacity to provide additional services on a short-term basis. Although significant impacts are not anticipated, any concerns would be noted during the environmental review for specific site construction.

4.1.7 Visual Resources.

Construction and operation of the DoD NAS facilities and the associated demolition of the ASR-9 would not affect the enjoyment of surrounding visual resources. The impact of DoD NAS on visual resources depends on its compatibility with the surrounding environment, as well as viewer sensitivity (USAF, 1987). In general, the DoD NAS is expected to be entirely compatible with its surrounding environment. Although the DASR component of DoD NAS would consist of a large radar (Figure 4-2), the proposed locations of the radar are on military installations on which there are existing, comparable radar systems. The physical attributes of the two systems are quite similar. In addition to the existing radars, the vicinity of an airstrip on a typical military airfield is expected to have numerous buildings and equipment. In areas such as these, the presence of the DASR would not be noticeable or conflict with existing uses. Therefore, the DASR is anticipated to have no significant impact on visual resources in the vicinity of a military airstrip.

[figure 4-2 ASR-9 RADAR]

At the proposed DoD NAS locations where the DASR might be sited at a distance from an airstrip, the DASR could be located in a natural, more pristine landscape with higher visual quality. The DASR would be incongruous with the surrounding scenery at these locations and therefore could detract from the enjoyment of visual resources in these areas. However, these sites would still be located on military property and therefore public access to these locations would be quite restricted. Consequently, viewer sensitivity to the DASRs at locations removed from military airstrips is anticipated to be very low, which would negate any impact to visual resources. The site-specific environmental documentation would identify the proposed DoD NAS sites at which the DASR component would be located within a natural landscape setting. However, the DASR sites that would be located in pristine settings are expected to have no significant impact on visual resources due to the anticipated low viewer sensitivities in these areas.

In summary, no significant visual resource impacts are anticipated to result from DoD NAS construction and operation, due to the compatibility of the proposed facilities with the existing environment and the anticipated low viewer sensitivity of the DoD NAS sites. In addition, sites which might result in high visual impact, such as those near adjacent housing and recreation areas, scenic vistas, and designated scenic rivers and highways would be avoided during the site selection process.

4.1.8 Cultural Resources

The new radar and automation facilities would be sited within the confines of existing DoD airfields. The sensitivity of the sites for containing any archaeological or historical resources would vary depending upon the prehistory and history of the area and the extent to which the project site may have been previously disturbed; the occurrence of other documented archaeologic findings on the airfield and in the surrounding area; the presence of other historic structures in the area; and the historical significance of the airfield itself. The potential effects of the project on resources listed on or eligible for the National Register of Historic Places, or on resources perceived as important to the specific culture of a region, would be assessed.

Archaeological Resources. The construction of a new concrete pad foundation for the radar antenna and equipment shelter would have the potential to disturb both prehistoric and historic archaeological resources. The extent to which resources could be disturbed would depend on factors cited in Section 3.10: whether the site has been previously disturbed; whether it is in or adjacent to an area of known finds; and whether it possesses characteristics of high sensitivity. However, no significant impacts to cultural resources are anticipated in general, as archaeologically sensitive areas would be avoided during the DoD NAS site selection process. Although areas known to be culturally sensitive would be avoided, the potential of discovering/disturbing archaeological resources during construction of the radar pad, equipment shelter, and utility conduits would be further assessed on a site-specific basis during individual site development. The assessment would be coordinated with the State Historic Preservation Officer (SHPO) and any other appropriate agency having special interest in the preservation of cultural resources. The assessment may include a Phase I reconnaissance, which consists of background research and site walkover, including field testing using a limited number of shovel test pits. Although not anticipated to be necessary, a Phase II survey, which involves more extensive field testing, would be conducted if required.

Since known or expected archaeological sites would be avoided during site selection to the maximum extent possible, mitigation measures are not anticipated to be necessary. However, mitigation for any discovered archaeological sites would be developed in consultation with the SHPO and other appropriate agencies, such as the Bureau of Indian Affairs. In general, mitigation may take several different forms: relocation of the radar to an alternative site; full or partial recovery of the archaeological resource; or in-place documentation of the resource using photography, testing, or narrative.

Historic Resources. The construction of a new concrete pad foundation for the radar antenna and equipment shelter, installation of the new radar antenna and tower, and upgrade of communication facilities could result in impacts to historic resources. The impact could occur as a result of actual physical disturbance to the historic structure(s), or indirect effects through visual or contextual changes to historic settings. The historic resources could be located on the airfield, adjacent to the airfield, or within the visual viewshed of the proposed facility. In general, however, no significant impacts are expected in regard to historic resources, as these resources would be avoided to the maximum extent possible during site selection.

Although historic resources would be avoided to the maximum extent possible, the potential for affecting historic resources would be evaluated on a site-specific basis during individual airfield upgrades. The evaluation would take place in coordination with the SHPO and other agencies as appropriate. Mitigation, although not anticipated, could also be developed in consultation with the SHPO and other agencies if deemed necessary, and may take the form of resiting the radar facilities at an alternative location on the airfield; relocating the historic resource; or documenting the resource using HABS-HAER methodology.

Cultural Resources Impacts. In summary, no significant impacts to cultural resources are anticipated as a result of DoD NAS construction and operation. Historic and archaeological resources would be avoided during site selection to prevent impacts to these valuable resources.

4.1.9 Socioeconomics

Socioeconomic conditions are not expected to be significantly affected as a result of operation of the DoD NAS project. No additional long-term staff would be required to operate the new radar and automation facilities. Consequently, there would be no impact upon local direct and indirect employment, housing markets, or local fiscal conditions. In addition, no private land would be removed from the community tax base.

Socioeconomic effects during construction are also expected to be fairly minor. An average of ten to twelve construction workers would be at the site for approximately six months. The majority of these workers would be local tradespeople. The potential effects during construction are briefly summarized below. These analyses are directed to effects that would result at each of the military airfields where the DASR facilities would be installed and do not address the potential effects related to the work of the systems contractor.

Employment. Construction activity would create a minor increase in direct employment. As noted above, an average of ten to twelve full time positions would be created for an approximately six month period. These positions would be drawn from the local workforce, and thus represent greater employment of the existing workforce. Although the duration of impact would be short-term, it represents a positive effect to the local area, especially in those regions with fairly high unemployment rates. In addition, the direct labor positions would create indirect employment in the construction and service sectors. This indirect effect would also be temporary, but would provide additional financial benefits to the local economy.

Housing. There would not be any significant impacts to the housing market as a result of the proposed project. As noted above, the average number of construction workers is fairly small, and the majority of these workers would be local tradesmen already residing in the area. Therefore, there would be no net effect on housing demand.

Fiscal Conditions. There would be a short-term positive effect upon local fiscal conditions, although it would be fairly minor. The increase in direct and indirect employment would result in increased taxes on personal income, while the purchase of materials and equipment may also generate additional sales taxes. Because the construction workers would be drawn from the local area there would not be an increase in demand of local services (water, sewer, schools) that would counter the positive fiscal effect of the increase in taxes or fees.

Socioeconomic Impacts. In summary, no significant socioeconomic impacts are expected to result from DoD NAS construction due to the anticipated small size of the workforce required and the expected employment of local labor during construction. Operation of DoD NAS would require no additional staff in excess of those currently operating the ASR-9 systems.

4.1.10 Pollution Prevention and Hazardous Waste Management

Pollution Prevention. A Pollution Prevention Plan is being developed for the DoD NAS program, and would be integrated throughout the life cycle of the DoD NAS program to fulfill Pollution Prevention Act, DoD, and USAF requirements. The Plan would identify, eliminate, minimize, and control the introduction of new pollutants and higher levels of existing pollutants into the environment. To help eliminate the dependence on and the release of ozone depleting chemicals, the Plan would prohibit the purchase of all Class I ozone depleting chemicals, and minimize the use of Class II ozone depleting chemicals by striving to find environmentally acceptable substitutes and processes. The Plan would implement the EPA's 17 Industrial Toxics program to minimize the use of the toxics targeted for reduction. Implementation of the Plan would minimize hazardous wastes from industrial, maintenance, and cleanup operations to the most practical extent; and would strive to reduce hazardous waste generation at the source.

Hazardous Substances and Wastes. Hazardous materials could be encountered and hazardous wastes could be generated during DoD NAS system installation. During siting, the applicable internal and external ECAMP, ECE, or ECAS reports would be reviewed to identify any areas of documented contamination from previous hazardous material release or disposal. As part of the site selection process, the Government would avoid, to the maximum extent possible, siting at any of the areas of contamination, as detailed in the NAS DASR Siting Plan.

Despite this avoidance of contaminated areas, it is possible that areas of previously undocumented contamination could be discovered during system installation. In addition, siting restrictions or limitations may require the system be installed at areas of documented contamination. In such cases, the hazardous materials would be evaluated, collected, stored, transported, and disposed of in compliance with all appropriate federal, state, military, and local regulations. RCRA is the primary legislation guiding DoD hazardous waste management practices; states may be authorized to implement the RCRA program and may implement additional requirements more stringent than the federal requirements. Any cleanup of previously undocumented waste sites is regulated by CERCLA.

During DoD NAS installation, excavations for foundations and trenching could uncover previously undocumented hazardous materials. The hazardous materials would be evaluated, collected, stored, transported, and disposed of in compliance with all appropriate federal, state, military, and local regulations; and any cleanup of the site would be in compliance with CERCLA regulations. The facility system would include the installation of an aboveground fuel storage tank for the emergency generator. The fuel supply line would be below grade. To prevent the release of fuel to the environment, the installation would be in accordance with all appropriate federal, state, military, and local regulations; and could include double-walled tanks and supply lines, spill detection alarms, and fuel containment dikes.

Although the implementation of the Pollution Prevention Plan would minimize the use and generation of hazardous materials and waste to the maximum extent possible, it is expected that some hazardous materials and wastes would be used and generated during DoD NAS installation. Construction equipment fuel, engine oil, hydraulic oil, grease, and other equipment operation and maintenance material would be used. In addition, refueling of equipment could be conducted on site. Such materials would be used, stored, transported, and disposed of in accordance with federal, state, military, and local regulations. Any releases of hazardous materials into the environment would be reported in compliance with the regulations. The transportation and disposal of hazardous wastes would be in accordance with all appropriate federal, state, military, and local regulations.

Hazardous substances and wastes would be expected to be used and generated at the facility after installation is complete, during DoD NAS operations. Paints, solvents, cleaners, grease, and other operation and maintenance materials would be used. Maintenance and refueling vehicles would frequent the facility; periodic refilling of the emergency generator fuel storage tanks would be required. In addition pesticides, herbicides, and other chemicals to aid in the control of insects, rodents, and vegetation could be required. The use, storage, transportation, and disposal of all hazardous materials would be in accordance with federal, state, military, and local regulations. Any releases would be reported in compliance with the regulations.

Deactivation and Demolition. The DoD NAS program's upgrade of the military air traffic control system would involve the deactivation of existing control system elements. This would include the replacement of control system equipment, and could include the renovation or demolition of existing facilities. Hazardous and non-hazardous materials controlled during the operational life of the existing system could become uncontrolled and inadvertent pollutants.

Deactivation for the DoD NAS system would include the dismantling and razing of existing surveillance radars, towers, and support buildings. Excavations for the removal of foundations could uncover previously undocumented hazardous materials. The hazardous materials would be evaluated, collected, stored, transported, and disposed of in compliance with all appropriate federal, state, military, and local regulations; and any cleanup of the site would be in compliance with CERCLA regulations. Deactivation for the DAAS and ETVS systems would include renovations to existing air traffic control facilities, and the DAAS system could include expansions of and alterations to existing support buildings.

Hazardous materials could be encountered and hazardous wastes could be generated during the dismantling of the radar structure, during renovations to air traffic control facilities, and during renovation or demolition of support buildings. The existing structures could contain asbestos-containing material such as ceiling and floor tiles, insulation, and siding; and PCB-contaminated substances such as insulating oil, hydraulic fluid, and lighting ballasts. The asbestos-containing and PCB-contaminated materials would be evaluated, collected, stored, transported, and disposed of in compliance with the TSCA regulations. Lead-containing materials could also be encountered during dismantling, renovations, and demolition. Lead-based paint, primers, and coatings; lead pipe and solder; and lead-shielded conductors could be present throughout existing buildings. The lead-containing materials would be evaluated, collected, stored, transported, and disposed of in compliance with the regulations of the EPA's 17 Industrial Toxics program. Facilities demolition could involve existing storage tanks (both underground and aboveground) and associated piping. The removal of existing USTs would be in compliance with EPA regulations.

During demolition for the DoD NAS installation and renovations for the DAAS and ETVS installations; construction equipment fuel, engine oil, hydraulic oil, grease, and other equipment operation and maintenance material would be used. In addition, refueling of equipment could be conducted on site. Such materials would be used, stored, transported, and disposed of in accordance with federal, state, military, and local regulations. Any releases of hazardous materials into the environment would be reported in compliance with the regulations. The transportation and disposal of hazardous wastes would be in accordance with all appropriate federal, state, military, and local regulations. Non-hazardous solid waste would be either recycled or placed in permitted sanitary landfills.

Hazardous Waste Impacts. In summary, no significant impacts are expected to result from hazardous waste use or discovery at the DoD NAS sites. First, known areas of contamination would be avoided during the screening of potential sites. Second, any hazardous materials encountered or used at the DoD NAS sites would be handled in accordance with all applicable regulations in order to prevent any significant pollution impacts.

4.1.11 Human Safety

RFR would be generated during the operation of the DASR that would be installed at the proposed DoD NAS sites. The DASR can be assumed to generate RFR over a similar range of frequencies as the existing ASR-9 system. The frequencies of ASR use would fall within the 3kHz to 300GHz range covered by the exposure standards. Therefore, the potential health effects of RFR discussed below would be those solely due to non-ionizing/electromagnetic radiation. Various peer reviewed scientific, epidemiological studies on the effects of RFR and findings of a Radiation Hazard Analysis of ASR-9 at White Sands Missile Range were analyzed to assess potential RFR impacts to human safety at the DoD NAS sites.

Although some results were conflicting, the preponderance of the studies found that chronic exposure to RFR at levels within the IEEE C95.1-1991 standard exposure guidelines did not result in demonstrable, detrimental health effects. Therefore, taken collectively, the epidemiologic studies indicate that chronic exposure to RFR at levels within any of the U.S. exposure guidelines is not hazardous to human health.

A theoretical radiation hazard analysis of the ASR-9 system shows that when the antenna is stationary there is no hazard to personnel standing on top of an equipment building at least 8 feet below the focal point of the ASR beam; when rotating, one would have to be 2 to 6 feet below the focal point to be in a hazardous zone. The tower immediately below the antenna would be in the feed spillover region (0-8 feet when stationary, or 0-6 feet when rotating) and, although blocked by the antenna structure, it would not be safe to personnel. Therefore, restricted access must be utilized to assure that no personnel are in close proximity to operating units.

It is necessary to distinguish between an effect and a hazard. For example, a person's metabolism can be increased harmlessly by mild exercise. Analogously, an effect produced at RFR intensities that yield heat that can be easily accommodated within the thermal regulating capabilities of an individual may not necessarily be harmful. Also, the effects produced thereby are generally reversible. However, the thermoregulatory capabilities of any given person may be exceeded at high RFR intensities, so compensation for such effects may be inadequate. Thus exposure at such intensities can cause thermal distress or even irreversible thermal damage and represent a hazard.

In conclusion, there is no credible scientific evidence that exposures to levels below the maximum levels specified in IEEE exposure standard would produce irreversible health effects. Therefore, the region outside of an area either eight feet below the focal point of the beam when stationary, or two-to-six feet when rotating, would pose no significant threat to human safety. There would be no human health threat outside the spillover region, and exposure within the spillover region would be safe within the IEEE exposure restrictions.

4.2 NO ACTION ALTERNATIVE

The alternative of no action would leave existing radar systems and air traffic control equipment in place. In addition, no new construction, renovation, or operations would be required. Since the no action alternative would involve no alteration to proposed DoD NAS sites, this alternative would result in no impact to environmental resources. However, selecting the no action alternative, and thereby having to maintain existing radar systems, would require relying on uneconomical existing radar equipment, resulting in unacceptably higher operation cost over time.

5.0 MITIGATION

Impacts associated with the implementation of the DoD NAS program are expected to be minor and largely temporary. This is primarily due to the configuration of the system and the fact that government property would be utilized for siting. The actual types and extent of the minor impacts would depend upon site-specific conditions and would be fully evaluated in the site-specific NEPA documents.

Impacts would be minimized through avoidance of the resources discussed in this document. In fact, the NAS DASR Siting Plan (Attachment A) directs that the following human and natural resources shall be avoided to the maximum extent possible during the site screening process: railroads, highways, and other human structures; wetlands and floodplains; wilderness areas; ecological/wildlife refuges, preserves, conservation areas and sanctuaries; threatened and endangered species and their habitat; coastal zones; steeply sloping terrain; hazardous waste sites; capped landfills; wild and scenic rivers; scenic highways; national natural landmarks; prime and unique farmlands; historical, archaeological, and cultural sites; and national and state parks and recreation areas. Therefore, the NAS project will result in no significant impacts to environmental or human resources and, as a result, will require minimal mitigation.

In general, expected minor impacts to air quality, soil, and water resources would be minimized through the use of Best Management Practices (specified by UBC, NFPA, BOCA and other national standards), such as dust control, revegetation of disturbed areas, runoff containment, and erosion control. Adverse impacts due to potential fuel spills could be avoided through use of spill containment measures and adherence to existing facility Spill Prevention, Control, and Countermeasures Plans.

Detailed mitigation measures would be identified as appropriate during the site-specific NEPA analysis. Any mitigation that would be required to mitigate for minor NAS impacts would be specified during the site-specific permit acquisition process as appropriate.

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ATTACHMENT A

NATIONAL AIRSPACE SYSTEM
DIGITAL AIRPORT SURVEILLANCE RADAR
SITING PLAN

A-1