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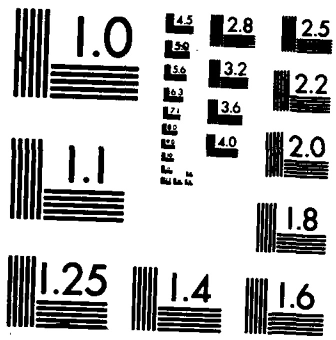
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AD-A173 827

LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT

SMALL INTERCONTINENTAL BALLISTIC MISSILE PROGRAM

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UNITED STATES AIR FORCE

NOVEMBER 1986

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Figure 12

Abstract: The U.S. Air Force proposes to deploy an advanced land-based Small Intercontinental Ballistic Missile (ICBM) to improve the nation's strategic deterrent force. Development of this missile system was recommended by a presidential commission and directed by Congress. The commission recommended that this missile be smaller and lighter than previous ICBMs, be compatible with both mobile and fixed basing modes, and meet modern performance and survivability goals. The Legislative Environmental Impact Statement (LEIS) identifies and compares potential regional impacts of deployment and peacetime operation of the Small ICBM in three alternative basing modes. This is to support decisions on full-scale development of the Small ICBM, and selection of the basing mode(s) and deployment area(s). Two of these modes involve special vehicles known as Hard Mobile Launchers (HMLs) that can transport and launch the missiles. The third basing mode involves deployment of the missiles in underground silos that are also hardened against attack. The Hard Mobile Launcher in Random Movement basing mode, the first mobile mode, involves day-to-day operation of the HMLs on existing Department of Defense (DOD) or Department of Energy (DOE) installations. The second mobile mode involves situating HMLs primarily at existing Minuteman ICBM launch facilities. The final alternative, the Hard Silo in Patterned Array basing mode, involves underground silos situated in staggered rows within fenced arrays. One or more of these basing modes may be selected. Six different deployment areas are under consideration for each of the three basing modes. The areas under consideration for the Hard Mobile Launcher in Random Movement are located in Arizona, California, Florida, Nevada, New Mexico/Texas, and Washington; those for the Hard Mobile Launcher at Minuteman Facilities are situated in Missouri, Montana, North Dakota (two areas), South Dakota, and Wyoming/Nebraska/Colorado; and the areas for the Hard Silo in Patterned Array are located in Arizona (three areas), California, New Mexico/Texas, and Wyoming. The number of missiles that have been analyzed in any given area ranges from 50 to 250. The total force to be eventually deployed could range from 250 to 1,000 missiles. The direct employment in any given area during the year of peak-construction activities could range from approximately 2,100 workers to more than 5,000, depending on the basing mode selected and the number of missiles deployed in the area. Potential project-induced environmental impacts in each area and for each basing mode are identified in the LEIS by the following categories: socioeconomics, utilities, transportation, land use, cultural and paleontological resources, biological resources and threatened and endangered species, air quality and noise, water resources, and geology and soils.

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LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT

SMALL INTERCONTINENTAL BALLISTIC MISSILE PROGRAM

NOVEMBER 1986

COVER SHEET
LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT
SMALL INTERCONTINENTAL BALLISTIC MISSILE PROGRAM

a. Responsible Agency: U.S. Air Force.

b. Proposed Action: Full-scale development, basing mode and area selection in support of the Small Intercontinental Ballistic Missile Program.

c. For further information contact: Director of Environmental Planning, AFRCE-BMS/DEV, Norton AFB, San Bernardino, California, (714) 382-4891. Copies of this document are available through the National Technical Information Service, 5285 Post Royal Road, Springfield, Virginia 22161.

d. Designation: Legislative Environmental Impact Statement.

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f. Date submitted to the United States Environmental Protection Agency: 7 November 1986.

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SUMMARY

PURPOSE AND NEED

In January 1983, President Reagan convened a bipartisan Commission on Strategic Forces (the Scowcroft Commission) to review the purpose, character, size, and composition of the strategic forces of the United States and make appropriate recommendations on intercontinental ballistic missile (ICBM) modernization. The commission's report was issued in April 1983. Its findings and recommendations were accepted by the President and Congress. Among its recommendations was that the United States immediately initiate engineering design of "...a single warhead ICBM weighing about fifteen tons...(leading)...to the initiation of full-scale development in 1987 and an initial operating capability in the early 1990s...Hardened silos or shelters and hardened mobile launchers should be investigated now..." (Report of the U.S. Commission on Strategic Forces 1983). In the 1984 Defense Authorization Act, Congress authorized start-up of the Small ICBM program at a pace that would permit full-scale engineering development to begin in fiscal year 1987. Congress directed that the program be pursued as a matter of the highest national priority with an initial operational capability by the end of 1992.

ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The Environmental Impact Analysis Process will provide supporting information to decision-makers at key decision points of the Small ICBM program through a process known as tiering. Tiering, which involves moving from general to specific analyses as a program evolves, provides the balance and perspective appropriate for each stage of decision-making and is recommended by the regulations implementing the National Environmental Policy Act. The initial tier supports the decision to enter full-scale development and the concurrent basing mode and deployment area decisions. This decision point is expected to be reached in late 1986 or early 1987. To aid in making these decisions, an analysis of regional-scale issues is provided in the Legislative Environmental Impact Statement (LEIS) as directed by the 1986 Defense Authorization Act. At a subsequent decision point in early 1988, the site-specific, Small ICBM facility-location decisions will be made. In preparation for that decision point, environmental issues in the proposed deployment areas will be examined in a second tier, site-specific, administrative environmental impact statement, which is also directed by the 1986 Defense Authorization Act.

The environmental issues addressed in the LEIS were identified through consultations with federal and state agencies and by Air Force and contractor personnel who have experience with programs of similar scope. The issues are grouped into nine resource categories which have a total of 28 subcategories called resource elements:

- Socioeconomics
  - Regional Growth (population and employment)
  - Housing
  - Public Services (including schools)
  - Public Finance (expenditures and revenues)

- o Utilities
  - Potable Water Treatment and Distribution
  - Wastewater
  - Solid Waste
  - Energy Utilities

- o Transportation
  - Highways

- o Land Use
  - Land Use and Status
  - Regional Recreation
  - Visual Resources

- o Cultural and Paleontological Resources
  - Prehistoric Cultural Resources (predating written records)
  - Historic and Architectural Resources (postdating written records)
  - American Indian Cultural Resources
  - Paleontological Resources (fossils, casts, molds, or impressions of extinct species)

- o Biological Resources and Threatened and Endangered Species
  - Vegetation
  - Wildlife
  - Aquatic Habitats
  - Unique and Sensitive Habitats
  - Threatened and Endangered Species

- o Air Quality and Noise
  - Air Quality
  - Noise

- o Water Resources
  - Surface Water Hydrology and Quality
  - Groundwater Hydrology and Quality

- o Geology and Soils
  - Engineering Geology (including geologic hazards)
  - Geologic Resources (including aggregate)
  - Soil Resources

It is estimated that $9.3 billion (1984 dollars) will be spent for full-scale development of the Small ICBM between 1987 and 1993. Each $1 billion spent in any year will support approximately 22,000 jobs in that year. Expenditures will fluctuate throughout the development period. Sales and employment will be concentrated in radio and television communication equipment, guided missiles, chemicals, electronic computing equipment, measuring and control instruments, and wholesale trade sectors. A number of critical materials (e.g., strategic metals) will be required for full-scale development; none of the full-scale development requirements for these materials encompass more than 1 percent of the total nationwide import needs. The nationwide effects of full-scale development can generally be described as beneficial. Even in conjunction with other military requirements, no significant industrial capacity problems are forecast and no critical material shortages are anticipated.

SYSTEM DESCRIPTION

The Small ICBM will be light enough to facilitate basing in both mobile and fixed modes. The missile will be 46 to 53 feet long, 46 inches in diameter, and weigh from 30,000 to 37,000 pounds. For comparison, the Peacekeeper, our most modern ICBM, is 71 feet long, 92 inches in diameter, and weighs 195,000 pounds. The major facilities required for system operation and support will be located at a Main Operating Base (MOB) and in the deployment area(s) associated with the MOB. The total force size could range from 250 to 1,000 missiles, with 500 missiles used for weapon system planning. The first 10 missiles could be in service by the early 1990s, with 500 deployed by the end of that decade.

A variety of both fixed and mobile ICBM basing modes have been studied by the Air Force over the past 3 decades. The three basing modes found suitable for the Small ICBM to enter full-scale development and meet the 1992 initial operational capability mandated by Congress are the Hard Mobile Launcher in Random Movement, the Hard Mobile Launcher at Minuteman Facilities, and Hard Silo in Patterned Array. Deployment of 500 missiles in one or more of these modes could require the selection of more than one deployment area. Consequently, a maximum of 250 missiles at any one area has been used for analyses.

Hard Mobile Launcher in Random Movement

The Hard Mobile Launcher in Random Movement basing mode will involve deployment of missiles exclusively on complexes consisting of existing Department of Defense (DOD) or Department of Energy (DOE) installations. A typical complex will generally include a single MOB and one or more deployment installations within approximately 50 miles of the MOB. The missiles will be carried and protected by special vehicles called Hard Mobile Launchers (HMLs). These HMLs will be nearly 100 feet long, up to 14 feet wide, and weigh approximately 200,000 pounds.

The HMLs will be dispersed within areas of their host installations that could be used with minimal disruption of ongoing host mission activities. An average of 8 square miles of normal day-to-day operating area (Random Movement Area [RMA]) will be needed for each HML. Most of the time, the vehicles will be stationary. They may be parked either ready to move or with the launcher in a hardened, ground-hugging configuration to maximize resistance to attack. From time to time, they will be moved to alternative locations on the installation and may resume a hardened configuration. Vehicle positions will be changed frequently enough to deny an attacker knowledge of exact HML locations.

During periods of heightened international tension and periodic training, the Strategic Air Command or a higher authority could order further dispersal on the installations to increase survivability. This command dispersal area will approximately double the operating area for each vehicle. To facilitate rapid dispersal, the HMLs will be capable of attaining highway speeds on gravel roads. They will also have off-road capability to ensure access to large dispersal areas.

Hard Mobile Launcher at Minuteman Facilities

The Hard Mobile Launcher at Minuteman Facilities basing mode will involve deployment of HMLs within fenced areas that surround missile silos at existing Minuteman installations in the north-central United States. Some HMLs may also be stationed adjacent to Minuteman launch control facilities and at the associated MOBs. The HMLs will be similar to those used in the Random Movement mode. Under normal conditions, the only HML movements on public roads will be to and from the MOB for training, maintenance, repair, or test purposes. To facilitate movement of HMLs to and from deployment sites, bridges and culverts in the deployment areas will be upgraded, where required, to enhance clearance and weight-bearing capability. Some roadway sections may be widened or structurally upgraded, generally within existing rights-of-way.

Hard Silo in Patterned Array

The Hard Silo in Patterned Array basing mode will involve deployment of the Small ICBMs in patterned silo arrangements that will incorporate newly developed silo-hardening technology. To enhance the integral hardness of the structures, these silos will be emplaced only where geologic features favor silo survivability. The areas being considered for Small ICBM siting in this mode are predominantly in the Southwest, on both public and private lands.

If this mode is selected, the silos will be deployed in staggered rows in fenced arrays. Each array will contain from 50 to 250 silos, depending on the amount of suitable area available at the chosen location. A typical array will be approximately 2 miles wide and from 3 to 10 miles long. A network of roads within the fenced array will provide access to the silos.

No Action Alternative

Under the No Action Alternative, the Air Force will continue to maintain existing Minuteman ICBMs and to deploy Peacekeeper ICBMs to the authorized level. The scope of such activities will not cause changes in the projected conditions within the areas under consideration for Small ICBM basing.

Alternative Basing Locations

Potential locations for siting the Small ICBM were identified through a screening process that included all 50 states. The criteria (some of which differed by basing mode) included technical, operational, legal, economic, and policy considerations. The process identified six areas, for each of the three basing modes, as potentially suitable for deployment. Several of these areas are suitable for more than one basing mode. The areas included for analysis in this LEIS and the approximate number of missiles they could support are listed in Table S-1. In addition to the installations listed in Table S-1, some Suitable Deployment Areas for the Hard Silo in Patterned Array basing mode may also occur on the following military installations which are located near alternative MOBs: China Lake Naval Weapons Center (NWC), Chocolate Mountain Aerial Gunnery Range, Luke Air Force Range (AFR), and White Sands Missile Range. The locations of all installations under consideration are illustrated in Figure S-1.

Table S-1

AREAS UNDER CONSIDERATION FOR DEPLOYMENT OF THE SMALL ICBM

Basing Mode and Location	Main Operating Bases and/or Installations	Number of Missiles Used for Analysis
Hard Mobile Launcher in Random Movement		
Arizona	Gila Bend Air Force Auxiliary Field, Luke Air Force Range, Yuma Proving Ground	200
Florida	Eglin Air Force Base	50
Nevada	Indian Springs Air Force Auxiliary Field, Nellis Air Force Base, Nellis Air Force Range, Nevada Test Site	200
New Mexico/Texas*	Fort Bliss, Holloman Air Force Base, White Sands Missile Range	200
South-Central California	China Lake Naval Weapons Center, Edwards Air Force Base, Fort Irwin National Training Center, Twentynine Palms Marine Corps Air-Ground Combat Center	200
Washington	Department of Energy Hanford Site, Yakima Firing Center	50
Hard Mobile Launcher at Minuteman Facilities		
South Dakota	Ellsworth Air Force Base	170
Wyoming/Nebraska/Colorado	F.E. Warren Air Force Base	200
North Dakota	Grand Forks Air Force Base	170
Montana	Malmstrom Air Force Base	200
North Dakota	Minot Air Force Base	170
Missouri	Whiteman Air Force Base	170
Hard Silo in Patterned Array		
Arizona	Davis-Monthan Air Force Base	250
California	Edwards Air Force Base	250
Wyoming	F.E. Warren Air Force Base	250
Texas/New Mexico	Fort Bliss	250
Arizona	Gila Bend Air Force Auxiliary Field	250
Arizona/California	Yuma Proving Ground	250

Note: *Throughout the LEIS, this area is referred to as the New Mexico Complex.

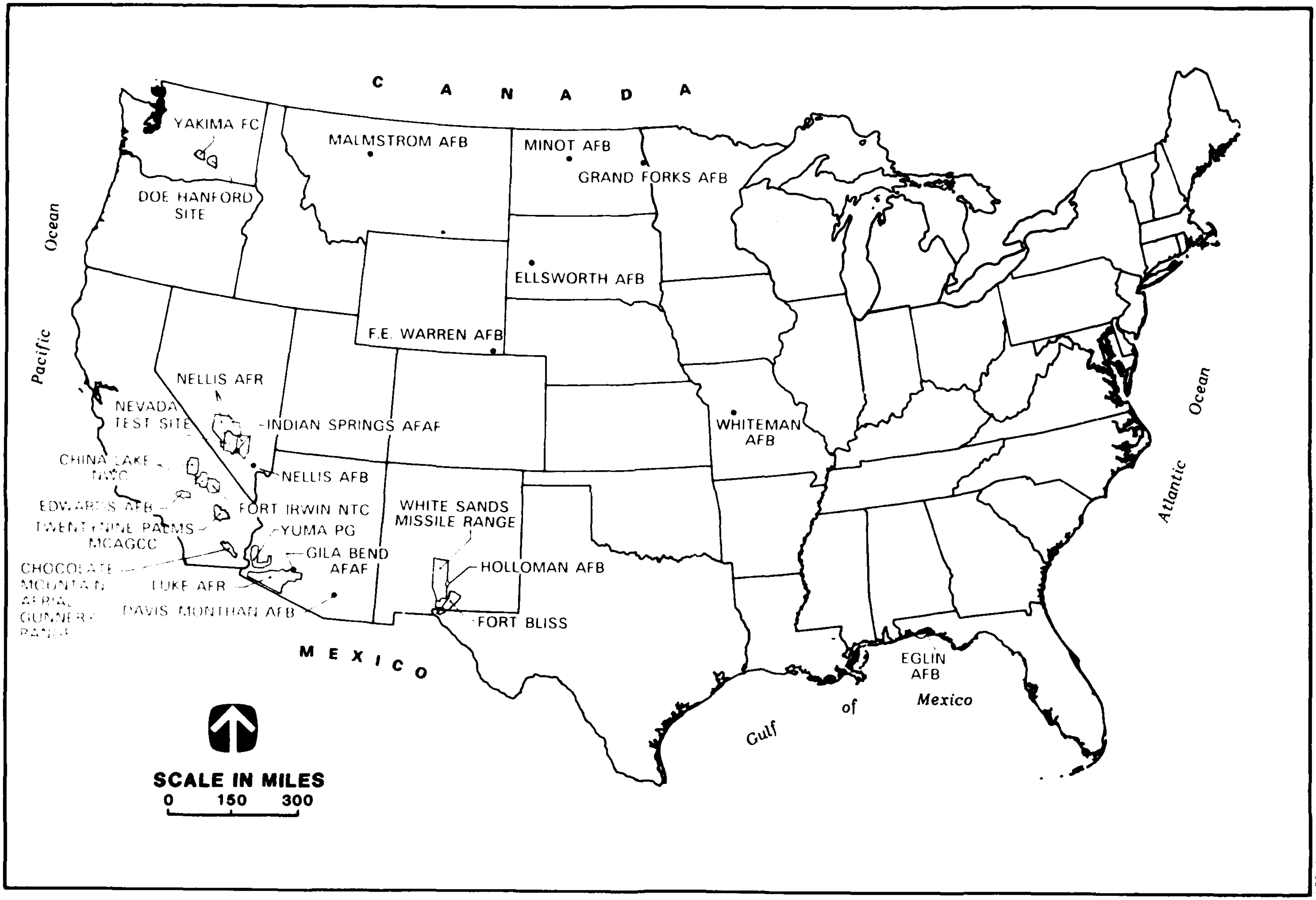


FIGURE S-1 LOCATIONS OF INSTALLATIONS UNDER CONSIDERATION FOR SMALL ICBM BASING

PROJECT RESOURCE REQUIREMENTS

As is typical of a major weapon system acquisition process, the engineering design and operating concepts for the Small ICBM are undergoing continual change. Change is rapid in the conceptual phase as new ideas are evaluated. Changes will continue through the validation phase as alternative solutions to problems are examined and compared. The process will continue during full-scale development as the system's final design emerges from the conceptual phase. At the same time, efforts will be made to increase performance and reliability, reduce costs and environmental impacts, and respond to changing treats. Typical system requirements that are subject to reevaluation are operation and training, land acquisition, number of missiles to be deployed in a given area, and missile design and performance.

The environmental analysis cannot await an exact project description based on final design drawings. However, development of the Small ICBM concept has advanced sufficiently to provide a basis for a regional-level environmental impact analysis; an analysis considered adequate to accommodate a range of system engineering refinements. At the regional level, the relative environmental impacts of alternatives will probably not change substantially as a result of these refinements. The environmental analysis in this LEIS used the most complete system data available at the time, and, as the tiering process progresses, more accurate system description information will be used in the environmental assessment process.

For the Hard Mobile Launcher in Random Movement basing mode, as shown in Table S-2, the proposed project will require about 1,600 operations workers (mostly military) for the 50-missile complexes and about 4,000 workers for the 200-missile complexes (Table S-1). This will result in a total operations-phase population inmigration of 3,900 and 9,800 persons for the 50 and 200-missile complexes, respectively. Peak-year construction activities will require direct employment of about 2,100 workers for the 50-missile complexes and 3,500 workers for the 200-missile complexes. Population inmigration associated with the construction phase will amount to about 4,400 persons for the 50-missile complexes and 10,400 persons for the 200-missile complexes.

The Hard Mobile Launcher at Minuteman Facilities basing mode will require 2,900 and 3,300 operations workers (mostly military) for the 170-missile and 200-missile options, respectively. Corresponding population inmigration will be 7,200 and 8,100 persons, respectively. Peak-year construction activities will result in the direct employment of 3,200 workers and an inmigration of 7,800 persons for the 170-missile option, and 3,600 workers and 8,800 inmigrants for the 200-missile option.

For the Hard Silo in Patterned Array basing mode, the proposed project will require approximately 1,800 workers (mostly military) for the operations phase. This will result in a population inmigration of about 4,400 persons. Peak-year construction activities will require 5,400 workers. However, population inmigration associated with the direct and indirect construction-phase workers will range from 8,200 to 11,500 persons. The number of construction workers needed to fill project-related jobs will depend on the availability of local workers in the various project locations.

Table S-2

DIRECT EMPLOYMENT AND POPULATION INMIGRATION

Basing Mode	Construction Phase (Peak Year)	Operations Phase (Representative Year)
Hard Mobile Launcher in Random Movement		
50 Missiles		
Direct Employment	2,140	1,570
Population Inmigration	4,500	3,900
200 Missiles		
Direct Employment	3,480	3,960
Population Inmigration	10,400	9,800
Hard Mobile Launcher at Minuteman Facilities		
170 Missiles		
Direct Employment	3,220	2,900
Population Inmigration	7,800	7,200
200 Missiles		
Direct Employment	3,650	3,290
Population Inmigration	8,800	8,200
Hard Silo in Patterned Array		
250 Missiles		
Direct Employment	5,370	1,770
Population Inmigration	8,200-11,500	4,400

Notes: Direct employment figures are rounded to the nearest 10 and population figures to the nearest 100. Population inmigration estimates vary slightly by location, with the greatest variability occurring for the Hard Silo in Patterned Array mode. The peak year for direct employment and population inmigration is not the same the Hard Mobile Launcher in Random Movement mode.

Other important resources required for all basing modes include water, aggregate, and land for facility construction and system operations. Total proposed project water and aggregate requirements are provided in Table S-3. The quantities of water required for domestic and related use by inmigrating military and civilian workers and their dependents are substantially larger than the requirements for construction water. These indirect water uses vary by deployment area as a function of the projected per capita consumption in the region. For the Hard Silo in Patterned Array basing mode, the projected number of inmigrating workers also varies by deployment area (Table S-2), further contributing to the variations in projected indirect water use.

Construction of facilities, including roads for the deployment of 50 missiles in the Hard Mobile Launcher in Random Movement basing mode, will disturb about 11 sq mi. For the deployment of 200 missiles, this figure will increase to about 35 sq mi. Approximately one-third of these areas will be permanently occupied by facilities, with the remainder temporarily disturbed during construction. In addition, about 8 square miles will be required for day-to-day operation of each HML; about 20 percent will be directly disturbed over a 20-year period. For the Hard Mobile Launcher at Minuteman Facilities basing mode, about 5 square miles will be disturbed for deployment of 170 missiles and slightly more for deployment of 200 missiles. For the Hard Silo in Patterned Array basing mode, about 31 square miles will be disturbed for deployment of 250 missiles. Approximately 28 square miles of this land will be needed for the silo arrays.

COMPARISON OF ENVIRONMENTAL CONSEQUENCES

The environmental consequences of the proposed Small ICBM program have been evaluated in terms of the potential magnitude and significance of the impacts. Magnitude is a measure of the numbers and kinds of consequences as compared to baseline conditions in the alternative areas. It is defined by the level of impact, which can be negligible, low, moderate, or high. Significance requires consideration of both the context and the intensity of impacts. Context and intensity are both defined in the Council on Environmental Quality regulations. Context includes consideration of whether the scope of an impact is local, regional, or national, and whether its duration is short or long term. The primary scope of this document is regional, with regions defined as counties or multiple county areas, watersheds, airsheds, or physical basins. However, when environmental impacts of local or national significance were identified in the analysis, they have been included in the discussion. Intensity, as defined in the regulations, "refers to the severity of an impact," which includes consideration of its magnitude.

The level of impact and significance of short and long-term effects were evaluated separately. Short-term impacts are transient effects of the proposed project that are of short duration and generally caused by construction activities or operations start-up. Long-term impacts will occur or persist over an extended period of time, whether they start during the construction or operations phases. Most impacts from the operations phase are expected to be long term since project operations essentially represent a "steady-state" condition where impacts result from actions that occur repeatedly over a long period of time. However, long-term impacts can also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of a disturbed resource is slow.

Table S-3

TOTAL PROJECT WATER AND AGGREGATE REQUIREMENTS

	CONSTRUCTION PHASE (1990-1996)				OPERATIONS PHASE
	Water (acre-ft)			Aggregate	Annual Water[2]
Basing Mode	Direct[1]	Indirect[2]	Total	(thousand tons)	(acre-ft/yr)
Hard Mobile Launcher in Random Movement 50 Missiles	1,120	4,660-4,690	5,780-5,810	8,890	690-730
Hard Mobile Launcher in Random Movement 200 Missiles	3,860	9,130-12,090	12,990-15,950	28,890	2,020-2,300
Hard Mobile Launcher at Minuteman Facilities 170 Missiles	600	3,440-6,100	4,040-6,700	3,940	800-1,400
Hard Mobile Launcher at Minuteman Facilities 200 Missiles	1,000	4,910-7,270	5,910-8,270	4,560	1,120-1,760
Hard Silo in Patterned Array[3] 250 Missiles	1,080	9,020-15,120	10,100-16,200	3,460	760-1,040

Notes: [1]Includes water for actual project construction, dust control, and revegetation.

[2]Includes the domestic and related water use by inmigrating military and civilian workers and their dependents.

[3]The construction phase for this mode extends into 1997.

All figures are rounded to the nearest 10; 1 acre-foot ≈ approximately 0.33 million gallons.

The environmental issues considered in the LEIS are grouped into 9 resource categories, with a total of 28 subcategories (the resource elements). The level of impact and significance for both short and long-term effects were evaluated for each of the 28 elements and are presented in Figures S-2 and S-3. Both beneficial and adverse impacts are identified in these figures. Adverse impacts are shown by the various sized circles, which are darkened when the impacts are expected to have regional or national significance. The level of impact is indicated by the size of the circles. Beneficial impacts are identified by shading.

Beneficial impacts are expected to occur to socioeconomics, transportation, and cultural and paleontological resources. Small ICBM deployment will create beneficial economic activity, regardless of the basing mode or region selected. Many of the workers hired for the proposed project are expected to be local residents. Almost all of the indirect jobs, created as a result of local expenditures of worker payrolls and from purchases of project-related material requirements, will be filled by local residents. With the inmigration of some construction and operations-phase workers and their dependents, the local housing market will expand, with associated increases in income to property owners. Local governments will experience increased revenues from income spent in the area and from improvements in the housing market. Although local expenditures (to meet increased public service demands) will also grow, some areas will experience revenue increases greater than expenditure growth.

If the Hard Mobile Launcher at Minuteman Facilities basing mode is selected, improvements to road systems and bridges will be required to accommodate HML movements. Because of these improvements, the civilians traveling on these roads will gain long-term benefits.

For any basing mode or location selected, some long-term, beneficial impacts to prehistoric cultural resources will occur. These include expansion of the data base and protection of some sites by fencing or other means. Some areas that are presently open to the public may be fenced, thereby protecting sensitive areas.

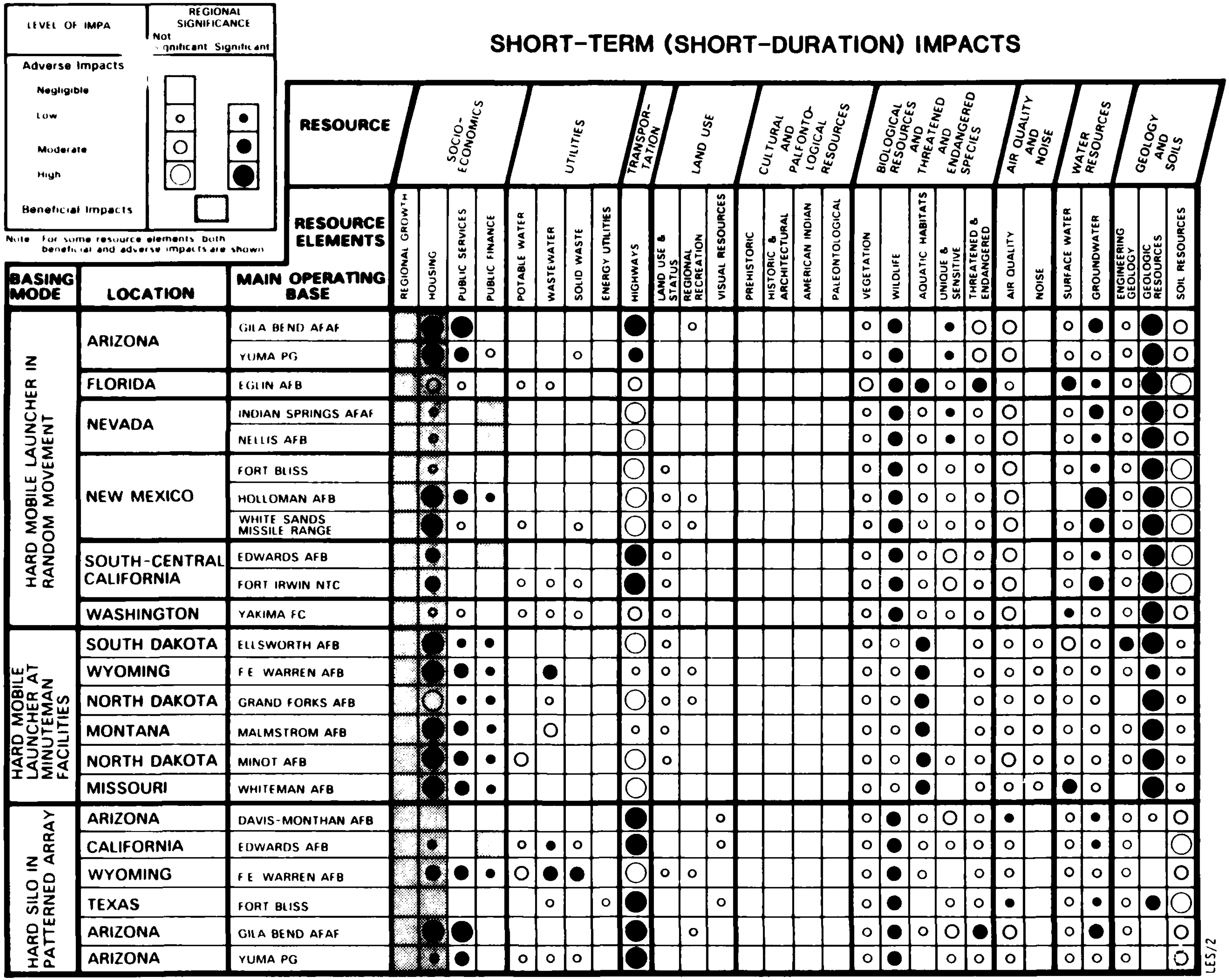
Impacts of regional significance resulting from Small ICBM deployment in each of the three basing modes at all of the alternative locations are discussed in the following paragraphs.

Hard Mobile Launcher in Random Movement

Regardless of the area selected, deployment of the Small ICBM in this basing mode will cause land surface disturbance to biological, soil, and cultural resources. The inmigrating population will cause socioeconomic impacts, as well as increased traffic flows in many areas under consideration. Other environmental consequences include impacts to geologic resources resulting from proposed project demands for aggregate, impacts to water resources and air quality, and potential land use conflicts.

Off-road HML operations are expected to result in long-term disturbance of soils, vegetation, and wildlife habitats. The size of the areas to be disturbed also increases the likelihood of adverse impacts to threatened and endangered species, aquatic habitats, and unique and sensitive habitats.

SHORT-TERM (SHORT-DURATION) IMPACTS



NOTE: ALL CULTURAL AND PALEONTOLOGICAL RESOURCE IMPACTS ARE ASSUMED TO BE LONG TERM.

FIGURE S-2 MATRIX COMPARISON OF POTENTIAL SHORT-TERM IMPACTS

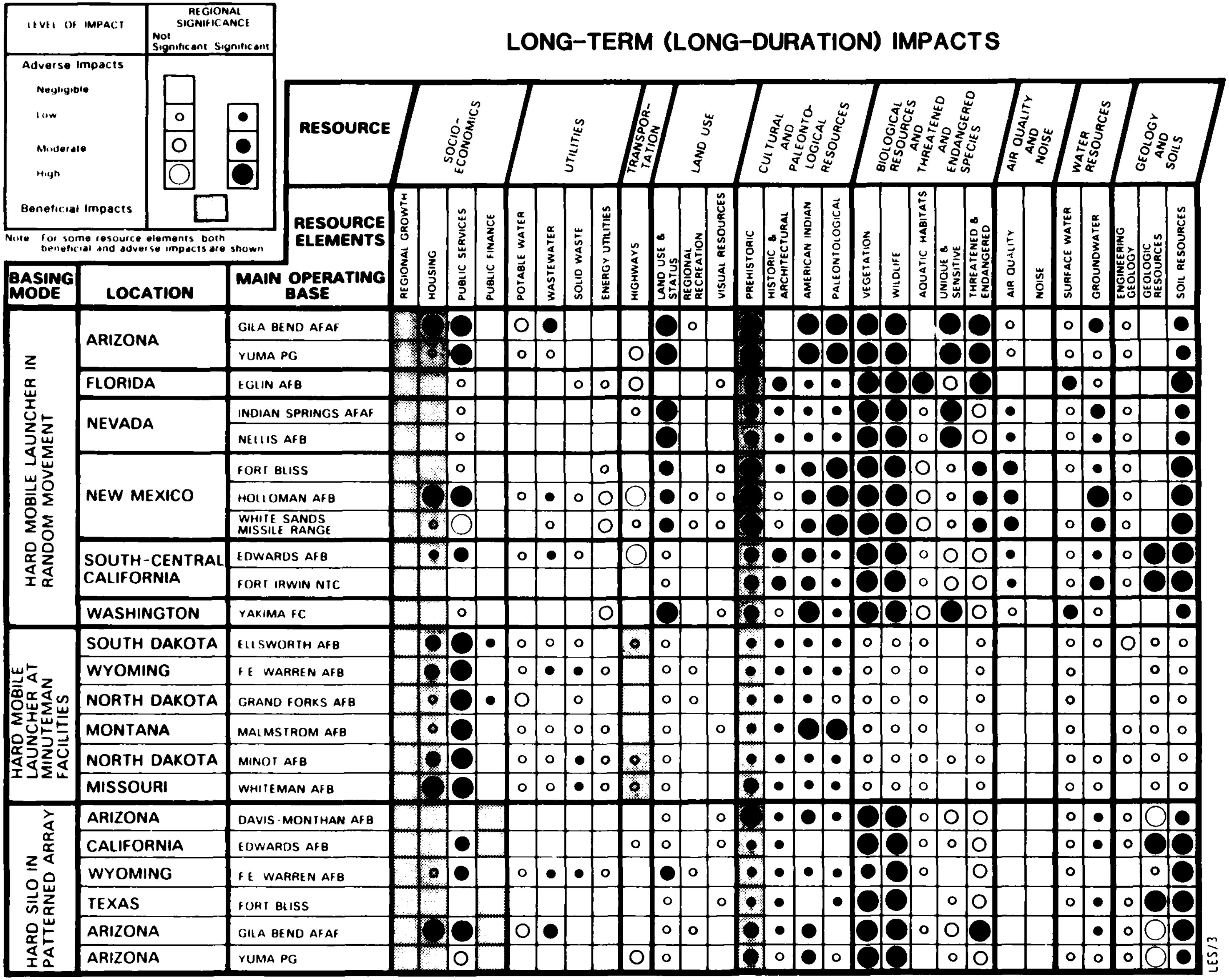


FIGURE S-3 MATRIX COMPARISON OF POTENTIAL LONG-TERM IMPACTS

Both short-duration (short-term) and long-duration (long-term) soil resources impacts can be expected. Short-term effects on soils will result from upgrading of existing roads, construction of new roads, and expansion or construction of new facilities at the MOB. These soils will be temporarily disturbed during or reclaimed after the construction phase. Long-duration effects in the operations phase will occur when the HMLs move off-road to park. This use will affect the productive capacity of the disturbed land areas and will accelerate soil erosion.

Impacts to cultural and paleontological resources will also occur as a result of surface and subsurface soil disturbance. The research potential, and therefore the value of a site, is closely related to the integrity of the stratigraphic and/or spatial associations among its artifacts and features. These resources are nonrenewable because disturbing the associations produces an irretrievable loss of information. Crushing and churning of unconsolidated soils, especially in desert areas, are likely to disturb or destroy the integrity of surface and near surface sites.

Socioeconomic consequences will include impacts to public services (including schools), public finance, and housing. For deployment of 200 missiles, approximately 1,900 additional pupils will enroll during the operations phase. Since a majority of military personnel will live onbase, school impacts will be primarily concentrated in districts that are near the MOB.

Regional impacts to transportation will occur principally from workers commuting on primary roads during peak-traffic hours. This effect is determined by the level and location of direct employment; local congestion may occur as the result of general economic stimulation and the trips generated by inmigrants. Short-term impacts experienced during the construction phase are expected to be significant in some localities. Long-term impacts will generally be negligible at most locations. The impacts to other transportation modes are expected to be negligible.

Short-term impacts to geologic resources include the effects resulting from the increase in the regional production rate of aggregate, from the development of new aggregate sources, or the depletion of regional aggregate supplies.

Project-related operations water use per missile will be greatest for this basing mode. Operations-phase water requirements for the 200-missile options will be approximately 2,000 acre-feet per year, varying by deployment area. In the arid Southwest, these water demands will cause additional stress on generally overdrafted groundwater basins.

Some air quality impacts are anticipated if a deployment area in the Southwest is selected. Traffic and construction activities will result in emissions of pollutants such as carbon monoxide, which will cause short-term impacts. Long-term degradation of visibility may occur at some areas as a result of dust generation if HML movements are frequent.

Portions of the areas available for random movement on the Arizona, Nevada, New Mexico, and Washington complexes overlap lands such as wildlife refuges, which are owned or managed by agencies other than the DOD or DOE. Use of these lands for HML operations may require modification of the existing co-use

agreements between the DOD or DOE and other federal and state agencies. In addition, several of these lands are under consideration for designation as wilderness areas.

In addition to these general environmental consequences common to all alternative basing locations, the potential impacts of particular concern to each of the Hard Mobile Launcher in Random Movement basing mode complexes are discussed in the following paragraphs.

Arizona Complex

The Arizona Complex consists of Luke AFR and Yuma Proving Ground (PG) as the deployment installations, with either Gila Bend Air Force Auxiliary Field (AFAF) or Yuma PG as the MOB. Areas of particular environmental concern for the Arizona Complex include land use conflicts, encroachment on the habitat of a threatened and endangered species, water requirements, housing and school shortages, wastewater treatment facilities requirements, disturbance of prehistoric cultural resources, American Indian concerns, and highway congestion.

A major portion of the Cabeza Prieta National Wildlife Refuge is located within Luke AFR. The existing co-use agreement with the U.S. Fish and Wildlife Service permits only the use of the air space above the wildlife refuge. Operation of the HMLs in this area would require modification of this agreement. In addition, a large area within the wildlife refuge is under consideration for designation as a wilderness area. Use of such an area for random movement could affect its wilderness characteristics.

Almost all of the United States population of the federally endangered Sonoran pronghorn occurs on Cabeza Prieta National Wildlife Refuge. The United States population of this species is approximately 85 to 90 animals. The remainder of the worldwide population (200 to 300 animals) occurs in Mexico. The overlap between the areas under consideration for random movement and prime pronghorn habitat is extensive. The proposed project may create a substantial threat to the continued occurrence of this species in the United States.

With Gila Bend AFAF as the MOB, an estimated 15,950 acre-feet of groundwater will be withdrawn from the severely overdrafted Gila Bend groundwater basin during the construction phase. During the operations phase, 2,300 acre-feet per year would be withdrawn. Although project-induced pumpage will represent a relatively small increase over the baseline conditions (approximately 1%), both short and long-term impacts to groundwater are considered significant because of the critical availability of water in the area. If Yuma PG is selected as the MOB, the impacts to water resources are not expected to be significant, since there is a relative abundance of water in the Lower Colorado groundwater basin, which supplies Yuma PG.

If Gila Bend AFAF is selected as the MOB, there will be a shortage of both housing and public services. By the peak-construction year (1990), almost 1,600 housing units will be needed by workers inmigrating into Maricopa County. Total vacancies are estimated to be approximately 250 units in the Gila Bend area. In addition, only limited public services are available in or near Gila Bend. Projected baseline enrollment in 1998 will be about

1,500 pupils, but as many as 1,900 pupils will be added during the operations phase. Housing and public services impacts will be less severe if Yuma PG is selected as the MOB.

If Gila Bend AFAF is selected as the MOB, wastewater flows are projected to increase by 47 percent in Gila Bend during the operations phase. New facilities will be required to handle the increased flows. If Yuma PG is selected as the MOB, impacts to regional wastewater facilities are not expected to be significant.

A variety of American Indian groups have historic connections to the region, and five reservations are located in the vicinity: Fort Yuma, Maricopa, Tohono O'odham (formerly Papago), Cocopa, and Colorado River. Potential sacred or traditional use areas have been identified in the region, including Tyson Wash and La Posa Plain. The Tohono O'odham, Maricopa, and Colorado River groups have expressed concerns regarding projects affecting areas important to them. Previous archaeological investigations in the region indicated average site densities to be 25 per square miles. Above-average densities occur on alluvial/colluvial fans, a landform zone that comprises about 65 percent of the area available for random movement on both deployment installations. Sites are especially vulnerable to disturbance because of the desert pavement soils characteristic of the region.

The proposed project has the potential for generating significant impacts to Arizona State Highway 85, a north-south, two-lane primary road joining Interstates 8 and 10 west of Phoenix. This roadway is heavily used by both passenger cars and heavy vehicles, and there are no convenient alternative routes.

Florida Complex

The Florida Complex consists of Eglin Air Force Base (AFB). The environmental issues of particular concern at this complex include impacts to wetlands, the disturbance of threatened and endangered species, and possible conflicts with future oil and gas leases onbase.

Streams, creeks, marshes, and estuarine bays with high quality water are abundant in and adjacent to the Random Movement Area. Construction and off-road HML operations have the potential to adversely affect aquatic habitats (including protected wetlands), surface water quality, and important shellfish production areas. Land disturbance and heavy rainfall may result in excessive sedimentation that could degrade the high quality of numerous local streams and prime shellfish areas of the adjacent Choctawhatchee Bay.

Ninety percent of the range of the federally endangered Okaloosa darter is on Eglin AFB. This fish occurs in streams throughout the area identified for random movement of HMLs, and it could be adversely affected during road construction and HML operations. Approximately 20 colonies of the federally endangered red cockaded woodpecker occur on Eglin AFB, though this species also occurs in scattered locations throughout the Southeast. The federally threatened eastern indigo snake can be found onbase, and elsewhere in Florida and Georgia. Because of siltation or other secondary effects, the proposed project could create a threat to the continued occurrence of the Okaloosa darter. Direct habitat disturbance could similarly affect the other species.

Oil and gas exploration activity and oil and gas production adjacent to the base suggest that the potential for onbase oil and gas leasing is high. Conflicts with future development of these resources may occur.

Nevada Complex

The Nevada Complex consists of Nellis AFR and the Nevada Test Site, the deployment installations, with the MOB at either Indian Springs AFAF or Nellis AFB. Areas of particular environmental concern include land use conflicts, water shortages, and possible degradation of air quality.

Nellis AFR contains portions of the Desert National Wildlife Range and the Nevada Wild Horse Range. Use of these areas for HML operations would be inconsistent with the provisions of the co-use agreements with the Department of the Interior. In addition, a large area within the Desert National Wildlife Range is under consideration for designation as a wilderness area. Use of those portions of the wildlife range under consideration, which coincide with areas designated for random movement of HMLs, could affect the wilderness characteristics of these areas. The area available for random movement also includes portions of the Yucca Mountain site, an area proposed for a high-level radioactive waste repository by the DOE.

During the construction phase, a total of 15,820 acre-feet of water will be required, of which 4,520 acre-ft of groundwater may be withdrawn from Indian Springs Valley and/or Las Vegas Valley groundwater basins, which are already overdrafted and under state control. These withdrawals represent approximately 200 and 2-percent increases over baseline conditions in the respective basins; both have been developed by the state as special groundwater management areas. Because of the intensive competition for groundwater, these impacts could be significant.

Las Vegas Valley is in nonattainment status for carbon monoxide. Project-related traffic to and from Nellis AFB and Indian Springs AFAF will pass through Las Vegas and Las Vegas Valley. Emissions from this traffic, in conjunction with dust generated from HML operations, could cause long-term, low, but significant impacts to regional air quality.

New Mexico Complex

The New Mexico Complex consists of Holloman AFB, Fort Bliss, and White Sands Missile Range, any of which could be selected as the MOB. Key environmental concerns include water shortages, land use conflicts, disturbance of threatened and endangered species, socioeconomic impacts, wastewater treatment facilities requirements, disturbance of cultural resources, and degradation of air quality.

Of the 13,000 to 14,200 acre-feet of groundwater required during the construction phase (depending upon the selected MOB), approximately 8,300 to 11,800 acre-feet will be withdrawn from the Tularosa and/or Hueco Bolson groundwater basins. Both are severely overdrafted, particularly the Tularosa Basin, which encompasses Holloman AFB and White Sands Missile Range. This will represent a significant impact to the water resources of the region.

Portions of the Jornada Experimental Range, San Andres National Wildlife Refuge, and Lincoln National Forest are within the installation boundaries of the New Mexico Complex. Operation of HMLs on these lands may be inconsistent with the provisions of the co-use agreements between the DOD and the U.S. Department of Agriculture and the Department of the Interior. In addition, a large portion of Fort Bliss is outleased by the Bureau of Land Management for livestock grazing. Use of these lands for HML operations could require modification of the existing grazing leases.

Federally endangered peregrine falcons occur and are considered likely to nest on both Fort Bliss and White Sands Missile Range. Portions of critical habitat designated for Todsen's pennyroyal, a federally endangered plant, lie in areas identified for random movement of HMLs. Kuenzler hedgehog cactus, Sneed pincushion cactus (both federally endangered), and numerous federal-candidate and state-protected species may also occur in the areas available for random movement. The proposed project may create a threat to the continued occurrence of one or more of these species in the area.

Socioeconomic consequences will vary substantially with the MOB selected. The greatest socioeconomic impacts are expected if Holloman AFB is selected as the MOB. Housing needs in the vicinity of Holloman AFB will exceed available vacancies required during the first year of construction. Small governmental units around the support community of Alamogordo will not be able to absorb the added demand for services without major disruptions. By 1996, county school enrollments will increase by 12 percent over baseline. Locating the MOB at Fort Bliss (El Paso County) will have the least socioeconomic impacts in the New Mexico Complex, with the White Sands Missile Range Headquarters location experiencing impacts between those at Fort Bliss and Holloman AFB.

If Holloman AFB is selected as the MOB, the wastewater treatment facilities in Otero County will lack the capacity necessary to process projected flows. Long-term impacts to wastewater systems are expected to be low but significant if this MOB is selected.

Known densities of cultural resource sites in the Tularosa Basin average about 17 per square miles. Up to 100,000 sites have been predicted for the New Mexico Complex. Most of the large and more important sites occur in alluvial fan zones, which comprise about 55 percent of the proposed Random Movement Areas. Rare Ice-Age fossils of large game animals and their footprints are known to occur around Lake Lucero (White Sands Missile Range). The fragile soils in the area are susceptible to damage by off-road vehicles. A high level of public concern has been expressed over damage to cultural resources.

The HML operations may cause elevated dust levels, resulting in degradation of long-range visibility in two federally protected wilderness areas. Elevated carbon monoxide levels may also occur in El Paso if Fort Bliss is selected as the MOB. Long-term impacts to air quality are expected to be moderate and significant.

South-Central California Complex

The South-Central California Complex consists of Edwards AFB, Fort Irwin National Training Center (NTC) (either could serve as the MOB), China Lake NWC, and Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC).

Areas of particular environmental concern include socioeconomic effects, lack of wastewater treatment capacity, groundwater depletion, disturbance of cultural resources, air quality degradation, conflicts with geothermal resource development, and highway congestion.

If Edwards AFB is selected as the MOB, most school children living onbase will attend schools in Kern County during the operations phase. By 1996, the proposed project will add about 1,100 pupils to an existing enrollment of 8,000. If Fort Irwin NTC is selected as the MOB, impacts to public services are not expected to be significant.

Wastewater treatment facilities serving the desert portions of Los Angeles County will lack the necessary capacity to process additional flows. A shortage of treatment capacity of 3.7 million gallons per day is forecast for 1996 and 5.4 million gallons a day for the year 2000.

Water required by the proposed project will be withdrawn from Antelope Valley and/or Bicycle-Langford-Coyote Lake groundwater basins, which are heavily overdrafted, particularly the Bicycle-Langford-Coyote Lake basin used by Fort Irwin NTC. Impacts to groundwater resources are expected to be significant.

Several sites identified as National Historic Landmarks and/or listed in the National Register of Historic Places are known to exist within the complex. These include Coso Hot Springs, 44Ker322, Bitter Springs, Big Petroglyph Canyon, Little Petroglyph Canyon, and Rogers Dry Lake. Professional archaeologists have expressed concern over projects in this area.

Long-term regional air quality impacts and decreasing visibility are expected to result from population increases accompanying proposed project implementation in the Mojave Desert area. Operation of HMLs will generate dust which could cause some degradation of regional visibility. Long-term impacts are expected to be low but significant.

The Coso Known Geothermal Resource Area is located in a part of China Lake NWC where HML operations could occur. Potential long-term impacts to exploration and development activities may be significant.

The proposed project has the potential for generating short-term, high, and significant impacts to California State Highway 14 if Edwards AFB is selected as the MOB, and to U.S. 395 between Interstate 15 and State Highway 14 if Fort Irwin NTC is selected as the MOB. Both routes are heavily used by passenger cars and heavy vehicles, and are major north-south travel, recreation, and commercial routes in the region.

Washington Complex

The Washington Complex consists of the DOE Hanford Site, a deployment installation, and Yakima Firing Center (FC), which would serve as both the MOB and as a deployment installation. Potential land use conflicts, surface water quality degradation, and American Indian concerns are likely to be particular environmental concerns if this complex is selected.

Portions of the Saddle Mountain National Wildlife Refuge and Wahluke Slope State Wildlife Recreation Area coincide with areas identified for random

movement of HMLs on the DOE Hanford Site. Use of the Saddle Mountain National Wildlife Refuge for HML operations would be inconsistent with provisions of the co-use agreement between the DOE and the U.S. Fish and Wildlife Service, which preclude off-road vehicle movements. Use of these lands for HML operations would require cancellation or modification of the existing agreement. The area available for random movement also includes a portion of the site under consideration by the DOE for a high-level radioactive waste repository.

Land disturbance associated with proposed project construction and operations will occur within the immediate vicinity of a 50-mile stretch of the Columbia River and a 15-mile stretch of the Yakima River. There is the substantial potential for degradation of the quality of these two important rivers.

Portions of the eastern edge of the area available for random movement at Yakima FC are used for a number of traditional activities by the Wanapum, who reside at Priest Rapids Dam. Sacred and traditional use areas, including a cemetery important to the Wanapum and the Yakima Indians, are known to exist on Yakima FC. Significant impacts to American Indian resources could occur.

Hard Mobile Launcher at Minuteman Facilities

Socioeconomic impacts, requirements for coarse and fine aggregate, disturbance of cultural resources, and short-term impacts to aquatic habitats are primary concerns at all Minuteman locations.

The six Minuteman bases are located primarily in rural areas that are experiencing low growth rates. Construction peaks may create economic fluctuations in slow growth areas. The proposed project will also stimulate some housing markets, resulting in beneficial effects. Therefore, depending on location, both beneficial effects and adverse significant impacts to housing are expected. Impacts to public services are expected to be largely adverse and significant. In all areas, local revenues will probably not be adequate to meet increased expenditures during the construction phase (short term), raising public finance concerns.

Short-term impacts to geologic resources include the effects that may result from the increase in the regional production rate of aggregate, from the development of new aggregate sources, or the depletion of the regional supply. Many of the MOBs are located in areas where the regional supply of aggregate is small compared to proposed project requirements.

Ground disturbance associated with road and bridge modification in the deployment area and facilities construction at the MOB may adversely affect cultural and/or paleontological resources at all locations. A relatively small portion of a deployment area will be affected. However, because the Regions of Influence are not well known archaeologically, it is likely that some affected sites will contain new scientific information. Therefore, the impacts could be significant. Some beneficial effects may result from preconstruction surveys in areas that have not been extensively studied.

Replacement of a large number of bridges or culverts in the deployment area will cause short-term, significant impacts to wetlands and aquatic habitats. Some short-term degradation of surface water quality due to soil erosion may also occur as a result of these activities.

In addition to these general environmental consequences common to all areas, the potential impacts of particular concern to each of the areas under consideration for the Hard Mobile Launcher at Minuteman Facilities basing mode are discussed in the following paragraphs.

Ellsworth Air Force Base

If Ellsworth AFB is selected, particular areas of environmental concern are socioeconomics and engineering geology.

Housing needs of the proposed project will exceed available vacant housing in the first year of construction. Existing public service levels, which are currently well below the state average, will decline further because of the added project population. County school systems may find it difficult to absorb peak construction-phase school enrollment of about 1,500 pupils (7.5% above baseline peak levels). This added enrollment will decline only slightly to about 1,400 pupils during the operations phase. Local revenues will not be sufficient to meet increased expenditures, leading to short and long-term, significant public finance impacts. Local housing, school, and public finance systems will also be required to absorb the socioeconomic effects of future missions at Ellsworth AFB, which include the B-1B bomber mission.

The bedrock geology (shale) and soils in the area suggest that mitigation of slope stability problems will be more difficult and the need more widespread than for many of the other Minuteman bases. Therefore, the potential for increases in the rate of mass movement and soil erosion is greater in the vicinity of Ellsworth AFB than other Minuteman bases. Impacts to engineering geology have consequently been rated as potentially significant.

F.E. Warren Air Force Base

If F.E. Warren AFB is selected, areas of special environmental concern will include housing, public services, wastewater treatment, and solid waste disposal.

Shortages of housing and public services could occur. Almost all of available housing will be needed by the proposed project. About 400 additional public service employees will be required during the peak year, 9 percent over baseline levels. By 1996, an addition of 1,600 students will increase enrollments by 8 percent over baseline.

The project-induced demands for wastewater treatment in Laramie County represent 11 and 10-percent increases over the projected baseline for 1996 and the year 2000, respectively. Capacity of the systems will be exceeded by 1.6 million gallons per day in 1996 and 2.4 million gallons per day in the year 2000. Short and long-term impacts to wastewater treatment are expected to be significant.

Solid waste disposal requirements will cause increases of 10 percent in 1996 and 8 percent during the operations phase over baseline conditions. These increases, along with the shortage of disposal space projected for 1990, will result in long-term, low, and significant impacts.

Grand Forks Air Force Base

If Grand Forks AFB is selected, socioeconomic factors will be of special concern. An addition of about 180 public service employees will be required during the peak-constructior - .r, 9 percent over baseline levels. By 1996, school enrollment will inc. case by about 11 percent. Local revenues will be inadequate to meet projec.-induced expenditures, leading to short and long-term, significant impacts :o public services.

Malmstrom Air Force Base

If Malmstrom AFB is selected, areas of particular concern will be possible conflicts with American Indians, disturbance of paleontological resources, and housing and public service issues.

The land in the vicinity of Malmstrom AFB has been used by a variety of Plains Indian groups including the Blackfeet, whose reservation adjoins the deployment area. Several types of sacred sites can be expected to occur in the area. The history of American Indian concerns about impacts in the area was recently exemplified by the Kutenai tribes' adverse reactions to the Northern Lights project. Several important paleontological localities, which contain fossils ranging from dinosaur eggs and nests to early primates and horses, have been identified in the vicinity of Malmstrom AFB. The presence of such known resources indicates that similar resources could occur in the direct project impact areas.

Shortages of housing and public services could occur during the construction phase. Nearly 60 percent of the available housing will be needed during the peak-construction year. By 1996, a demand for 260 additional public service employees will be created, 9 percent over baseline levels. During the operations phase, school enrollments will increase by 1,600 students, 10 percent over the baseline enrollments.

Minot Air Force Base

If Minot AFB is selected, particular areas of concern will be short and long-term housing and public services shortages, and problems associated with solid waste disposal.

Considerable housing and school shortages will occur during the first construction year and thereafter. During the operations phase, 1,100 housing units, approximately 110 percent of the available vacancies, will be needed. An additional 1,400 students will be enrolled in county schools, representing an increase of 10.3 percent over the baseline enrollments in 1998.

The project-induced demands for solid waste disposal in Ward County represent 10 and 5-percent increases over the projected baseline for 1990 and the year 2000, respectively. Capacity of the 80-acre landfill site serving the majority of the county will be exhausted in 1996, requiring a new facility.

Whiteman Air Force Base

If Whiteman AFB is selected, areas of concern will include possible disturbance of prehistoric and historic cultural resources, shortages of housing

and public services, solid waste disposal, and short-term surface water quality impacts resulting from bridge construction.

Previous research has identified high cultural resource site densities (34 per square miles) along major drainages. The Mellor Village and Mounds Archaeological District, listed in the National Register of Historic Places, occurs within the Region of Influence. Historic American Indian villages and trails have been identified in nearby Saline and Vernon counties. Impacts to prehistoric and historic cultural resources could be significant.

Considerable housing shortages will occur during the initial construction year. By 1996, over 200 additional public service workers (17% above baseline levels) will be needed. Beginning in 1996, about 1,400 pupils (nearly 20% above baseline levels) will be added by the proposed project.

The project-induced demands for solid waste disposal in Johnson and Pettis counties represent approximately 10 and 9-percent increases over the projected baseline for 1996 and the year 2000, respectively. The capacity of the three landfill sites servicing the area is estimated to be available for 5 to 10 years. Additional sites will need to be developed in 1990 as existing sites begin to close.

The density of perennial streams in the vicinity of Whiteman AFB is high. When combined with the relatively high rainfall of the region, it is possible that bridge and road upgrades required for the proposed project will cause a short-term, significant degradation of surface water quality.

Hard Silo in Patterned Array

Regardless of which area is selected, deployment of 250 missiles in any one area will cause long-term disturbances to approximately 28 square miles (18,000 acres) of public or private land. Disturbance of such an area will have a wide range of environmental consequences. Also, the inmigrating population and water requirements will cause socioeconomic and other impacts.

Construction and operation of facilities in the deployment area are expected to result in long-term disturbance of vegetation and wildlife habitats, soils, and cultural resources. Because of the size of the disturbed area, the potential exists for adverse impacts to threatened and endangered species, aquatic habitats, and unique and sensitive habitats. Long-term disturbance will also accelerate soil erosion and affect the productive capacity of the soil. In turn, soil disturbance will alter or destroy the integrity of archaeological sites.

Offbase lands currently used for agricultural purposes may be required by the proposed project. These lands include public (Bureau of Land Management) and private grazing lands, and lands classified as prime farmlands. Use of these lands for the proposed project will result in the long-term loss of these areas for agricultural uses.

Corridors for transmission lines and pipelines either exist or are planned in some areas identified as suitable for silo construction. Depending on the location, conflicts may occur with other future planning activities in the areas available for deployment.

If this basing mode is selected, between 8,200 and 11,500 inmigrants are expected in the peak year (1994) depending on the project area. This inmigration will result in a peak-year school enrollment of up to 1,900 pupils and a housing requirement of about 2,800 units. In the less urban areas, this will strain the existing school capacities and housing market.

Regional impacts to transportation will occur as a result of workers commuting on primary roads during peak-traffic hours. The potential for short-term, significant impacts is particularly great for this alternative because of the substantial volumes of multiyear commuting traffic to the deployment area. Reductions in impact levels may be possible in some locations through deployment-area selection, which determines the access roads that will be affected. Because of its location within a community with many alternative routes, short-term impacts at one location, F.E. Warren AFB, are not expected to be significant at a regional level. However, short-term, significant impacts to transportation can be expected at all other alternative areas.

The construction-phase water use will be greatest for this basing mode. When the domestic water needs of the project inmigrants are included, total water use over the construction phase is projected to range from 10,100 acre-feet if Davis-Monthan AFB is selected, to 16,200 acre-feet if Gila Bend AFAF is selected. At most of the alternative locations, the water will be drawn from groundwater basins that are already greatly overdrafted. Impacts to water resources could be significant at these locations.

In addition to these general environmental consequences common to all areas, potential impacts particular to each of the areas under consideration for the Hard Silo in Patterned Array basing mode are discussed in the following paragraphs.

Davis-Monthan Air Force Base

If Davis-Monthan AFB is selected as the MOB for Hard Silo in Patterned Array deployment, cultural and water resources are likely to be important concerns.

Portions of the Tohono O'odham Nation (formerly Papago) and San Xavier Indian Reservation are within the region, and at least one sacred peak, Baboquivari, is located in the general project area. The existence of other sacred areas within the region is likely, and the Tohono O'odham have expressed concern over other projects in this region. Site densities of cultural resources average only about 5 per square miles, but typically, sites tend to be large and complex enough that 80 percent of any given land section falls within a site. A large proportion of sites will be eligible for the National Register of Historic Places, and avoidance through alternative siting may be difficult.

Most of the project-related water use will be drawn from the heavily overdrafted Upper Santa Cruz groundwater basin. This basin is federally recognized as a sole-source aquifer supplying the city of Tucson. It is also part of the state-designated Tucson Active Management Area, which is slated for drastic reduction of groundwater use over the next several decades. The level of impact to groundwater resources in the Tucson area is expected to be low but significant to the region.

Edwards Air Force Base

Potentially significant impacts to schools and other public services, wastewater treatment facilities, groundwater resources, and geologic resources are likely to be particular environmental concerns if Edwards AFB is selected as the MOB.

During the operations phase, onbase pupils will attend schools in Kern County. The proposed project will add 500 pupils to the 8,000 students currently enrolled in the school district serving the base. These long-term impacts to schools may be significant.

Wastewater treatment facilities serving the desert portion of Los Angeles County will lack the necessary capacity to process additional flows. The proposed project will contribute about 0.5 million gallons per day to a shortage of capacity of 3 million gallons per day forecast for 1994 and 5 million gallons per day in the year 2000.

Proposed project water requirements will be met by withdrawals from the heavily overdrafted Antelope Valley groundwater basin. During the peak-construction year, proposed project requirements will represent only 0.5 percent of the current average annual withdrawal. Therefore, the level of impact has been rated as low. However, due to the critical needs for water in the area, this impact is expected to be significant at the regional level

Impacts to geologic resources in the region could be significant since some of the Suitable Deployment Area is located in regions of active borate and aggregate mining.

F.E. Warren Air Force Base

If F.E. Warren AFB is selected as the MOB, special environmental concerns include land use conflicts, wastewater treatment and solid waste disposal, shortages of housing and public services, and possible disturbance of historic sites.

Use of approximately 28 square miles of offbase lands for the proposed project will potentially disrupt existing agricultural practices and transportation routing. The impact to existing land use is expected to be significant.

By 1994, the wastewater systems in Laramie County are projected to reach capacity. The project-induced demands for wastewater treatment will result in projected capacity shortages of approximately 1.4 million gallons per day. By the year 2000, other wastewater treatment requirements will cause this figure to increase to 1.8 million gallons per day. These shortages will create a short and long-term, significant impact at the regional level. Solid waste disposal requirements will increase by 12 percent in 1994 and by 5 percent during the operations phase. These increases, along with the existing shortages of disposal space projected for 1990, will result in a significant impact.

Considerable housing shortages will occur between 1992 and 1996. About 400 additional public service workers (10% above baseline levels) will be required in the peak-construction year. During the operations phase,

200 additional workers will be needed. The proposed project will create an increase in school enrollment of about 1,900 pupils by 1994 (10.7% over baseline). By 1998, this figure will decline to 800 pupils (4.5% over baseline enrollments).

Known cultural resources in the region include more than 150 historic sites, including a National Register of Historic Places district at F.E. Warren AFB, which contains Fort D.A. Russell and Cheyenne Depot. The level of impact is expected to be low but possibly significant.

Fort Bliss

Environmental areas of particular concern at Fort Bliss include disturbance of cultural resources, depletion of groundwater resources, and impacts to future development of geologic resources.

Cultural resource site densities average about 17 per square miles, with more than 10,000 sites already recorded on 30 percent of the MOB. Thirty-six limited-activity areas have been designated to protect some known sites, and Memoranda of Agreement are in effect for other parts of the installation. Levels of impact to prehistoric, historic, and paleontological resources are expected to be low but possibly significant.

During the construction phase, nearly 14,000 acre-feet of groundwater will be drawn from the severely overdrafted Hueco Bolson aquifer, which serves as the primary supply for the cities of El Paso and Ciudad Juarez. This represents a 1-percent increase in pumpage and is considered potentially significant given the rapid, widespread declines in water levels occurring in most of the basin.

Present oil, gas, and geothermal exploration activity and leasing in the region suggest that the potential for onbase outleasing is high. Known Geothermal Resource Areas exist in the region, and other favorable areas exist on Fort Bliss (Hueco Tanks area). In addition, the western part of the area suitable for silo deployment is encompassed by a Known Geothermal Resource Field according to New Mexico state designation, and Known Geothermal Resource Areas (Kilbourne Hole and Radium Springs) are also immediately adjacent. Impacts to future development of geologic resources in the region could be significant.

Gila Bend Air Force Auxiliary Field

Shortages of housing, schools, and wastewater treatment facilities; disturbance of cultural resources; disturbance of the habitat of the Sonoran pronghorn; and water shortages will be special concerns if Gila Bend AFAF is selected.

By the peak-construction year (1994), 2,200 housing units will be needed; however, only about 300 vacant units will be available in the Gila Bend area. In 1994, over 1,800 pupils will be added to the projected baseline enrollments of 1,400 students, an increase of about 128 percent.

Wastewater flows are projected to increase by 21 percent in Gila Bend during the operations phase. New facilities will be required to handle the increased flows.

Several American Indian groups have historic connections to the region, and five reservations are located in the vicinity: Fort Yuma, Maricopa, Tohono O'odham, Cocopa, and Colorado River. Potential sacred or traditional use areas have not been identified in the area, but they probably occur because of the proximity of several American Indian groups. The Tohono O'odham, Maricopa, and Colorado River groups have expressed concern regarding projects affecting areas important to them. Previous archaeological investigations in the region indicate average prehistoric cultural site densities of 25 per sq mi. Sites are especially sensitive to disturbance because of the desert pavement soils characteristic of the region.

Several large parcels of land among all areas suitable for deployment of Hard Silos include habitat for the only United States population of the endangered Sonoran pronghorn. The proposed project may be viewed as jeopardizing the continued occurrence of this species in the area.

Project-related water, amounting to more than 16,000 acre-feet during the construction phase, will be withdrawn from the severely overdrafted Gila Bend groundwater basin. Because of the scarcity of water in the region and the relatively low quality of the supply available to the base and its support community, the short and long-term impacts to groundwater resources are expected to be significant.

Yuma Proving Ground

The environmental concerns at Yuma PG, particularly disturbance of cultural resources and American Indian concerns, will be similar to those of Gila Bend AFAF. However, availability of water will be a less serious concern as a result of the greater abundance of groundwater in the Lower Colorado Basin, from which Yuma PG derives its water. In addition, the support community of Yuma has a surface water supply that will adequately meet project-induced needs. Some housing and school shortages will be experienced during the construction phase.

SUMMARY OF IMPACTS

The proposed project will have three general types of impacts: those related to the inmigrating population, impacts to the physical environment related to the amount and type of land area disturbed by the project, and impacts resulting from construction material requirements. Resource categories most affected by the inmigrating population include socioeconomics, utilities, and transportation. Those most affected by land disturbance include cultural and paleontological resources, biological resources and threatened and endangered species, and soils. Impacts to other resource categories are related in different measures to personnel requirements, land disturbance, and construction-material requirements of the proposed project.

Population-related impacts are a function of the personnel requirements of the proposed project and the ability of the region to absorb the inmigrating population. In general, the socioeconomic impacts at the locations under consideration for the Hard Mobile Launcher at Minuteman Facilities basing mode are expected to be greater than at most of the locations considered for the other basing modes. The Minuteman bases are generally supported by small, isolated communities, which are also expected to support most of the inmigrating

population. Impacts to utility systems vary by location and are generally greatest for the Hard Mobile Launcher at Minuteman Facilities basing mode. Short-term impacts to highway transportation are expected to be greatest for the Hard Silo in Patterned Array locations, and lowest for the Hard Mobile Launcher at Minuteman Facilities locations, where they are not expected to be significant at the regional level. No long-term, significant impacts to transportation are expected at any locations.

Land disturbance impacts depend on the amount of surface area to be disturbed and the characteristics of the resources in the disturbed area. In general, impacts to cultural and paleontological resources, biological resources and threatened and endangered species, and soils may be greatest for the Hard Mobile Launcher in Random Movement basing mode and least for the Hard Mobile Launcher at Minuteman Facilities basing mode.

The land use, air quality and noise, water resources, and geologic resources categories are affected by the inmigrating population, land disturbance, and construction material requirements. Land use impacts are expected to be greatest when onbase special status lands are required. The use of these lands may be required at most locations for the Hard Mobile Launcher in Random Movement basing mode. Land use impacts may also occur if offbase agricultural lands are required for the proposed project. Air quality impacts will be the greatest if the Hard Mobile Launcher in Random Movement basing mode is selected in any of the southwestern locations, primarily because of the dust generated from HML operations. Water resource impacts are expected to be greatest for the Hard Mobile Launcher in Random Movement basing mode and the least for the Hard Mobile Launcher at Minuteman Facilities basing mode because of scarcity or abundance of water in the respective regions. Short-term impacts to geologic resources will probably be greatest for the Hard Mobile Launcher in Random Movement basing mode because of the quantities of aggregate needed for road construction and improvements.

1.0 PROGRAM OVERVIEW

In 1984, the Congress of the United States directed the Air Force to develop a new, Small Intercontinental Ballistic Missile (ICBM) in accordance with the recommendations of a presidential commission. The commission recommended that this missile be smaller and lighter than previous ICBMs, be compatible with both mobile and fixed basing modes, and meet modern performance and survivability goals. The total force size could range from 250 to 1,000 missiles, with 500 missiles used for weapon system planning. The first 10 missiles could be in service by the early 1990s, with 500 deployed by the end of that decade.

Three Small ICBM basing concepts are feasible for initial deployment. Two concepts emphasize mobility, while the third relies principally on physical protection. Both mobile modes will use special vehicles, hardened against nuclear attack, to transport and launch the missiles. These continuously manned Hard Mobile Launchers (HMLs) will be capable of rapid on and off-road movement, making it possible for them to disperse over large areas in a short time.

The Hard Mobile Launcher in Random Movement basing mode will involve day-to-day operations of the HMLs exclusively on Department of Defense (DOD) or Department of Energy (DOE) installations (Figure 1.0-1). The HMLs will be moved as often as necessary to reduce the chance that they can be targeted individually. The vehicles may be parked in a hardened (ground-hugging) configuration for maximum resistance against attack.

The installations under consideration for siting the Hard Mobile Launcher in Random Movement are in southwestern Arizona, the western Florida Panhandle, southern Nevada, south-central New Mexico and adjacent parts of Texas, south-central California, and south-central Washington. Basing 500 missiles in this mode could require deployment in three or more of these regions.

The Hard Mobile Launcher at Minuteman Facilities basing mode will involve locating the HMLs exclusively at the existing north-central deployment areas for Minuteman missiles (Figure 1.0-2). The crews stationed with each HML will make rapid dispersal possible upon warning of an attack, providing survivability similar to that of the Random Movement mode.

All six existing Minuteman bases are under consideration for this basing mode and include (1) Ellsworth Air Force Base (AFB) near Rapid City, South Dakota; (2) F.E. Warren AFB adjacent to Cheyenne, Wyoming (with missile fields extending into southwestern Nebraska and northeastern Colorado); (3) Grand Forks AFB near Grand Forks, North Dakota; (4) Malmstrom AFB adjacent to Great Falls, Montana; (5) Minot AFB near Minot, North Dakota; and (6) Whiteman AFB adjacent to Knob Noster, Missouri. Basing 500 missiles in this mode could require deployment at three or more of these locations.

The Hard Silo in Patterned Array basing mode will use buried structures to protect the missiles. They will be similar to existing missile silos but will be more resistant to damage. These silos will be grouped in compact arrays rather than dispersed over large areas.

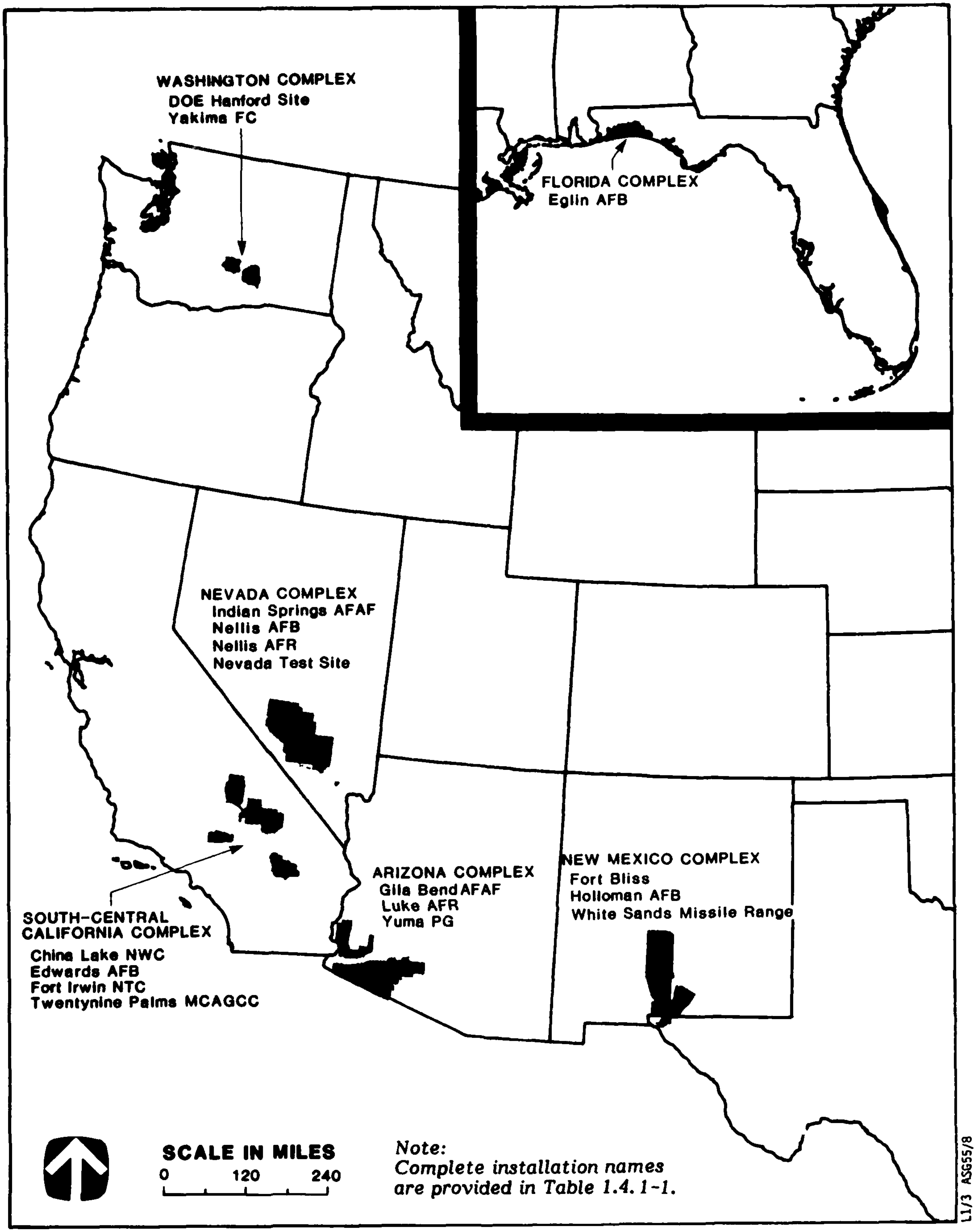


FIGURE 1.0-1 AREAS UNDER STUDY FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT

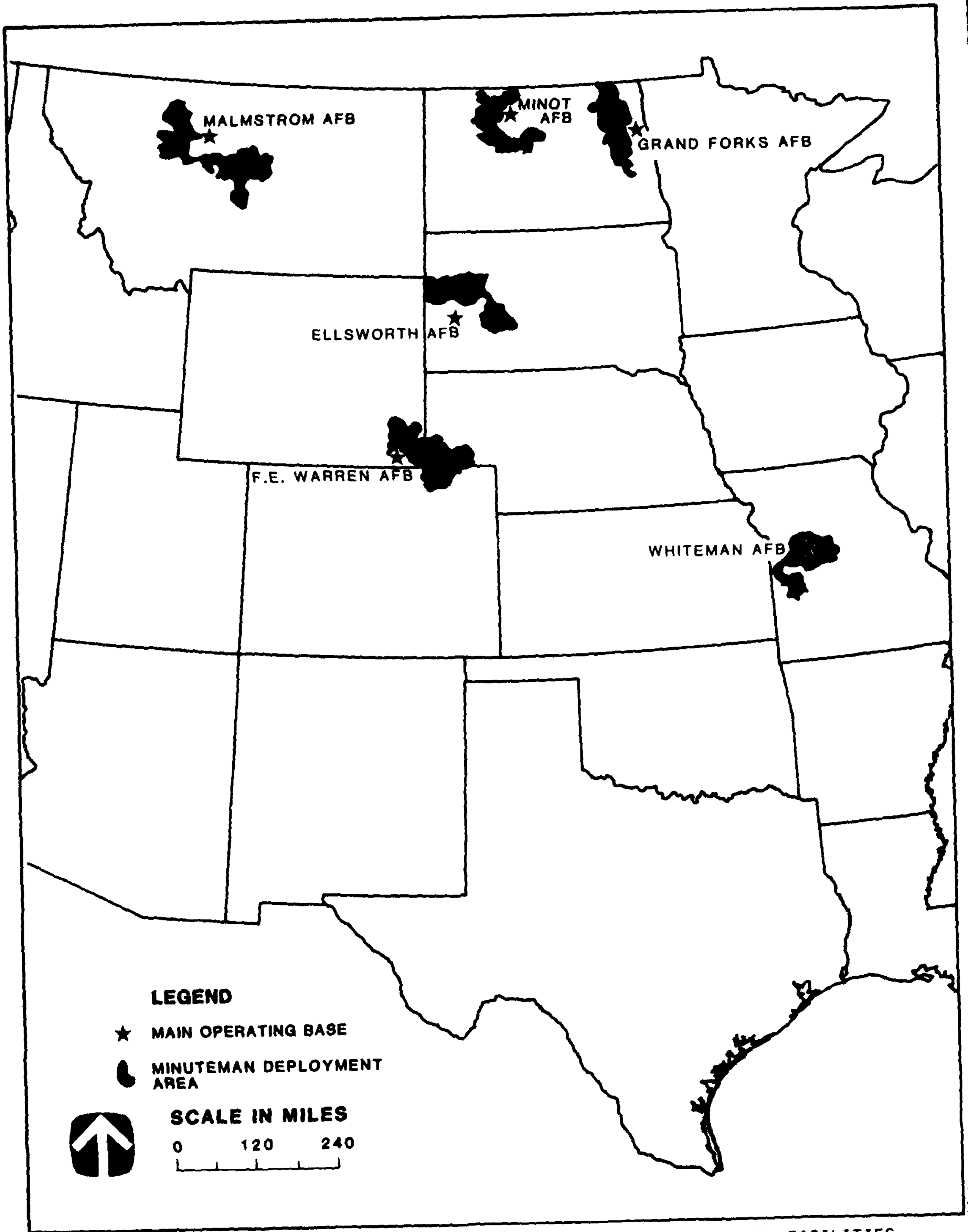


FIGURE 1.0-2 AREAS UNDER STUDY FOR HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES

The regions under consideration for the Hard Silo in Patterned Array basing mode (Figure 1.0-3) are in the vicinities of Davis-Monthan AFB near Tucson, Arizona; Edwards AFB near Palmdale in south-central California; F.E. Warren AFB near Cheyenne, Wyoming; Fort Bliss near El Paso, Texas (suitable area for silos is also present in adjacent areas of New Mexico); Gila Bend Air Force Auxiliary Field (AFAF) near Gila Bend, Arizona; and Yuma Proving Ground (PG) near Yuma, Arizona (suitable area for silos is also present in adjacent areas of California). Basing of 500 missiles in this mode could require deployment in two or more of these regions.

All three basing mode alternatives and their respective deployment areas are viable candidates for selection. Alternatively, some combination of two or all three of the basing modes may be selected. The Air Force has studied these basing modes sufficiently to establish their technical feasibility. The feasibility of developing the Small ICBM and related equipment has also been established. Once the demonstration and validation phase for the Small ICBM is completed, the program will be ready for full-scale development. During full-scale development, the system will be upgraded until it meets performance requirements and can be produced and placed into service (deployed) at an acceptable cost. Production and deployment constitute the final phase in system procurement.

This Legislative Environmental Impact Statement (LEIS) provides information for three concurrent decisions concerning the Small ICBM: (1) the selection of basing mode(s) from the alternatives previously described, (2) the selection of the areas where the system can be deployed, and (3) the decision to enter full-scale development of the missile and the associated hardware needed for the chosen basing mode(s).

1.1 Environmental Impact Analysis Process

The 1986 Defense Authorization Act directed the Air Force to prepare this LEIS for the Small ICBM. This document provides the information necessary for analysis of the potential environmental impacts of each alternative under consideration, and constitutes the first tier of the Environmental Impact Analysis Process (EIAP) (Section 1.1.1). The LEIS will be provided to the President, the Secretary of Defense, appropriate congressional committees, and the Environmental Protection Agency. (See Chapter 8.0 for a complete list of recipients.)

1.1.1 Tiering

The EIAP will provide supporting information to decision-makers at key points of the Small ICBM program through a process known as tiering. Tiering, which involves moving from general to specific analyses as a program evolves, provides the balance and perspective appropriate for each stage of decision-making and is recommended by the regulations implementing the National Environmental Policy Act. The initial tier supports the selection of basing mode and deployment area decisions, and the decision to enter full-scale development. This decision point is expected to be reached in late 1986 or early 1987. To aid in making these decisions, an analysis of regional-scale issues is provided in this LEIS. The site-specific, Small ICBM facility-location decisions will be made at the next tier in early 1988. In preparation for that decision point, environmental issues in the proposed deployment areas will be examined in a site-specific administrative environmental impact statement.

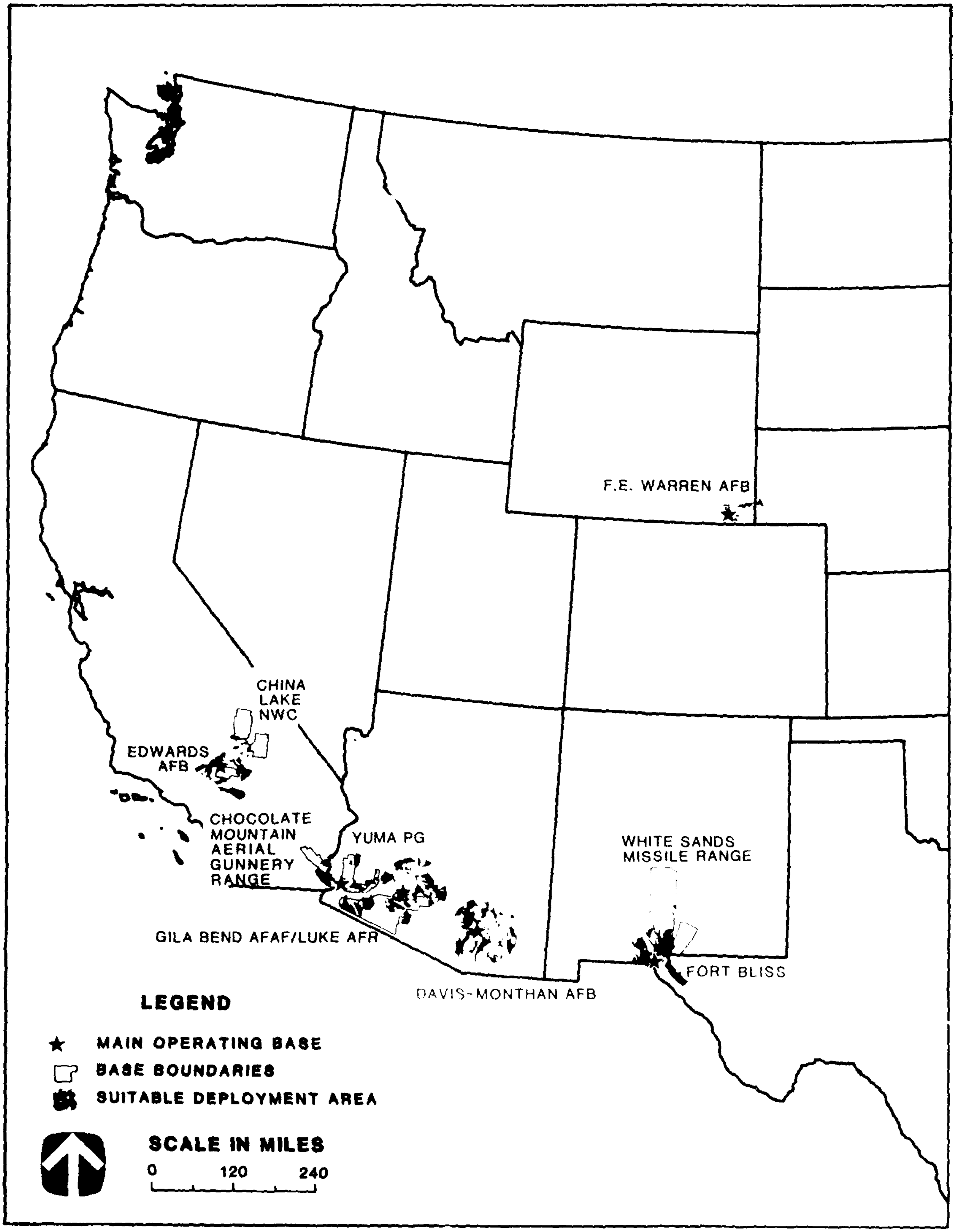


FIGURE 1.0-3 AREAS UNDER STUDY FOR HARD SILO IN PATTERNED ARRAY

As is typical of a major weapon system acquisition process, the engineering design and operating concepts for the Small ICBM are undergoing continual change. Change is rapid in the conceptual phase as new ideas are evaluated. Changes will continue through the validation phase as alternative solutions to problems are examined and compared. The process will continue during full-scale development as the system's final design emerges from the conceptual phase. At the same time, efforts will be made to increase performance and reliability, reduce costs and environmental impacts, and respond to changing threats. Typical system requirements that are subject to reevaluation are operations and training, land acquisition, number of missiles to be deployed in a given area, and missile design and performance.

The environmental analysis cannot await an exact project description based on final design drawings. However, development of the Small ICBM concept has advanced sufficiently to provide a basis for regional-level environmental impact analysis; an analysis considered adequate to accommodate a range of system engineering refinements. At the regional level, the relative environmental impacts of alternatives will probably not change substantially as a result of these refinements. The environmental analyses in this LEIS used the most complete system data available at the time, and, as the tiering process progresses, more accurate system description information will be used in the environmental assessment process.

1.1.2 Structure of the Legislative Environmental Impact Statement

The environmental issues addressed in this LEIS were identified through consultations with federal and state agencies and by Air Force and contractor personnel who have experience with programs of similar scope. For discussion and analysis, the issues are grouped into nine resource categories: socio-economics, utilities, transportation, land use, cultural and paleontological resources, biological resources and threatened and endangered species, air quality and noise, water resources, and geology and soils. The current environmental conditions and projected future conditions without the project are described in Chapter 3.0 (Affected Environment) for each of these resources in the potential siting regions. The potential project-induced impacts are summarized and compared in Chapter 2.0 (Comparison of Alternatives). More detailed descriptions of environmental impacts are presented in Chapter 4.0 (Environmental Consequences). Safety Considerations are provided in Chapter 5.0. Chapters 6.0 through 11.0 consist of the following supporting information: Authorizing Actions, List of Preparers, List of Recipients, Bibliography, Glossary of Terms and Acronyms, and Index.

This document provides information on the potential impacts of deployment and peacetime operation of the system in three candidate basing modes within the six regions suitable for each basing mode. To facilitate comparisons, each basing mode and deployment area was analyzed as if it were the one selected to support the first operational missiles by the early 1990s. If several areas are selected, construction is not expected to start simultaneously in all areas, but it is expected to be staggered with some possible overlap. Although a common starting date has been used, the regional impacts reported generally apply to actions occurring at somewhat later dates.

1.2 Purpose and Need

American strategic forces exist to deter attacks on the United States and its allies and to prevent the coercion that could arise if the public or decision-makers believed that the United States could be attacked successfully. Such a policy of deterrence, like the security policy of the West itself, is essentially defensive and is based on a balance of mutually supportive forces. The strategic triad of the United States consists of submarine-launched ballistic missile, bombers, and land-based ICBMs. In the past, the ICBM component of the triad has relied upon Titan (now being decommissioned) and Minuteman missiles. As missile technology has advanced, a need has developed for the United States to deploy newer, more accurate and more survivable missiles to complement the existing forces. The Small ICBM is being developed and the new Peacekeeper missiles are being deployed to meet this need.

In January 1983, President Reagan convened a bipartisan Commission on Strategic Forces (the Scowcroft Commission) to review the purpose, character, size, and composition of the strategic forces of the United States and make appropriate recommendations on ICBM modernization. The Commission's report was issued in April 1983 with its findings and recommendations being accepted by the President and Congress. Among its recommendations was that the United States immediately initiate engineering design of "...a single warhead ICBM weighing about fifteen tons...(leading)...to the initiation of full-scale development in 1987 and an initial operating capability in the early 1990s...Hardened silos or shelters and hardened mobile launchers should be investigated now..." (Report of the U.S. Commission on Strategic Forces 1983). In the 1984 Defense Authorization Act, Congress authorized start-up of the Small ICBM program at a pace that would permit full-scale engineering development to begin in fiscal year 1987. Congress recommended that the program be pursued as a matter of the highest national priority, with an initial operational capability by the end of 1992.

1.3 System Description

The Small ICBM (Figure 1.3-1) is intended to be effective against hardened military targets, and will be small and light enough to facilitate basing in both mobile and fixed modes. The missile will be 46 to 53 feet long, 46 inches in diameter, and weigh from 30,000 to 37,000 pounds. For comparison, the Peacekeeper, our most modern ICBM, is 71 feet long, 92 inches in diameter, and weighs 195,000 pounds.

The Small ICBM weapon system will include the operations facilities and equipment necessary to protect the missiles from accidental or deliberate damage, to monitor and control their status, to maintain them in proper operating condition, and to launch them if necessary. The personnel operating and supporting the system will also require various facilities in order to maintain a suitable quality of life.

The major facilities required for system operation and support will be located at a Main Operating Base (MOB) and in the deployment area associated with that base. The division of operations facilities between the MOB and the deployment location will depend on the basing mode selected, and is discussed in more detail in the following sections. Existing military bases will be used

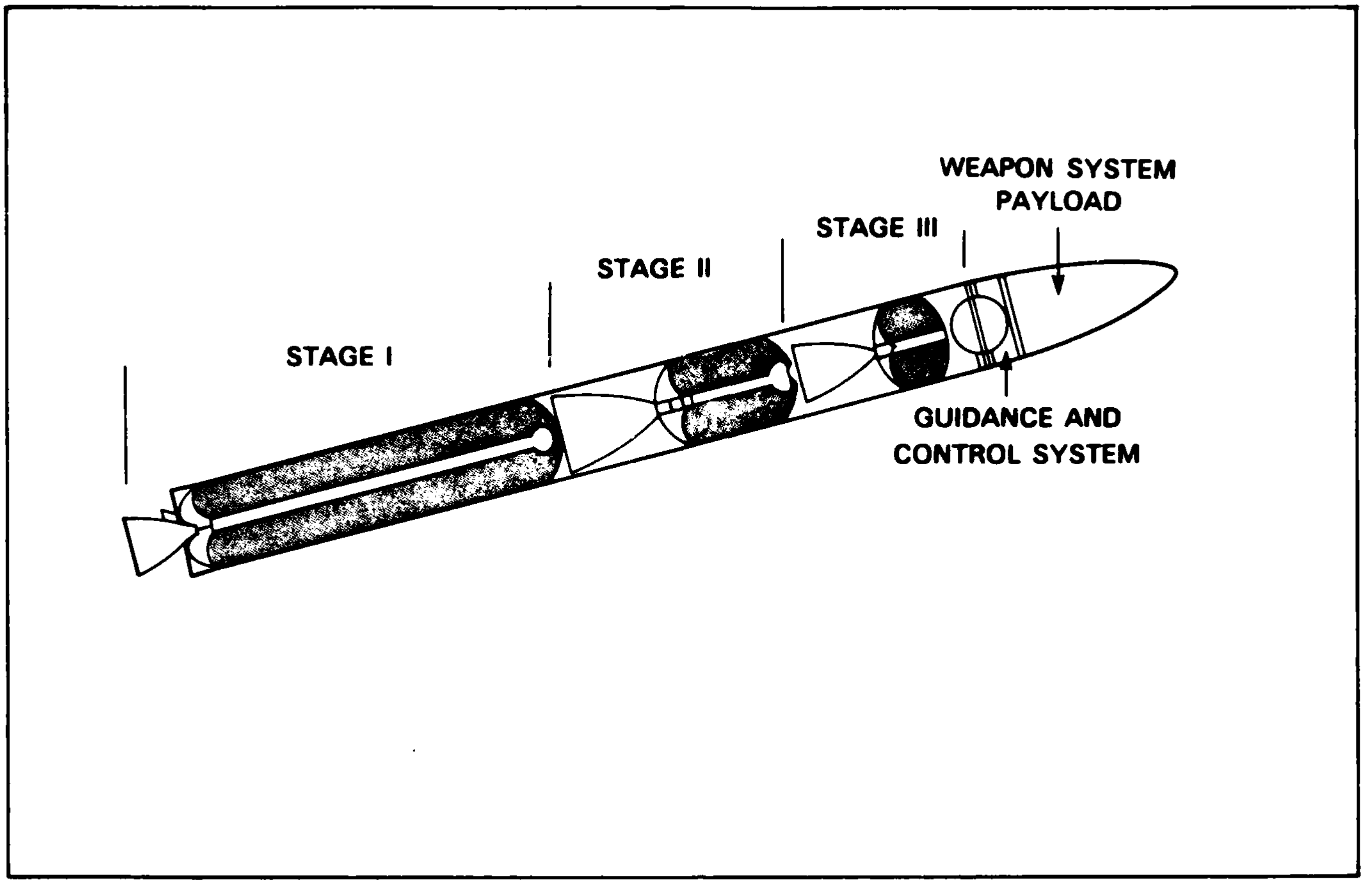


FIGURE 1.3-1 SMALL ICBM

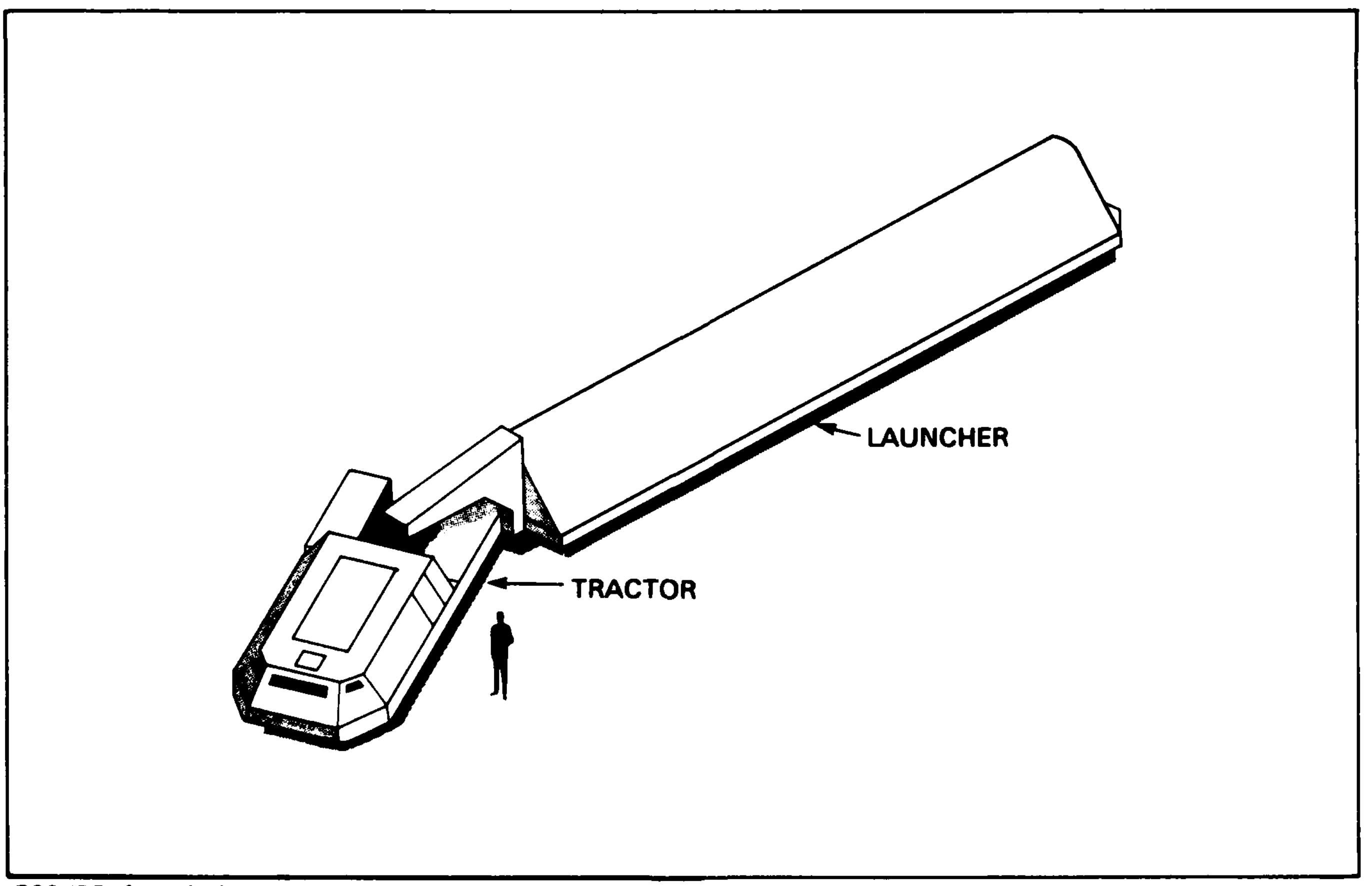


FIGURE 1.3.1-1 HARD MOBILE LAUNCHER CONCEPT

as MOBs and existing roads will be used whenever feasible. Any requirement for new facilities will depend on the existing facilities available at the chosen MOB locations.

Complex maintenance functions requiring highly specialized skills or sophisticated equipment will be carried out at existing centralized maintenance locations by Air Force Logistics Command personnel. Most of these functions will be performed at Hill AFB in Ogden, Utah, the major center for ICBM logistics support. Operations-phase test and evaluation and some phases of training will also use facilities at designated bases other than the MOB.

1.3.1 Basing Modes

A variety of both fixed and mobile ICBM basing modes have been studied by the Air Force over the past 3 decades. Modern versions of these basing modes were evaluated for the Small ICBM using criteria that included survivability, quick response capability, technical feasibility, minimization of public contact, cost, compatibility with other military missions, and ability to meet the 1992 initial operational capability mandated by Congress. The three basing modes found suitable for full-scale development consideration are the Hard Mobile Launcher in Random Movement, the Hard Mobile Launcher at Minuteman Facilities, and the Hard Silo in Patterned Array.

1.3.1.1 Hard Mobile Launcher in Random Movement

The Hard Mobile Launcher in Random Movement basing mode will involve deployment of missiles on DOD or DOE installations. The missiles will be carried and protected by HMLs that are hardened to withstand high levels of blast and radiation. These HMLs (Figure 1.3.1-1) will be nearly 100 feet long, up to 14 feet wide, and weigh approximately 200,000 pounds.

The HMLs will be dispersed within areas (Random Movement Areas [RMA]) of their host installations that could be used with minimal disruption of ongoing activities. An average of 8 square miles (sq mi) is needed for normal day-to-day operations of each HML. Most of the time, the vehicles will be stationary and may be parked either ready to move or with the launcher in a hardened (ground-hugging) configuration to maximize resistance against attack. From time to time, they will be moved to alternative locations on the installation and may resume a hardened configuration. Vehicle positions will be changed frequently enough to deny an attacker knowledge of exact HML locations.

During heightened international tension or periodic training exercises, the Strategic Air Command (SAC) or a higher authority could order further dispersal on the installation to increase survivability. This Command Dispersal Area will approximately double the area available for random movement for each vehicle. To facilitate rapid dispersal, the HMLs will be capable of attaining highway speeds on graveled roads. They will also have off-road capability to ensure access to large dispersal areas.

The HMLs will be deployed on groups of DOD or DOE installations, which are referred to as complexes in this LEIS. A typical complex will generally include a single MOB and one or more deployment installations within approximately 50 miles of the MOB. Figure 1.3.1-2 is a conceptual representation of the Hard Mobile Launcher in Random Movement basing mode, showing potential deployment installations, an MOB, and the possible dispersal areas.

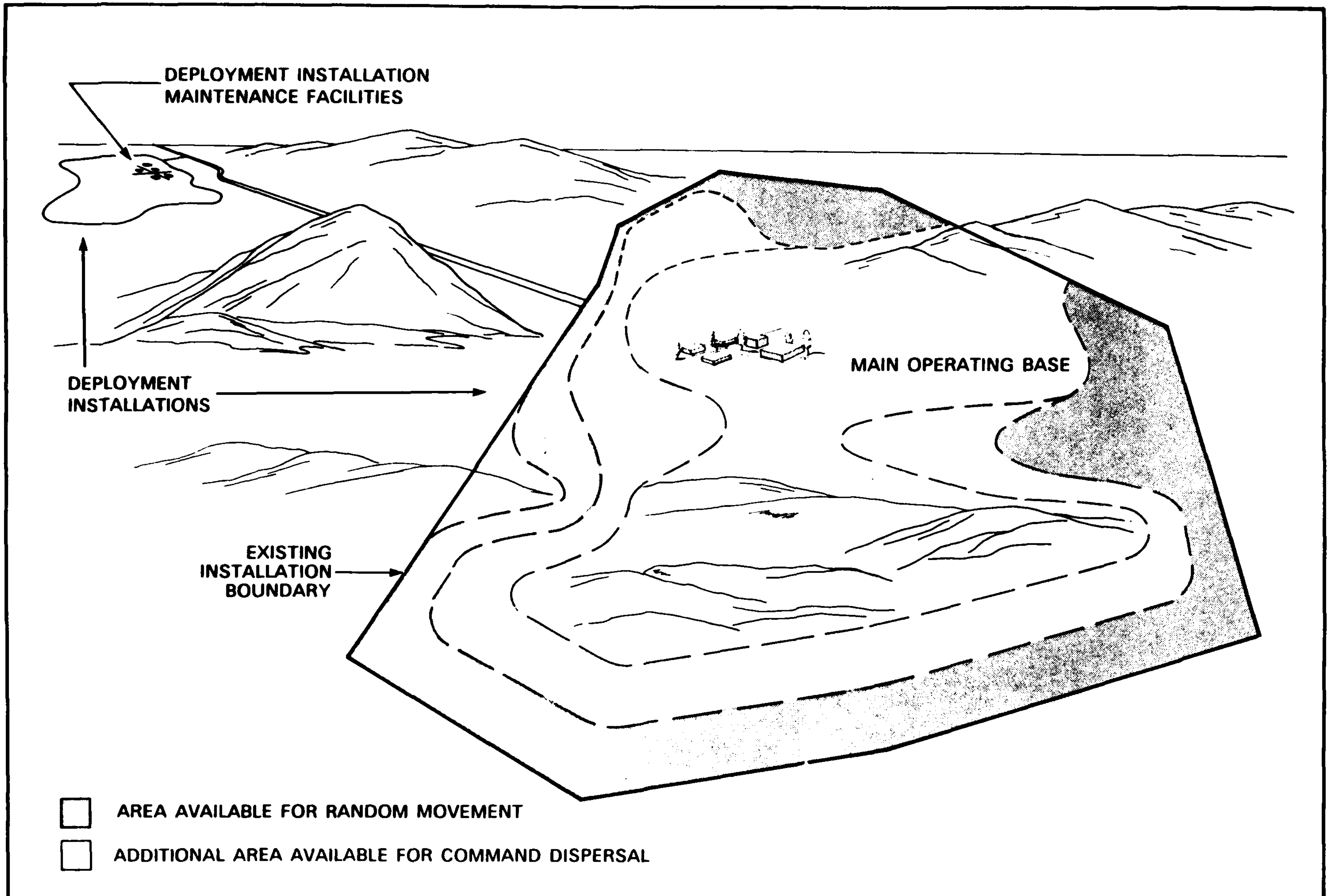


FIGURE 1.3.1-2 HARD MOBILE LAUNCHER IN RANDOM MOVEMENT BASING CONCEPT

The MOB will provide principal command, operational, security, maintenance, logistics, and personnel support functions. At some MOBs, facilities for most of these functions will have to be constructed. At other MOBs, many of the existing personnel support facilities may be used and less new construction will be required. To minimize the need to return vehicles or equipment to the MOB for maintenance or repair, such facilities will be provided on the deployment installations to the extent feasible. These maintenance facilities will be located near fuel storage areas and security response forces. Support facilities at these locations will provide living quarters and food service for maintenance and security personnel.

Several overlapping systems will monitor and control the missiles to provide reliability and survivability. A launch control center at each MOB, supplemented by one or more ground mobile launch control centers, will provide day-to-day peacetime monitoring and control functions. The communications network may be augmented by permanent radio relay towers. Primary backup for the system will be provided by the ground mobile launch control centers, which will be within normal size and weight limits for operation on public roads. They may be dispersed over large areas and may move frequently to ensure their survivability. Aircraft and satellite communication links will provide additional monitoring and control backup.

While not in use, critical system components will be stored in facilities that are double-fenced, lighted, guarded, and equipped with intrusion-sensing devices. The HMLs will be equipped with devices that will deny or delay unauthorized access to critical system components until nearby security forces can arrive. The HML crew and sensors on the vehicle will provide the necessary alarms. When HMLs travel on public roads between the deployment installations and the MOB, they will be escorted by security teams or will be under security response force coverage. Safety escorts will normally be provided while the HMLs are on public roads. These movements will occur during initial deployment, when major HML or missile maintenance is necessary, and for training exercises.

1.3.1.2 Hard Mobile Launcher at Minuteman Facilities

The Hard Mobile Launcher at Minuteman Facilities basing mode will involve deployment of HMLs within the fenced areas that surround missile silos at existing Minuteman installations (Figure 1.3.1-3). Some HMLs may also be stationed adjacent to Minuteman launch control facilities and at the associated MOBs. The six Minuteman bases are identified in Section 1.4.2 (Table 1.4.2-1). Three or more of these bases may be required for deployment of 500 missiles in this mode.

The HMLs will be similar to those used in the Random Movement mode and will be accompanied by crews ready to disperse them on short notice. However, under normal conditions, their only movements will be to and from the MOB for training, maintenance, repair, or test purposes. Under warning of an attack, dispersal from the Minuteman facilities could be ordered. The geographically diffused arrangement of the Minuteman facilities will enable the rapid dispersal of the HMLs over a large area (Command Dispersal Area) with a corresponding increase in survivability. To facilitate movement of HMLs to and from deployment sites, bridges and culverts in the deployment areas will be upgraded, where required, to provide enhanced clearance and weight-bearing

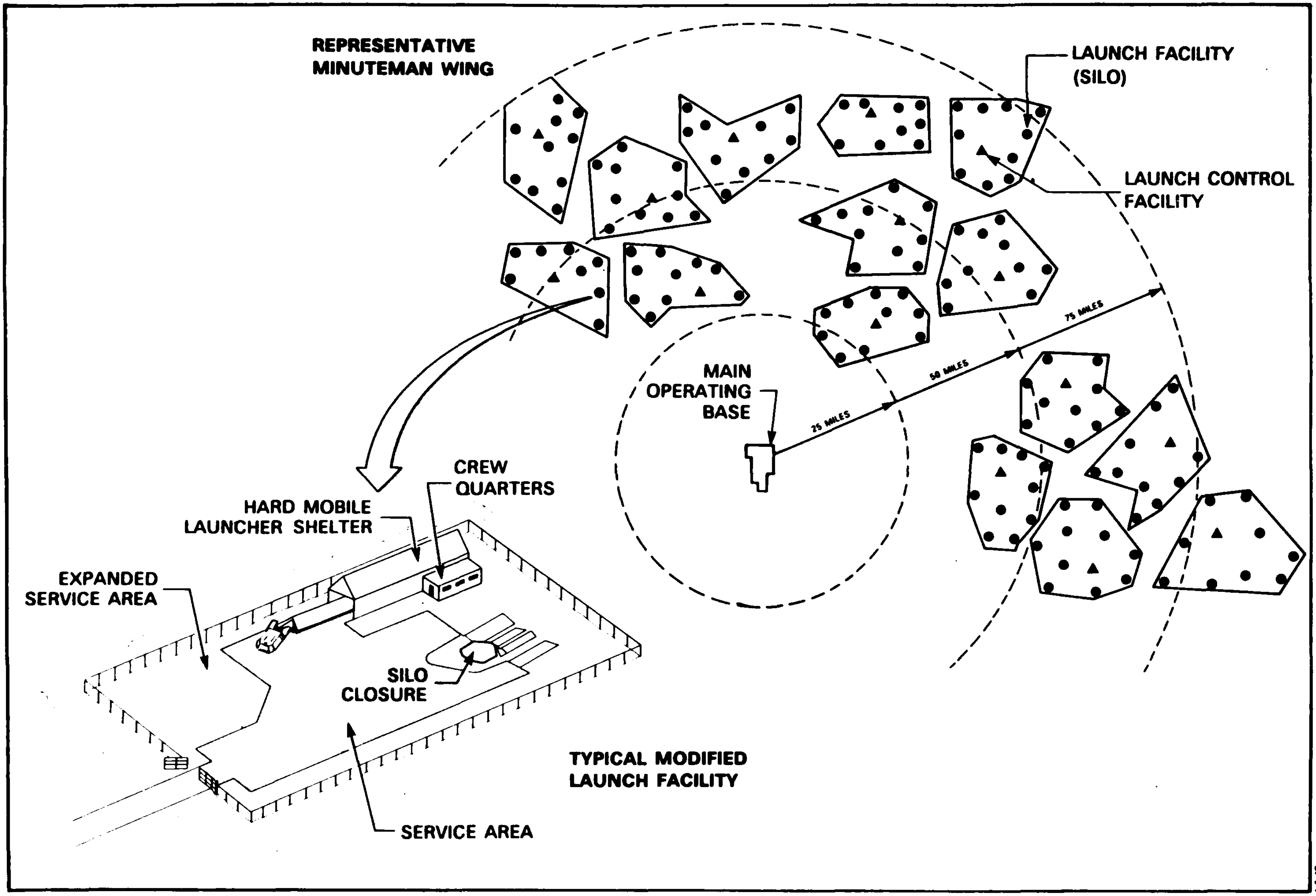


FIGURE 1.3.1-3 HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES BASING CONCEPT

capability. Some roadway sections may be widened or structurally upgraded, generally within existing rights-of-way. The total number of bridges and culverts to be upgraded will vary with the deployment area; 300 has been used for purposes of environmental analysis.

The MOB is connected to the Minuteman silos by existing roads. The HML movements will be restricted to these roads, as is currently the case with Minuteman transporters. Safety and security coverage on public roads will be similar to that provided in the Random Movement mode. Some modifications will be required at the silo sites, including construction of a shelter to protect the HMLs from the elements, to facilitate maintenance, and to house alert crews. In addition, the existing safety easements may have to be expanded. Minor improvements to some access roads may also be necessary. Service and all feasible HML repairs or maintenance will be performed at the launch facility or, if extensive, at the MOB or centralized maintenance facility.

The MOB will provide the principal command, maintenance, logistics, and personnel support functions for the system. Technical and personnel facilities may need to be constructed for these purposes. Some of the existing facilities at the Minuteman bases may be usable because of similarities between the ICBM missions. Therefore, less construction may be necessary for this mode than for the Hard Mobile Launcher in Random Movement mode.

Where feasible, existing Minuteman monitoring and control systems will be adapted for use with this mode. A new launch control center will be built at each MOB and the ground mobile launch control centers proposed for use with the Hard Mobile Launcher in Random Movement mode will also be required. Aircraft and satellite communication links will provide additional backup.

The HML security system will be integrated with the existing Minuteman system. At present, Minuteman silos are unmanned, but are equipped with intrusion alarms and are frequently checked by roving patrols. Presence of onsite HML crews will increase security for the Minuteman system. Security teams will respond to alarms from the Minuteman system, the HML, or its alert crew. As with the Random Movement mode, when HMLs travel on public roads between the deployment installations and the MOB, they will be escorted by security teams or will be under security response force coverage. Safety escorts will be provided while on public roads during peacetime operations. These movements will occur during initial deployment, for training exercises, and when major HML or missile maintenance is necessary.

1.3.1.3 Hard Silo in Patterned Array

The Hard Silo in Patterned Array basing mode involves deployment of Small ICBMs in a patterned silo arrangement that will incorporate newly developed silo-hardening technology. To enhance the integral hardness of the structures, these silos will be emplaced only where geologic features favor silo survivability. The areas being considered for Small ICBM siting in this mode are predominantly in the Southwest, on both public and private land.

The silos will be deployed in staggered rows within fenced arrays as shown in Figure 1.3.1-4. Each array will contain from 50 to 250 silos depending on the amount of suitable area available at the chosen location. A typical array will be approximately 2 miles wide and from 3 to 10 miles long. A network of

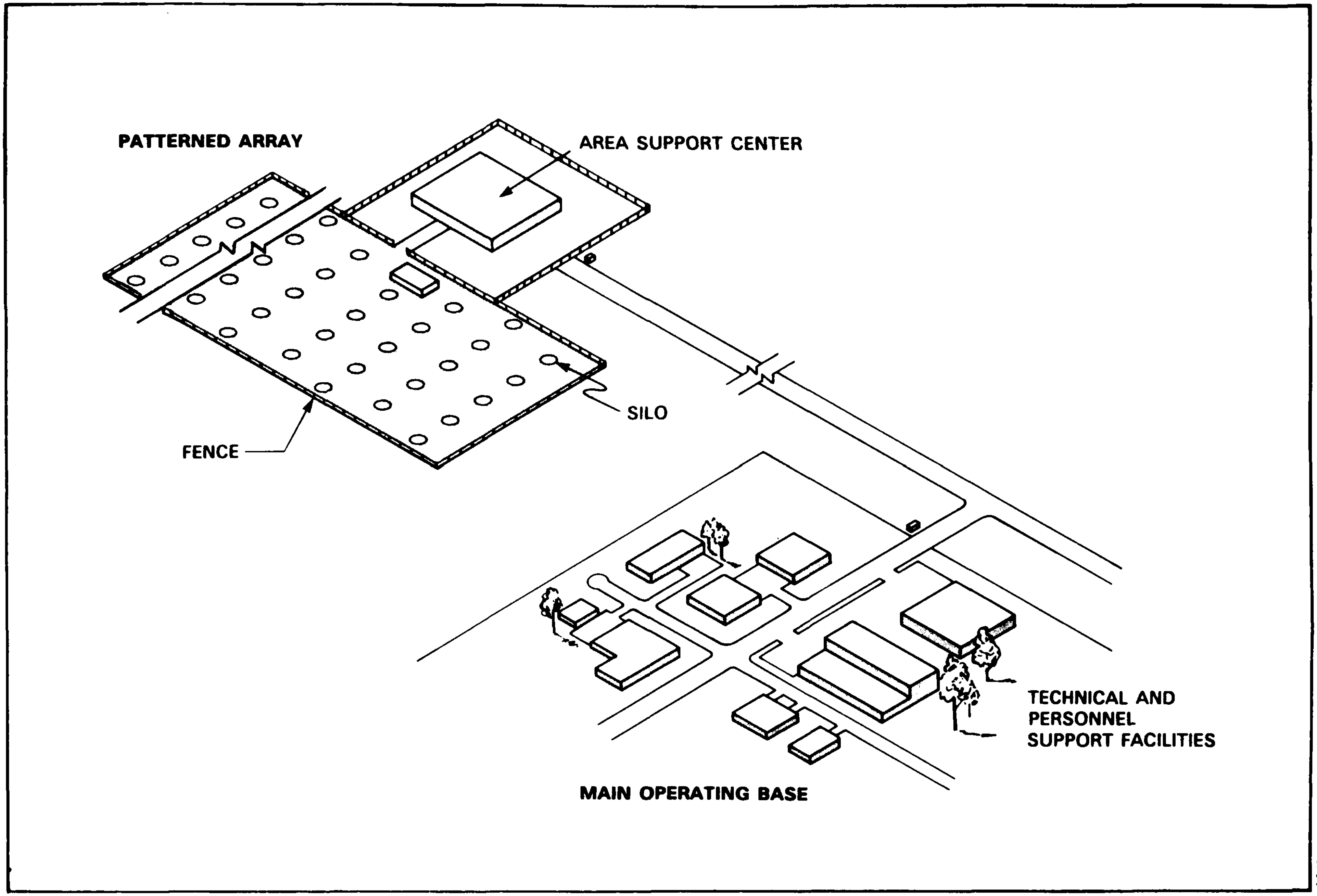


FIGURE 1.3.1-4 HARD SILO IN PATTERNED ARRAY BASING CONCEPT

roads within the fenced array will provide access to the silos. Except for security patrols, launch crews, and maintenance vehicles, there will be little traffic on these roads. Other facilities within the fenced area will include a launch control center, intrusion radar support buildings, and antennas.

A fenced area support center, located near the array, will contain a weapons storage area, technical facilities for maintenance and logistic support, security and fire-protection facilities, and housing and dining accommodations.

The MOB will provide the principal command, operations, maintenance, logistics, and personnel support functions for the associated arrays. At some MOBs, almost all of the facilities for these functions will need to be constructed, while at other MOBs, some of the personnel support facilities may be available and less new construction will be required.

Redundant command and control systems will be provided to ensure positive, survivable control of the Small ICBM force. Most of the backup systems will not require new or unique facilities. The primary backup system will include ground mobile launch control centers similar to those for the other two basing modes. Maintenance and storage facilities for these vehicles will be located at the area support center.

The physical security system for Hard Silo basing will include double fences for the weapons storage area, guards, and intrusion sensors at the area support center to protect critical components; security response facilities in the area support centers and the arrays; and sensors at each silo site, including surveillance radars.

1.3.1.4 No Action Alternative

Under the No Action Alternative, the Air Force will continue to maintain existing Minuteman ICBMs and to deploy additional Peacekeeper ICBMs to the authorized level. The scope of such activities will not cause changes in currently projected future conditions in the areas under consideration for basing of the Small ICBM. The environmental consequences of the No Action Alternative are discussed in detail in Chapter 4.0 and summarized in Chapter 2.0.

1.3.2 Full-Scale Development Test and Logistics

During full-scale development, all elements of a major weapon system are built and tested at full scale, ensuring that both individual elements and the complete system can meet stated levels of performance and reliability. Some tests are independent of the basing mode selected (e.g., flight tests to establish missile performance); others are basing-mode specific (e.g., HML and silo tests). All tests will require logistics support, principally to transport large test items (e.g., the HML), and to ensure availability of spare parts, consumables, and instrumentation.

It is estimated that $9.3 billion (1984 dollars) will be spent for full-scale development between 1987 and 1993. Each $1 billion spent in a given year is expected to generate about 21,400 jobs in that year. Expenditures will fluctuate throughout the development period. Sales and employment will be concentrated in radio and television communication equipment, guided missiles, chemicals, electronic computing equipment, measuring and control instruments,

and wholesale trade. States with large concentrations of these industries, such as California, Massachusetts, New York, Florida, Texas, Pennsylvania, and Washington, will be the main beneficiaries of full-scale development activities. A number of critical materials, for example, strategic metals, will be required for full-scale development; none of the requirements for these materials will encompass more than 1 percent of the nationwide import needs. The nationwide effects of full-scale development can generally be described as beneficial. Even in conjunction with other military requirements, no significant industrial capacity problems are forecast; likewise, no critical material shortages are anticipated.

A preliminary schedule of test activities is provided in Table 1.3.2-1. Other tests may be required as the system evolves. For the Hard Mobile Launcher at Minuteman Facilities basing mode, it may also be necessary to construct and test a HML alert shelter. The Hard Silo flight test program will be essentially the same as the HML flight test program, except that in some tests, silos will be used instead of missile launchers.

Potential environmental impacts of full-scale development test and logistics will be analyzed under the environmental programs for the organizational units charged with conducting the tests. The environmental analyses will follow established procedures and will address local conditions. Many tests that will be conducted at existing facilities should be covered by existing environmental documents. Examples of such documentation are the Installation Environmental Impact Assessment prepared for Yuma PG (U.S. Air Force 1978) and the Environmental Assessment for the Trestle Electromagnetic Pulse Simulator at Kirtland AFB (U.S. Air Force 1976).

The tests will not require activities of unusual scope, will be similar to activities already performed at the test locations, and will be relatively short in duration. Standard transportation methods will be used. The number of shipments will be small and the test locations are currently equipped to receive, handle, and test similar items. The major test elements for the program are outlined in the following sections.

1.3.2.1 Missile Tests

The missile flight tests range from individual static tests of rocket motor stages at the factory, through a series of pad launches, to test launches simulating actual deployment using silos or HMLs. The main tests will involve flights from Vandenberg AFB, California, the major center for efforts of this type. No changes in the existing range or targets used for Minuteman and Peacekeeper flight tests are anticipated.

1.3.2.2 Hard Mobile Launcher Tests

The HML is a critical element in two of the alternative basing modes. Therefore, it is vital to establish, with confidence, that the system will meet expected hardness capabilities. As with the missile, HML tests will become increasingly complex; they will range from individual component tests to complete vehicle tests. The HML testing program will include mobility tests at Yuma PG, climatic tests at Eglin AFB, electromagnetic pulse tests at Kirtland AFB, and simulated operational launch tests at Vandenberg AFB. These tests are similar to current testing activities at these locations. Blast, shock, and thermal tests will occur at locations to be determined as part of full-scale development.

Table 1.3.2-1

PRELIMINARY SCHEDULE OF SMALL ICBM FULL-SCALE DEVELOPMENT TESTS

Test Article	Test	Location	Test Start	Test End	Existing Facilities
HML (Mobility Test Bed)	Mobility	Yuma PG	Jan 1986	Sept 1986	Yes
HML (Mobility Test Bed)	Road	Yuma PG	Jan 1986	June 1987	Yes
HML (Mobility Test Bed)	Climatic	To be determined Minuteman Site	Oct 1986	June 1987	Yes
HML (Mobility Test Bed)	Climatic	White Sands Missile Range	Oct 1986	June 1987	Yes
HML 1/6 Scale	High Explosive Blast	White Sands Missile Range	Oct 1986	May 1987	Yes
HML	Shock Tube Blast	Kirtland AFB	Mar 1987	June 1990	Yes
HML	PSS/Access Delay	To be determined	June 1987	Dec 1987	Yes
HML	Mobility	Yuma PG and Vandenberg AFB	June 1988	Oct 1990	Yes
HML	Lightning	To be determined	June 1988	Dec 1988	Yes
HML	Canister Launch	To be determined	Sept 1988	June 1989	Yes
HML	PSS/Access Delay	To be determined	May 1989	July 1990	Yes
Missile	Lightning	To be determined	July 1988	May 1989	Yes
Missile	Flight	Vandenberg AFB	Early 1989	Early 1990	Yes
Missile	Electromagnetic Pulse	Kirtland AFB	Sept 1989	Dec 1990	Yes
Guidance and Control	Land Navigation/ Accuracy	Holloman AFB	Mar 1987	Sept 1991	Yes
Weapon System	Blast	To be determined	Sept 1988	July 1989	---
Weapon System	Electromagnetic Pulse	Kirtland AFB	Sept 1988	July 1989	Yes
Weapon System	Flight	Vandenberg AFB and Patrick AFB	1990	1992	Yes
Weapon System	Climatic	Eglin AFB	Dec 1990	Dec 1991	Yes
Weapon System	Operational/Mobility	Yuma PG, Vandenberg AFB, and Operational Base(s)	Dec 1990	Dec 1991	Yes
Weapon System	Radiation	Aurora	Apr 1991	Jan 1992	Yes
Weapon System	Electromagnetic Compatibility	Vandenberg AFB	Jan 1992	Sept 1992	Yes
Ground Mobile Launch Control Center	Electromagnetic Pulse	Kirtland AFB	Feb 1990	Oct 1990	Yes

Note: Other tests, including static and dynamic tests, subsystem integration tests, and operational tests, will occur on all HML-related systems. Some of the locations and the detailed schedules are still undetermined.

1.3.2.3 Hard Silo Tests

The sequence of activities in the Hard Silo test program will be similar to that for the HML; it will proceed from system element tests to simulated operational launches at Vandenberg AFB, where three test silos will be required. These silos may be constructed at previously approved Peacekeeper launch sites, or three existing decommissioned Minuteman test silos may be modified. Further tests will be performed to determine compatibility of special support vehicles with silo configuration.

1.3.2.4 Support Tests

Additional tests will be required on other system components. For example, the ground mobile launch control centers will require some tests similar to those for the HMLs. Environmental consequences of these tests are not expected to be significant, but will be reviewed in accordance with Air Force procedures that have been developed in compliance with National Environmental Policy Act of 1969 regulations.

1.4 Alternative Basing Locations

Potential locations for siting the Small ICBM were identified through a screening process that included all 50 states. The criteria (some of which differed by basing mode) included technical, operational, legal, and policy considerations. The process identified six areas, for each of the three basing modes, as potentially suitable for deployment. Several of these areas are suitable for more than one basing mode.

The first step in the screening process consisted of applying criteria that eliminated areas where it would clearly be infeasible to operate the system. The remaining areas were then evaluated with additional criteria to ascertain relative suitability. Application of these evaluative criteria eliminated additional areas which could not meet system operability goals. The narrowing process for the three basing modes under consideration is described in the following sections.

1.4.1 Hard Mobile Launcher in Random Movement

In order to limit project impacts and to enhance system safety and security, HMLs deployed in the Random Movement mode will operate primarily in areas where public access can be restricted. Such areas exist predominantly on DOD and DOE properties, which number approximately 4,200 in the United States.

Practical considerations require that a deployment area be capable of accommodating at least 40 HMLs, and that deployment installations be within approximately 50 miles of the MOB. To achieve survivability, an average of 16 sq mi of an installation must be accessible to each HML. At least half of this area, or an average of 8 sq mi per vehicle, must be suitable for day-to-day use, without interfering with activities of the host installations. When these exclusionary criteria were applied, potential deployment installations were reduced from 4,200 to 24.

Application of evaluative criteria, such as size of RMAs and availability of land on the MOB for expansion, further reduced the number of deployment

installations to 14. These areas fell into six natural geographic groupings termed "complexes," and are listed in Table 1.4.1-1 and shown in Figure 1.0-1. The Florida and Washington complexes can accommodate no more than approximately 50 HMLs; each of the remaining complexes can accommodate approximately 200 HMLs.

1.4.2 Hard Mobile Launcher at Minuteman Facilities

This alternative limits HMLs to existing Minuteman missile deployment areas in the central United States. No other areas exist in the United States where numerous well-dispersed, large, secure, accessible, and government-controlled sites are found within a reasonable distance of a military base. Any of the six Minuteman bases is capable of supporting the Small ICBM mission. These bases are shown in Table 1.4.2-1 and Figure 1.0-2.

Approximately 200 HMLs may be deployed at F.E. Warren AFB and Malmstrom AFB, and approximately 170 may be deployed at the other Minuteman bases.

1.4.3 Hard Silo in Patterned Array

For the Hard Silo in Patterned Array alternative, areas suitable for deployment must meet ground slope requirements for accessibility and stringent requirements with respect to subsurface water and bedrock conditions in order for the silos to have the necessary degree of hardness. Such exclusionary criteria, combined with the need to have the deployment area within approximately 50 miles of a military installation, narrowed the potential siting areas to 35.

Application of evaluative criteria, such as availability of land on the MOB for expansion and infrastructure support capability, further reduced the number of siting areas to six. Each of these has a military base appropriate for use as an MOB and substantial areas which meet the requirements for Hard Silo deployment. These Suitable Deployment Areas (SDAs) are not limited to military reservations; some are on other public lands while some are on private lands. The bases suitable to serve as MOBs are Davis-Monthan AFB, Arizona; Edwards AFB, California; Fort Bliss, Texas; F.E. Warren AFB, Wyoming; Gila Bend AFAF, Arizona; and Yuma PG, Arizona (Figure 1.0-3). Some SDAs supported by these bases may also occur on the following nearby military installations: China Lake Naval Weapons Center (NWC), Chocolate Mountain Aerial Gunnery Range, Luke Air Force Range (AFR), and White Sands Missile Range. Each of these candidate bases is capable of supporting at least 250 Small ICBMs.

1.5 Construction, Assembly and Checkout, Operations, and Decommissioning

Deployment of the Small ICBM in any basing mode will involve a number of steps. Before construction begins, land rights will be acquired, locations will be surveyed, design criteria will be prepared, and sources of materials, for example, aggregate (sand/gravel mix) and water, will be identified. In general, construction staging areas, access roads, utility lines, and workspace for supervisory and inspection personnel will be established before construction begins.

Table 1.4.1-1

ALTERNATIVE LOCATIONS ANALYZED FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT BASING MODE

Main Operating Base	Associated Candidate Deployment Installation(s)
ARIZONA COMPLEX	
o Gila Bend Air Force Auxiliary Field	Luke Air Force Range, Yuma Proving Ground
o Yuma Proving Ground	Luke Air Force Range, Yuma Proving Ground
FLORIDA COMPLEX	
o Eglin Air Force Base	Eglin Air Force Base
NEVADA COMPLEX	
o Indian Springs Air Force Auxiliary Field	Nellis Air Force Range, Nevada Test Site
o Nellis Air Force Base	Nellis Air Force Range, Nevada Test Site
NEW MEXICO COMPLEX*	
o Fort Bliss	Fort Bliss, Holloman Air Force Base, White Sands Missile Range
o Holloman Air Force Base	Fort Bliss, Holloman Air Force Base, White Sands Missile Range
o White Sands Missile Range	Fort Bliss, Holloman Air Force Base, White Sands Missile Range
SOUTH-CENTRAL CALIFORNIA COMPLEX	
o Edwards Air Force Base	China Lake Naval Weapons Center, Edwards Air Force Base, Fort Irwin National Training Center
o Fort Irwin National Training Center	China Lake Naval Weapons Center, Edwards Air Force Base, Fort Irwin National Training Center, Twentynine Palms Marine Corps Air-Ground Combat Center
WASHINGTON COMPLEX	
o Yakima Firing Center	Department of Energy Hanford Site, Yakima Firing Center

Note: *Because this complex includes deployment areas in Texas, it has been referred to in some other Air Force documents as the New Mexico/Texas Complex.

Table 1.4.2-1

MINUTEMAN BASES AND NUMBER OF MINUTEMAN MISSILES CURRENTLY DEPLOYED

Base	Missiles Currently Deployed
Ellsworth Air Force Base, South Dakota	150
F.E. Warren Air Force Base, Wyoming	200[a]
Grand Forks Air Force Base, North Dakota	150
Malmstrom Air Force Base, Montana	200
Minot Air Force Base, North Dakota	150
Whiteman Air Force Base, Missouri	150

Note: [a]Fifty of these missiles are scheduled to be replaced with Peacekeeper missiles by 1989.

As new facilities become available during the assembly and checkout process, technical equipment will be installed and tested until groups of operationally ready missiles are turned over to SAC. At the end of the system life, the missiles will be decommissioned by the Air Force Logistics Command.

1.5.1 Facility Construction

System facilities will be specified by the Air Force and designed and constructed by the Army Corps of Engineers (COE) using established, conventional methods. Some facilities essential for initial deployment will have special requirements and their construction must begin early. This effort will occur at the MOB and deployment area for the Hard Mobile Launcher alternatives and at the MOB and area support center for the Hard Silo alternative. Early efforts at the MOB and in the deployment areas may also include construction of access roads and utilities where these are nonexistent or inadequate. Personnel support facilities at the MOB will be constructed as needed, providing accommodations for operations personnel.

Construction activities will vary in intensity depending on the deployment alternative. The Hard Mobile Launcher in Random Movement alternative will require early construction of deployment installation maintenance facilities to support initial deployment, followed by a prolonged period of moderate activity when road construction will be the major effort. The Hard Mobile Launcher at Minuteman Facilities alternative will not require supplementary maintenance facilities in the deployment area. Offbase construction efforts will consist of modification of silo sites to accommodate HMLs and roadway improvements necessary for base-to-silo HML movements. These activities will involve a small number of silos at any one time, and will require a stable level of effort until the system is fully deployed. The Hard Silo in Patterned Array alternative will involve initial construction of an area support center and the first group of silos. This will be followed by construction of roads and utilities to the next silo group, silo construction, and extension of roads and utilities until the module involved is completed.

1.5.2 Assembly and Checkout

Assembly and checkout is managed by the Air Force and conducted with contractor support. The process begins with receipt of hardware items which are inspected and then assembled or installed as appropriate. Completed items are then integrated into the system and further checked for proper performance. After final acceptance tests, operationally ready missiles are turned over to SAC for service. For both mobile basing alternatives, most assembly and checkout activities will be at the MOB. For the Hard Silo mode, most assembly and checkout efforts will be either in the deployment area or at the MOB.

1.5.3 Operations

Operations activities are those required to maintain the system in a secure, survivable, launch-ready condition. These activities include operational vehicle movements, monitoring and control of system status, maintenance and repair, supply, and security. Operations activities will occur at the MOBs, the deployment areas, and, except for the Hard Mobile Launcher at Minuteman Facilities alternative, at support facilities in or near the deployment area. Most operations activities will be conducted by Air Force military personnel.

Fixed launch control centers, manned continuously, will monitor and control the missile in all basing alternatives. Their primary backup will be ground mobile launch control centers. Numerous additional backups, including airborne systems, will assure positive control of the missile force.

Depending on the basing mode, specific maintenance tasks will occur in the deployment area, at a maintenance facility in or near the deployment area, or at the MOB. For the Hard Mobile Launcher in Random Movement alternative, a deployment installation maintenance facility will be used for minor vehicle repair and removal and replacement of some equipment items. No comparable facility will be provided for the Hard Mobile Launcher at Minuteman Facilities alternative. In this mode, these actions will occur at the silo site where feasible, or at the MOB. Specialized vehicles for towing, lifting, missile stage transportation, and maintenance will support these operations.

For the Hard Silo alternative, the operations associated with weapon assembly, surveillance, inspection, and storage will occur at an area support center close to the silo arrays. The area support center will include a security response force facility in addition to maintenance and related facilities. A special vehicle will transport maintenance personnel and equipment to the silos, and provide access for equipment maintenance. Other vehicles will permit missile removal, missile transport, and related functions when more complex actions require that the missile or its associated equipment be moved to the MOB.

1.5.4 Decommissioning

At the end of the Small ICBM project, the system will be decommissioned. Decommissioning will require several years to establish realistic alternatives, plan for implementation, conduct required environmental reviews, and carry out the selected action. It will occur after approximately 20 years of operations and will comply with the applicable laws.

1.6 Project Resource Requirements

Deployment of the Small ICBM will require approximately 8 years of construction activities in each deployment area, followed by 20 or more years of operations. Construction and operations will cause environmental impacts which will include disturbance of the earth's surface, consumption of materials such as water and aggregate, and inmigration of workers. This section identifies the estimated project requirements used in this environmental analysis.

Because of the many combinations possible with three basing modes and multiple deployment installations, representative basing assumptions were made for analysis (Table 1.6-1).

A list of proposed facilities was developed for each of the basing scenarios. These lists include facilities that may already be available at some locations; therefore, predicted impacts may be slightly exaggerated for such locations.

Estimated annual direct employment for each basing mode, for calendar years 1990 through 1998, is presented in Table 1.6-2. For each basing mode, the activities include construction, assembly and checkout, site activation, and operations. The employment estimates are based on Army COE and Air Force experience on similar projects. Total population growth resulting from direct employment in each deployment area is presented in Chapter 4.0.

To evaluate the potential environmental effects of the proposed project alternatives, it was necessary to estimate the ground surface areas that will be temporarily and permanently disturbed as a result of facility construction. Approximate areas of disturbance are identified for the MOB and deployment area for each basing mode in Table 1.6-3. Surfaces that will be covered by impervious materials or kept in a cleared condition to accommodate buildings, parking lots, roads, and security zones are considered permanently disturbed. Surfaces disturbed during construction, but later regraded, revegetated, or those able to return to a natural state during the operations phase of the project are considered to be temporarily disturbed. Desert soils and vegetation recover very slowly, evidenced by wagon trails made in the 1800s which still exist today. Therefore, surface disturbances to potential deployment areas in the arid West are reported as long-term impacts.

Surface disturbance will also occur during operation of the HMLs in the Random Movement mode. The approximate area available for day-to-day random movement at each complex is presented in Table 1.6-4. Within these areas, the potential direct surface disturbance during off-road operation over a 20-year period will range from 50 to 100 sq mi for the Florida and Washington complexes and from 175 to 350 sq mi for the other complexes. All area figures are preliminary and subject to revision pending further consideration of existing land uses and operational concepts. Surface disturbance areas were estimated according to the following assumptions: (1) each HML will move every 48 hours to a new location within the Random Movement Area, (2) the HMLs will park within 750 feet of a road or trail, (3) all movements except to park will be on roads, (4) the linear zone of disturbance for each wheel or track will be 3 feet wide, and (5) the HMLs will traverse new paths each time they park. The range of disturbed areas will depend on the final HML vehicle and operational characteristics.

Table 1.6-1

NUMBER OF SMALL ICBMs USED FOR ANALYSIS

Basing Mode and Location	**Number of Missiles per Installation**
Hard Mobile Launcher in Random Movement	
Florida Complex	50
Washington Complex	50
Arizona Complex	200
Nevada Complex	200
New Mexico Complex	200
South-Central California Complex	200
Hard Mobile Launcher at Minuteman Facilities	
Ellsworth Air Force Base, South Dakota	170
Grand Forks Air Force Base, North Dakota	170
Minot Air Force Base, North Dakota	170
Whiteman Air Force Base, Missouri	170
F.E. Warren Air Force Base, Wyoming	200
Malmstrom Air Force Base, Montana	200
Hard Silo in Patterned Array	
Davis-Monthan Air Force Base, Arizona	250
Edwards Air Force Base, California	250
F.E. Warren Air Force Base, Wyoming	250
Fort Bliss, Texas	250
Gila Bend Air Force Auxiliary Field, Arizona	250
Yuma Proving Ground, Arizona	250

Table 1.6-2

TOTAL ESTIMATED ANNUAL DIRECT EMPLOYMENT, MILITARY AND CIVILIAN, FOR SMALL ICBM PROGRAM
BY CALENDAR YEAR
(Full-Time Equivalent Jobs)

	1990	1991	1992	1993	1994	1995	1996	1997	1998 and on
Hard Mobile Launcher in Random Movement									
50 Missiles									
Main Operating Base	1,628	1,290	1,674	1,686	1,898	1,609	1,571	1,570	1,570
Deployment Area	511	310	154	95	11	0	0	0	0
50 Missiles, Total:	2,139	1,600	1,828	1,781	1,909	1,609	1,571	1,570	1,570
200 Missiles									
Main Operating Base	2,316	1,772	2,052	2,029	2,824	3,728	4,294	3,955	3,955
Deployment Area	1,166	868	680	547	74	0	0	0	0
200 Missiles, Total:	3,482	2,640	2,732	2,576	2,898	3,728	4,294	3,955	3,955
Hard Mobile Launcher at Minuteman Facilities									
170 Missiles									
Main Operating Base	2,433	1,526	1,458	1,231	1,728	2,766	3,219	2,900	2,900
Deployment Area	49	82	230	354	228	117	4	0	0
170 Missiles, Total:	2,482	1,608	1,688	1,585	1,956	2,883	3,223	2,900	2,900
200 Missiles									
Main Operating Base	2,440	1,530	1,457	1,221	1,768	3,002	3,640	3,285	3,285
Deployment Area	86	99	255	406	261	131	5	0	0
200 Missiles, Total:	2,526	1,629	1,712	1,627	2,029	3,133	3,645	3,285	3,285
Hard Silo in Patterned Array									
250 Missiles									
Main Operating Base	1,007	1,054	1,675	1,997	2,331	2,606	2,626	1,905	1,773
Deployment Area	903	1,368	2,479	2,819	3,038	2,439	1,478	212	0
250 Missiles, Total:	1,910	2,422	4,154	4,816	5,369	5,045	4,104	2,117	1,773

Table 1.6-3

APPROXIMATE AREAS DISTURBED BY
SMALL ICBM FACILITIES

Basing Mode	Area Disturbed in Square Miles (acres) Temporary		Permanent		Total	
Hard Mobile Launcher in Random Movement (50 missiles)						
Main Operating Base	2.3	(1,440)	0.6	(390)	2.9	(1,830)
Deployment Area	4.8	(3,060)	3.2	(2,090)	8.0	(5,150)
Subtotal:	7.1	(4,500)	3.8	(2,480)	10.9	(6,980)
Hard Mobile Launcher in Random Movement (200 missiles)						
Main Operating Base	2.4	(1,510)	0.9	(610)	3.3	(2,120)
Deployment Area	20.6	(13,180)	11.4	(7,300)	32.0	(20,480)
Subtotal:	23.0	(14,690)	12.3	(7,910)	35.3	(22,600)
Hard Mobile Launcher at Minuteman Facilities (170 missiles)						
Main Operating Base	1.8	(1,140)	0.6	(390)	2.4	(1,530)
Deployment/Dispersal Area	0.2	(100)	2.3	(1,480)	2.5	(1,580)
Subtotal:	2.0	(1,240)	2.9	(1,870)	4.9	(3,110)
Hard Mobile Launcher at Minuteman Facilities (200 missiles)						
Main Operating Base	1.8	(1,140)	0.6	(400)	2.4	(1,540)
Deployment/Dispersal Area	0.2	(100)	2.9	(1,860)	3.1	(1,960)
Subtotal:	2.0	(1,240)	3.5	(2,260)	5.5	(3,500)
Hard Silo in Patterned Array (250 missiles)						
Main Operating Base	1.5	(960)	1.1	(740)	2.6	(1,700)
Deployment Area	0	0	28.1	(18,000)	28.1	(18,000)
Subtotal:	1.5	(960)	29.2	(18,740)	30.7	(19,700)

Table 1.6-4

PRELIMINARY RANDOM MOVEMENT AREAS IDENTIFIED AT EACH COMPLEX

Complex	Area in Square Miles	Area in Acres
Arizona	1,762	1,127,700
Florida	300	191,900
Nevada	1,752	1,121,200
New Mexico	1,795	1,149,100
South-Central California	906	580,100
Washington	386	247,000

Infrequent HML operations will also take place in the Command Dispersal Areas. Environmental impacts associated with these operations are briefly discussed in Chapter 4.0. Further consideration will be given to these activities at the second tier of the EIAP, when areas and operations scenarios are better defined.

Estimates of water required for construction, including dust control and revegetation, and the aggregate requirements for construction, are summarized in Table 1.6-5 according to MOB and deployment-area requirements.

1.7 Safety Considerations

Safety concerns will be primarily related to the possibility of accidents that could occur during silo or HML operations, movement of HMLs for training or maintenance purposes, or transportation of the missiles. Consideration must be given to effects that would occur from the release of solid propellants, liquid hydrazine fuels, and nuclear materials. The Air Force has formal safety programs covering all phases of weapon system acquisition and operations. The goals of these programs include design safety, operations safety, and contingency plans. Air Force safety programs, possible accident scenarios, and the environmental consequences of such accidents are discussed in Chapter 5.0 (Safety Considerations).

1.8 Authorizing Actions/Procedures

This LEIS does not address specific authorizing actions or procedures because no construction activities are associated with the decisions it is intended to support. However, deployment of the Small ICBM system will involve authorization of certain actions by federal, state, and local authorities. The Air Force is subject to all federal permit requirements, and is subject to some state and local permits as a result of executive orders and Air Force policies. Therefore, general federal authorizing actions are tabulated in Chapter 6.0; specific permit requirements (federal, state, and local) will be identified in the site-specific environmental impact statement to be completed in the next tier.

Table 1.6-5

ESTIMATED WATER AND AGGREGATE REQUIREMENTS FOR CONSTRUCTION
SMALL ICBM PROJECT

	Water Requirements[1] in Acre-Feet	(million gallons)	Aggregate Requirements in Thousand Short Tons
Hard Mobile Launcher in Random Movement			
50 Missiles			
Main Operating Base	207	(67)	325
Deployment Area	915	(298)	8,565
50 Missiles, Total:	1,122	(365)	8,890
200 Missiles			
Main Operating Base	251	(82)	642
Deployment Area	3,605	(1,175)	28,245
200 Missiles, Total:	3,856	(1,257)	28,887
Hard Mobile Launcher at Minuteman Facilities			
170 Missiles			
Main Operating Base	163	(53)	492
Deployment Area	438	(143)	3,451
170 Missiles, Total:	601	(196)	3,943
200 Missiles			
Main Operating Base	165	(54)	492
Deployment Area	834	(272)	4,064
200 Missiles, Total:	999	(326)	4,556
Hard Silo in Patterned Array			
250 Missiles			
Main Operating Base	112	(37)	377
Deployment Area	965	(315)	3,080
250 Missiles, Total:	1,077	(352)	3,457

Note: [1]Includes water for construction, dust control, and revegetation.

1.9 Mitigation Measures

Mitigations are measures undertaken to minimize the adverse environmental impacts of a given project. For the Small ICBM, efforts will be made to avoid sensitive areas and thereby eliminate or reduce project impacts. In addition, other mitigative programs may be employed to rehabilitate or restore the affected environment or to reduce or eliminate impacts through preservation procedures or compensation.

Since only potential impacts can be identified at this first tier of the EIAP, specific mitigation measures have not been developed. However, in the impact analysis described in Chapter 4.0, various assumed mitigation mechanisms, such as mitigation by avoidance, have been included in the analysis. During the second tier of the EIAP, specific measures to mitigate impacts will be developed and presented in the administrative environmental impact statement.

2.0 COMPARISON OF ALTERNATIVES

A comparison of potential project impacts at each alternative location for each basing mode is presented in this chapter. The magnitude and significance of impacts are discussed. Magnitude is a measure of the numbers and kinds of environmental consequences as compared to baseline conditions. It is defined by the level of impact (LOI), which can be negligible, low, moderate, or high. Significance requires consideration of both the context and the intensity of impacts.

Context and intensity are defined in the Council on Environmental Quality (CEQ) regulations. Context includes consideration of whether the scope of an impact is local, regional, or national, and whether its duration is short or long term. The primary scope of this document is regional, with regions defined as counties or multiple county areas, watersheds, airsheds, or physical basins. However, if environmental impacts of local or national significance were identified in the analysis, they were included in the discussion. Intensity, as defined in the regulations, "refers to the severity of an impact" which includes consideration of its magnitude.

Potentially significant impacts of the proposed project have been identified through a three-phase process. First, the environmental impacts within resource element categories were evaluated, then the LOI was identified, and finally significance was assessed. The LOI is a rating (negligible, low, moderate, or high) of the magnitude of an impact. The magnitude has been evaluated in terms of "numbers and kinds" of effects. The evaluation of LOI is based on both the absolute quantity of an affected resource and comparisons of this quantity with the regional resource base. Once the LOI is determined, an evaluation must be made as to whether the impact is significant. Significance is determined by evaluating the impact within the ten settings of intensity defined in the CEQ regulations and in Chapter 4.0 of this Legislative Environmental Impact Statement (LEIS), or by other criteria deemed appropriate for a given resource. In many cases, high LOIs will be judged as significant, but not in all cases. For example, the excess capacity of a system may be large enough so that even a moderate or large impact will not be rated as significant.

Both the LOI and significance of short and long-term impacts were evaluated separately. Short-term impacts are transient effects of the proposed project that are of short duration and generally caused by construction activities or operational start-up. Long-term impacts will occur over an extended period whether they start during the construction or operations phases. Most impacts from the operations phase are expected to be long term since project operations essentially represent a "steady-state" condition when impacts result from actions that occur repeatedly over a long period. However, long-term impacts can also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of a disturbed resource is slow.

Complete definitions of LOI and significance, in both general terms and for specific resources, are provided in Chapter 4.0, Environmental Consequences. These discussions include further consideration of both context and intensity.

The environmental issues were grouped into 9 resource categories with 28 sub-categories called resource elements. The LOI and significance for both short and long-term effects were evaluated for each of the 28 elements and are presented in Figures 2.0-1 and 2.0-2. The resource categories and their elements are the following:

- Socioeconomics
  - Regional Growth
  - Housing
  - Public Services
  - Public Finance

- Utilities
  - Potable Water Treatment and Distribution
  - Wastewater
  - Solid Waste
  - Energy Utilities

- Transportation
  - Highways

- Land Use
  - Land Use and Status
  - Regional Recreation
  - Visual Resources

- Cultural and Paleontological Resources
  - Prehistoric Cultural Resources
  - Historic and Architectural Resources
  - American Indian Cultural Resources
  - Paleontological Resources

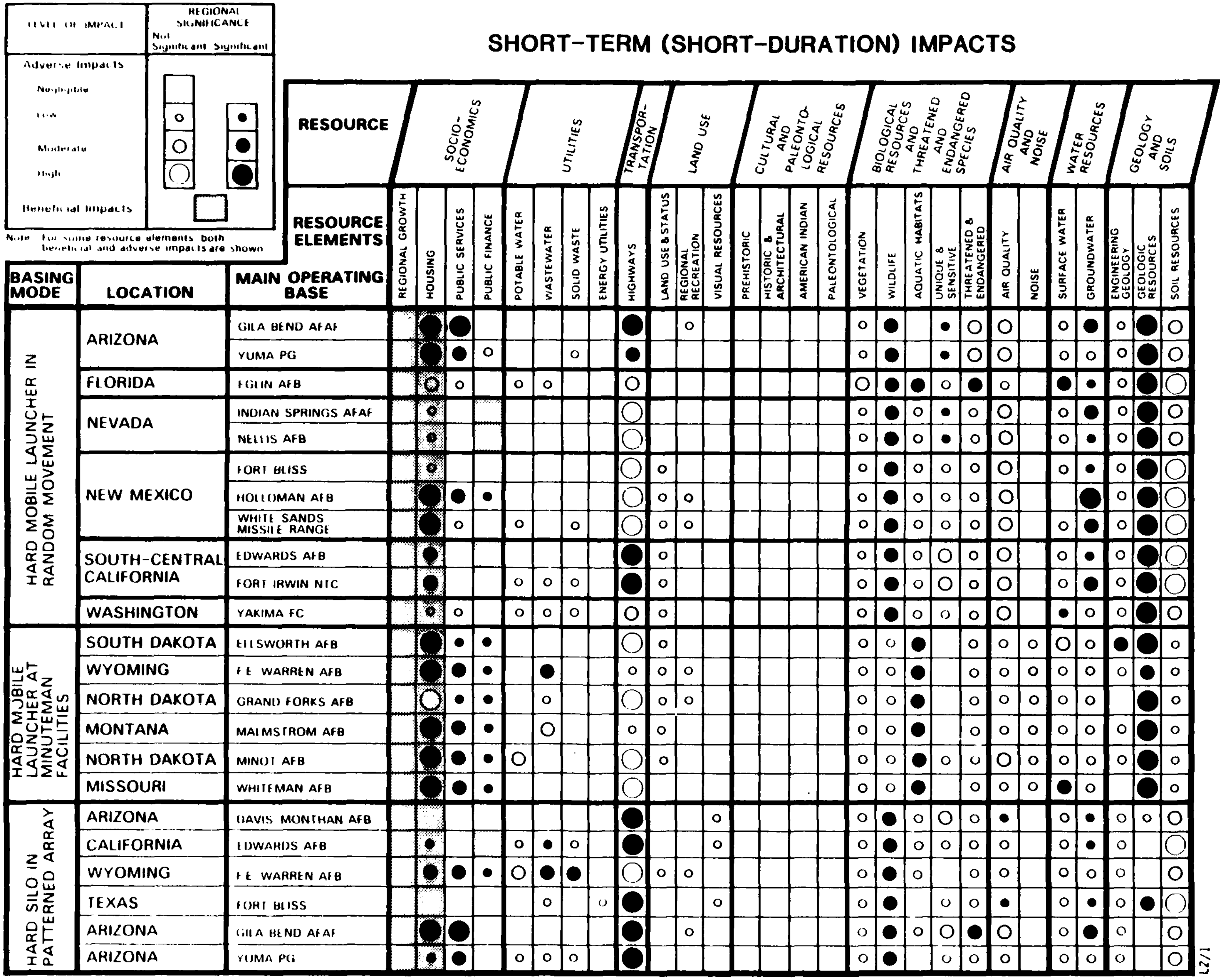
- Biological Resources and Threatened and Endangered Species
  - Vegetation
  - Wildlife
  - Aquatic Habitats
  - Unique and Sensitive Habitats
  - Threatened and Endangered Species

- Air Quality and Noise
  - Air Quality
  - Noise

- Water Resources
  - Surface Water Hydrology and Quality
  - Groundwater Hydrology and Quality

- Geology and Soils
  - Engineering Geology
  - Geologic Resources
  - Soil Resources

SHORT-TERM (SHORT-DURATION) IMPACTS



NOTE: ALL CULTURAL AND PALEONTOLOGICAL RESOURCE IMPACTS ARE ASSUMED TO BE LONG TERM.

FIGURE 2.0-1 MATRIX COMPARISON OF POTENTIAL SHORT-TERM IMPACTS

LONG-TERM (LONG-DURATION) IMPACTS

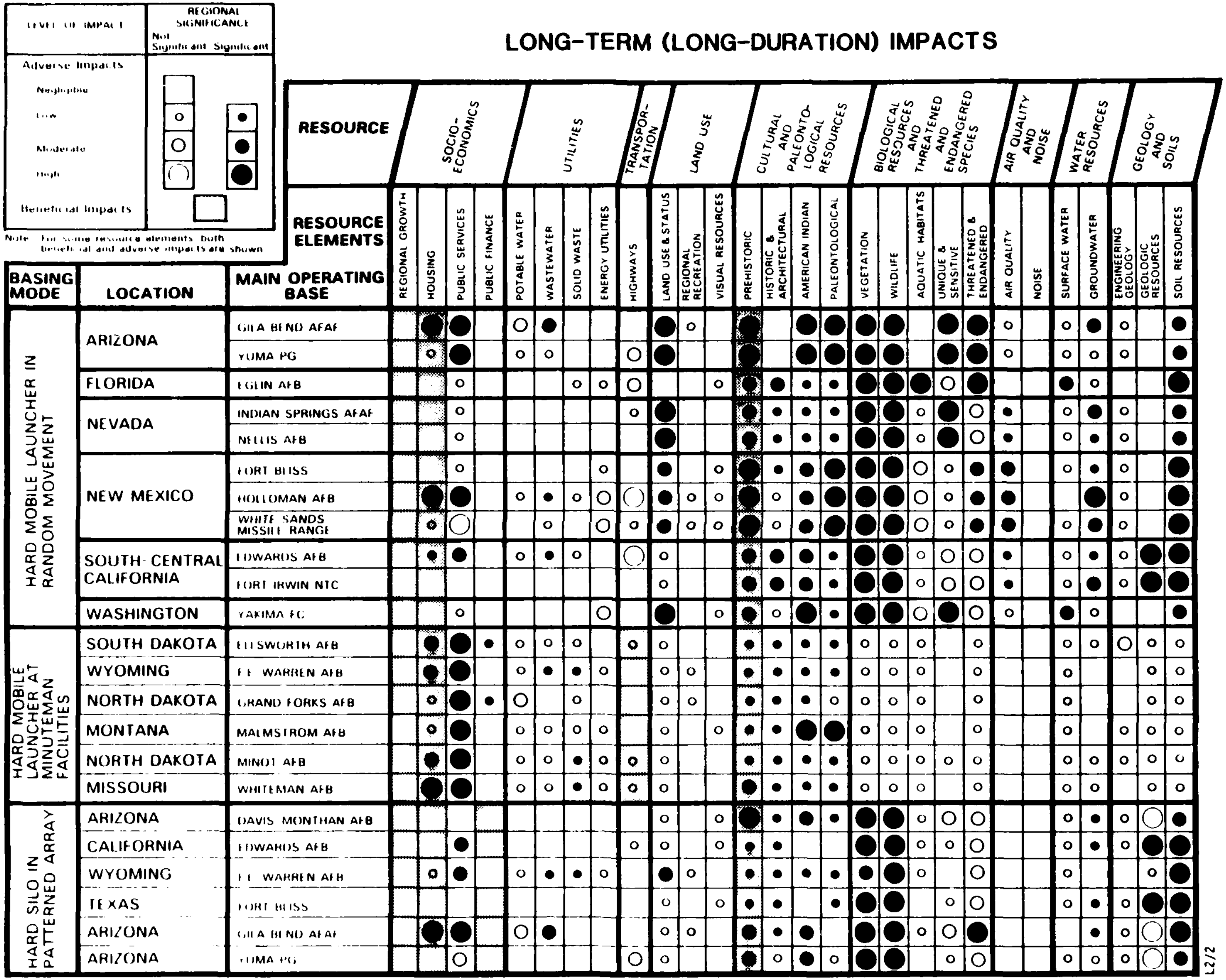


FIGURE 2.0 2 MATRIX COMPARISON OF POTENTIAL LONG-TERM IMPACTS

In Figures 2.0-1 and 2.0-2, potential adverse impacts of the proposed Small Intercontinental Ballistic Missile (ICBM) program are identified by various sized circles, which are darkened if the impacts are expected to have regional or national significance. The LOI for any resource element is indicated by the size of the circle. Beneficial impacts are identified by a shade pattern. As indicated in Figures 2.0-1 and 2.0-2, the proposed project may have both beneficial and adverse impacts for some resource elements. Since each resource element may have different regional importance or different perspectives, no attempt has been made to sum impacts either horizontally or vertically through the matrices. The figures identify regional impacts resulting from activities at the Main Operating Bases (MOBs) and their associated deployment areas. For the Hard Mobile Launcher in Random Movement basing mode, these impacts vary with the MOB selected. Therefore, impacts for this mode are shown for 11 alternative deployment configurations within 6 complexes.

The remainder of this chapter contains comparisons of the environmental impacts of alternative basing modes and basing locations and the No Action Alternative. The general impacts associated with the three basing modes are compared for each resource category, followed by a comparison of the potential environmental impacts at the alternative locations for each of the basing modes and the No Action Alternative.

2.1 Comparison of Basing Modes

The proposed project will have three general types of impacts: social impacts related to the inmigrating population, impacts to the physical environment related to the amount and type of land area disturbed by the project, and impacts resulting from construction material requirements. Resource categories most affected by the inmigrating population include socioeconomics, utilities, and transportation, and those most affected by land disturbance include cultural and paleontological resources, biological resources and threatened and endangered species, and soils. Impacts to other resource categorie are related in different measures to personnel requirements, land disturbance, and construction material requirements of the proposed project.

Population-related impacts are a function of the personnel requirements of the proposed project and the ability of the region to absorb the inmigrating population. In general, the socioeconomic impacts at the locations under consideration for the Hard Mobile Launcher at Minuteman Facilities basing mode are expected to be greater than at most of the locations considered for the other basing modes. The Minuteman bases are generally supported by small, isolated communities, which are also expected to support most of the inmigrating population. For the other basing modes, the potential socioeconomic impacts vary by location, ranging from negligible at some locations to high and significant at others. Impacts to utility systems vary by location and are generally greatest for the Minuteman Facilities basing mode. Short-term impacts to highway transportation are expected to be greatest for the Hard Silo in Patterned Array locations, where they will generally be high and significant, and lowest for the Minuteman locations, where they may be low to high, but not significant at the regional level. No regional, long-term, significant impacts to transportation are expected at any location.

Land disturbance impacts depend on the amount of surface area to be disturbed and the characteristics of the resources in the disturbed area. In general,

impacts to cultural and paleontological resources, biological resources and threatened and endangered species, and soils may be greatest for the Hard Mobile Launcher in Random Movement basing mode and least for the Minuteman Facilities basing mode.

The land use, air quality and noise, water resources, and geology and soils resource categories will be affected in various measures by the inmigrating population, land disturbance, and construction material requirements. Land use impacts are expected to be greatest for the Random Movement basing mode if onbase special status lands are affected. The use of special status lands may be required at several locations for this basing mode. Land use impacts may also occur if offbase lands are required for the Hard Silo basing mode. Air quality impacts will be the greatest if the Random Movement basing mode is selected in any of the southwestern locations, primarily because of dust generated from Hard Mobile Launcher (HML) operations. Water resources impacts are expected to be greatest for the Random Movement basing mode and least for the Minuteman Facilities basing mode because of scarcity or abundance of water in the respective regions. Short-term impacts to geology and soils will be greatest for the Random Movement and Minuteman Facilities basing modes and least for the Hard Silo basing mode.

2.1.1 Socioeconomics

The three alternative basing modes differ in their potential socioeconomic impacts because of the resource requirements of each basing mode and the socioeconomic characteristics of the areas suitable for deployment under each mode. The various basing modes are associated with different geographical regions, each with differences in available community infrastructure. Socioeconomic effects will be the greatest for the Hard Mobile Launcher at Minuteman Facilities basing mode and will be the least for the Hard Mobile Launcher in Random Movement basing mode.

The Minuteman Facilities basing mode will cause substantial long-term population increases because of operations needs for nearly 3,300 military personnel (for a force of 200 missiles). These increases will occur in areas that are generally less populated than areas suitable for other deployment modes. Consequently, housing, public services, and public finance impacts will be higher relative to without-project forecasts for these areas. Housing demands from the proposed project will be large relative to available vacancies in almost all areas. Public services impacts will be particularly important, primarily because of the long-term need to provide public education for between 1,400 and 1,600 additional students. Generally, local government revenues will not expand enough to cover incremental expenditures.

The Hard Silo in Patterned Array basing mode will have a lower overall impact potential than the Minuteman Facilities basing mode, and the pattern of impacts will differ substantially. Proposed project employment will peak in 1994 at approximately 5,400 direct jobs, and decline to a long-term level of less than 1,800 jobs (for a force of 250 missiles). The ability of local areas to absorb this growth will generally be greater for the Hard Silo basing mode than for Minuteman Facilities basing mode, since the Hard Silo deployment areas are usually more populated and the local housing and public service infrastructure is more extensive. Relatively low operations personnel requirements for this mode will reduce long-term socioeconomic impacts related to

operations. However, the build-up and phase-down cycles related to the construction phase will likely cause short-term, significant impacts at several locations. Temporary accommodations will be required for housing, schools, and other services during the peak years. Long-term public service effects will be significant at several of the less populated areas, while long-term housing and public finance impacts will be generally beneficial.

The Random Movement basing mode will have the lowest overall socioeconomic impacts. Although it will require a larger operations workforce than the other two modes (more than 3,900 personnel for a force of 200 missiles), its deployment areas are generally more populated than the Minuteman areas. Available housing and services in these areas could more easily support project-induced growth. Fewer of the potential deployment locations will experience high and significant impacts than will be the case for the Minuteman bases, and impact levels will be lower overall. Public services impacts will be significant at many locations because of long-term school enrollment increases of 1,900 students. Housing (short-term) impacts will be significant at one-half of the locations considered. Public finance impacts are generally negligible for most deployment locations. This basing mode will create slightly lower overall socioeconomic impacts than the Hard Silo basing mode. There will also be no substantial phase-down cycle to create needs for temporary housing and service facilities.

2.1.2 Utilities

The evaluation of impacts to regional utility systems is the product of numerous factors including the size of the project-related demand for the service, the projected growth of the region, and the system's capacity. Short and long-term impacts to utility systems will be the greatest for the Hard Mobile Launcher at Minuteman Facilities basing mode, lower for the Hard Silo in Patterned Array basing mode, and least for the Hard Mobile Launcher in Random Movement basing mode.

The Minuteman Facilities basing mode will have the greatest overall impact potential, though the impacts expected are moderate or low, and mostly not significant. All potable water treatment systems will have long-term, low to moderate impacts. Since the majority of the MOBs are supplied by major municipal suppliers, these impacts will not be significant since excess capacity will be available to meet average daily demands. Wastewater treatment systems will generally have adequate capacity to process additional flows, with the exception of the facilities in Laramie County, Wyoming (F.E. Warren Air Force Base [AFB] alternative), where short-term impacts will be moderate and significant and long-term impacts will be low and significant. Planning for future growth will be necessary to meet long-term demands. Solid waste disposal capacity will be adequate except at three locations, where new facilities may be required if present facilities do not receive permits. Long-term impacts to energy systems will be low and not significant at four locations.

Deployment of the Hard Silo basing mode, while almost equal to the Random Movement basing mode in the number of inmigrating persons, is proposed near urban areas that are experiencing substantial growth and increased demands on their utility systems. Short-term, low to moderate, and not significant impacts to potable water treatment systems will occur at three locations. Long-term, low to moderate, and not significant impacts will occur at two

locations. Wastewater systems in two locations will have short-term, low to moderate, and significant impacts during the construction phase. Long-term, low to moderate, and significant impacts will occur at two of the alternative locations. Demands for solid waste disposal capacity will burden the existing facilities at three locations where additional facilities are planned. Short and long-term, low, and not significant impacts to energy systems will also occur at two locations.

The Random Movement basing mode will have the lowest overall utility impacts, though there will be a larger inmigrating population than for the other modes. The utility systems at most locations have been experiencing significant growth. They have either developed excess capacity or have ongoing efforts in these areas to meet the growing demands through adequate facility planning. Potable water systems will have excess capacity to meet average daily demands in all locations. Eight MOB locations will have either short or long-term, low to moderate, but not significant impacts to potable water because of the amount of increased demand. Short-term wastewater treatment impacts will be low but not significant at three locations because of the increased amount of flow expected. Long-term, low, and significant impacts will occur at two locations because the baseline and project-induced demands will exceed capacity. One location will have long-term, moderate, and significant impacts. Several locations will have short-term, low, but not significant impacts to solid waste disposal facilities because of the increased use of these facilities and the consumption of excess capacity. Energy utilities will generally be adequate, with the exception of long-term, moderate, and not significant impacts at the Washington Complex and at two MOB locations of the New Mexico Complex.

2.1.3 Transportation

The three alternative basing modes differ in their potential for increasing congestion and travel time, and decreasing driver satisfaction and safety on regional primary roads. No regional impacts to other transportation modes are expected. The Hard Silo in Patterned Array basing mode is expected to have the greatest impacts and the Hard Mobile Launcher at Minuteman Facilities basing mode the least.

The Hard Silo basing mode is expected to generate substantially larger volumes of commuting traffic during the construction phase, and substantially smaller volumes (about one-half) during the operations phase than either of the Hard Mobile modes. In the construction phase, peak-year traffic flow to the deployment area will be approximately three to eight times larger than for the Hard Mobile modes, and volumes in other years will exceed the peak volume for either of the mobile modes for approximately 6 years. This prolonged period of high-volume commuting will generally result in multiyear, short-term, high, and significant impacts; these will likely affect the same roads every year of construction. Long-term impacts may range from negligible to moderate but will not be significant at the regional level during the operations phase.

The Hard Mobile Launcher in Random Movement basing mode will have smaller impacts to transportation than those of the Hard Silo basing mode. During the construction phase, short-term impacts will be moderate to high and may be significant at the regional level, but will be shorter and less intense because of the shorter construction period, smaller numbers of workers, and

distribution of commuter traffic over different roads at different times. Long-term impacts could be larger than the Hard Silo basing mode because of the larger numbers of operations workers. However, the differences are highly dependent on site selection, and none of the impacts are expected to be significant at the regional level. Minor differences in long-term impacts are not expected to outweigh the generally short-term, high, and significant effects associated with silo construction.

The Minuteman Facilities alternative will have the lowest impacts to transportation. The regions where this alternative will be deployed have well developed but comparatively lightly traveled primary road networks that can accommodate moderately large volumes of additional traffic within their remaining capacities. Although short-term impacts may be high in some areas during the construction phase, they will not persist for more than 1 or 2 years and will not be significant at the regional level. Long-term impacts will be low to negligible and not significant in the region during the operations phase. Beneficial long-term impacts will result from road and bridge improvements associated with this alternative.

2.1.4 Land Use

The Hard Mobile Launcher in Random Movement basing mode will have the greatest overall impacts to the land use resource. The Hard Silo in Patterned Array basing mode will result in somewhat smaller impacts than the Random Movement basing mode, and the Hard Mobile Launcher at Minuteman Facilities basing mode will have the least impacts to the land use resource.

Deployment of the Random Movement basing mode will generally cause the greatest impacts to land use and status because there is a potential for some operation of HML vehicles on federal lands designated for special control or set aside for resource management purposes (special status lands) at all but the Florida and South-Central California complexes. However, this basing mode will have the least impact to regional recreation because of the variety of recreation opportunities available in these regions and the capability of the recreation areas to absorb increased usage. Impacts to visual resources will be less for the Random Movement basing mode than for the Hard Silo basing mode because of the smaller amount of disturbed land within the viewshed areas which will be scattered over much larger areas.

Deployment of the Hard Silo basing mode will result in smaller impacts to land use and status. The primary concerns are the potential use of agricultural and special status lands. Impacts to regional recreation for this basing mode will be similar to those for the Random Movement basing mode, except that short-term impacts will be slightly greater because of a higher project-induced population during the construction phase. However, this basing mode will have the greatest impact to visual resources because the large disturbed area (approximately 18,000 acres) will be on relatively flat (and therefore more visible) land.

The Minuteman Facilities basing mode will have the least overall impact to land use and status because no special status lands will be disturbed and land disturbance will only occur for road, bridge, and culvert improvements. Because the proposed project facilities will generally be compatible with the surrounding visual environment and will be widely dispersed, this basing mode

will have the least impact to visual resources. However, this basing mode will have greater impacts to regional recreation because the percent increase in recreation use will be larger than in either of the other two basing modes.

2.1.5 Cultural and Paleontological Resources

The three alternative basing modes differ in regard to the level and type of potential impacts to cultural and paleontological resources. Cultural and paleontological impacts will be greatest for the Hard Mobile Launcher in Random Movement basing mode, followed by the Hard Silo in Patterned Array basing mode. The Hard Mobile Launcher at Minuteman Facilities basing mode will produce the least impacts. All impacts to cultural and paleontological resources are considered long term because the resources are nonrenewable. Some beneficial cultural resources impacts may occur through preconstruction identification and examination of currently unknown areas, which may add to the existing cultural and paleontological data base.

The Random Movement basing mode presents the highest potential for impacts to cultural and paleontological resources. Impacts from off-road movement for parking (within 750 ft of roads) of the HML will adversely affect these resources. This basing mode will cover a greater area and, therefore, have a potential for affecting more cultural and paleontological resource sites than other basing modes. For all installations, prehistoric site densities are moderate to high in Random Movement Areas (RMAs). Depending on road location, areas of possible disturbance include alluvial plains and alluvial/colluvial fans, which often contain prehistoric and American Indian site locations. In addition, the fragile desert pavement and/or sandy soils of all the installations except the Florida Complex are easily disturbed by off-road vehicles. Prehistoric sites associated with such deposits will also be disturbed. In instances where National Register of Historic Places (NRHP) historic and architectural sites are located within the RMA, installations have been estimated as having moderate and significant impacts (e.g., South-Central California). Impacts to American Indian cultural resources will be significant for most installations in this basing mode. Impacts to paleontological resources are projected to be high and significant for the Arizona and New Mexico complexes and low and significant elsewhere.

Impacts to cultural and paleontological resources at Hard Silo basing mode locations will be less than the Random Movement basing mode but more than the Minuteman Facilities basing mode. For the Hard Silo basing mode, approximately 28 square miles (sq mi) will be fenced and a network of semi-improved roads will be constructed to provide access to the silos. Direct impacts to sites or areas identified through surveys can be minimized and avoided in many instances. Some long-term, beneficial impacts could occur with this basing mode since any sites not affected during construction within the array would be protected from future vandalism and illegal excavation.

The Minuteman Facilities basing mode will have the least potential for impacts to cultural and paleontological resources. Existing facilities will be upgraded for this basing mode, and most impacts will occur when turning areas on access roads are enlarged, or additional base facilities are constructed. High, significant impacts will occur to American Indian and paleontological resources at Malmstrom AFB. Moderate, significant impacts could also occur to prehistoric resources at Whiteman AFB. All other elements will have low impacts.

2.1.6 Biological Resources and Threatened and Endangered Species

The Hard Mobile Launcher in Random Movement basing mode is expected to have the greatest biological impacts of the three basing modes because it will disturb the largest amount of biological habitat and most of this disturbance will result in long-term biological effects. The Hard Silo in Patterned Array basing mode will disturb less total area than the Random Movement basing mode, but will still result in severe, long-term disturbance of large areas of habitat, and therefore is expected to have major biological effects. The Hard Mobile Launcher at Minuteman Facilities basing mode is expected to have the least biological impacts because the disturbance to biological habitat is expected to be small in magnitude and duration compared to the other two basing modes. Short-term impacts are generally expected to be smaller than long-term impacts for all modes because relatively few impacts will be transitory. The environmental characteristics of the regions under consideration for deployment of the three basing modes tend to increase the magnitude of the biological impacts of the Random Movement and Hard Silo basing modes, and to decrease the impacts of the Minuteman Facilities basing mode. At most of the Random Movement and Hard Silo locations, proposed project actions will primarily affect relatively undisturbed vegetation and wildlife habitat, with resulting large ecological effects. The Minuteman sites are located in areas (mostly in northern tier states) where much of the natural habitat has already been removed or disturbed for agriculture or grazing. In addition, most of the Random Movement and Hard Silo locations are in arid regions of the western United States where ecological recovery rates are slow because of low rainfall and slow growth rates; therefore, complete recovery may never occur (the exception is the Florida Complex). As a result of project disturbances in these areas, biological effects will be longer in duration than those at most of the Minuteman locations, where higher rainfall results in faster biological growth and recovery rates.

The Random Movement basing mode will have the greatest biological impacts of the three basing modes, primarily because it will disturb the greatest amount of biological habitat. For this basing mode, construction will temporarily or permanently disturb a total of 22,600 acres (6,980 acres for 50 HMLs), and off-road HML operations will disturb an additional 175 to 350 sq mi (50-100 sq mi for 50 HMLs) over the life of the program. This will represent a major, long-term disruption of the vegetation and wildlife communities and biological production of each region. Although this mode will disturb large areas, it is generally not expected to create significant impacts to aquatic habitats because most of the proposed complexes are located in deserts where these habitats are rare. The exception is the Florida Complex, where significant aquatic impacts are expected. Because of the large area that will be disturbed by this basing mode, impacts to unique and sensitive habitats and to threatened and endangered species will be significant where numerous or important resources occur in the direct impact area.

Overall biological impacts for the Hard Silo basing mode will be less than those of the Random Movement basing mode because the Hard Silo basing mode will disturb less biological habitat (19,700 acres). However, this basing mode will still have long-term, significant impacts to vegetation and wildlife because the disturbed area will be large and the disturbance will result in a major disruption of the vegetation and wildlife communities and biological production of each region. The Hard Silo basing mode is generally not

expected to have significant impacts to aquatic habitats because of the small number of habitats that occur in the direct impact areas (deserts or semiarid areas). This basing mode is not expected to have significant impacts to unique and sensitive habitats because few such habitats occur in direct impact areas, or because there is a good likelihood of avoiding disturbance to these habitats. Although threatened and endangered species occur in all direct impact areas, impacts to these species are expected to be generally not significant because of the feasibility of avoiding or mitigating impacts.

The lowest overall biological impacts will occur for the Minuteman Facilities basing mode because this mode will disturb less biological habitat (3,110 acres for 170 HMLs; 3,500 acres for 200 HMLs) than the other modes. In addition, much of the vegetation and wildlife habitat that will be affected has already been disturbed by agriculture, grazing, or road construction and maintenance. Therefore, the expected disturbance will not represent a significant impact to the vegetation or wildlife communities or biological production of each region. The greatest biological impacts for this basing mode are expected to be short-term, significant impacts to aquatic habitats resulting from upgrading approximately 300 bridges and culverts at each location. Impacts to unique and sensitive habitats will not be significant for this basing mode because very few such habitats occur in or near the direct impact areas. Impacts to threatened and endangered species are expected to be less than for the other basing modes, primarily because of the smaller amount of habitat disturbed, and will therefore not be significant.

2.1.7 Air Quality and Noise

Air quality and noise impacts depend on two parameters: the extent of the area of the proposed project and the number of people involved (for both construction and operations phases). Air quality effects are governed by the location, extent, and schedule of the actions needed to construct the system. Operations requirements are different for each basing mode, ranging from an extensive surface disturbance potential for the Hard Mobile Launcher in Random Movement basing mode, to a more widespread but much less active positioning scenario for the Hard Mobile Launcher at Minuteman Facilities basing mode. The Hard Silo in Patterned Array basing mode falls in between in terms of area affected and operations, since it requires a compact module at a fixed location in some part of a suitable area. The 200-missile alternatives for the Random Movement basing mode will have the largest personnel impact because an operating force of more than 3,900 will be required. This will be about 600 more personnel than the 200-missile alternatives for the Minuteman Facilities basing mode, and over twice as many as the Hard Silo basing mode requirement of about 1,800. During the construction phase, the Hard Silo basing mode will have the largest average yearly workforce. Overall, the Random Movement basing mode will have the most effects on air quality and the Minuteman Facilities basing mode will have the least. Long-term noise impacts for all basing modes are expected to be negligible; however, some short-term impacts are expected for the Minuteman Facilities basing mode.

The Random Movement basing mode will cause long-term, significant air quality impacts in some areas. The potentially large disturbed area in the RMA, the frequency of HML movements and relocation, and a relatively large operating workforce contribute to this evaluation. Long-term impacts will not be significant where only 50 HMLs will be deployed. Short-term air quality

impacts from construction will be moderate and not significant at the regional level at all locations except the Florida Complex, which is rated as low. These impacts will be caused primarily by the operation of heavy equipment, the large number of trucks hauling aggregate, and congestion along workforce transportation routes. Short-term noise impacts will be negligible, because they will be confined to construction sites or the immediate vicinity of heavily used roads. Long-term, negligible impacts to noise levels are expected from HML movements in remote areas.

The Hard Silo basing mode will have short-term air quality impacts that will be low in most of the areas. Noise impacts will be negligible everywhere. In Tucson and El Paso, the relatively large workforce required for construction of this mode will cause some short-term, significant air quality impacts, though they are expected to be low. Both cities have designated nonattainment air quality areas, where incoming workers and their families will cause impacts from normal automobile use. Carbon monoxide (CO) levels may be particularly affected if traffic volumes in the city increase enough to cause congestion. Tucson is also subject to impacts from dust generated during construction. Long-term air quality and noise impacts will be negligible in all areas for this basing mode since movement will be limited and only a few operations personnel will be involved.

The Minuteman Facilities basing mode will have short-term, low, and not significant impacts in all but one location because of the limited construction and the widespread deployment locations. Occasionally, the nonattainment area at Great Falls may be moderately affected during the peak-construction years. Localized, low noise impacts will occur at isolated construction sites or possibly along the more heavily traveled roads. Long-term air quality and noise impacts will be negligible because of the very low level of activity associated with this basing mode.

2.1.8 Water Resources

Most of the significant water resource impacts will be associated with the Hard Mobile Launcher in Random Movement basing mode because all MOBs, except Eglin AFB, are situated in desert areas. With the exception of Eglin AFB and Yakima Firing Center (FC), the MOBs and their support communities have very limited water resources available to support proposed project needs. All but one of the MOBs in the Hard Silo in Patterned Array basing mode are also situated in desert areas. However, with the exception of Gila Bend Air Force Auxiliary Field (AFAF), water availability in the Hard Silo Regions of Influence (ROIs) is generally greater, and/or imported water is available to supply a portion of the proposed project water requirements. The Hard Mobile Launcher at Minuteman Facilities basing mode will generally have the least impact to water resources. This results from the generally greater degree of ground and surface water availability within the ROIs. However, the greater abundance of surface water features in the area associated with this basing mode indicates a higher potential for water quality degradation during the construction phase and accounts for the significant impact at Whiteman AFB.

Significant water resource impacts will occur for the Random Movement basing mode at 10 of the 11 alternative MOBs (Yuma Proving Ground [PG] is the exception). Significant surface water impacts will occur for the Eglin AFB and Yakima FC alternatives, resulting from expected water quality degradation

associated with land disturbance. Also, the impacts resulting from this basing mode will be generally higher for the groundwater element because, for most alternatives, the majority of project-induced water must be withdrawn from groundwater basins which are already substantially overdrafted and undergoing serious declines in groundwater levels.

For the Hard Silo basing mode, significant groundwater impacts will occur at four of the six MOBs because of water pumpage from heavily overdrafted groundwater basins. Impacts to the Gila Bend AFAF alternative will be moderate because of the lack of alternative water resources in this region. Suitable Deployment Areas (SDAs) for the silo modules are generally remote from perennial streams, and no significant surface water impacts will occur for this basing mode.

Significant water resource impacts for the Minuteman Facilities basing mode will occur at only one alternative, Whiteman AFB. This impact results from water quality degradation of the numerous streams in this region resulting from road and bridge upgrades in the missile deployment area. The MOBs for this basing mode lie within regions that have considerably higher availabilities of ground and surface water than the other two basing modes. Therefore, the potential for impact due to water demands associated with the project will be the least of the three basing modes. This basing mode also has the least amount of land disturbance associated with its construction and operations.

2.1.9 Geology and Soils

Short-term impacts are anticipated to be greater for the Hard Mobile Launcher in Random Movement and Hard Mobile Launcher at Minuteman Facilities basing modes than for the Hard Silo in Patterned Array basing mode. Long-term, significant impacts are expected for the Random Movement basing mode. Long-term, significant impacts were also identified for the Hard Silo basing mode. No long-term, significant impacts are anticipated for the Minuteman Facilities basing mode.

The Random Movement basing mode has the greatest potential for short and long-term impacts to geology and soils. Geologic resources will be adversely affected by the proposed project demand for aggregate, which is expected to be a substantial portion of the regional aggregate production rate and will adversely affect the availability of this resource. Therefore, short-term, significant impacts are expected at all alternative locations. Long-term, significant impacts to soil resources are anticipated because of the off-road operation of the HML vehicles, with additional short-term impacts expected as a result of construction activities at the MOB and in the deployment area.

The Hard Silo basing mode will generate fewer impacts to geology and soils than the Random Movement basing mode. Long-term and significant impacts will occur to geologic resources at two locations because of the potential conflict with mineral and energy resource development in the SDA. Long-term impacts to soil resources are expected to be significant at all alternative locations because of the presence of important farmland and erodible soils in the SDA.

The Minuteman Facilities basing mode will have the least potential for impacts to the geology and soils resource. However, significant adverse impacts are

anticipated for the geologic resource element as a result of high aggregate demand during the construction phase of the proposed project.

2.2 Comparison of Alternative Locations

Potential impacts at the alternative locations for each basing mode and the No Action Alternative are compared in this section for each of the nine resource categories. For the Hard Mobile Launcher in Random Movement basing mode, potential long-term, high, and significant impacts have been identified at various locations for socioeconomics, transportation, land use, cultural and paleontological resources, biological resources and threatened and endangered species, water resources, and geology and soils. Consequently, for this basing mode, no clear distinction can be made among locational alternatives except at the resource level, other than the lowest LOIs were generally identified for the two 50-HML locations (Florida and Washington). For the Hard Mobile Launcher at Minuteman Facilities basing mode, there is no clear distinction among locational alternatives relative to environmental consequences. For the Hard Silo in Patterned Array basing mode, the greatest number of potential short and long-term, high impacts have been identified for the Gila Bend AFAF alternative. For the No Action Alternative, projected conditions at the alternative basing locations, as discussed in Chapter 3.0, will prevail.

2.2.1 Hard Mobile Launcher in Random Movement

2.2.1.1 Socioeconomics

Overall, the highest LOIs for the Hard Mobile Launcher in Random Movement basing mode will occur in the Arizona Complex with Gila Bend AFAF as the MOB and at the New Mexico Complex with Holloman AFB as the MOB. The Arizona Complex with Yuma PG as the MOB and the New Mexico Complex with White Sands Missile Range Headquarters as the MOB will experience relatively lower impacts. Of the 200-missile complexes, the Nevada Complex, with either Nellis AFB or Indian Springs AFAF as the MOB, will have the lowest impacts, followed by the New Mexico Complex with the MOB at Fort Bliss, and the South-Central California Complex with the MOB at Fort Irwin National Training Center (NTC). This result is because of the proximity of major urban centers to the MOB. The deployment of 50 missiles at the Florida or Washington complexes will cause not significant impacts at either location.

Of the 11 alternatives, significant housing impacts will occur at 6 locations: the Arizona Complex with the MOB at Gila Bend AFAF or Yuma PG, the New Mexico Complex with the MOB at Holloman AFB or White Sands Missile Range Headquarters, and the South-Central California Complex with the MOB at either Edwards AFB or Fort Irwin NTC. Short-term impacts will be high and significant because proposed project housing requirements will exceed available vacancies at Gila Bend AFAF and Holloman AFB, and use over 50 percent of projected vacant housing at White Sands Missile Range and Yuma PG. Short-term impacts will be moderate and significant at Edwards AFB and Fort Irwin NTC since these remote areas will experience appreciable project housing demand during the early construction years. Long-term impacts at Gila Bend AFAF and at Holloman AFB will be high and significant since offbase housing requirements will exceed available vacancies. Edwards AFB will have long-term, low, and significant impacts since over 50 percent of available vacancies will be needed. For the other five alternative MOB locations, short-term housing impacts will

be either low or moderate and not significant since sufficient housing will be available. The lowest short-term housing impacts will be experienced at either of the Nevada Complex bases. Short and long-term beneficial effects of reduced vacancies will occur at all locations.

For the public services element, the Arizona Complex with Gila Bend AFAF as the MOB will experience the most severe impacts to local government employment. The Arizona Complex with the MOB at Yuma PG and the New Mexico Complex with the MOB at Holloman AFB will experience long-term, high, and significant public service impacts. The lowest public services impact levels for the 200-missile deployment alternatives will be at the South-Central California Complex with Fort Irwin NTC as the MOB, followed by the New Mexico Complex with Fort Bliss as the MOB, or the Nevada Complex with the MOB at either Nellis AFB or Indian Springs AFAF. The 50-missile deployment at the Florida or Washington complexes will cause minimal public service impacts in either MOB county.

For the public finance element, the most adverse effects will occur at the New Mexico Complex with Holloman AFB as the MOB, where short-term impacts will be low and significant and long-term impacts will be negligible. This location is followed by Yuma PG (Arizona Complex), where short-term impacts will be low but not significant and long-term impacts negligible. Revenue shortfalls in 5 years over the fiscal year (FY) 1990 to 1998 period are expected. The third highest impact location is the Eglin AFB (Florida Complex) alternative, where short and long-term impacts will be negligible, though revenue shortfalls in 8 years over the FY 1990 to 1998 period are expected. However, these shortfalls are relatively lower than those at Yuma PG when compared to their respective baseline revenue levels. The lowest public finance impacts for the 200-missile deployment alternatives will be found at the South-Central California Complex with Edwards AFB as the MOB and the Nevada Complex with the MOB at either Nellis AFB or Indian Springs AFAF. These rankings are based upon the estimated effects when measured against countywide revenue levels. Fiscal effects on individual local governments within each MOB county may be more severe than those implied by the countywide indicators.

2.2.1.2 Utilities

Impacts to the 200-missile alternative deployment locations for the Hard Mobile Launcher in Random Movement basing mode will be greatest at either the Holloman AFB alternative of the New Mexico Complex or the Gila Bend AFAF alternative of the Arizona Complex. Potable water and solid waste impacts at Holloman AFB will be long-term, low, and not significant; wastewater impacts will be long-term, low, and significant; and energy utilities impacts will be long-term, moderate, and not significant. At Gila Bend AFAF, potable water impacts will be long-term, moderate, and not significant, and wastewater impacts will be moderate and significant. Impacts in the Arizona (Yuma PG), South-Central California, and New Mexico complexes (with MOBs at Fort Bliss or White Sands Missile Range Headquarters) will be less severe, with the least severe impacts at the Nevada Complex. For the 50-missile deployment locations, impacts will be slightly greater for the Washington Complex.

Short-term impacts to potable water treatment systems will occur at Eglin AFB, White Sands Missile Range, Fort Irwin NTC, and Yakima FC, and long-term impacts at Gila Bend AFAF, Yuma PG, Holloman AFB, and Edwards AFB. Proposed

project deployment at these locations will result in low to moderate and not significant impacts to potable water treatment capacity. In these cases, the municipal potable water systems either have adequate average daily capacity or have programmed additional capacity to meet increased demands associated with a growing population. Short-term impacts at both 50-missile deployment locations will be low and not significant.

Impacts to wastewater treatment facilities at 200-missile deployment locations will be greatest at the Gila Bend AFAF alternative of the Arizona Complex. Long-term impacts will be moderate and significant since the inmigrating population will require additional capacity. Long-term impacts at Edwards AFB will be low and significant since growth in the region will consume all available capacity and expansion plans will not provide sufficient capacity to meet the increased flows from the project-induced population. Long-term impacts at the Holloman AFB alternative of the New Mexico Complex will be low and significant since smaller deficits in treatment capacity are anticipated. The White Sands Missile Range alternative will have low and not significant impacts as a result of adequate treatment capacity but increased flows. Wastewater flows for either of the 50-missile locations (Florida or Washington complexes) will increase slightly; however, projected capacity will be adequate and the short-term impact will be low and not significant.

Impacts to solid waste facilities at 200-missile deployment locations will occur at the Arizona, New Mexico, and South-Central California complexes. Short-term impacts will be low and not significant at these locations because of the increased amount of solid waste requiring disposal. All other alternative locations have adequate capacity and are planning for additional facilities to meet increasing demands. Long-term impacts at the Edwards AFB and the Holloman AFB MOB alternatives will be low and not significant. For the 50-missile deployment alternatives, long-term impacts at the Florida Complex will be low and not significant and short-term impacts at the Washington Complex will be low and not significant.

Long-term impacts to energy utilities at 200-missile deployment locations will be greatest at the Holloman AFB and White Sands Missile Range alternatives of the New Mexico Complex. At these locations, impacts will be moderate and not significant because of an appreciable increase in natural gas consumption in Dona Ana and Otero counties, which may require an improvement in the natural gas infrastructure. Long-term, low, and not significant impacts will occur at the Fort Bliss MOB location. At all other 200-missile locations, impacts will be negligible. Energy utilities impacts for the Washington Complex (50-missile deployment) will be moderate and not significant since project-induced demands for natural gas will represent a substantial increase in regional projected demands. However, demands can be met with available capacity.

2.2.1.3 Transportation

For the Hard Mobile Launcher in Random Movement basing mode, the South-Central California Complex with the MOB at Edwards AFB is projected to have the largest potential for regional impacts to transportation. Short and long-term impacts will be high, and the short-term impacts are expected to be significant at the regional level. The smallest regional impacts for 200-missile deployment are expected for either the Nevada Complex with the MOB at Nellis AFB, or in the New Mexico Complex with the MOB at Fort Bliss (El Paso, Texas).

In either case, short-term impacts will be high but not significant at the regional level, and long-term impacts will be negligible from a regional perspective.

Deployment in the South-Central California Complex with the MOB at Edwards AFB is projected to have the highest overall impact potential of all location alternatives for this mode. An appreciable length of a heavily traveled primary road could sustain reductions in service to a substantially degraded level of service (LOS E) during the peak-construction year. This condition would be followed by substandard service (LOS D) that could continue indefinitely into the operations phase. Additional regional roadways could also sustain substandard (LOS D) service during the construction phase.

Short-term, moderate to high impacts with regional significance could also be experienced if the system is based in the Arizona Complex with the MOB at Gila Bend AFAF or Yuma PG, or in the South-Central California Complex with the MOB at Fort Irwin NTC. The corresponding long-term impacts will be negligible to moderate and not significant at the regional level.

At the regional level, short-term, high, and not significant impacts and long-term, negligible to high, and not significant impacts will occur with basing at Fort Bliss, Holloman AFB, or White Sands Missile Range in the New Mexico Complex or Indian Springs AFAF or Nellis AFB in the Nevada Complex.

Short-term, moderate impacts without regional significance, and long-term, moderate to negligible impacts are expected to accompany basing at Eglin AFB and at Yakima FC, respectively (50-missile locations). These are the lowest LOIs projected for this basing alternative.

2.2.1.4 Land Use

For the Hard Mobile Launcher in Random Movement basing mode, the Arizona and Nevada complexes will have the greatest overall land use impacts because of the high and significant impacts that will result from the potential use of special status lands that include portions of proposed wilderness areas. Impacts at the New Mexico and Washington complexes will be somewhat less, with moderate and high, significant impacts, respectively, resulting from the potential use of existing onbase grazing lands and special status lands. Overall impacts to land use will be least at the Florida and South-Central California complexes, where both short and long-term impacts to all three elements will be negligible or low and not significant.

Proposed project deployment in the Nevada Complex will have the greatest overall impact to land use and status if HML operations are allowed in the Nevada Wild Horse Range and the Desert National Wildlife Range (a proposed wilderness area). The Arizona and Washington complexes will have high impacts and the New Mexico Complex will have moderate impacts resulting from possible HML operations within the Cabeza Prieta National Wildlife Refuge (a proposed wilderness area), the Wahluke Slope State Wildlife Recreation Area and Saddle Mountain National Wildlife Refuge, and the Jornada Experimental Range and Lincoln National Forest, respectively. Impacts at these four complexes will be significant because of the potential use of these special status lands and the potential for precluding the designation of portions of the Cabeza Prieta National Wildlife Refuge and Desert National Wildlife Range as wilderness

areas. The South-Central California Complex will have low and not significant impacts as a result of proposed project deployment on onbase grazing lands, and the Florida Complex will have negligible impacts.

Proposed project deployment at the New Mexico Complex (with the MOB at either Holloman AFB or White Sands Missile Range Headquarters) or the Arizona Complex (with the MOB at Gila Bend AFAF) will have the greatest impacts to regional recreation. Deployment at these locations will result in percentage increases in regional recreation use which are similar to the other locations. However, these locations have recreation areas in proximity to potentially affected population centers which may receive a higher proportion of the increased recreation use. Impacts at all other locations will be negligible.

The greatest long-term visual resource impacts, though rated as low, will occur at the Florida and Washington complexes. Viewshed areas for these complexes contain high percentages of the total RMAs and relatively large areas of special visual quality. The New Mexico Complex, with its large viewshed area and relatively large number of scenic highways, will have only slightly lower impacts. Short-term impacts at these three complexes will be negligible. Visual resources impacts at the Arizona, Nevada, and South-Central California complexes are expected to be negligible.

2.2.1.5 Cultural and Paleontological Resources

Proposed project deployment for the Hard Mobile Launcher in Random Movement basing mode in the Arizona and New Mexico complexes will have the highest impacts. Lower impacts will occur at the other installations.

High and significant impacts to prehistoric cultural resources will occur in the Arizona and New Mexico complexes. Moderate and significant impacts are expected in the Nevada, South-Central California, Florida, and Washington complexes because of lower site densities.

Deployment in the South-Central California and Florida complexes will have the highest impacts to historic and architectural resources. Low and significant impacts will be experienced in the Nevada Complex and in the New Mexico Complex with Fort Bliss as the MOB. The Arizona Complex will experience the least impacts to historic and architectural resources.

High and significant impacts will occur to American Indian cultural resources in the Arizona and Washington complexes because many American Indian groups still live in the vicinity of the military installations, and areas important for sacred or ceremonial reasons probably exist within the RMA. Moderate and significant impacts are expected in the New Mexico and South-Central California complexes, where many American Indians have a long history of use and/or occupation. Low and significant impacts may occur in the Florida and Nevada complexes, where American Indian use or occupation has been sporadic or not recent.

High and significant impacts to paleontological resources are expected in the Arizona and New Mexico complexes. Fossiliferous materials have been identified in RMAs on both complexes, and the likelihood of affecting additional deposits is high. Low but significant impacts may occur in the remaining complexes. Paleontological formations have been identified but may be avoided if they occur in the RMAs.

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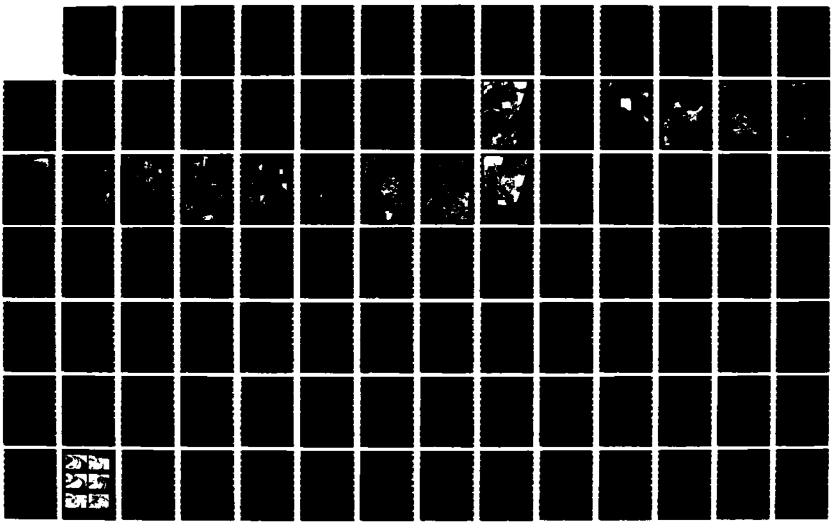

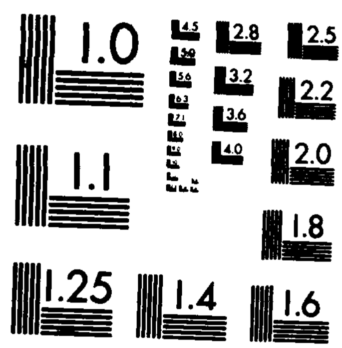
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2.2.1.6 Biological Resources and Threatened and Endangered Species

Significant biological impacts are expected to occur at all six locations for the Hard Mobile Launcher in Random Movement basing mode because of the large area of biological habitat expected to be disturbed at each location and the presence of sensitive habitats and species at some locations. Overall biological impacts will be greatest at the Florida and Arizona complexes because of long-term, high, and significant impacts to four of the five elements (vegetation, wildlife, threatened and endangered species, and aquatic habitats [Florida] or unique and sensitive habitats [Arizona]). Overall impacts will be least at the South-Central California Complex, where significant impacts to only two elements (vegetation and wildlife) are expected. At the remaining complexes (Nevada, New Mexico, and Washington), three elements are expected to receive significant impacts.

Long-term impacts to vegetation and wildlife will be high and significant at all locations because of the large amount of vegetation and wildlife habitat that will be disturbed, and the resulting disruption of ecological systems and biological productivity of each region. These impacts will be greater at the 200-HML complexes (Arizona, New Mexico, Nevada, and South-Central California) than at the 50-HML complexes (Florida and Washington) because of the larger amount of habitat disturbed.

Impacts to aquatic habitats will be significant only at the Florida Complex because of the presence of many high-quality habitats in the RMAs. Aquatic impacts will not be significant at the other complexes because of the small number of habitats potentially affected and/or the likelihood of avoiding impacts to these habitats.

Impacts to unique and sensitive habitats will be significant at the Arizona, Nevada, and Washington complexes, primarily because of potential impacts to national wildlife refuges. At the other three complexes (Florida, New Mexico, and South-Central California), impacts to unique and sensitive habitats will not be significant because of the likelihood of avoiding impacts to the biological uniqueness of these habitats.

Potential impacts to threatened and endangered species are considered significant at the Arizona, Florida, and New Mexico complexes because of the high presence of listed species in the direct impact area, and the potential difficulty for mitigating impacts to these species. Impacts to threatened and endangered species will be greatest at the Arizona Complex because of expected habitat disturbance of the only United States population of the federally endangered Sonoran pronghorn (nationally significant). At the Nevada, South-Central California, and Washington complexes, impacts to threatened and endangered species are considered not significant because of the expected feasibility of mitigating impacts. Evaluation of impacts to threatened and endangered species should be considered preliminary, because the exact location of species in impact areas will not be known until site-specific studies are conducted, and because the extent that the proposed project can be modified to avoid impacts to these species is not yet known in detail.

2.2.1.7 Air Quality and Noise

For the Hard Mobile Launcher in Random Movement basing mode, the Nevada, New Mexico, and South-Central California complexes will have potentially long-term and significant air quality impacts. Impacts will range from moderate in the New Mexico Complex to low in the South-Central California and Nevada complexes, and will be associated with increased dust levels and visibility degradation from HML movements within the RMAs. At the South-Central California Complex, visibility degradation has occurred in the Mojave Desert because of increasing population levels. At the Nevada Complex, the Las Vegas Valley is a nonattainment area for air quality. At the New Mexico Complex, moderate impacts are related to the RMA's proximity to two Class I areas where visibility is an important consideration, and the potential for moderate impacts is greater than in the South-Central California or Nevada complexes. For the Arizona, Florida, and Washington complexes, impacts to air quality will not be significant, though they may occasionally reach moderate levels.

At the Washington Complex, the possibility of affecting the nonattainment area in Yakima will raise the regional short-term impact evaluation to moderate. For the Arizona Complex with Yuma PG as the MOB, CO levels may occasionally cause moderate impacts in the city of Yuma. With the MOB at Gila Bend AFAF, moderate, regional impacts to air quality from population increases associated with the proposed project will occur. In the Florida Complex with the MOB at Eglin AFB, low air quality impacts are expected, and these will be primarily associated with dust potential in the drier portions of the year.

Short-term, moderate impacts to air quality may occur in the New Mexico Complex, where the construction of an MOB at Fort Bliss may result in increased CO emissions during the construction phase. The El Paso nonattainment area for CO will largely affect this evaluation. For the other MOB locations in New Mexico and the MOBs associated with the remaining complexes in other states, the short-term air quality impacts will be low or moderate and not significant on a regional basis. They will be primarily associated with CO emissions from construction equipment, aggregate-hauling trucks, and the vehicles of commuting workers.

Short-term noise impacts from the expected increase in truck traffic in the region will be negligible for all Random Movement basing mode complexes. Noise impacts are expected only near the construction sites and in the immediate vicinity of the more heavily traveled major highways. Some community impacts may occur depending on traffic routing. Long-term, negligible noise impacts from HML movements are expected in all complexes.

2.2.1.8 Water Resources

Generally, water resource impacts for the Hard Mobile Launcher in Random Movement basing mode will be the highest for the New Mexico Complex, where two of the three alternative MOBs will result in moderate to high and significant impacts. For the Arizona Complex, Gila Bend AFAF will have the next highest impact because of lack of water availability. The Florida and Washington complexes are the only alternatives that will have significant surface water impacts. The South-Central California and Nevada complexes will have overall water impacts generally similar to each other, though water availability may be somewhat more limited for the Fort Irwin NTC alternative (South-Central

California Complex). The least water impact will occur for the Yuma PG alternative for the Arizona Complex, where low and not significant impacts will occur.

Significant surface water impacts for this basing mode will occur at the Florida Complex (Eglin AFB) and the Washington Complex (Yakima FC and Department of Energy [DOE] Hanford Site). Land disturbance associated with proposed project construction and operations has the potential to seriously degrade the surface water quality of the numerous streams flowing through these bases, and in the case of Eglin AFB, may also degrade the quality of an adjacent estuary. At Yakima FC and the DOE Hanford Site, the short-term impacts will likely be low and significant while the long-term impacts will be moderate and significant. All remaining surface water impacts will be low and not significant except for the Holloman AFB alternative (New Mexico Complex). The actual absence of project-affected surface water features associated with this alternative will result in negligible impacts.

The Holloman AFB alternative has the highest potential to affect groundwater. Both the MOB and its support community of Alamogordo are facing increased competition for the same, rather limited groundwater source, which will be considerably accelerated by the proposed project. No other readily available sources can provide large, additional quantities of water to the area. This is the only alternative where high and significant water impacts were identified. Gila Bend AFAF (Arizona Complex) and its support community of Gila Bend draw their water supply from a groundwater source of marginal quality in an overdrafted basin. Proposed project requirements will substantially exceed the developed supply and require extensive additional groundwater development. Additional groundwater supplies can be developed in the basin but short and long-term groundwater impacts will be moderate and significant.

Other alternatives will have similar impacts to those at Gila Bend AFAF. Groundwater conditions at White Sands Missile Range (New Mexico Complex) are similar to those at Holloman AFB, except that the former does not compete with any other major water users and also has access to a substantial additional groundwater source within reasonable distance. Similarly, Fort Irwin NTC and Indian Springs AFAF (Nevada Complex) do not compete with their respective support communities for water. However, groundwater availability is limited and each base will probably need to develop new groundwater sources in basins that are, or will become, overdrafted. In addition, the support community for Fort Irwin NTC, Barstow, will increase pumpage within an overdrafted basin.

A somewhat lower level of groundwater impact will result if Fort Bliss, Nellis AFB, Edwards AFB, or Eglin AFB is selected. Although Fort Bliss (New Mexico Complex) and its support community use a severely overdrafted groundwater basin for most of their supply, there is a large quantity of groundwater available and the proposed project will increase total pumpage by only a small percent. Short and long-term impacts will be low and significant for all but Eglin AFB, where the short-term impacts will similarly be low and significant but the long-term impacts will be low and not significant. The groundwater conditions are generally similar for the Nellis AFB and Edwards AFB alternatives, except that the MOBs and their support communities have access to imported water supplies that might be used to further reduce groundwater impacts. The support community for Eglin AFB, Fort Walton Beach, draws

its water from a declining aquifer. The proposed project may accelerate this decline during the construction phase, along with an associated saltwater intrusion of the aquifer.

No significant groundwater impacts were identified for either Yuma PG in the Arizona Complex or Yakima FC in the Washington Complex. The groundwater impacts for these two alternatives will be low and not significant.

2.2.1.9 Geology and Soils

The Hard Mobile Launcher in Random Movement basing mode is expected to have impacts at all alternative locations, with significant impacts anticipated for geologic and soil resources. Long-term impacts will be greatest at the South-Central California Complex because of high, significant impacts to geologic and soil resources. Impacts will be slightly less severe for the New Mexico and Florida complexes, with the least impacts expected at the Arizona, Nevada, and Washington complexes. Short-term impacts will be greatest at the California, Florida, and New Mexico complexes because of high aggregate demand. Proposed project aggregate demand is estimated to be a large percentage of the regional aggregate production rate near most complexes, but this demand will not extend beyond the construction phase of the project. Soil erosion is expected to accelerate as a result of construction activities on the installations and off-road operation of the HMLs in the RMAs. Many of the complexes are located in arid or semiarid regions where wind erosion of the soil is a concern.

Short and long-term impacts to engineering geology will be low and not significant for all alternative installations except for long-term, negligible impacts to the Florida and Washington complexes. It was assumed that the necessary construction engineering practices will be used to mitigate project-induced impacts to this element. Short-term impacts to geologic resources will be high and significant for all alternatives because of the demand for aggregate resources. Long-term impacts for the South-Central California Complex will be high and significant because of the potential effects on geothermal resource development at China Lake Naval Weapons Center (NWC). Long-term impacts for the other alternatives will be negligible. Peak-year project aggregate demand, a factor that drives the impacts to geologic resources at most of the alternatives and expressed as a percentage of the annual production in the ROI, is estimated to be 36 percent (Arizona Complex), 47 percent (South-Central California Complex), 165 percent (Washington Complex), 297 percent (Nevada Complex), 439 percent (Florida Complex), and 398 percent (New Mexico Complex).

Long-term impacts to soil resources will be high and significant for the Florida, New Mexico, and South-Central California complexes and moderate and significant for the other complexes. Many soils on the complexes in the Southwest are highly susceptible to wind and sheet erosion and difficult to revegetate because of the lack of precipitation. Off-road operation of the HMLs in the RMAs accounts for the majority of the impacts to soil resources.

2.2.2 Hard Mobile Launcher at Minuteman Facilities

2.2.2.1 Socioeconomics

Impacts to housing, public services, and public finance for the Hard Mobile Launcher at Minuteman Facilities basing mode will occur at all six locations. Areas where effects will be highest are Whiteman and Minot AFBs, because the proposed project will create short and long-term growth which will be large compared to each area's support capacities. Ellsworth AFB will experience the third highest LOIs because of lower impact levels for public services and public finance. If Malmstrom AFB is chosen for deployment, the effects will be the least because both short and long-term housing and public finance impacts will be relatively lower.

Short-term housing impacts will be most severe at Whiteman, Minot, and Ellsworth AFBs since proposed project housing demand will exceed available vacancies during the construction phase. Housing impacts will be lowest at Grand Forks AFB, because less than 50 percent of available housing units will be required. At Minot and F.E. Warren AFBs, a substantial portion of available housing will be needed by the proposed project, which may cause some temporary shortages. Long-term housing impacts at Grand Forks and Malmstrom AFBs will be low and not significant since 85 percent of military personnel will be housed onbase. The other four bases will experience long-term, moderate to high, and significant impacts with only 60 percent of personnel housed onbase.

Since these alternatives are all located in small and slowly growing rural areas, public services impacts will be significant regardless of the site selected. Whiteman AFB will experience the greatest impacts to local government employment. Similar conditions will exist at Minot and Malmstrom AFBs. Ellsworth AFB will experience the lowest public service impacts, though public employment issues will remain significant.

Public finance impacts will be greater at Grand Forks AFB and Ellsworth AFB, where short and long-term impacts will be low and significant. For all MOBs, project-induced revenues will be inadequate for 2 years or more. Minot, Whiteman, F.E. Warren, and Malmstrom AFBs will experience lower public finance impacts, where short-term impacts will be low and significant and long-term impacts will be negligible.

2.2.2.2 Utilities

Impacts to alternative deployment locations for the Hard Mobile Launcher at Minuteman Facilities basing mode will be greatest at F.E. Warren AFB, where short-term, moderate, and significant impacts to wastewater facilities and long-term, low, and not significant impacts to potable water treatment and energy utilities have been identified. In addition, long-term, low, and significant impacts to wastewater and solid waste facilities will occur. Impacts at Minot, Whiteman, Malmstrom, and Grand Forks AFBs will be less severe, and impacts will be least at Ellsworth AFB.

Short-term impacts to potable water treatment systems will be greatest at the Minot AFB location, where they will be moderate and not significant. Long-term impacts will be greatest at Grand Forks AFB, where impacts will be

moderate and not significant. All other alternative locations will have long-term, low, and not significant impacts. In these cases, the municipal potable water systems either have adequate average daily capacity or have programmed additional capacity to meet increased demands associated with a growing population.

Short and long-term impacts to wastewater treatment facilities will be greatest at F.E. Warren AFB. Wastewater treatment facilities in Laramie County will experience shortages in treatment capacity beginning in 1996, and conditions will be exacerbated by growth in the onbase population during the operations phase. Short-term, moderate, and not significant impacts are expected at Malmstrom AFB because of increased flows. Adequate facilities should be available to handle this flow. Impacts at all other alternative deployment locations will be negligible or low.

Impacts to solid waste disposal facilities will be greatest at the F.E. Warren, Whiteman, and Minot AFB alternatives since existing landfills are either near capacity or will close, and additional facilities are not being actively developed. This situation, combined with a 10-percent increase in demand for disposal space during the construction phase, will create a long-term, low, and significant impact. All other alternative deployment locations will have long-term, low, and not significant impacts since disposal sites are available or are in the process of being sited.

Long-term impacts to energy utilities will be low and not significant at F.E. Warren AFB since the increase in electrical demand in Laramie County and the region surrounding F.E. Warren AFB represents a reduction in the capacity margin from 9.4 to 8.2 percent. Impacts at Malmstrom, Minot, and Whiteman AFBs are also considered low and not significant since demands for electricity may require system upgrades or additional generating capacity. All other alternative locations will have negligible impacts.

2.2.2.3 Transportation

Deployment of the Hard Mobile Launcher at Minuteman Facilities basing mode at Ellsworth, Minot, and Whiteman AFBs is projected to have the largest potential for regional impacts to transportation. Short-term impacts will be high, and long-term impacts will be low and are not expected to be significant at the regional level. The smallest regional impacts are expected for deployment either at F.E. Warren AFB or Malmstrom AFB. In either case, short-term impacts will be low and not significant at the regional level, and long-term impacts in the region will be negligible.

Deployment at Grand Forks AFB is intermediate in impact potential between these two groups. Short-term impacts are projected to be high but not significant at the regional level, and long-term impacts will be negligible on a regional basis.

2.2.2.4 Land Use

Deployment of the Hard Mobile Launcher at Minuteman Facilities basing mode at any of the proposed bases will result in negligible or low and not significant impacts to the land use resource elements. Impacts to regional recreation will be greatest at the F.E. Warren and Grand Forks AFB locations because of

the proximity of several major recreation areas to these locations. The Malmstrom AFB location will have the greatest impacts to visual resources because of the high average annual daily traffic (AADT) on the scenic highways in the region.

Proposed project deployment at any of the bases except Whiteman AFB will result in short-term, low impacts to land use and status as a result of the potential disturbance of onbase agricultural leased lands from project construction activities. Long-term, low impacts for all six alternative locations will occur as a result of the potential use of agricultural lands for the road improvements required to accommodate HML movements.

Proposed project deployment at F.E. Warren and Grand Forks AFBs will have the greatest overall impacts to regional recreation. Deployment at these locations will result in percentage increases in regional recreation use which are similar to the other locations. However, these locations have recreation areas close to potentially affected population centers which may receive a higher proportion of the increased recreation use. Impacts at all other locations will be negligible.

Deployment at Malmstrom AFB will have the greatest long-term impacts to visual resources because of the relatively large number of launch facilities (compared to other Minuteman bases) within the viewshed areas and the relatively high AADT on the scenic highways. Short-term impacts at Malmstrom AFB will be negligible. Impacts at other locations will be negligible.

2.2.2.5 Cultural and Paleontological Resources

Deployment of the Hard Mobile Launcher at Minuteman Facilities basing mode at Whiteman AFB will have moderate but significant impacts to prehistoric cultural resources. Impacts to American Indian and paleontological resources will be high and significant at Malmstrom AFB. At the remaining installations, impacts are expected to be low and significant for all elements except paleontological resources, where at Grand Forks AFB, will experience low but not significant impacts.

Moderate and significant impacts to prehistoric cultural resources will occur at Whiteman AFB; site density is high along drainages and floodplains, and many drainages occur in the deployment area. The remaining installations can expect low but significant impacts. Impacts are expected to be low because site densities are low, HMLs will operate on existing roads, and silos already exist.

Low and significant impacts to historic and architectural resources are predicted for all installations. Most NRHP-eligible sites are located in areas where avoidance or protection is possible, and the nature of the proposed project dictates that overall impacts will be low.

The potential impacts to American Indian cultural resources will be high and significant at Malmstrom AFB because many American Indian groups hunted and lived in, or passed through, the ROI. The Kutenai, Blackfeet, and Flathead are known to have sacred or ceremonial areas where any impact will be significant. Impacts at the other locations are expected to be low and significant because avoidance of potential sacred areas within the ROI may be possible.

Paleontological resources of scientific value have been identified adjacent to Malmstrom AFB on the west. Impacts to these materials could be high and significant. Low but not significant impacts are expected at Grand Forks AFB. At the remaining installations, impacts are expected to be low and significant.

2.2.2.6 Biological Resources and Threatened and Endangered Species

Regardless of the the location chosen for the Hard Mobile Launcher at Minuteman Facilities basing mode, biological impacts are expected to not be significant, with the exception of short-term impacts to aquatic habitats. All other biological impacts will be minor at all locations because of the relatively small amount of natural biological habitat expected to be disturbed. Overall impacts are slightly greater at Minot AFB than at the other locations because of a higher potential for impacts to unique and sensitive habitats. Otherwise, overall biological impacts are similar for all locations.

Vegetation and wildlife impacts are not expected to differ significantly among the six locations, because little biologically valuable vegetation or wildlife habitat will be disturbed at any location. Slightly more habitat will be affected at the 200-HML locations (F.E. Warren and Malmstrom AFBs) than at the other four locations, but the difference is minor. Disturbance in the deployment areas of Grand Forks, Minot, and Whiteman AFBs will primarily affect agricultural land, while a combination of grassland and agricultural land will be affected at the Ellsworth, F.E. Warren, and Malmstrom AFB deployment areas.

Short-term impacts to aquatic habitats are expected to be significant at all locations, consisting of disturbance of aquatic habitat and water quality from upgrading of approximately 300 bridges and culverts in each deployment area. Recovery is expected to be reasonably rapid, so that long-term impacts will not be significant, as will aquatic impacts resulting from other aspects of the proposed project.

Impacts to unique and sensitive habitats are not expected to be significant at any location because of the small area that will be disturbed and the general absence of such habitats from direct impact areas. At Minot AFB, minor impacts may occur to biological habitats of a national wildlife refuge, part of which occurs in the deployment area.

Although threatened and endangered species are known or are likely to occur in direct impact areas at all locations, impacts are expected to be low and not significant because of the small amount of habitat that will be disturbed and the likelihood of satisfactorily mitigating any potential impacts. Federally listed species are most likely to be affected at Ellsworth and Malmstrom AFBs.

2.2.2.7 Air Quality and Noise

Short-term impacts to air quality for all proposed Hard Mobile Launcher at Minuteman Facilities basing mode alternatives will be low or moderate and not significant at the regional level, and long-term impacts will be negligible. For the Ellsworth AFB region, many of the launch facilities will be close to the boundaries of the Badlands National Monument, a Prevention of Significant Deterioration (PSD) Class I area. However, the activity level associated with this deployment mode will be so low and intermittent that no long-term effects

are anticipated. The same is true for the wilderness areas west of Malmstrom AFB and Lostwood Wilderness near Minot AFB. At least one Minuteman facility is situated on the Lostwood Wilderness boundaries; therefore, short-term, moderate impacts are anticipated.

Short-term noise impacts are expected to be low and not significant for populated locations, with disturbances primarily related to small-scale, local construction activities at the launch facilities and their access roads. Long-term noise impacts will be negligible.

2.2.2.8 Water Resources

Short-term, moderate, and significant water resource impacts were identified for the Whiteman AFB alternative for the Hard Mobile Launcher at Minuteman Facilities basing mode. One alternative, Ellsworth AFB, will have a short-term, moderate, and not significant impact. The remaining four alternatives will have low and not significant or negligible water resource impacts. Locating the MOB at Malmstrom AFB will probably result in the least water impact because of the availability of an ample project water supply from the nearby Missouri River. All but one of the MOBs under consideration for this basing mode (Whiteman AFB) receive their water supply from their respective support communities. Several of the bases will need a substantial increase of the contract water amount supplied by the community and/or the physical supply capacity of the lines serving the bases in order to meet proposed project demands. These include Ellsworth, Grand Forks, Malmstrom, and Minot AFBs.

Locating the MOB at Whiteman AFB will have the highest surface water impact. Extensive road, bridge, and culvert upgrades will result in short-term water quality degradation within the relatively dense network of streams flowing through this area. Long-term impacts will be low and not significant. Moderate, not significant surface water impacts will probably occur for the Ellsworth AFB alternative because of a lesser degree of water quality degradation associated with road and bridge upgrades. These impacts will also occur because of increased wastewater discharges within watersheds of streams which only marginally meet water quality standards (Rapid and Boxelder creeks). The remaining surface water impacts will be low and not significant.

The short and long-term groundwater impacts for the Ellsworth, Minot, and Whiteman AFB alternatives will be low and not significant because of continued groundwater use to support the proposed project. The remaining three alternatives are not likely to extract groundwater during the operations phase; consequently, they will have long-term, negligible impacts.

2.2.2.9 Geology and Soils

The Hard Mobile Launcher at Minuteman Facilities basing mode is expected to have short-term impacts for all alternatives. Impacts are expected to be high and significant for geologic resources because of the large quantities of aggregate required for the project. Proposed project aggregate demand is estimated to be a large percentage of the regional aggregate production rate for all deployment alternatives, but this demand will not extend beyond the construction phase of the proposed project. Impacts to geology and soil resources will be similar for all alternatives except Ellsworth AFB, which will have greater impacts to engineering geology. High, significant impacts will be restricted to geologic resources.

Impacts to the engineering geology element will be low and not significant or negligible for all locations except Ellsworth AFB. Short and long-term, moderate impacts are expected at Ellsworth AFB because of the widespread presence of geologic units susceptible to mass movements, but only the short-term impacts are considered significant. It was assumed that the necessary construction engineering practices will be used to mitigate the majority of the project-induced impacts.

Short-term impacts to geologic resources will be high and significant for all alternatives, except F.E. Warren AFB which is rated moderate because of the proposed project demand for aggregate resources. Peak-year project aggregate demand, as a percent of the annual production in the ROI, is estimated to be 35 percent (F.E. Warren AFB), 198 percent (Malmstrom AFB), 203 percent (Grand Forks AFB), 253 percent (Minot AFB), 435 percent (Ellsworth AFB), and 592 percent (Whiteman AFB).

Impacts to soil resources will be low and not significant for all alternatives because of the minimal surface disturbance or land withdrawal in the deployment area and minimal surface disturbance at the MOB.

2.2.3 Hard Silo in Patterned Array

2.2.3.1 Socioeconomics

For the Hard Silo in Patterned Array basing mode, overall impacts to socioeconomics will be greatest at Gila Bend AFAF because of the lack of available housing and public services, including education. F.E. Warren AFB will be the next most affected area, followed by Yuma PG. Housing at these locations will not be sufficient to provide for the needs of the inmigrating project population. Locating the proposed project at Davis-Monthan AFB or Fort Bliss will create minimal socioeconomic impacts since the large urban areas associated with these bases have sufficient housing and public services to absorb project requirements.

Short-term housing impacts will be most severe at Gila Bend AFAF, followed by F.E. Warren AFB, Yuma PG, and Edwards AFB. In these areas, project-induced housing demand will exceed available vacancies during the construction phase. Furthermore, long-term impacts at Gila Bend AFAF will be high and significant since offbase housing requirements will exceed available vacancies. The urban areas surrounding Davis-Monthan AFB and Fort Bliss have a sufficiently large housing stock that can absorb project requirements with only minor impacts. Long-term impacts at Davis-Monthan AFB and Fort Bliss will be negligible.

The greatest public services impacts will be experienced at Gila Bend AFAF and F.E. Warren AFB. Project-induced changes in local government employment and public school enrollments relative to baseline trends will be most severe in these areas. Edwards AFB will have long-term, moderate, and significant impacts for public services because of school enrollment in Kern County. Public services impacts will be lowest at Davis-Monthan AFB since the urban character of Pima County can absorb added population with minimal effects. Fort Bliss will also have low public services impacts overall.

Impacts to public finance will be the greatest at F.E. Warren AFB where short-term, low, and significant impacts are estimated. However, long-term impacts

at this location will be negligible. Impacts at Edwards AFB will be the least since the growth in expenditures caused by the immigrating project population is more than offset by additional revenues. The remaining alternatives all will have short-term, negligible impacts and long-term, beneficial impacts.

2.2.3.2 Utilities

Impacts are greatest for the Hard Silo in Patterned Array basing mode if F.E. Warren AFB is chosen as the MOB. This is a result of the potential for short-term, moderate, and not significant impacts to potable water systems and short-term, moderate, and significant impacts to wastewater treatment and solid waste disposal facilities. In addition, long-term, low, and not significant impacts to potable water systems and low and significant impacts to wastewater and solid waste facilities will occur. Impacts at Gila Bend AFAF, Edwards AFB, Yuma PG, and Fort Bliss will be less severe, and the least impacts are expected at Davis-Monthan AFB.

Short-term impacts to potable water treatment systems will be moderate and not significant at F.E. Warren AFB and low and not significant at the Edwards AFB and Yuma PG alternative locations. Long-term impacts will be moderate and not significant at Gila Bend AFAF and low and not significant at F.E. Warren AFB. In all cases, the municipal potable water systems either have adequate average daily capacity or have programmed additional capacity to meet increased demands associated with a growing population. Yuma PG and Yuma County will have excess treatment capacity available, but will have the least amount available to meet peak demands. With the importation of water from the Central Arizona Project and the construction of facilities to process that supply, Davis-Monthan AFB will have the greatest excess treatment capacity.

For F.E. Warren AFB, short-term impacts to wastewater facilities will be moderate and significant during the construction phase as treatment facilities in Laramie County experience shortages in capacity. These conditions will be exacerbated by the onbase population growth during the operations phase, resulting in long-term impacts that will be low and significant. Long-term wastewater impacts at Gila Bend AFAF will be moderate and significant because the immigrating population will require additional capacity at the town of Gila Bend's facilities. Short-term impacts to wastewater treatment facilities will be low and significant in the study area for Edwards AFB since facilities with excess capacity will not be available. At Fort Bliss and Yuma PG, short-term impacts will be low but not significant. Impacts at other alternative locations will be negligible.

Short-term impacts to solid waste disposal facilities will be moderate and significant at F.E. Warren AFB since existing facilities may be closed during the construction phase and no plans for expansion exist. Short-term impacts at Edwards AFB and Yuma PG will be low and not significant because of the increased amount of solid waste requiring disposal. All other alternative locations have adequate capacity and are planning for additional facilities to meet increasing demands.

Long-term impacts to energy utilities will be greatest at F.E. Warren AFB since the increase in electrical demand in Laramie County and the region surrounding F.E. Warren AFB represents a reduction in the capacity margin from 9.4 to 8.2 percent. Short-term, low, but not significant impacts at

Fort Bliss are associated with increased consumption of natural gas. All other alternative locations will have negligible impacts.

2.2.3.3 Transportation

The Hard Silo in Patterned Array basing mode differs appreciably from the Hard Mobile basing modes in its method of impact to transportation. The major source of impact in the Hard Mobile modes is the commuting stream to the MOB. The principal impacts will be on the major roads between the MOB and its associated population centers. Commuting to the deployment areas may increase impacts to these roads when commuting streams overlap, but will generally not result in appreciable LOIs to other roads.

This situation is reversed for the Hard Silo mode. Although commuting streams to the MOB remain appreciable, the potential for short-term impact is dominated by commuting volumes to the deployment area. These volumes not only exceed those encountered in the peak years for either Hard Mobile mode, but may do so for as many as 4 years and be appreciable for several additional years.

The volumes of deployment-area traffic are generally large enough to result in short-term, high impacts, with peak-hour service at LOS D, E, or F. The regional significance of these impacts depends strongly on site selection, with its resultant influence on routes traveled, the length of roads that are affected, the LOSs attained, and the volume and composition of nonproject-related traffic affected.

The values shown for short-term impacts to transportation in Figure 2.0-1 represent the estimated maximum impact potential for the corresponding locality. However, in some localities, selection of alternative deployment sites could result in short-term impacts that, though still high, will no longer carry regional significance. Consequently, differences in impact potential may be larger among sites in some regions than they are among siting regions.

This situation applies, for example, to deployment at Yuma PG, which is judged to have the highest impact potential of the alternatives. Selection of an alternative deployment site could result in short-term impacts that, though still high, will no longer carry regional significance. However, the long-term, moderate versus low or negligible LOIs that are expected to continue into the operations phase make it less favorable than the other alternatives.

Similarly, deployment at F.E. Warren AFB is expected to have the lowest potential for impact to transportation, since short-term impacts, though high, are not expected to be significant at the regional level regardless of site selection, and long-term impacts are expected to be negligible on a regional scale.

Of the other alternatives, deployment at Edwards AFB or Gila Bend AFAF is judged to have a somewhat high potential for impact to transportation than will deployment at Davis-Monthan AFB or Fort Bliss. Short-term impacts will be high in all cases, but there is a somewhat higher possibility that regional impact significance could be avoided through siting for the last two of these localities.

2.2.3.4 Land Use

Deployment of the Hard Silo in Patterned Array basing mode will have the greatest overall impacts to land use at F.E. Warren AFB because the land in the region proposed for project deployment is mainly used for agriculture. In addition, impacts will be the greatest because of the proximity of several regional recreation areas. Deployment at other locations will have slightly less impacts to land use because of smaller amounts of croplands or the presence of special status lands in the SDAs. Impacts to visual resources will be greatest at Davis-Monthan AFB because of its larger viewshed area and its higher AADT. Impacts will be the least at Fort Bliss because of the minimal amount of agricultural and special status lands in the SDAs. Impacts at Edwards AFB, Yuma PG, and Gila Bend AFAF will fall between these alternatives.

Proposed project deployment at the F.E. Warren AFB alternative will have the greatest overall impact to land use and status because of the high probability of disturbing agricultural lands within the SDA and disturbance to transportation routing. All other locations will have slightly less impacts because of the lower probability of disturbance resulting from the small amount and dispersed pattern of irrigated and agricultural land within the SDA.

Proposed project deployment at Gila Bend AFAF and F.E. Warren AFB will have the greatest overall impact to regional recreation. Deployment at these locations will result in percentage increases in regional recreation use which are similar to the other locations. However, these locations have recreation areas in proximity to potentially affected population centers which may receive a higher proportion of the increased recreation use. Impacts at all other locations will be negligible.

Both short and long-term visual resources impacts at Davis-Monthan AFB, Edwards AFB, and Fort Bliss will be low and not significant, with the greatest impacts occurring with deployment at Davis-Monthan AFB because of a larger viewshed area. Visual resources impacts at the other three locations will be negligible.

2.2.3.5 Cultural and Paleontological Resources

Proposed project deployment of the Hard Silo in Patterned Array basing mode at Davis-Monthan AFB will have the highest impacts, followed by Gila Bend AFAF. Impacts are expected to be lower at F.E. Warren AFB and Fort Bliss, and lowest at Edwards AFB.

The highest impacts to prehistoric cultural resources will occur at Davis-Monthan AFB because of the existence of high densities of complex sites, especially near water sources in the SDA. Slightly lower impacts will occur at Gila Bend AFAF and Yuma PG because of slightly lower site densities. Low and significant impacts are expected at Edwards AFB, Fort Bliss, and F.E. Warren AFB, where there is a good potential for avoidance.

Low and significant impacts to historic and architectural resources will occur at Davis-Monthan AFB, Fort Bliss, F.E. Warren AFB, Edwards AFB, and Gila Bend AFAF. Low, not significant impacts are expected at Yuma PG. Expected impacts are low for this element because most NRHP-eligible sites are located in urban areas, outside the SDAs.

Impacts to American Indian cultural resources at Davis-Monthan AFB, Yuma PG, and Gila Bend AFAF are expected to be moderate and significant because of the proximity of several American Indian reservations to the ROIs. At F.E. Warren AFB, impacts will be low and significant. Negligible impacts are expected at Edwards AFB and Fort Bliss.

Low but significant impacts to paleontological resources may occur at Davis-Monthan AFB, F.E. Warren AFB, and Fort Bliss, where paleontological formations have been identified in or near some SDAs. Low and not significant impacts are expected at Yuma PG, and negligible impacts are expected at Edwards AFB and Gila Bend AFAF.

2.2.3.6 Biological Resources and Threatened and Endangered Species

Long-term, significant impacts to vegetation and wildlife resources are expected at all locations, primarily because of the large area of biological habitat that will be severely disturbed by the Hard Silo in Patterned Array basing mode. Overall biological impacts are slightly greater at Gila Bend AFAF than at other locations because of higher potential impacts to threatened and endangered species.

Impacts to vegetation and wildlife are expected to be significant at all locations because the large amounts of native vegetation and wildlife habitat disturbed will represent a major disruption of ecological systems and biological productivity of each region. Impacts will be slightly less at F.E. Warren AFB than at the other locations because much of the vegetation of the area has been disturbed by grazing or agriculture, and because ecological recovery rates are higher than in the arid environments of the other five locations. In addition, the F.E. Warren AFB direct impact area supports less undisturbed wildlife habitat and fewer sensitive wildlife species than the other locations.

Impacts to aquatic habitats are expected to not be significant at all of the bases because of the small number of habitats in the direct impact areas of these arid regions, the low probability of construction or operations directly in an aquatic resource, and the likelihood of avoiding these sensitive resources. Minor, locally important aquatic impacts are likely to occur at all six sites.

Impacts to unique and sensitive habitats are also expected to not be significant at all locations. Although unique and sensitive habitats occur in direct impact areas at all locations, there is a good likelihood of avoiding impacts to the biological uniqueness of these habitats because of their generally low numbers and small size. The potential for impacts is greater at Gila Bend AFAF and Davis-Monthan AFB than at the other locations because a larger number of habitats occur in their direct impact areas, the overlap between the direct impact areas and these sensitive habitats is larger, and the potentially affected habitats have more sensitive status than at the other locations. The potential for impacts is lowest at F.E. Warren AFB.

Although threatened and endangered species occur in SDAs at all locations, impacts to these species are expected to not be significant at all but one location because of expected flexibility in locating silos and other facilities to avoid impacts to listed species. Potential impacts are considered

significant at Gila Bend AFAF because of the expected difficulty of mitigating adverse effects on the only United States population of the federally endangered Sonoran pronghorn. Evaluation of impacts to threatened and endangered species should be considered preliminary, because the exact location of species in impact areas will not be known until site-specific studies are conducted, and because the extent that the proposed project can be modified to avoid impacts to these species is not yet known in detail.

2.2.3.7 Air Quality and Noise

For two-thirds of all Hard Silo in Patterned Array basing mode locations, short-term air quality impacts are expected to not be significant because of the relatively small amount of surface disturbance involved. If the silos are located near PSD Class I areas, which will occur with Davis-Monthan AFB, significant impacts from dust generated during the construction phase may occur for short periods. Short-term, low impacts to visibility may occur in the Edwards AFB area from population or construction-related emissions in the peak-construction years; otherwise, impacts are expected to be negligible. At F.E. Warren AFB and Yuma PG, short-term, low impacts to CO levels may occur from increased traffic in the peak-workforce years. Increased airborne CO concentrations from construction at Fort Bliss may occasionally reach significant levels in El Paso. Possible short-term CO exceedances at Gila Bend AFAF will raise impact levels to moderate.

Long-term air quality impacts for all locations will be negligible. Effects on the PSD Class I areas near Tucson, where visibility is already a concern, will continue as population increases in the area. Project-related population growth will contribute to this effect. In the area where visibility has been decreasing, potential long-term impacts to regional visibility from the small population increments will be negligible.

Short and long-term impacts to noise levels will be negligible for each of the Hard Silo areas. During the construction phase, when equipment noise levels might be of concern, the area affected will be limited to local construction sites. Noise excursions will be confined mainly to small areas remote from populated areas, and therefore, impacts will be negligible on a regional basis.

2.2.3.8 Water Resources

Four of the six alternatives for the Hard Silo in Patterned Array basing mode will result in significant water impacts. The Gila Bend AFAF alternative will have short-term, moderate, and significant impacts. The impacts of the other three alternatives (Davis-Monthan AFB, Edwards AFB, and Fort Bliss) will be low and significant. The water resource impacts of the F.E. Warren AFB and Yuma PG alternatives will be low and not significant.

No significant surface water impacts will occur for this basing mode. Surface water impacts will be low and not significant at all locations except Gila Bend AFAF, where long-term impacts are expected to be negligible.

The limited availability of groundwater and the marginal quality of the supply available to the base and its support community will result in the highest groundwater impact occurring for the Gila Bend AFAF alternative, as discussed

in Section 2.2.1.8. Short-term, moderate, and significant impacts to groundwater will occur. Long-term impacts will be low and significant because of substantially lower operations water needs. The Davis-Monthan AFB, Edwards AFB, and Fort Bliss alternatives will all have short and long-term, low, and significant groundwater impacts. These impacts will occur as a result of groundwater withdrawal from basins that are currently overdrafted. Location of the MOB at either Davis-Monthan AFB or Edwards AFB will probably be preferable since their support communities will be able to supply water from imported sources, which will reduce total groundwater pumpage. In addition, it is likely that these imported water sources could be made available to the two bases to meet project-induced needs. The F.E. Warren AFB and Yuma PG alternatives will have either low and not significant or negligible groundwater impacts.

2.2.3.9 Geology and Soils

Impacts for the Hard Silo in Patterned Array basing mode are expected to be greatest for the Fort Bliss and Edwards AFB locations, with long-term, high, and significant impacts expected for geologic and soil resources. Long-term, high, not significant impacts to geologic resources are expected for the Davis-Monthan AFB, Gila Bend AFAF, and Yuma PG alternatives. Several mineral and energy commodities exist in the SDAs and there is the potential for conflict through restriction of access to the resources. Soil erosion is expected to accelerate as a result of ground disturbances associated with construction and operations activities. The alternatives are located in arid or semiarid areas where wind erosion is a concern.

Short and long-term impacts to the engineering geology element are anticipated to be low and not significant for all alternatives except F.E. Warren AFB, which will have long-term, negligible impacts. Construction activities in the deployment area may induce flooding and cause mass movements (e.g., debris flows and landslides). It was assumed that the necessary construction engineering practices will be used to mitigate the majority of the project-induced impacts.

For the Fort Bliss alternative, short-term impacts to geologic resources are expected to be moderate and significant and long-term impacts will be high and significant. The only other significant impact to geologic resources expected is a long-term, high impact at Edwards AFB because of the presence of active mines in the SDA. Long-term impacts at the Davis-Monthan AFB, Gila Bend AFAF, and Yuma PG alternatives will be high but not significant. All other impacts to geologic resources will be negligible or low and are not considered significant. Impacts to geologic resources could result from the proposed project demand for aggregate resources and the potential restriction of exploration and development of mineral and energy resources located in the SDAs. Peak-year project aggregate demand, as a percentage of the annual production in the ROI, is estimated to be 3 percent (Edwards AFB and Gila Bend AFAF), 4 percent (Yuma PG), 10 percent (Davis-Monthan AFB), 13 percent (F.E. Warren AFB), and 24 percent (Fort Bliss).

Long-term impacts to soil resources will be high and significant for the Edwards AFB, Fort Bliss, F.E. Warren AFB, and Gila Bend AFAF alternatives with moderate and significant impacts anticipated at all other alternatives. Short-term, high, and not significant impacts are predicted for the Edwards AFB and

Fort Bliss alternatives. Many soils in these areas of the Southwest are highly susceptible to wind and sheet erosion and are difficult to reclaim. In addition, important farmland exists on most SDAs, with the largest acreages occurring in the Edwards AFB, Davis-Monthan AFB, and Gila Bend AFAF alternatives.

2.2.4 No Action Alternative

2.2.4.1 Socioeconomics

The baseline and projected forecasts of Section 3.1 represent the implications of the No Action Alternative. The projected populations in the alternative basing locations are forecast to change at average annual growth rates that range from -0.1 to 3.1 percent. Under the No Action Alternative, socioeconomic activity associated with maintenance of the current Minuteman force will continue at the Minuteman bases included in this analysis. Socioeconomic effects associated with the deployment of 50 Peacekeeper missiles (the authorized level) will also continue at F.E. Warren AFB.

2.2.4.2 Utilities

Recent population projections indicate that regional growth without the project will cause the capacity of some utility systems to be exceeded before the year 2000. Potable water treatment capacity is expected to be exceeded in Maricopa County serving the Gila Bend AFAF MOB alternative. Similarly, wastewater treatment capacity will be exceeded at six of the alternative locations: Maricopa County (Gila Bend AFAF), Otero County (Holloman AFB), the desert portion of Los Angeles and San Bernardino counties near both Edwards AFB and Fort Irwin NTC, Laramie County (F.E. Warren AFB), and Pima County (Davis-Monthan AFB). Solid waste disposal capacity will be exceeded at four of the locations: Clark County (Nevada Complex), Laramie County (F.E. Warren AFB), Ward County (Minot AFB), and Johnson and Pettis counties (Whiteman AFB). Finally, the capacity of electrical energy systems will be exceeded at three of the locations: the Washington Complex, Grand Forks AFB, and Whiteman AFB.

2.2.4.3 Transportation

Currently, substandard service levels exist in many, but not all, of the local areas potentially affected by Small ICBM deployment. Under the No Action Alternative, regional growth will consequently result in progressive losses in LOS, barring timely highway improvements to accommodate the increased volumes. For the locations suitable for deployment of the Hard Mobile Launcher in Random Movement basing mode, current substandard LOSs are estimated to exist on primary roads influenced by urban conditions, or on two-lane rural roads with heavy traffic and/or unfavorable terrain. Severe degradation (LOS E or F) is currently estimated to exist on primary roads influenced by urban conditions in El Paso, Texas and Phoenix, Arizona. For the areas suitable for the Hard Mobile Launcher at Minuteman Facilities basing mode, the situation is substantially different. The majority of roadways in most of the Minuteman areas are at LOS A, with comparatively few at service levels below LOS B. Conditions for the locations suitable for the Hard Silo in Patterned Array basing mode are similar to those for the Random Movement basing mode, particularly where the ROIs overlap for these two alternatives and the potentially affected roads are identical.

2.2.4.4 Land Use

Under the No Action Alternative, existing offbase land uses and status will, for the most part, continue. The use of land for agricultural purposes is decreasing in many areas. Recreation use will increase in each ROI because of regional population growth (with the exception of the Whiteman AFB ROI, where projected population decreases may result in a corresponding decline in use). In addition, while recreation use increases, it is expected that the development and construction of new recreation facilities, including campground facilities, will become minimal because of fiscal restrictions at all levels of government. Therefore, existing recreation facilities will become more heavily used. For the No Action Alternative, the existing visual settings will remain essentially unchanged.

2.2.4.5 Cultural and Paleontological Resources

Because such resources are nonrenewable, future activities under the No Action Alternative, like those of the past, will cause losses of these resources from military testing and training, construction, agricultural and mining development, vandalism and looting, and natural erosion. These general trends can be expected at almost any location.

2.2.4.6 Biological Resources and Threatened and Endangered Species

Present activities, policies, and trends under the No Action Alternative will continue to have impacts to biological resources. New and continuing projects, missions, and associated construction at the various MOBs and federal government installations can be expected to disrupt biological habitat and otherwise disturb flora and fauna. Present and future projects at the defense installations under consideration for the Hard Mobile Launcher in Random Movement basing mode are, in particular, likely to cause adverse biological effects. Current and planned activities at these installations that destroy habitat and kill or disturb biota include off-road tests of military vehicles, troop training and maneuvers, impact of artillery fire and ballistic missiles, and air-to-ground firing and bombing. In addition, at Nellis Air Force Range (AFR), Luke AFR, and China Lake NWC, low-altitude flying of military aircraft startle and disrupt daily activities of wildlife. Lands managed by the Bureau of Land Management (BLM) make up much of the SDA for the Hard Silo in Patterned Array basing mode. Many of these lands will be used for grazing, mineral development, recreation, and other uses which result in adverse biological effects. However, present BLM policy favors sustainable, long-term multiple use, including natural habitat and wildlife use, so that major or extensive adverse biological impacts to these lands should not occur. In all locations, regional recreational activities, such as off-road vehicle use, boating, hunting, and fishing, also affect biota adversely. Increased development and recreation will degrade aquatic habitats and biologically unique habitats and add to cumulative impacts to threatened and endangered species.

2.2.4.7 Air Quality and Noise

Increases in fugitive dust emissions are expected in many of the proposed project areas from population growth and nonproject-related construction. In some populated areas, such as El Paso, Tucson, Great Falls, Rapid City, and Yakima, nonattainment areas have been identified for particular pollutants and

long-term control measures have been instituted. New or increased pollutant emissions sources in such areas are required to meet stringent conditions prior to starting operations. With federal emission controls on automobiles and trucks and various transportation control measures adopted in the various state implementation plans, CO emissions are likely to remain under control in rural areas. It is planned that attainment status in urban areas will be reached and maintained with the presently instituted controls. The typical range of noise levels associated with general construction activities is not expected to differ from existing conditions. New federal regulations on permitted noise levels from heavy duty trucks and equipment may decrease these levels in the future.

2.2.4.8 Water Resources

In the absence of the proposed project, water withdrawals from severely over-drafted groundwater basins will continue to occur in the Arizona, Nevada, New Mexico, and the South-Central California complexes. Therefore, competition among existing groundwater users will be intensified and regional groundwater level declines will persist, particularly in the fast-growing urban areas of Las Cruces, Alamogordo, and El Paso-Ciudad Juarez of the New Mexico Complex. An exception is the Yuma PG area of the Arizona Complex, which has adequate groundwater supplies and sufficient entitlement of Colorado River water to meet future needs. Localized groundwater level declines will continue to occur in the coastal region of the Florida Complex. A major expansion of the Columbia River Basin project in the 1990s will eliminate some of the groundwater level declines being experienced in the Washington Complex ROI. Water resources are relatively abundant in the vicinity of the Minuteman bases, and the absence of the project will not represent a substantial change in their regional availability.

2.2.4.9 Geology and Soils

For the No Action Alternative, the conditions of engineering geology will in general not be materially different from historical geologic baseline conditions. Normal regional land development will initiate or accelerate some geologic processes that could potentially cause localized occurrences of geologic hazards. Within installation boundaries, the No Action Alternative is the same as baseline and projected conditions, since the present restrictions to mineral development are not expected to change in the future. Present restrictions are based upon the incompatibility of existing base missions with mineral resource development. For aggregate resources and other geologic resources outside of installations, future trends without the project will reflect historic responses to market demands. For soil resources on the installations, some erosion and destruction of soil cover will occur as a result of continued mission use of the areas. Disturbance to soil resources offbase will be dependent upon offbase changes in land use patterns and other changes in the regional and local economy.

3.0 AFFECTED ENVIRONMENT

This chapter presents a description of the potentially affected environment at all locations under consideration; it depicts both existing and future baseline conditions without the proposed project. Because proposed project operations will likely be extended into the early part of the next century, it is necessary to evaluate potential impacts against projected future conditions. The affected environment was analyzed through the evaluation of specific resource categories under which all basing mode and location alternatives were considered.

Regional maps depicting the alternative locations for both of the Hard Mobile basing modes and the Hard Silo in Patterned Array basing mode are presented in Figures 3.0-1 through 3.0-15. Six complexes are being considered for deployment of the Hard Mobile Launcher in Random Movement, all six existing Minuteman bases are currently under consideration for deployment of the Hard Mobile Launcher at Minuteman Facilities, and six Main Operating Bases (MOBs) are being considered for deployment of the Small Intercontinental Ballistic Missile (ICBM) in Hard Silo in Patterned Array.

The six complexes retained for further study of Hard Mobile Launcher in Random Movement deployment are located in Arizona, Florida, Nevada, New Mexico, south-central California, and Washington. A complex consists of one or more deployment installations, which are either Department of Defense (DOD) or Department of Energy (DOE) installations, plus one or more military bases that will serve as MOBs.

The Arizona Complex (Figure 3.0-1), located in southwestern Arizona, consists of Gila Bend Air Force Auxiliary Field (AFAF), Luke Air Force Range (AFR), and Yuma Proving Ground (PG). The MOB will be either Gila Bend AFAF, a Tactical Air Command (TAC) base (base population of 500), or Yuma PG, a U.S. Army base (base population of 2,000).

The Florida Complex (Figure 3.0-2), located along the Florida Panhandle near Pensacola, consists only of Eglin Air Force Base (AFB), an Air Force Systems Command base (base population of 15,700).

The Nevada Complex (Figure 3.0-3), located in southeastern Nevada near Las Vegas, consists of Nellis AFR and the Nevada Test Site, with the MOB at either Indians Springs AFAF (base population of 350) or Nellis AFB (base population of 11,800). Both MOBs are TAC bases.

The New Mexico Complex (Figure 3.0-4), located in south-central New Mexico near Alamogordo, consists of Fort Bliss, Holloman AFB, and White Sands Missile Range, with the MOB at either Fort Bliss, a U.S. Army base (base population of 32,000); Holloman AFB, a TAC base (base population of 7,700); or White Sands Missile Range Headquarters, a U.S. Army base (base population of 2,600).

The South-Central California Complex (Figure 3.0-5) consists of China Lake Naval Weapons Center (NWC), Fort Irwin National Training Center (NTC), Edwards AFB, and Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC), with the MOB at either Edwards AFB, an Air Force Systems Command base (base population of 10,150), or Fort Irwin NTC, a U.S. Army base (base population of 10,500).

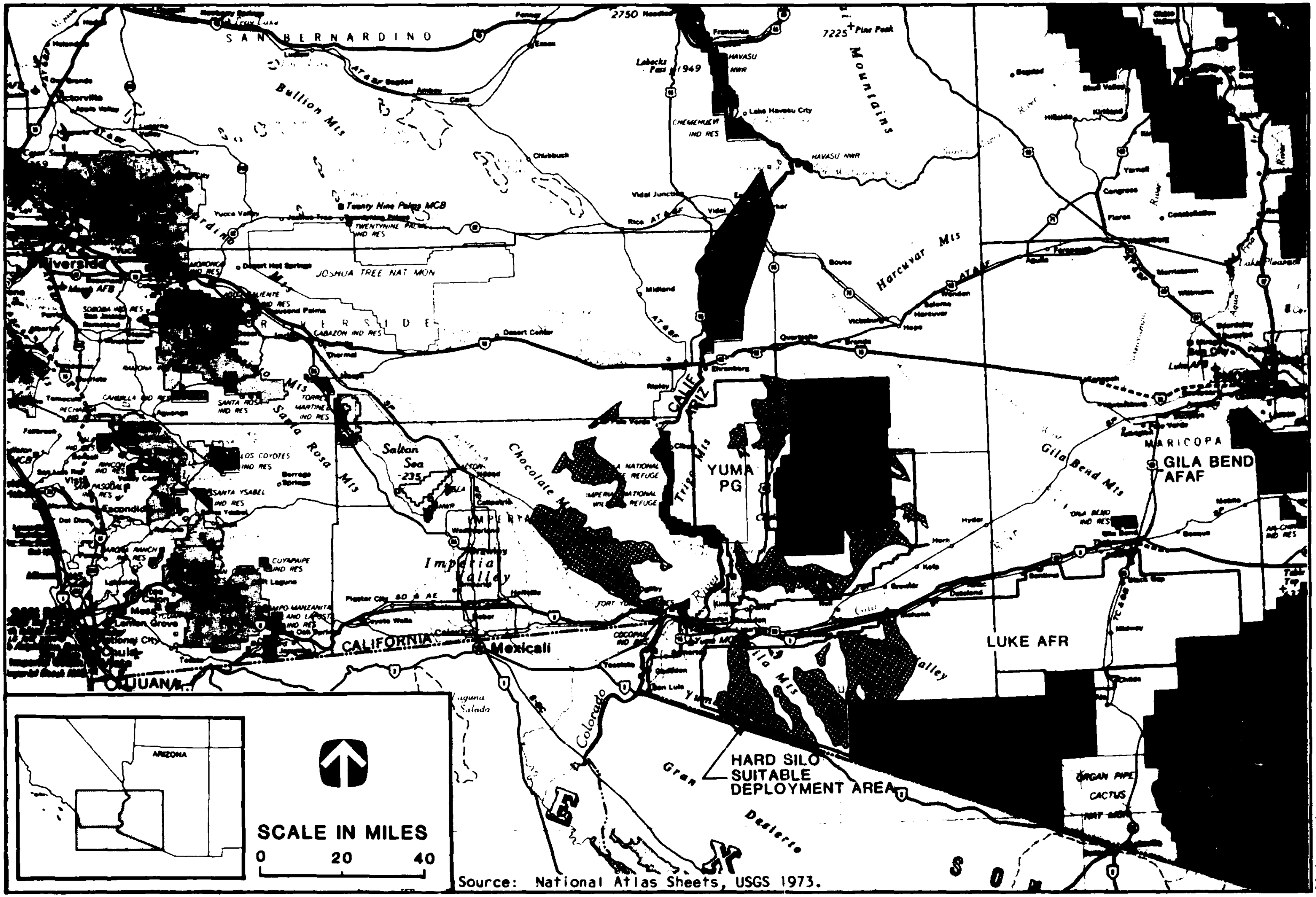
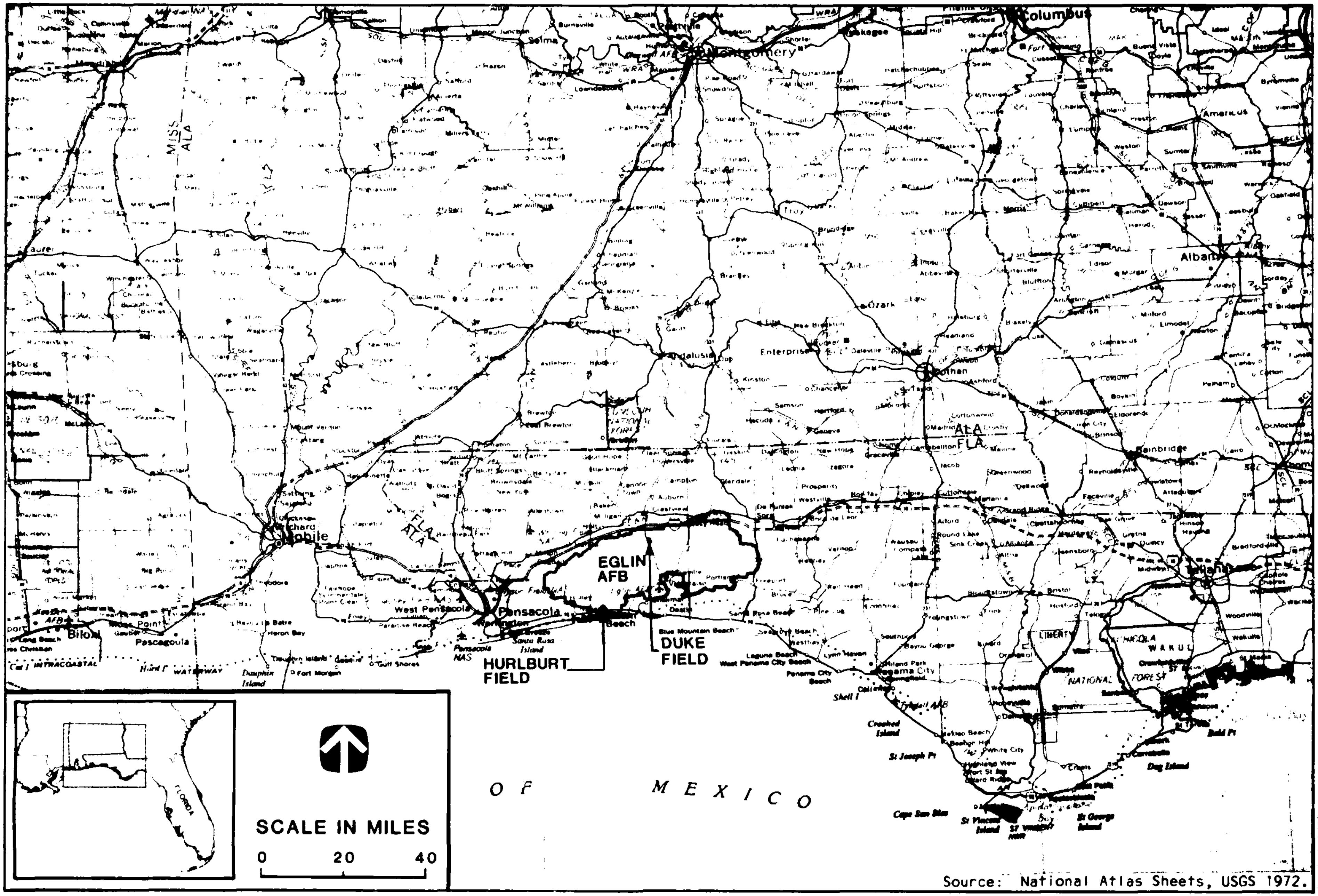
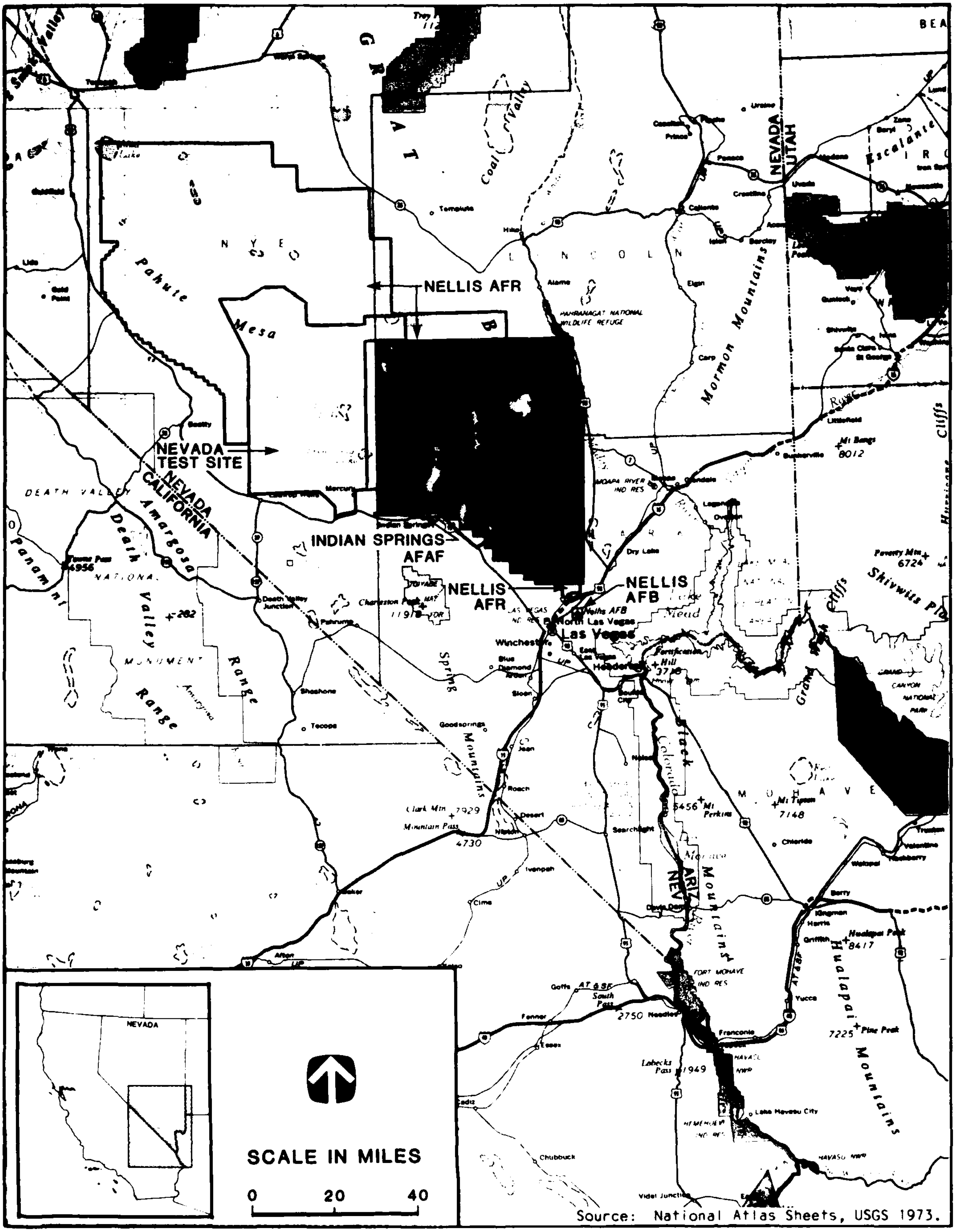


FIGURE 3.0-1 LOCATION OF THE ARIZONA COMPLEX (GILA BEND AFAF, LUKE AFR, AND YUMA PG) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT AND THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT YUMA PG, INCLUDING THE GEOTECHNICALLY SUITABLE DEPLOYMENT AREA



D3/2 (L3/2)

FIGURE 3.0-2 LOCATION OF THE FLORIDA COMPLEX (EGLIN AFB, INCLUDING DUKE FIELD AND HURLBURT FIELD) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT



03/3 (L3/3)

FIGURE 3.0-3 LOCATION OF THE NEVADA COMPLEX (INDIAN SPRINGS AFAF, NELLIS AFB, NELLIS AFR, AND NEVADA TEST SITE) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT

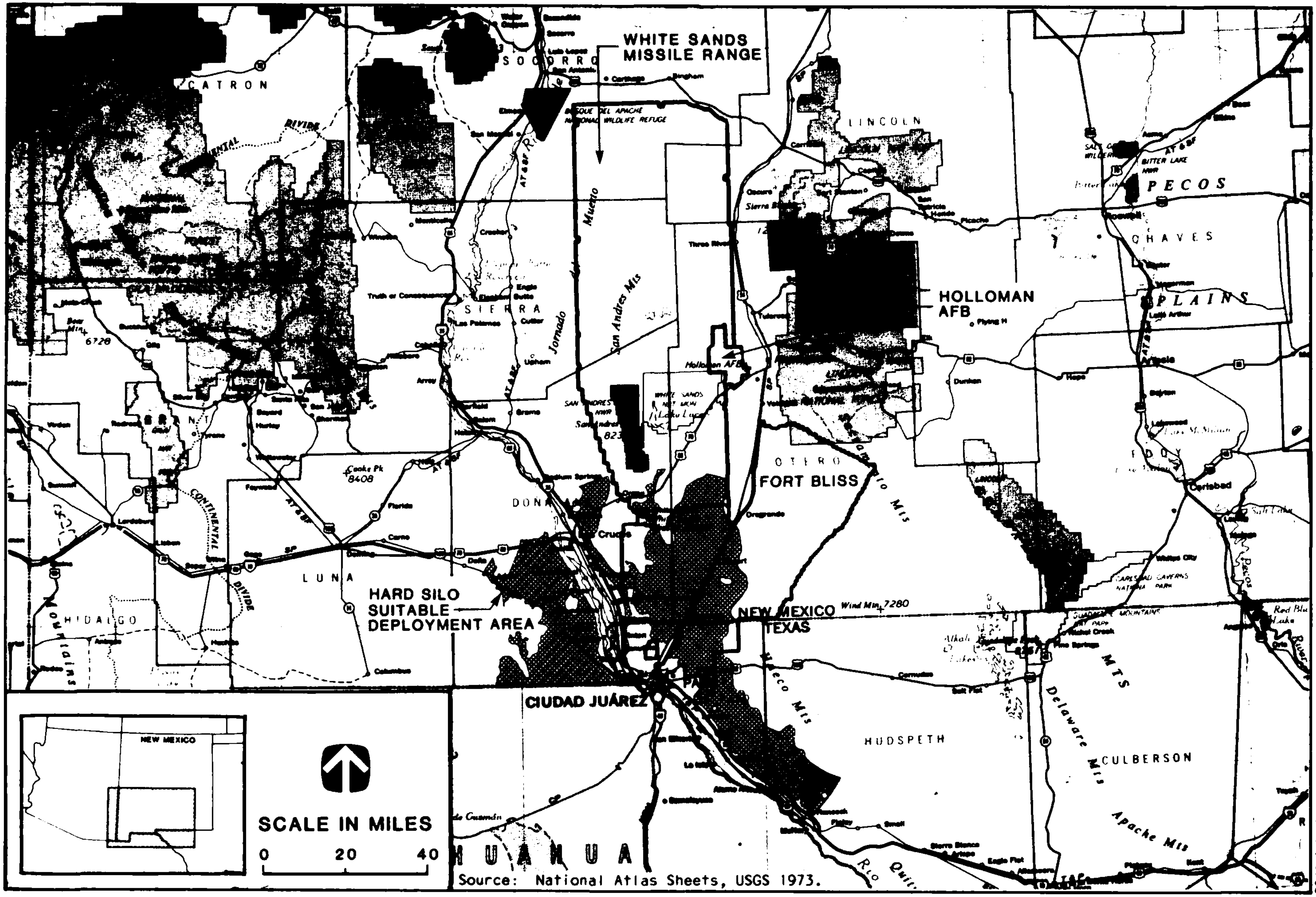
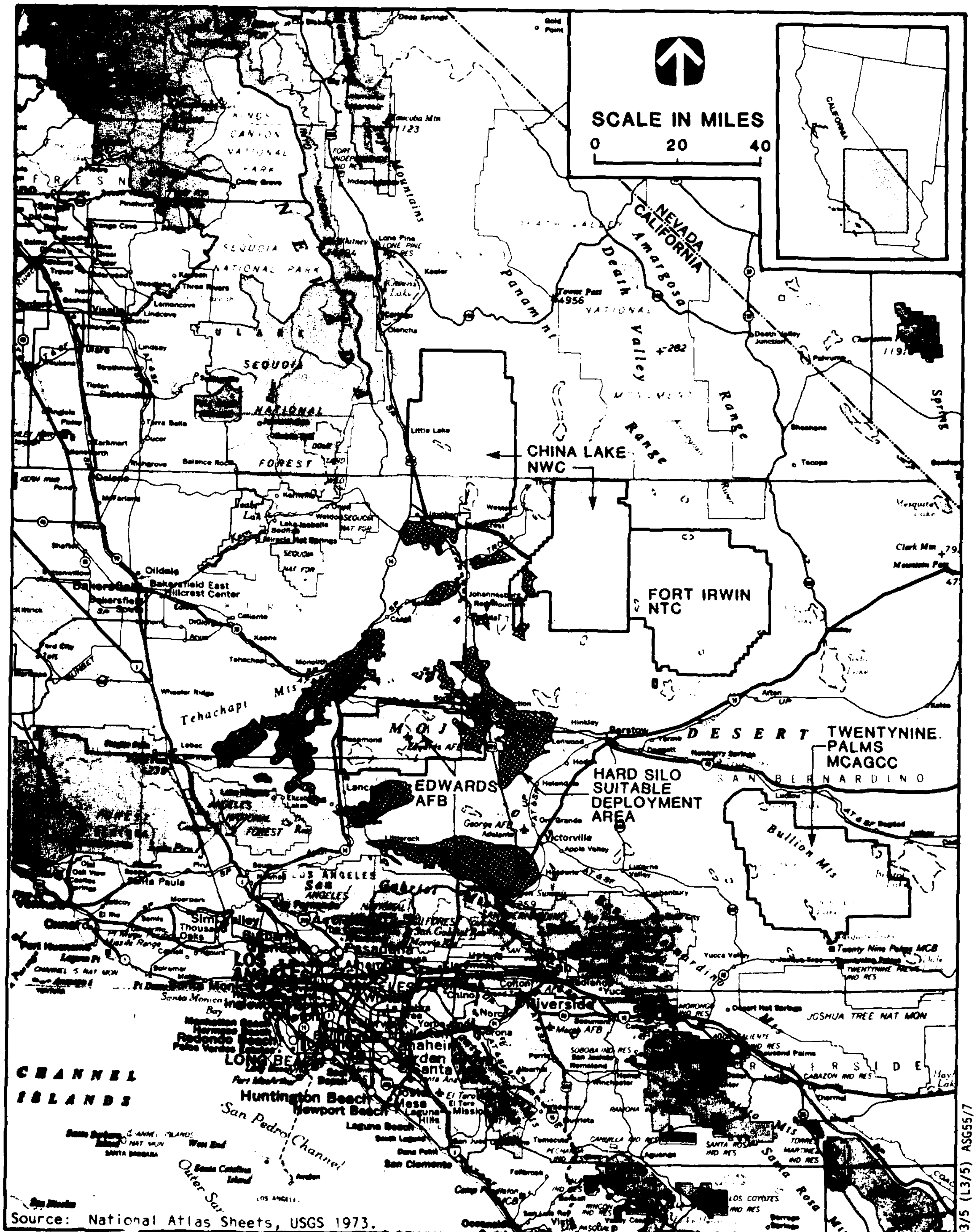


FIGURE 3.0-4 LOCATION OF THE NEW MEXICO COMPLEX (FORT BLISS, HOLLOMAN AFB, AND WHITE SANDS MISSILE RANGE) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT AND THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT FORT BLISS

D3/4 (L3/4)



D3/5 (L3/5) ASG55/7

FIGURE 3.0-5 LOCATION OF THE SOUTH-CENTRAL CALIFORNIA COMPLEX (CHINA LAKE NWC, FORT IRWIN NTC, TWENTYNINE PALMS MCAGCC, AND EDWARDS AFB) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT AND THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT EDWARDS AFB

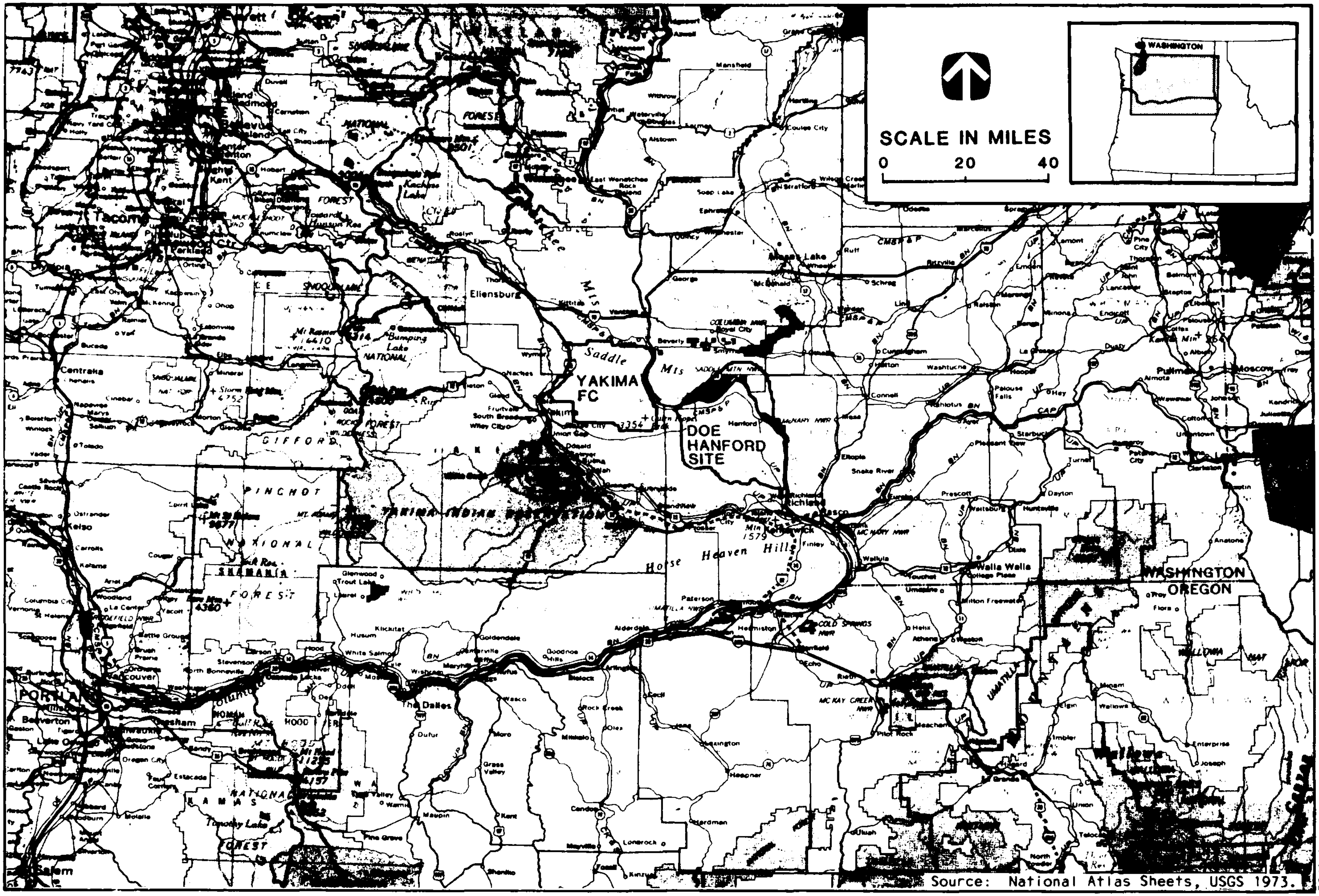
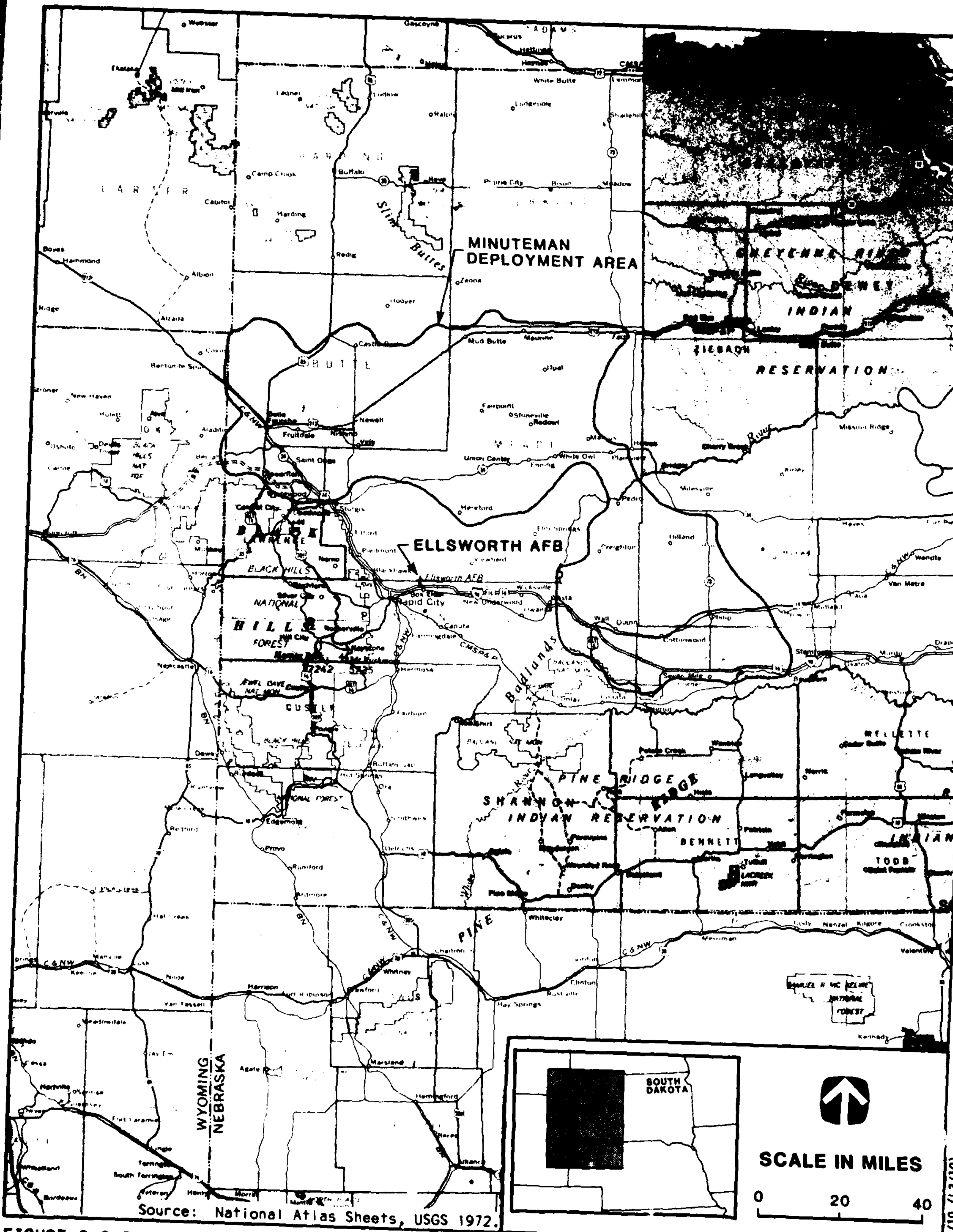


FIGURE 3.0-6 LOCATION OF THE WASHINGTON COMPLEX (DOE HANFORD SITE AND YAKIMA FC) FOR HARD MOBILE LAUNCHER IN RANDOM MOVEMENT

D3/6 (L3/6)



Source: National Atlas Sheets, USGS 1972.

FIGURE 3.0-7 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT ELLSWORTH AFB

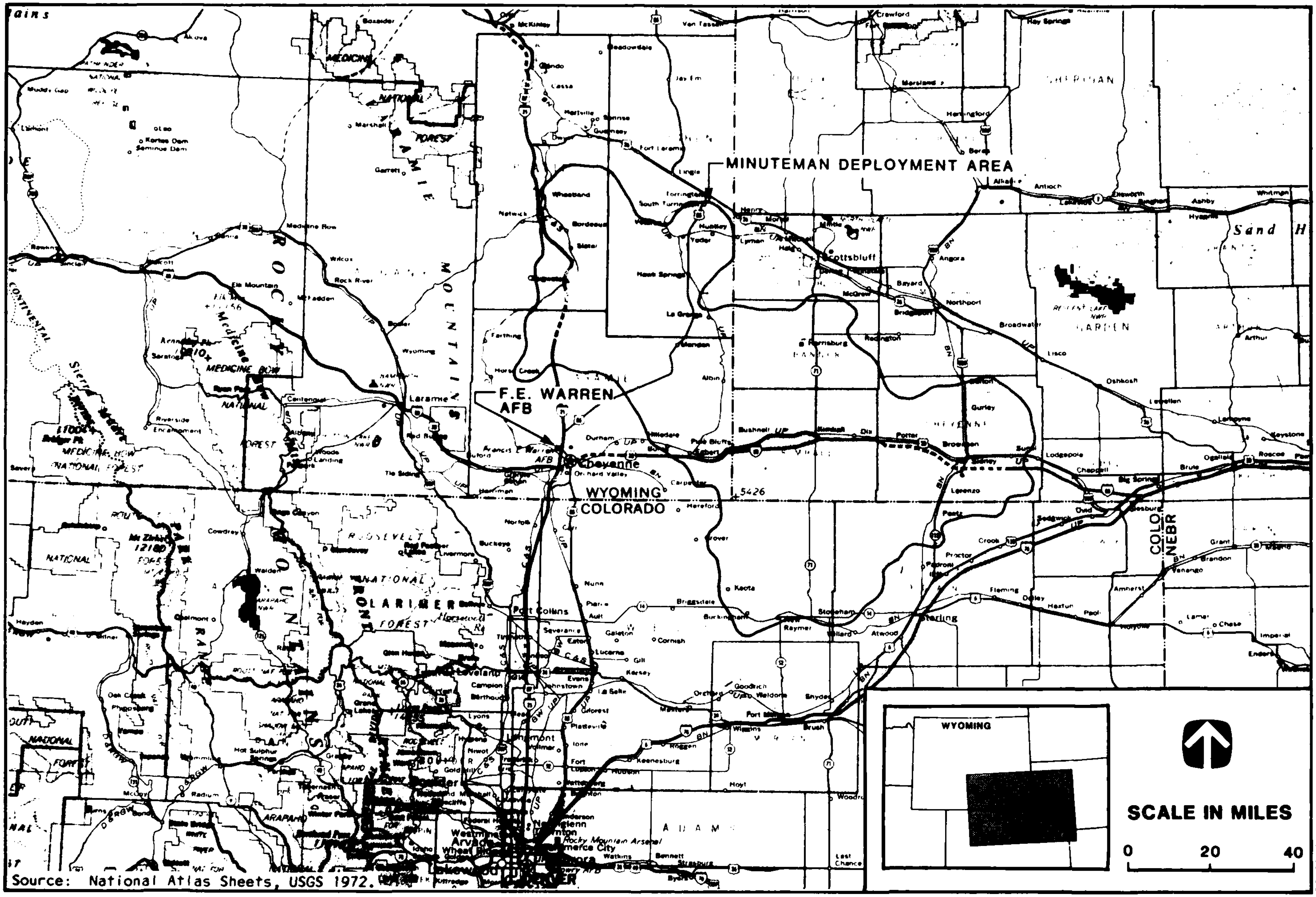
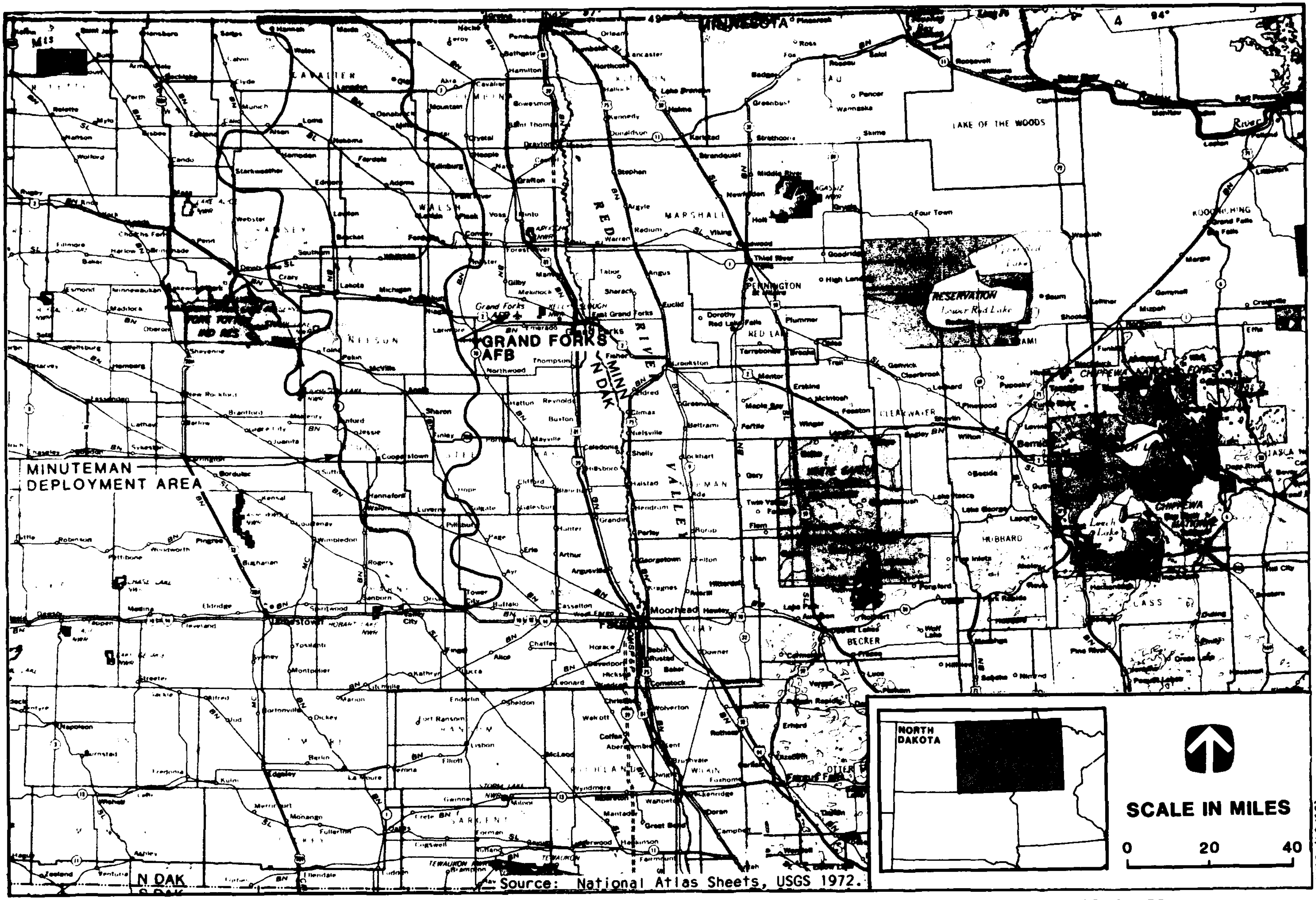


FIGURE 3.0-8 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT F.E. WARREN AFB



D3/12 (L3/12)

FIGURE 3.0-9 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT GRAND FORKS AFB

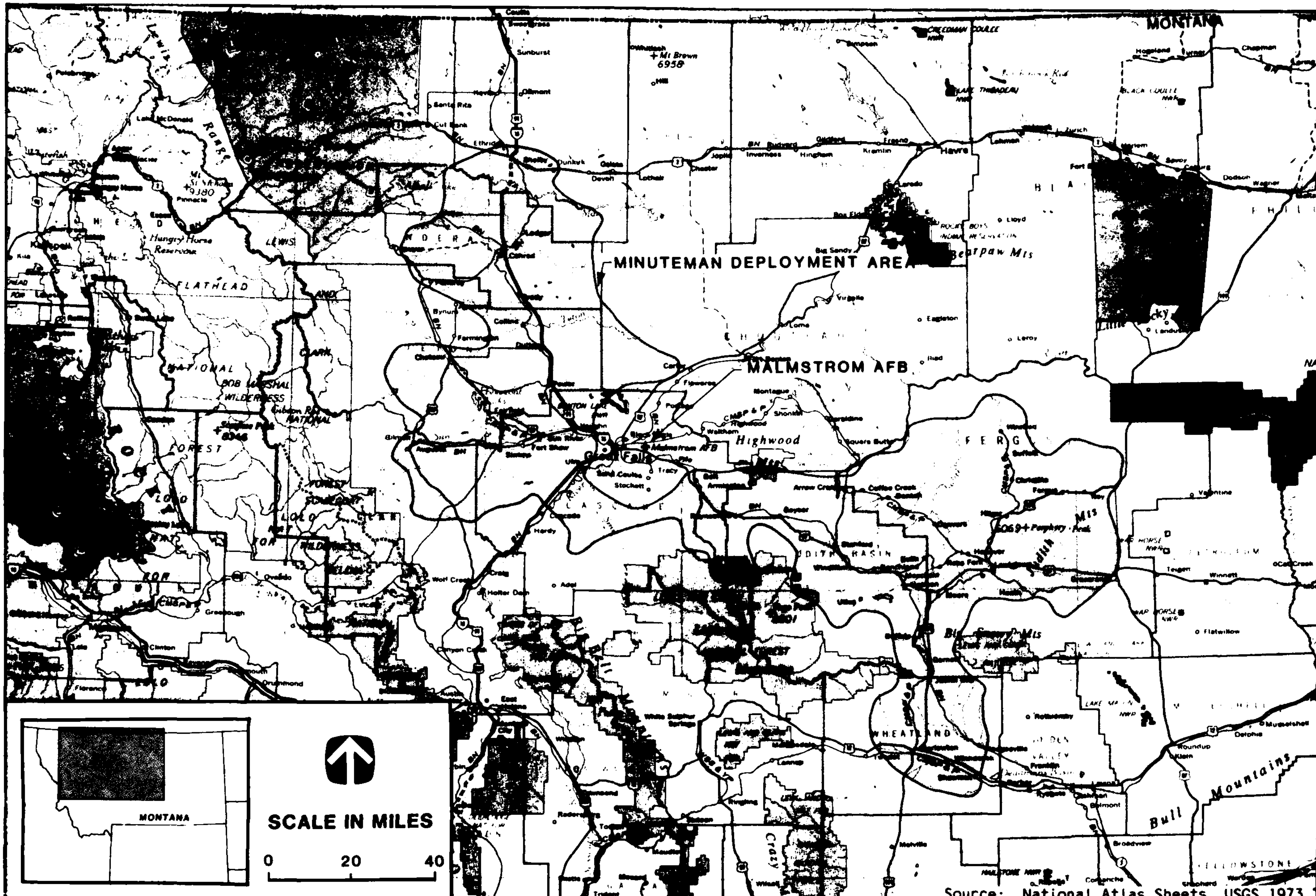


FIGURE 3.0-10 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT MALMSTROM AFB

D3/13 (L3/13)

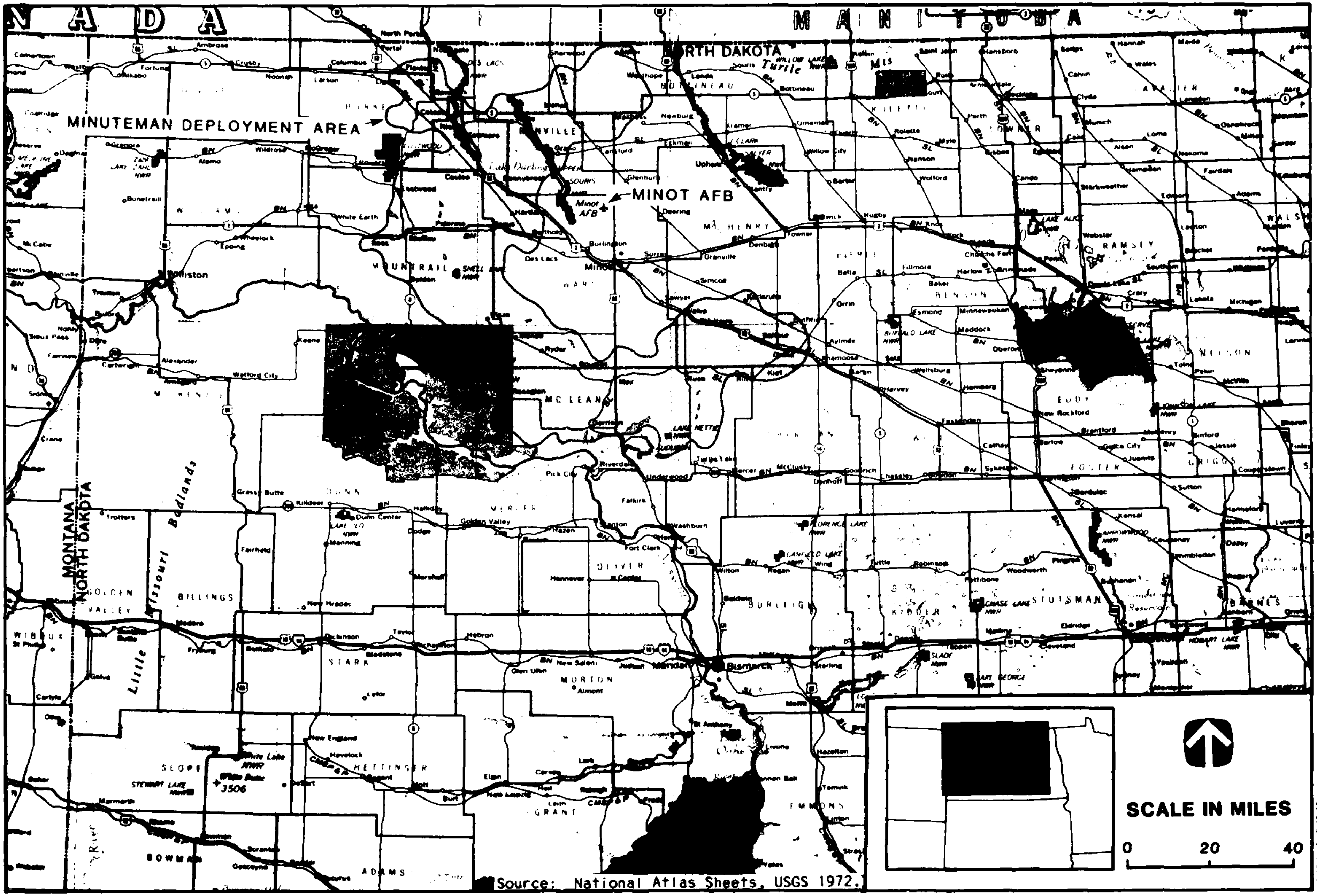
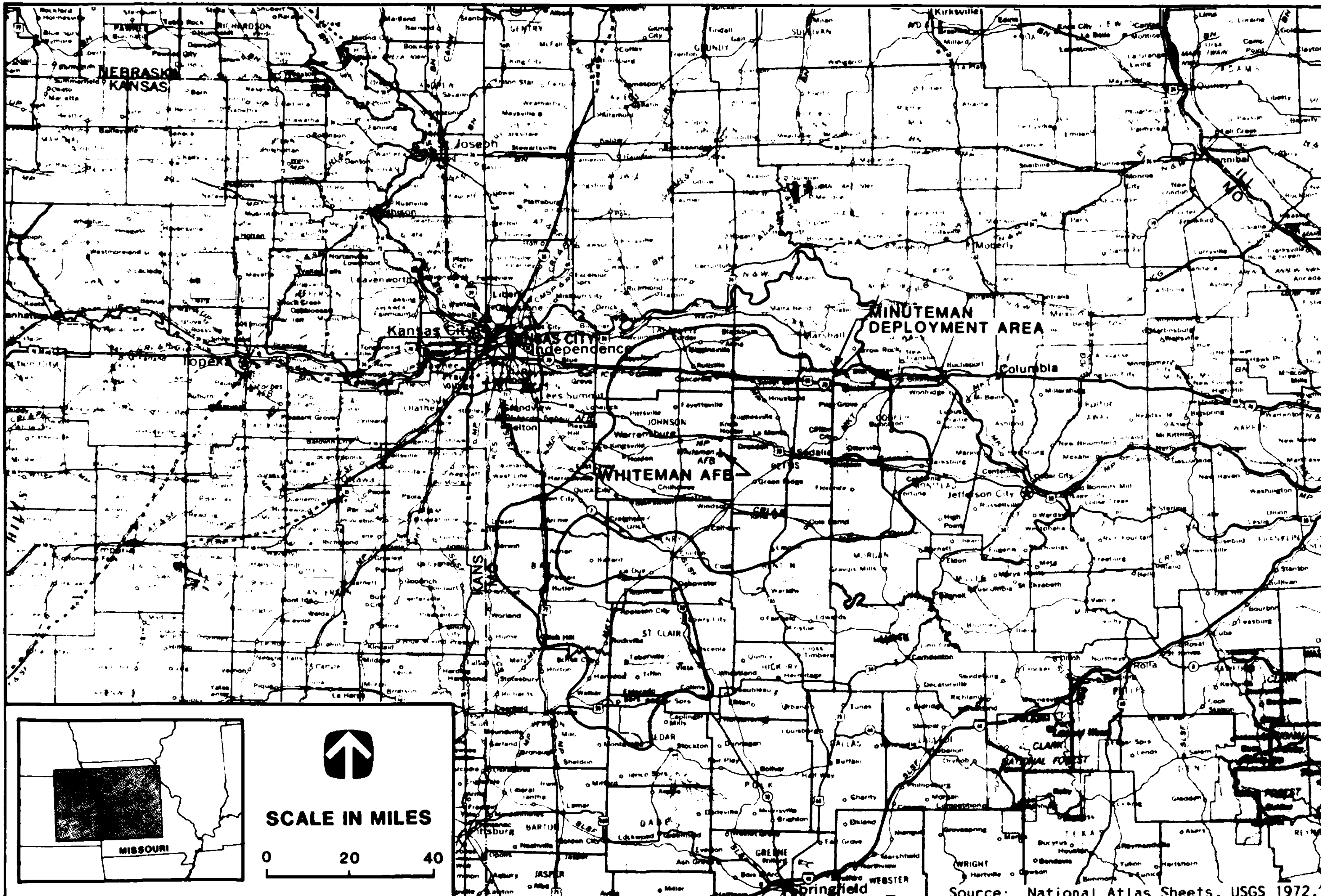


FIGURE 3.0-11 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT MINOT AFB

D3/14 (L3/14)



Source: National Atlas Sheets, USGS 1972.

D3/15 (L3/15)

FIGURE 3.0-12 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT WHITEMAN AFB

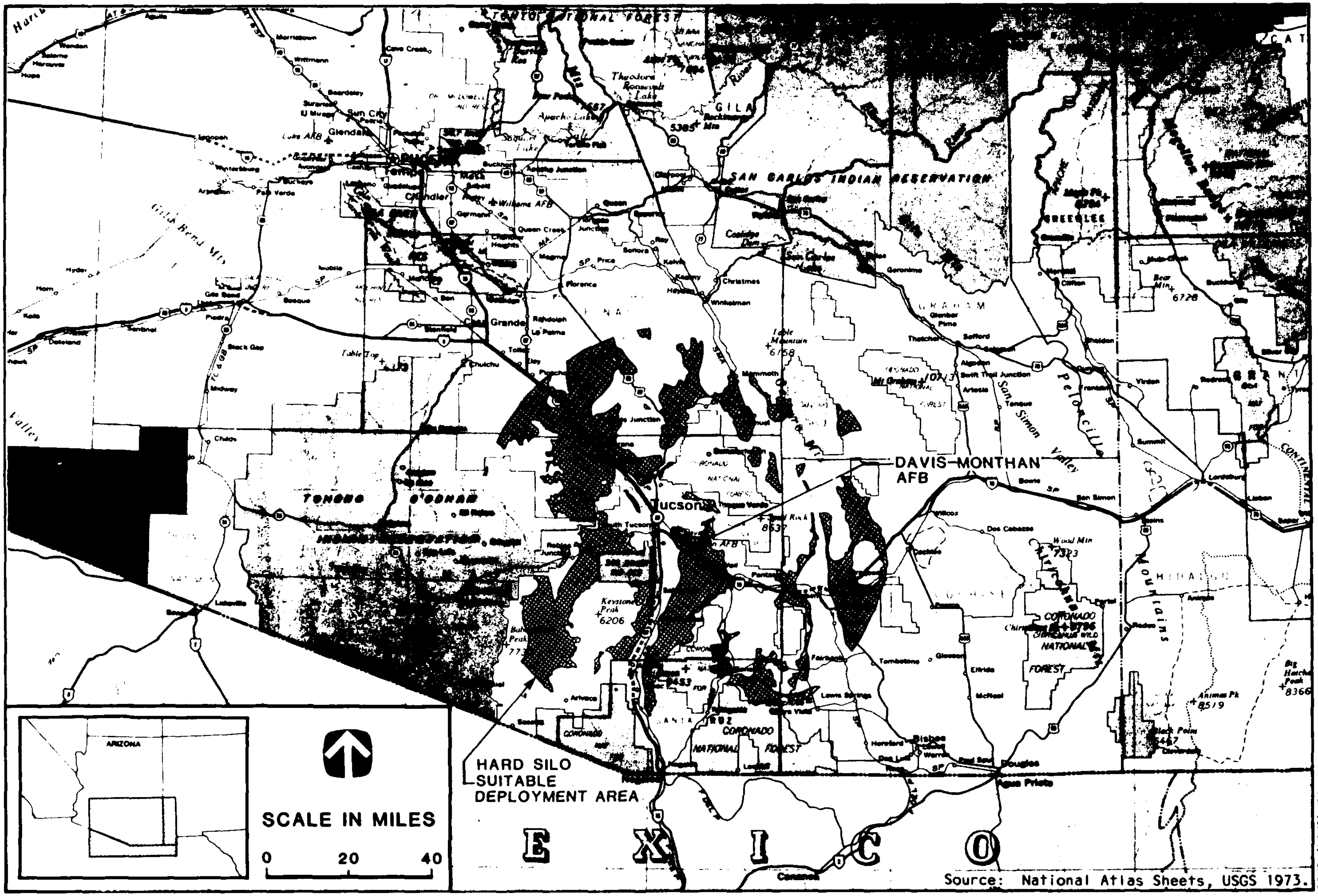


FIGURE 3.0-13 LOCATION OF THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT DAVIS-MONTHAN AFB

D3/9 (L3/9) ASG55/6

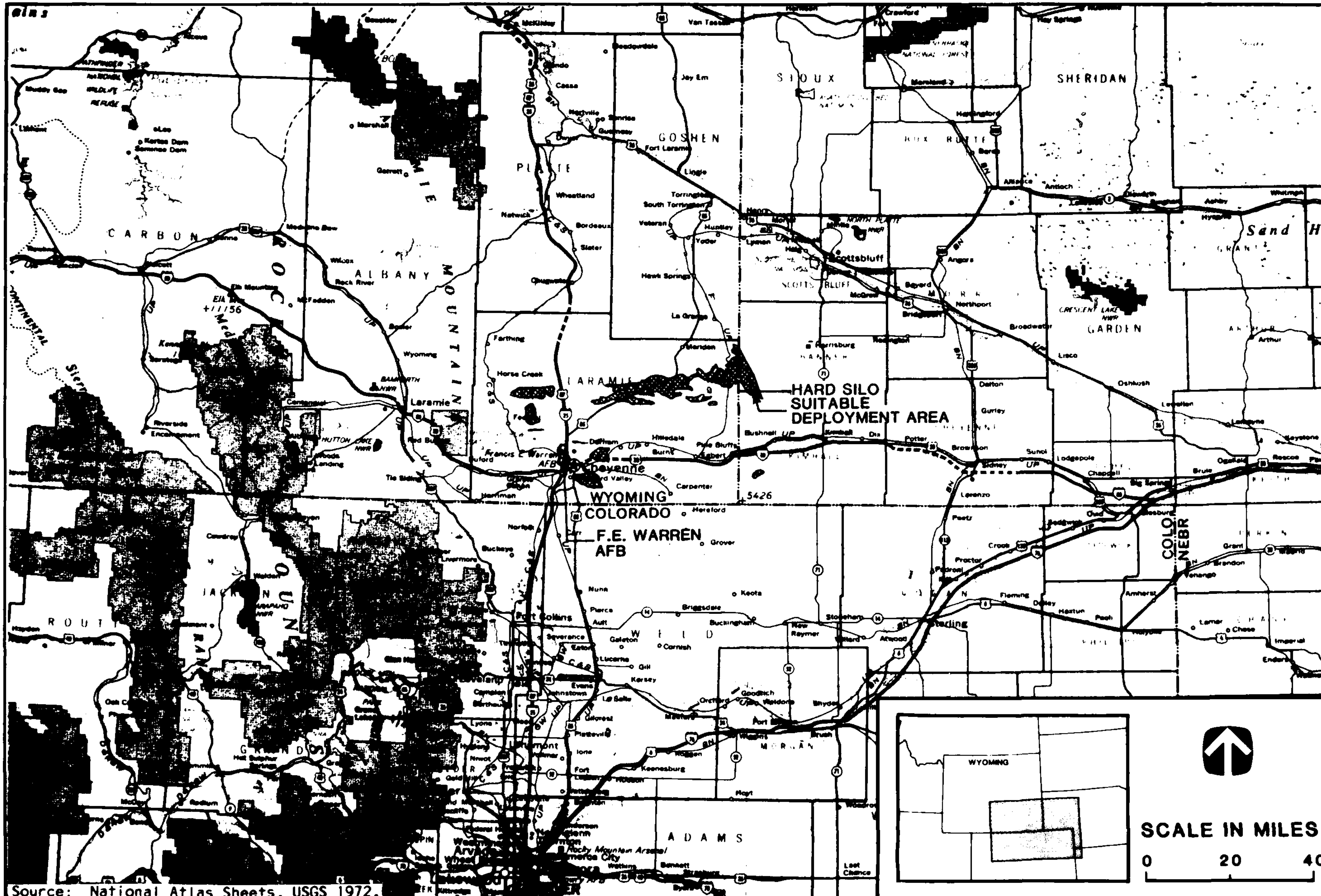
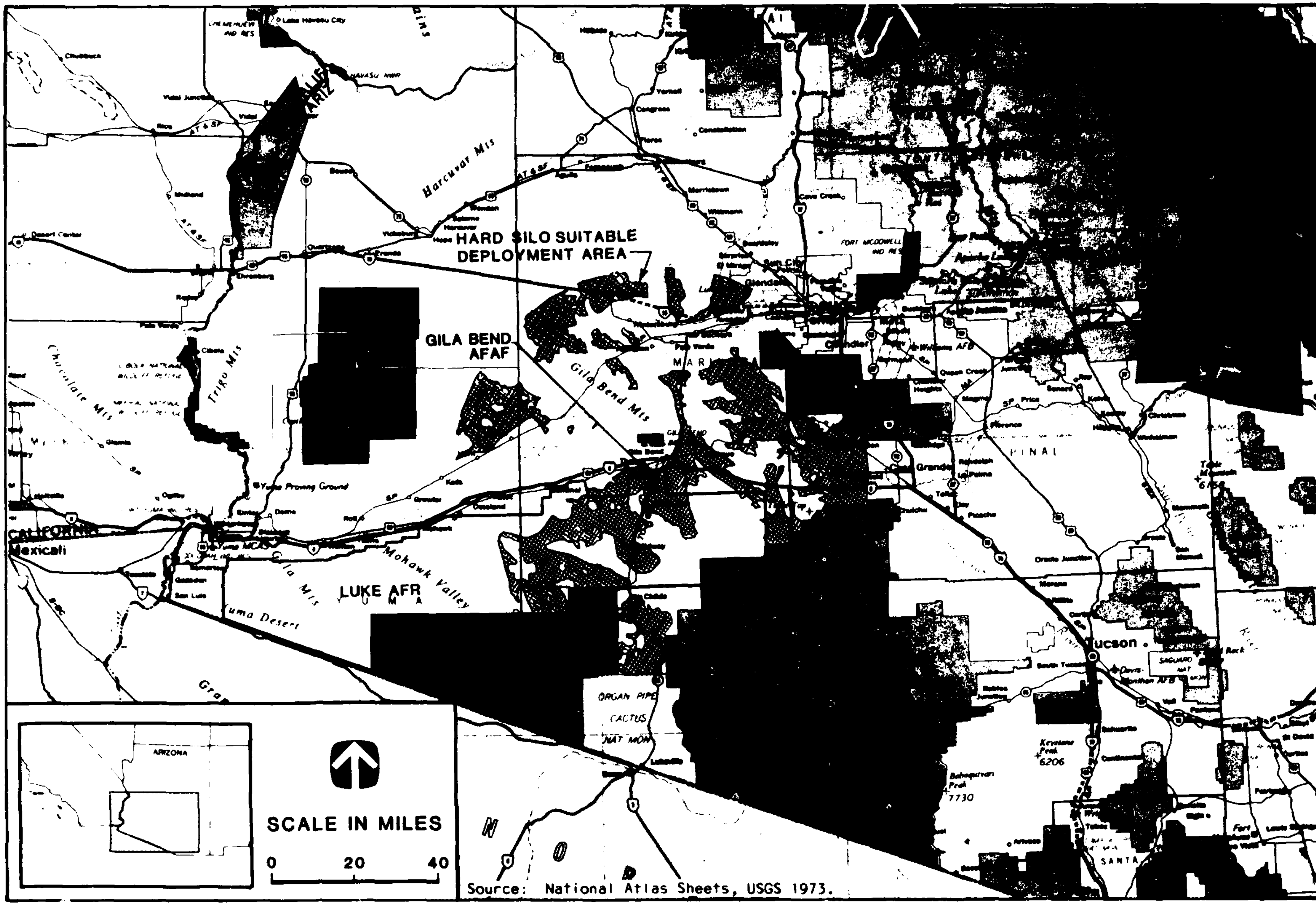


FIGURE 3.0-14 LOCATION OF THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT F.E. WARREN AFB

D3/8 (L3/8)



03/7 (L3/7)

FIGURE 3.0-15 LOCATION OF THE HARD SILO IN PATTERNED ARRAY ALTERNATIVE AT GILA BEND AFAF

The Washington Complex (Figure 3.0-6), located in south-central Washington near the city of Yakima, consists of Yakima Firing Center (FC) and the DOE Hanford Site, with the MOB at Yakima FC, a U.S. Army base (base population of 90).

The six Minuteman bases under consideration for Hard Mobile basing are Ellsworth, F.E. Warren, Grand Forks, Malmstrom, Minot, and Whiteman AFBs.

Ellsworth AFB (base population of 9,900) is a Strategic Air Command (SAC) base located 11 miles east-northeast of Rapid City, South Dakota (Figure 3.0-7). The base provides operations and maintenance facilities for both aircraft and missile components of the strategic deterrence forces of SAC. The base supports 150 Minuteman II missiles.

F.E. Warren AFB (base population of 4,300) is a SAC base located on the outskirts of Cheyenne in southeastern Wyoming (Figure 3.0-8). It supports 200 Minuteman III missiles.

Grand Forks AFB (base population of 6,000) is a SAC base located 16 miles west of Grand Forks, North Dakota (Figure 3.0-9). The base maintains and supports 150 Minuteman III missiles. The base also provides operations and maintenance facilities for both aircraft and missile components of the strategic deterrence forces of SAC. Beginning in 1988, Grand Forks AFB will be the MOB for the central region Over-the-Horizon Backscatter Radar facility.

Malmstrom AFB (base population of 4,400) is a SAC base located 1.5 miles east of Great Falls, Montana (Figure 3.0-10). The base is responsible for maintaining 150 Minuteman II and 50 Minuteman III missiles. It also serves as a training base for strategic missile warfare.

Minot AFB (base population of 6,700) is a SAC base located 13 miles north of Minot, North Dakota (Figure 3.0-11). The base develops and maintains operations capability to permit conduct of strategic missile warfare. The base maintains and supports 150 Minuteman III missiles.

Whiteman AFB (base population of 3,400) is a SAC base located 1.5 miles south of Knob Noster, Missouri (Figure 3.0-12). The base is responsible for the maintenance and support of 150 Minuteman II missiles.

The six MOBs retained for further study of Hard Silo deployment are Davis-Monthan AFB, Edwards AFB, F.E. Warren AFB, Fort Bliss, Gila Bend AFAF, and Yuma PG.

Davis-Monthan AFB (base population of 7,200) is a TAC base located in southeastern Arizona within the city limits of Tucson (Figure 3.0-13). Davis-Monthan AFB serves as a personnel training base for Ground-Launched Cruise missiles and as the Military Aircraft Storage and Disposition Center.

Edwards AFB (base population of 10,150) is located in the west-central Mojave Desert of south-central California; it is approximately 70 miles from the eastern margins of the Los Angeles metropolitan area (Figure 3.0-5). The base is used as a flight test center and it supports the National Aeronautics and Space Administration's (NASA) Space Shuttle program.

F.E. Warren AFB has been previously discussed as a Minuteman base. The Suitable Deployment Area (SDA) for Hard Silo in Patterned Array is illustrated in Figure 3.0-14.

Fort Bliss (base population of 32,000) is located in the westernmost portion of Texas, adjacent to the eastern limits of the city of El Paso (Figure 3.0-4). The Fort Bliss range extends northeast from El Paso into southeastern New Mexico. The current base mission is air defense weapons training.

Gila Bend AFAF (base population of 500) is located approximately 4 miles south of Gila Bend and 58 miles southwest of Phoenix (Figure 3.0-15). The base serves as an auxiliary support airfield to Luke AFB for on-range activities.

Yuma PG (base population of 2,000) is located in southeastern Arizona, approximately 24 miles north of Yuma (Figure 3.0-1). The base is used for a wide range of testing and evaluative functions, including product improvement testing and acceptance testing of weapons and ammunitions. Test functions include extensive mobility equipment tests, Army aircraft and aircraft armament tests, air drop and air delivery tests, desert environmental tests, aircraft maneuvering, firing range tests, air-to-ground test firings, rocket firings, attack helicopter tests, low-altitude test drops, and laser range tests.

The remainder of this chapter is divided into discussions of each of the resources that were used to define the affected environment. Within each of these discussions, descriptions of the conditions at each location are included. Analyses were conducted for all geographic regions that could potentially be affected by the proposed project. These areas, known as the Regions of Influence (ROIs), vary from resource to resource. The following resource categories were selected to represent the full set of issues required to evaluate potential impacts of the proposed project: socioeconomics; utilities; transportation; land use, including regional recreation and visual resources; cultural and paleontological resources; biological resources and threatened and endangered species; air quality and noise; water resources; and geology and soils.

3.1 Socioeconomics

Deployment of the Small Intercontinental Ballistic Missile (ICBM) system in any of the candidate areas will lead to regional socioeconomic changes. While the local economy will benefit from the creation of jobs, money spent by workers, and contractor purchases, inmigrating labor (and dependents) required for the proposed project could also result in substantial population increases and their associated effects. To evaluate the likelihood and implications of these changes, four elements have been included for analysis: regional growth (population, employment, and income), housing, public services, and public finance.

3.1.1 Resource Description

Regional Growth. For this element, population, employment, and income trends in the Regions of Influence (ROIs) were determined. While population trends mainly affect other issues (e.g., housing and public services), employment and income data are measures of economic status which were used as inputs to derive population inmigration and public finance estimates.

Housing. For this element, housing availability was examined. Baseline conditions were determined and projected for total housing stock and available vacant housing units. Housing includes single and multiple-family units, mobile homes, and transient facilities (e.g., hotel and motel rooms).

Public Services. For this element, total local government employment in public services was evaluated. Local government employment, including education and police personnel, was used as an indicator of baseline public service delivery levels and as a determinant of a local government's response to public service demands. Historical data on pupil enrollments were also used to evaluate Main Operating Base (MOB) county public school facility availability.

Public Finance. For this element, combined local government jurisdictions' total and per capita expenditures and revenues were evaluated and projected. The jurisdictions combined for analysis included county governments, municipalities, schools, and various special districts within the MOB county.

3.1.2 General Analysis Methodology

Region of Influence. The ROI for the regional growth element is a multicounty market area, generally within a 50-mile radius of a designated MOB, that serves as a supply region for labor and major construction materials. The ROI for the housing, public services, and public finance elements is generally limited to the MOB county, since most proposed project activities are likely to occur near the base. In those instances when the MOB is located far from major population centers, analyses were performed for subcounty areas.

Regional Growth. Population estimates for current and future conditions were obtained from state sources. If the data were incomplete, statistical methods were used to produce consistent time series. Employment projections were derived from population data, projected labor force participation, and unemployment rates. Income data were obtained from the Bureau of Economic Analysis and were used with employment data to generate baseline income

projections. All income values are expressed in 1984 dollars and all growth rates are annual compound rates.

Housing. Vacancy rates and persons per household were derived from the 1980 Census of Population and Housing and were assumed to remain constant through the year 2000. This information, in addition to state-source population projections, was used to forecast housing stocks and vacancies. Baseline data and forecasts for hotel and motel rooms were derived from industry association sources. All growth rates are annual compound rates.

Public Services. Baseline local government employment projections were made using state-source population forecasts and the most recent (1982) Census of Governments. County-level employment rates per 10,000 population for the total local government, police, and education employment in the MOB counties were used in this analysis. Pupil enrollment data were obtained from state departments of education and forecast in proportion to projected county populations. All growth rates are annual compound rates.

Public Finance. Baseline expenditures and revenues were aggregated for all MOB county local governments. Historical data were derived from the Census of Governments. Various statistical techniques applied to past fiscal patterns provided expenditure and revenue forecasts. While estimates of county personal income were used to project revenue levels, the expenditures projections were determined by estimated changes in county population. All expenditure and revenue data are expressed in 1984 dollars.

3.1.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

Figure 3.1.3-1 displays the ROI and MOB counties, and the principal population centers for the Hard Mobile Launcher in Random Movement basing mode locations. Table 3.1.3-1 provides summary data describing selected socioeconomic characteristics for each ROI.

3.1.3.1 Arizona Complex

The Arizona Complex ROI is a five-county region in south-central and southwestern Arizona with a 1984 population of 2.5 million. The population is expected to increase by 3 percent annually, reaching 4.1 million by the year 2000. The civilian labor force within the ROI increased to over 1.2 million in 1984 and is estimated to reach over 2.2 million in the year 2000. The unemployment rate was 4.4 percent in 1984 and is expected to average 5.5 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $12,300, amounting to 94 percent of the United States average of $13,100 in 1984. It is projected to grow 0.4 percent annually and reach about $13,100 in the year 2000.

The MOB for this complex will be either Gila Bend Air Force Auxiliary Field (AFAF) in Maricopa County or Yuma Proving Ground (PG) in Yuma County. Maricopa County's 1984 population of 1.7 million is projected to increase to nearly 2.9 million in the year 2000. Southern Maricopa County, near Gila Bend, had a 1984 population of 5,500 and is projected to be 8,500 in the year 2000. The housing stock in the Gila Bend area of Maricopa County is projected to increase from about 1,800 units in 1984 to nearly 2,800 in the year 2000.

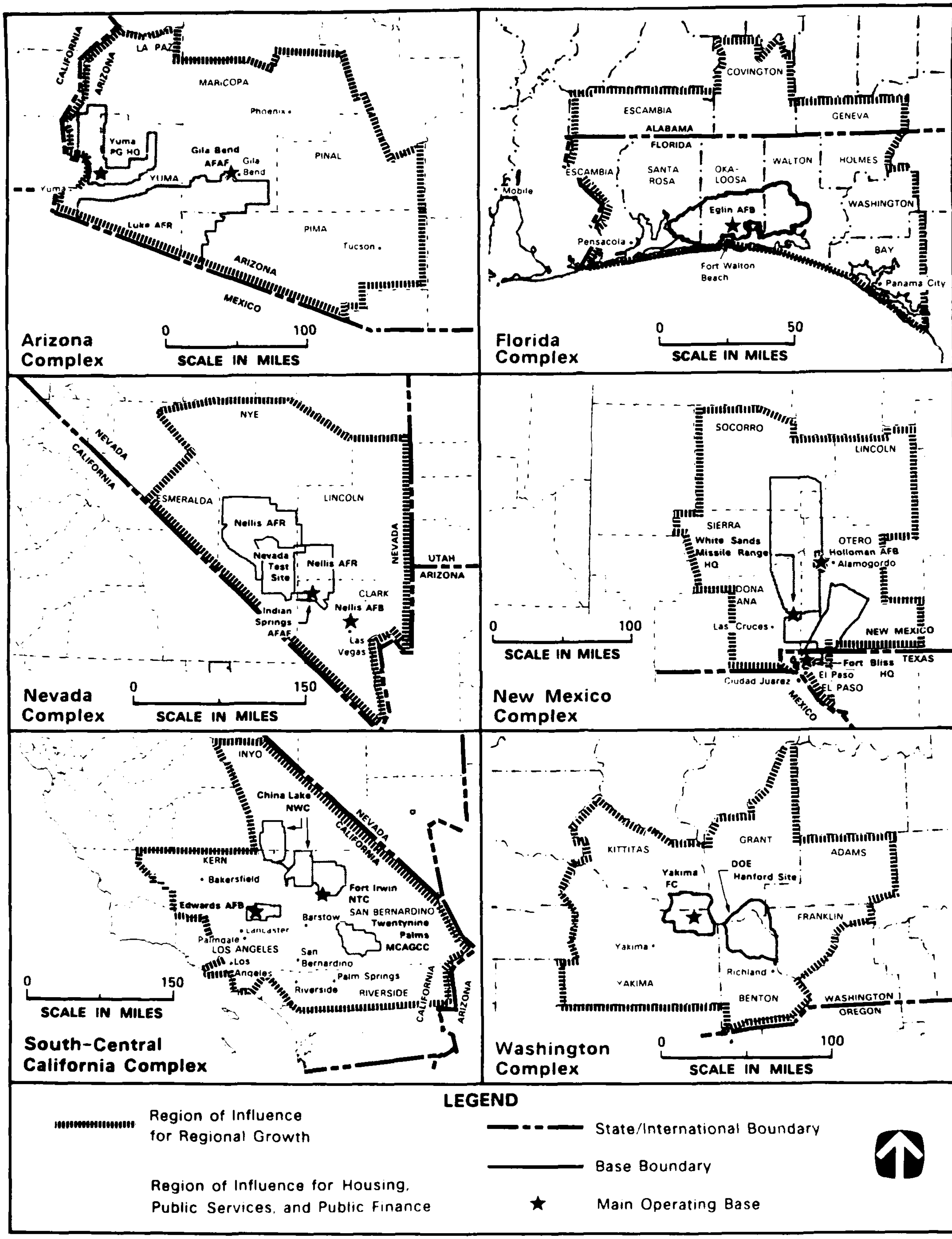


FIGURE 3.1.3-1 HARD MOBILE LAUNCHER IN RANDOM MOVEMENT REGIONS OF INFLUENCE COUNTIES

D3-SO/1 (L3-SO/1)

Table 3.1.3-1

SELECTED SOCIOECONOMIC CHARACTERISTICS, HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES

Complexes	Arizona		Florida	Nevada	New Mexico			South-Central California		Washington
Main Operating Bases	Gila Bend AFAF	Yuma PG	Eglin AFB	Indian Springs AFAF Nellis AFB	Fort Bliss	Holloman AFB	White Sands Missile Range	Edwards AFB	Fort Irwin NTC	Yakima FC
Main Operating Base Counties	Maricopa	Yuma/La Paz[1]	Okaloosa	Clark	El Paso	Otero	Dona Ana	Los Angeles	San Bernardino	Yakima
Regional Growth Population (000):										
ROI and (MOB County) 1984	2,532 (1,731)	(99)	713 (129)	580 (557)	724 (525)	(49)	(112)	10,177 (7,888)	(1,032)	412 (180)
ROI and (MOB County) 1990	3,091 (2,156)	(105)	799 (151)	704 (662)	866 (632)	(59)	(131)	10,931 (8,165)	(1,264)	438 (194)
ROI and (MOB County) 2000	4,081 (2,883)	(125)	916 (187)	942 (889)	1,072 (791)	(72)	(158)	11,947 (8,539)	(1,551)	495 (226)
ROI-Projected Average Annual Population Growth (1984-2000)	3.0%		1.6%	3.1%	2.5%			1.0%		1.2%
ROI-Civilian Labor Force, (000) (Unemployment Rate)										
1984	1,236 (4.4%)		306 (7.4%)	286 (8.6%)		276 (9.0%)		4,714 (8.2%)		200 (13.6%)
1990	1,576 (5.0)		363 (6.5)	365 (7.2)		342 (7.9)		5,262 (7.0)		230 (10.0)
2000	2,203 (5.5)		442 (6.5)	512 (6.5)		440 (7.3)		5,922 (6.5)		268 (9.5)
ROI-Labor Force Participation Rate (%)										
1984	48.8%		43.0%	49.3%		38.2%		46.2%		48.5%
1990	51.0		45.4	51.9		39.5		48.1		52.4
2000	54.0		48.2	54.4		41.0		49.6		54.2
ROI-Personal Income (Bill, $84), (per Capita)										
1984	$31.2 ($12,300)		$ 7.0 ($ 9,800)	$ 7.0 ($12,100)		$ 6.2 ($8,600)		$136.7 ($13,400)		$4.9 ($11,900)
1990	38.7 (12,500)		8.5 (10,600)	9.1 (12,900)		7.8 (9,000)		148.9 (13,800)		5.5 (12,600)
2000	53.6 (13,100)		10.6 (12,000)	12.5 (13,200)		10.0 (9,300)		167.5 (14,000)		6.2 (12,600)
ROI-Projected Growth, Personal Income (per Capita) ($/yr, $84)	3.4% (0.4%)		2.6% (1.1%)	3.7% (0.6%)		3.1% (0.6%)		1.3% (0.3%)		1.5% (0.4%)

Table 3.1.3-1 Continued, Page 2 of 2

Complexes	Arizona		Florida	Nevada	New Mexico			South-Central California		Washington
Main Operating Bases	Gila Bend AFAF	Yuma PG	Eglin AFB	Indian Springs AFAF Nellis AFB	Fort Bliss	Holloman AFB	White Sands Missile Range	Edwards AFB	Fort Irwin NTC	Yakima FC
Main Operating Base Counties	Maricopa	Yuma/ La Paz[1]	Okaloosa	Clark	El Paso	Otero	Dona Ana	Los Angeles	San Bernardino	Yakima
Housing										
MOB County-Total Year-Round Units (Available Units) (000)										
1984	1.8 (0.2)[a]	34.5 (1.8)	47.1 (3.1)	223.0 (14.3)	159.3 (5.3)	17.2 (1.0)	37.4 (2.0)	53.8 (2.2)[a]	47.6 (1.9)[a]	66.5 (2.5)
1990	2.2 (0.2)	36.5 (1.9)	55.3 (3.6)	265.1 (17.0)	191.9 (6.3)	20.3 (1.2)	43.8 (2.4)	69.0 (2.8)	59.4 (2.0)	71.8 (2.7)
2000	2.8 (0.3)	43.5 (2.3)	68.2 (4.5)	356.3 (22.8)	240.1 (7.9)	24.9 (1.4)	52.8 (2.9)	92.8 (3.8)	71.1 (2.8)	83.4 (3.2)
Vacancy Rate	10.7%	5.3%	6.5%	6.4%	3.3%	5.7%	5.4%	4.1%	4.1%	3.8%
Hotel and Motel Rooms										
1984	60[a]	850	3,600	30,400	4,300	340	500	700[a]	1,600[a]	1,800
2000	60	1,000	4,300	40,000	5,000	400	600	900	1,800	2,100
Public Services										
Public-Sector Jobs, Local Governments per 10,000 Population, 1982, MOB County (State)										
TOTAL	346 (350)	352 (350)	321 (350)	315 (348)	370 (372)	291 (331)	449 (331)	356 (348)	311 (348)	273 (294)
Education	121 (129)	149 (129)	152 (104)	[illegible] (114)	154 (152)	135 (151)	174 (151)	103 (110)	111 (110)	111 (95)
Police	25 (24)	21 (24)	17 (28)	[illegible] (34)	19 (21)	23 (21)	14 (21)	28 (24)	19 (24)	17 (17)
No. Pupils, K-12, MOB County										
1980	650[a]	18,700	23,900	88,500	117,000	8,900	21,900	26,000[a]	26,800[a]	35,600
1985	750	21,800	22,700	89,300	120,700	8,600	22,500	28,800	31,700	35,200
Potential Additional Pupil Capacity	No	No	Yes	No	No	Yes	No	No	No	Yes
Public Finance										
Expenditures per MOB County Capita ($84),										
1984	$2,130	$1,347	$1,121	$1,476	$1,074	$ 794	$1,458	$2,059	$1,554	$1,138
1990	2,402	1,372	1,272	1,506	1,183	899	1,637	2,106	1,544	1,312
2000	2,876	1,431	1,497	1,543	1,290	1,008	1,810	2,164	1,536	1,676
Revenues per Capita ($84), MOB County										
1984	$2,016	$1,356	$1,183	$1,410	$1,198	$ 868	$1,389	$2,139	$1,578	$1,160
1990	2,473	1,563	1,382	1,488	1,432	887	1,497	2,186	1,563	1,328
2000	3,263	1,661	1,689	1,537	1,665	924	1,606	2,206	1,527	1,521

Notes: [1]Historical and projected data for Yuma County include La Paz County.
[a]Data based on subcounty region adjacent to MOB.

The vacancy rate in 1984 was 10.7 percent, with about 200 available units. There were fewer than 100 hotel and motel rooms in the Gila Bend area in 1984, with no change projected to the year 2000.

Local government employment in Maricopa County was 346 per 10,000 population, about equal to the state average in 1982. Education employment in 1982 was 121 per 10,000 population, compared to the state average of 129. Police employment in 1982 was 25 per 10,000 population, about equal to the state average of 24. School enrollments in the Gila Bend area increased from 650 in 1980 to 750 pupils in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Maricopa County were $2,130 and $2,016 in fiscal year (FY) 1984, respectively. Per capita expenditures are forecast to grow to $2,876 in FY 2000 or approximately 1.9 percent per year. Per capita revenues are forecast to grow to $3,263 in FY 2000, approximately 3.1 percent per year.

Existing and projected conditions for Yuma County are presented in Section 3.1.5.6.

3.1.3.2 Florida Complex

The Florida Complex ROI is a ten-county region of the Florida Panhandle and southern Alabama with a 1984 population of 713,000. The population is expected to increase by 1.6 percent annually, reaching over 916,000 in the year 2000. The civilian labor force within the ROI increased to over 306,000 in 1984 and is estimated to reach almost 442,000 in the year 2000. The unemployment rate was 7.4 percent in 1984 and is expected to average 6.5 percent during the late 1980s and through the year 2000. The ROI's per capita income was $9,800, amounting to 75 percent of the United States average in 1984. It is projected to grow 1.1 percent annually and reach $12,000 in the year 2000.

The MOB for this complex is Eglin Air Force Base (AFB) in Okaloosa County. The 1984 population of the county was 128,900 and is projected to grow to 186,600 by the year 2000. The housing stock in Okaloosa County is estimated to increase from 47,100 units in 1984 to about 68,200 units in the year 2000. The vacancy rate in 1984 was 6.5 percent, with about 3,100 available units. Hotel and motel rooms are forecast to increase from about 3,600 units in 1984 to nearly 4,300 in the year 2000.

Local government employment in Okaloosa County was 321 per 10,000 population, 8.3 percent below the state average in 1982. Education employment in 1982 was 152 per 10,000 population, compared to the state average of 104. Police employment in 1982 was 17 per 10,000 population, considerably below the state average of 28. School enrollments decreased from 23,900 in 1980 to 22,700 in 1985, suggesting possible available capacity. Per capita public expenditures and revenues of local governments in Okaloosa County were $1,121 and $1,183 in FY 1984, respectively. Per capita expenditures are forecast to grow to $1,497 in FY 2000, or about 1.8 percent per year. Per capita revenues are forecast to grow to $1,689 in FY 2000, or approximately 2.3 percent per year.

3.1.3.3 Nevada Complex

The Nevada Complex ROI is a four-county region in southern Nevada with a 1984 population of over 580,000. The population is expected to increase by

3.1 percent annually, reaching almost 942,000 in the year 2000. The civilian labor force within the ROI was 286,000 in 1984 and is estimated to reach 512,000 in the year 2000. The unemployment rate was 8.5 percent in 1984 and is expected to average 6.5 percent during the late 1990s and through the year 2000. Per capita income in the ROI was $12,100, amounting to 92 percent of the United States average in 1984. It is projected to grow 0.6 percent annually and reach $13,200 in the year 2000.

The MOB for this complex will be either Indian Springs AFAF or Nellis AFB, both in Clark County. The county's 1984 population totaled 556,600 and is forecast to increase to 889,300 by the year 2000. The housing stock in Clark County was estimated at 223,000 units in 1984 and is projected to increase to over 356,000 by the year 2000. The 1984 vacancy rate was 6.4 percent, with about 14,300 available units. Hotel and motel rooms are expected to increase from about 30,400 units in 1984 to nearly 40,000 by the year 2000.

Local government employment in Clark County was 315 persons per 10,000 population in 1982, 9.5 percent below the state average. Education employment in 1982 was 95 per 10,000 population, compared to the state average of 114. Police employment in 1982 was 32 per 10,000 population, compared to the state average of 34. School enrollments increased from 88,500 pupils in 1980 to 89,300 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Clark County were $1,476 and $1,410 in FY 1984, respectively. Per capita expenditures are projected to increase slightly from $1,476 in FY 1984 to $1,543 in FY 2000. Per capita revenues are projected to increase slightly through FY 2000, increasing from $1,410 in FY 1984 to $1,537 in FY 2000.

3.1.3.4 New Mexico Complex

The New Mexico Complex ROI is a six-county region in south-central New Mexico and west Texas with a 1984 population of almost 724,000. Population in the ROI is expected to increase by 2.5 percent annually, reaching 1.1 million in the year 2000. The civilian labor force within the ROI reached 276,000 in 1984 and is estimated to rise to 440,000 in the year 2000. The unemployment rate was 9 percent in 1984 and is expected to average 7.3 percent during the late 1990s and through the year 2000. The ROI's per capita income was $8,600, which amounted to about 65 percent of the United States average in 1984. It is projected to grow 0.6 percent annually and reach $9,300 in the year 2000.

The MOB will be either Fort Bliss in El Paso County, Texas; Holloman AFB in Otero County, New Mexico; or White Sands Missile Range Headquarters in Dona Ana County, New Mexico. El Paso County's 1984 population is estimated at 524,800 and is projected to increase to 791,000 by the year 2000. Otero County's population totaled 49,500 in 1984 and is forecast to be 71,700 in the year 2000. Dona Ana County's population was 112,200 in 1984 and is expected to grow to 158,300 by the year 2000.

Existing and projected housing, public service, and public finance conditions in El Paso County are presented in Section 3.1.5.4.

The housing stock in Otero County was estimated at 17,200 units in 1984 and is forecast to increase to nearly 25,000 by the year 2000. The vacancy rate in 1984 was 5.7 percent, with about 1,000 available units. Hotel and motel rooms are expected to increase from about 340 units in 1984 to 400 by the year 2000.

Local government employment in Otero County was 291 per 10,000 population, 12 percent below the state average. Education employment in 1982 was 135 per 10,000 population, compared to the state average of 151. Police employment in 1982 was 23 per 10,000 population, slightly higher than the state average of 21. School enrollments declined from 8,900 pupils in 1980 to 8,600 in 1985, suggesting possible current available capacity. Per capita public expenditures and revenues of local governments in Otero County were $794 and $868 in FY 1984, respectively. Per capita expenditures are projected to grow to $1,008 in FY 2000 or 1.5 percent per year. Per capita revenues are projected to grow to $924 in FY 2000, or 0.4 percent per year.

Dona Ana County had a 1984 housing stock estimated at 37,400 units and is projected to grow to nearly 53,000 by the year 2000. The vacancy rate was 5.4 percent with about 2,000 available units. Hotel and motel rooms are projected to increase from 500 to 600 units between 1984 and the year 2000.

Local public-sector employment in Dona Ana County was 449 per 10,000 population, 36 percent higher than the state average in 1982. Education employment in 1982 was 174 per 10,000 population, compared to the state average of 151. Police employment in 1982 was 14 per 10,000 population, considerably lower than the state average of 21. School enrollments increased from 21,900 pupils in 1980 to over 22,500 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Dona Ana County were $1,458 and $1,389 in FY 1984, respectively. Per capita expenditures are forecast to grow to $1,810 in FY 2000, or 1.4 percent per year. Per capita revenues are forecast to grow to $1,606 in FY 2000, or 0.9 percent per year.

3.1.3.5 South-Central California Complex

The South-Central California Complex ROI is a five-county region extending from metropolitan Los Angeles northeast through the Mojave Desert to the Nevada border. The ROI had a 1984 population of 10.2 million. The population is expected to increase by 1 percent annually, to 11.9 million in the year 2000. The civilian labor force within the ROI reached 4.7 million in 1984 and is estimated to rise to about 5.9 million in the year 2000. The unemployment rate was 8.2 percent in 1984 and is expected to average 6.5 percent during the late 1990s and through the year 2000. The ROI's per capita income was $13,400, slightly higher than the United States average in 1984. It is forecast to grow 0.3 percent annually and reach $14,000 in the year 2000.

The MOB for this complex will be either Edwards AFB, with Los Angeles County being the most likely county to be affected by proposed project activities, or Fort Irwin National Training Center (NTC) in San Bernardino County. The 1984 population of Los Angeles County was 7.9 million and is forecast to be 8.5 million in the year 2000. The northeastern portion of the county nearest Edwards AFB had a 1984 population of 121,500 and is projected to grow to 216,000 by the year 2000. Kern County had a 1984 population of 461,200, with a projected population of 622,400 in the year 2000. The southeastern part of the county, which contains portions of Edwards AFB, had a 1984 population of 26,800, with a projected population of 39,900 in the year 2000. San Bernardino County's population was more than 1 million in 1984 and is projected to reach nearly 1.6 million by the year 2000. The Barstow-Victorville area in the vicinity of Fort Irwin NTC had a population of 131,900 in 1984 and is forecast to grow to 196,700 in the year 2000.

The 1984 housing stock in the two-county Edwards AFB area was estimated to include about 54,000 permanent units with nearly 10,000 units located in southeastern Kern County and over 44,000 units in northeastern Los Angeles County. The area vacancy rate in 1984 was 4.1 percent, resulting in about 2,200 available vacancies. By the year 2000, the permanent housing stock in this area is projected to increase to nearly 93,000 units. Hotel and motel rooms in the Edwards AFB area are expected to increase from 700 to 900 units between the years 1984 and 2000.

Local government employment in Los Angeles County was 356 per 10,000 population, 2.3 percent above the state average in 1982. Education employment in 1982 was 103 per 10,000 population, compared to the state average of 110. Police employment in 1982 was 28 per 10,000 population, compared to the state average of 24. School enrollments increased from about 26,000 pupils in 1980 to 28,800 in 1985 in the Edwards AFB vicinity, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Los Angeles County were $2,059 and $2,139 in FY 1984, respectively. Per capita expenditures are projected to grow to $2,164 in FY 2000, or 0.3 percent per year. Per capita revenues are projected to grow to $2,206 in FY 2000, or 0.2 percent per year. Local governments in the immediate vicinity of Edwards AFB are expected to account for an increasing share of the projected countywide public expenditures, from approximately 1.5 percent in FY 1984 to 2.5 percent in FY 2000.

The housing stock in the Fort Irwin NTC area of San Bernardino County was estimated at 47,600 units in 1984 and is projected to increase to about 71,100 by the year 2000. In 1984, the vacancy rate was 4.1 percent, with about 1,900 available units. Hotel and motel rooms are expected to increase from 1,600 to 1,800 units between the years 1984 and 2000.

Local government employment in San Bernardino County was 311 persons per 10,000 population, 10.6 percent below the state average in 1982. Education employment in 1982 was 111 per 10,000 population, compared to the state average of 110. Police employment in 1982 was 19 per 10,000 population, compared to the state average of 24. School enrollments in the Fort Irwin NTC area increased from about 26,800 pupils in 1980 to 31,700 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in San Bernardino County were $1,554 and $1,578 in FY 1984, respectively. Per capita expenditures are projected to decrease slightly, reaching $1,536 in FY 2000. Per capita revenues also are forecast to decrease slightly, reaching $1,527 in FY 2000.

3.1.3.6 Washington Complex

The Washington Complex ROI is a six-county region in south-central Washington with a 1984 population of 412,200. The population is expected to increase by 1.2 percent annually, to 495,100 in the year 2000. The civilian labor force within the ROI reached nearly 200,000 in 1984 and is expected to grow to about 268,000 in the year 2000. The unemployment rate was 13.6 percent in 1984 and is expected to average 9.5 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $11,900, amounting to 91 percent of the United States average in 1984. It is projected to grow 0.4 percent annually and reach $12,600 in the year 2000.

The MOB is located in Yakima County, with a 1984 population of 180,000 and a projected population of 225,500 in the year 2000. The housing stock in Yakima County was estimated at 66,500 units in 1984 and is expected to reach 83,000 units by the year 2000. The vacancy rate in 1984 was 3.8 percent, with about 2,500 available units. Hotel and motel rooms are expected to increase from 1,800 to 2,100 units between the years 1984 and 2000.

Local government employment in Yakima County was 273 per 10,000 population, 7.1 percent below the state average in 1982. Education employment in 1982 was 111 per 10,000 population, compared to the state average of 95. Police employment in 1982 was 17 per 10,000 population, about equal to the state average. School enrollments declined from 35,600 in 1980 to 35,200 in 1985, suggesting possible current available capacity. Per capita public expenditures and revenues of local governments in Yakima County were $1,138 and $1,160 in FY 1984, respectively. Per capita expenditures are projected to grow to $1,676 in FY 2000, or 2.4 percent per year. Per capita revenues are projected to grow to $1,521 in FY 2000, or 1.7 percent per year.

3.1.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

Figure 3.1.4-1 displays ROI and MOB counties, and the principal population centers for the Hard Mobile Launcher at Minuteman Facilities basing mode locations. Table 3.1.4-1 provides summary data describing selected socioeconomic characteristics for each ROI.

3.1.4.1 *Ellsworth Air Force Base*

The Ellsworth AFB ROI is a nine-county region of western South Dakota with a 1984 population of 143,700. The population is expected to increase by 1.1 percent annually, to 169,900 by the year 2000. The civilian labor force within the ROI increased to about 71,000 in 1984 and is expected to reach nearly 90,500 in the year 2000. The unemployment rate was 4.1 percent in 1984 and is estimated to average 4.5 percent per year during the 1990s and through the year 2000. The ROI's per capita income was $10,800, amounting to 82 percent of the United States average in 1985. It is projected to grow 0.5 percent annually and reach $11,500 in the year 2000.

The MOB is located in Meade County; however, the nearest population centers are in Pennington County. Therefore, Pennington is the MOB county. Pennington County had a 1984 population of 74,700 and is projected to increase to 96,900 in the year 2000. The housing stock in Pennington County was estimated at 28,200 units in 1984 and is expected to reach over 36,000 units by the year 2000. The vacancy rate in 1984 was 5.5 percent, with about 1,600 available units. Hotel and motel rooms are expected to increase from about 2,000 to 2,300 units between the years 1984 and 2000.

Local government employment in Pennington County was 298 per 10,000 population, 6 percent below the state average in 1982. Education employment in 1982 was 141 per 10,000 population, compared to the state average of 146. Police employment in 1982 was 21 per 10,000 population, compared to the state average of 17. School enrollments increased from about 14,500 pupils in 1980 to 15,200 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments were $1,051 and $1,166 in

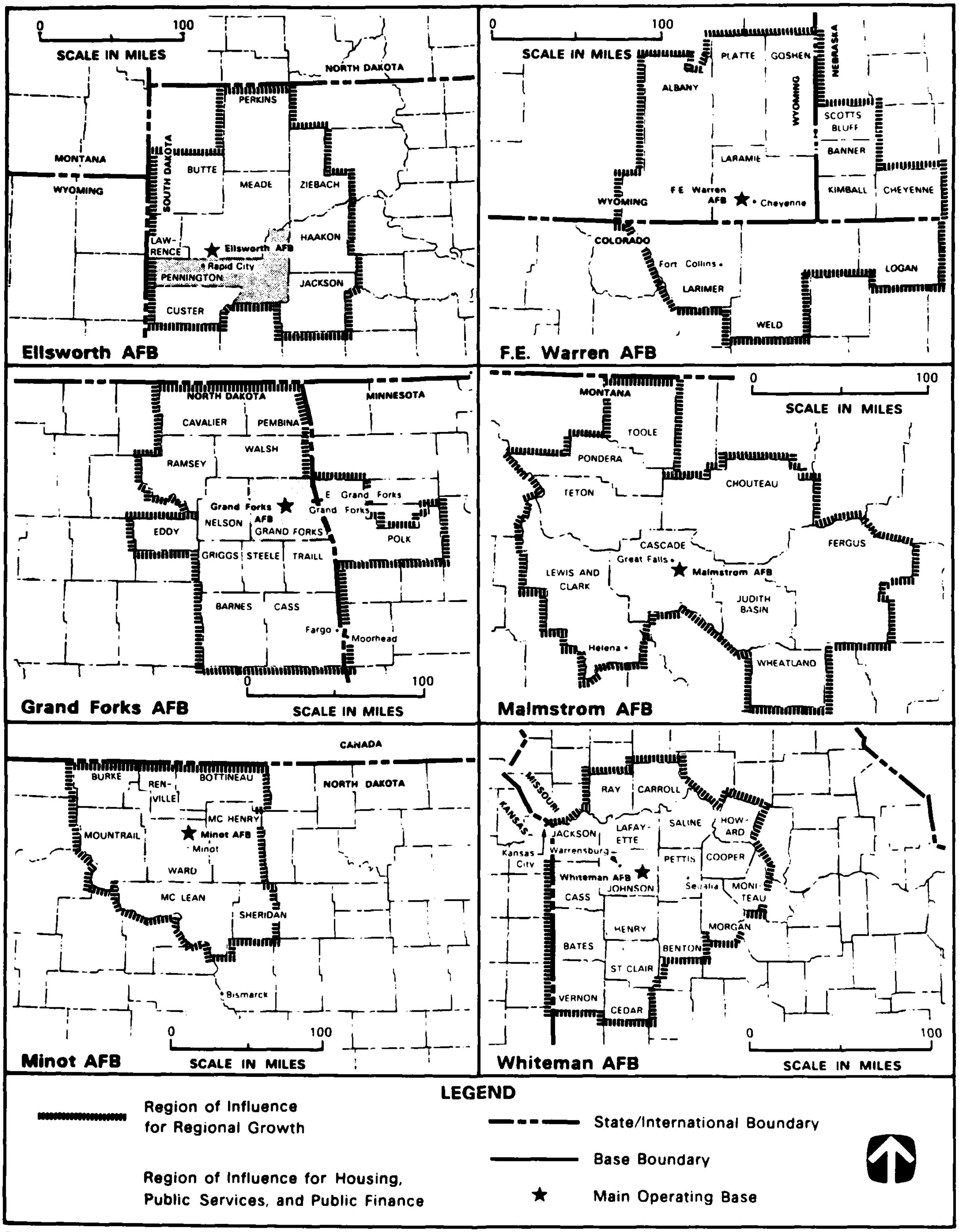


FIGURE 3.1.4-1 HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES REGIONS OF INFLUENCE COUNTIES

D3-S0/2 (L3-S0/2)

Table 3.1.4-1

SELECTED SOCIOECONOMIC CHARACTERISTICS, HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES

Main Operating Bases Main Operating Base Counties	Ellsworth AFB Pennington, SD	F.E. Warren AFB Laramie, WY	Grand Forks AFB Grand Forks, ND	Malmstrom AFB Cascade, MT	Minot AFB Ward, ND	Whiteman AFB Johnson, MO
Regional Growth						
Population (000)						
ROI and [MOB County] 1984	144 [75]	503 [72]	285 [69]	171 [82]	111 [62]	991 [38]
ROI and [MOB County] 1990	154 [85]	596 [81]	312 [79]	180 [86]	120 [68]	974 [41]
ROI and [MOB County] 2000	170 [97]	734 [97]	337 [85]	194 [92]	127 [75]	972 [43]
ROI-Projected Average Annual Population Growth (1984-2000)	1.1%	2.4%	1.1%	0.8%	0.8%	-0.1%
ROI-Civilian Labor Force, (000) [Unemployment Rate]						
1984	71 [4.1%]	252 [5.3%]	138 [4.7%]	82 [6.6%]	47 [6.3%]	492 [6.4%]
1990	78 [4.3]	307 [5.0]	159 [5.0]	91 [6.0]	55 [5.8]	507 [6.0]
2000	90 [4.5]	387 [5.0]	181 [5.0]	102 [6.0]	63 [5.5]	524 [6.0]
ROI-Labor Force Participation Rate %						
1984	49.5%	50.2%	48.5%	48.1%	42.7%	49.6%
1990	50.4	51.5	50.9	50.3	46.1	52.1
2000	53.0	52.7	53.7	52.6	49.2	54.0
ROI-Personal Income (Bill, $84), [per Capita]						
1984	$1.5 [$10,800]	$6.1 [$12,100]	$3.7 [$12,950]	$2.0 [$11,700]	$1.4 [$12,700]	$12.1 [$12,200]
1990	1.7 [11,200]	7.5 [12,600]	4.1 [13,200]	2.1 [11,900]	1.5 [12,700]	12.5 [12,800]
2000	2.0 [11,500]	9.7 [13,200]	4.6 [13,700]	2.3 [12,000]	1.6 [12,800]	12.9 [13,300]
ROI-Projected Growth, Personal Income, [per Capita] (%/yr, $84)	1.5% [0.5%]	2.9% [0.6%]	1.4% [0.3%]	0.9% [0.2%]	1.2% [0.1%]	0.4% [0.5%]
Housing:						
MOB County-Total Year-Round Units [Available Units], 000						
1984	28.2 [1.6]	29.7 [1.2]	25.1 [1.8]	31.6 [1.8]	22.0 [0.9]	13.8 [1.6]
1990	32.2 [1.8]	32.1 [1.3]	28.5 [2.1]	33.3 [1.9]	24.1 [1.0]	13.8 [1.3]
2000	36.6 [2.1]	38.5 [1.5]	30.8 [2.2]	35.7 [2.0]	26.6 [1.1]	13.8 [1.0]
Vacancy Rate	5.5%	4.0%	7.3%	5.8%	3.9%	•
Hotel and Motel Rooms						
1984	1,950	2,000	750	830	900	120
2000	2,280	2,400	900	980	1,000	120

Table 3.1.4-1 Continued, Page 2 of 2

Main Operating Bases Main Operating Base Counties	Ellsworth AFB Pennington, SD	F.E. Warren AFB Laramie, WY	Grand Forks AFB Grand Forks, ND	Malmstrom AFB Cascade, MT	Minot AFB Ward, ND	Whiteman AFB Johnson, MO
Public Services						
Public-Sector Jobs, Local Governments per 10,000 Population, 1982, MOB County (State)						
TOTAL	298 (317)	446 (468)	238 (297)	291 (353)	265 (297)	287 (312)
Education	141 (146)	178 (183)	143 (139)	124 (163)	127 (139)	118 (116)
Police	21 (17)	24 (30)	15 (17)	17 (20)	16 (16)	13 (24)
No. Pupils, K-12, MOB County						
1980	14,500	13,700	10,900	14,900	10,300	6,100
1985	15,200	13,600	10,700	13,900	10,600	6,200
Potential Additional Pupil Capacity	No	Yes	Yes	Yes	No	No
Public Finance						
Expenditures per Capita ($84), MOB County						
1984	$1,051	$1,329	$1,023	$ 914	$959	$791
1990	1,343	1,521	1,188	1,125	955	902
2000	1,667	1,826	1,284	1,388	937	979
Revenues per Capita ($84), MOB County						
1984	$1,166	$1,680	$1,066	$1,227	$1,013	$ 985
1990	1,385	1,860	1,171	1,281	1,014	1,073
2000	1,631	2,026	1,263	1,304	996	1,133

Note *Vacancy rate is assumed to decline from 11.6% in 1984 to 7.2% in the year 2000.

FY 1984, respectively. Per capita expenditures are projected to increase 2.9 percent per year through the year 2000, from $1,051 in FY 1984 to $1,667 in FY 2000. Per capita revenues are projected to increase 2.1 percent per year through the year 2000, from $1,166 in FY 1984 to $1,631 in FY 2000.

3.1.4.2 F.E. Warren Air Force Base

The F.E. Warren AFB ROI is an 11-county region in southeastern Wyoming, western Nebraska, and northern Colorado which had a 1984 population of 502,600. The population is expected to increase by 2.4 percent annually, reaching 734,400 in the year 2000. The civilian labor force within the ROI increased to nearly 252,300 in 1984 and is expected to reach about 387,200 in the year 2000. The unemployment rate was 5.3 percent in 1984 and is estimated to average 5 percent per year during the 1990s and through the year 2000. The ROI's per capita income was $12,100, amounting to 92 percent of the United States average in 1984. Per capita income is projected to grow 0.6 percent annually and reach $13,200 in the year 2000.

The MOB is located in Laramie County, which had a 1984 population of 72,300 and is projected to grow to 96,800 by the year 2000. The housing stock in Laramie County was estimated at 29,700 units in 1984 and is expected to reach 38,500 units by the year 2000. The vacancy rate in 1984 was 4 percent, with about 1,200 available units. Hotel and motel rooms are projected to increase from 2,000 to 2,400 units between the years 1984 and 2000.

Local government employment in Laramie County was 446 per 10,000 population, 4.7 percent below the state average in 1982. Education employment in 1982 was 178 per 10,000 population, compared to the state average of 183. Police employment in 1982 was 24 per 10,000 population, compared to the state average of 30. School enrollments remained steady at about 13,600 pupils between 1980 and 1985, suggesting no current available capacity. Per capita public expenditures and revenues by local governments in Laramie County were $1,329 and $1,680 in FY 1984, respectively. Per capita expenditures are projected to grow 2.0 percent per year, reaching $1,826 in FY 2000. Per capita revenues are projected to grow 1.2 percent per year, reaching $2,026 in FY 2000.

3.1.4.3 Grand Forks Air Force Base

The Grand Forks AFB ROI is a 13-county region of eastern North Dakota and northwestern Minnesota with a 1984 population estimated at 284,800. The population is expected to increase to 337,000 by the year 2000, an annual growth averaging 1.1 percent. The civilian labor force within the ROI increased to about 138,100 in 1984 and is expected to reach nearly 180,900 in the year 2000. The unemployment rate was 4.7 percent in 1984 and is estimated to average 5 percent per year during the late 1980s and through the year 2000. The ROI's per capita income was $12,950, which was almost equal to the United States average in 1984. It is projected to grow 0.3 percent annually and reach $13,700 in the year 2000.

The MOB is located in Grand Forks County. In 1984, the county's population was 69,500 and by the year 2000 it is forecast to be 85,400. The housing stock in Grand Forks County was estimated at 25,100 units in 1984 and is expected to reach 31,000 units by the year 2000. The vacancy rate in 1984 was 7.3 percent, with about 1,800 available units. Hotel and motel rooms are expected to increase from 750 to about 900 between the years 1984 and 2000.

Local government employment in Grand Forks County was 238 per 10,000 population in 1982, 19.9 percent below the state average. Education employment in 1982 was 143 per 10,000 population, compared to the state average of 139. Police employment in 1982 was 15 per 10,000 population, compared to the state average of 17. School enrollments fell from 10,900 pupils in 1980 to 10,700 in 1985, suggesting possible current available capacity. Per capita public expenditures and revenues for local governments in Grand Forks County were $1,023 and $1,066 in FY 1984, respectively. Per capita expenditures are expected to increase, reaching $1,284 in FY 2000. Per capita revenues also are expected to increase, reaching $1,263 in FY 2000.

3.1.4.4 Malmstrom Air Force Base

The Malmstrom AFB ROI is a nine-county region of north-central Montana with a 1984 population of 170,800. The population is expected to increase by 0.8 percent annually, reaching 193,900 in the year 2000. The civilian labor force within the ROI increased to about 82,200 in 1984 and is expected to reach almost 101,900 in the year 2000. The unemployment rate was 6.6 percent in 1984 and is estimated to average 6 percent per year during the late 1980s and through the year 2000. The ROI's per capita income was $11,700, amounting to 89 percent of the United States 1984 average. It is projected to grow 0.2 percent annually and reach $12,000 in the year 2000.

The MOB is located in Cascade County, which had a 1984 estimated population of 81,600. The county is projected to have a population of 92,100 in the year 2000, assuming a recovery from adverse economic conditions in recent years in the central Montana agriculture and mining sectors. The housing stock in Cascade County was estimated at 31,600 units in 1984 and should reach nearly 35,700 units by the year 2000. The vacancy rate in 1984 was 5.8 percent, with about 1,800 available units. Hotel and motel rooms are expected to increase from about 800 to nearly 1,000 units by the year 2000.

Local government employment in Cascade County was 291 per 10,000 population, 18 percent less than the state average in 1982. Education employment in 1982 was 124 per 10,000 population, compared to the state average of 163. Police employment in 1982 was 17 per 10,000 population, compared to the state average of 20. School enrollments decreased from 14,950 in 1980 to 13,900 in 1985, suggesting possible current available capacity. Per capita public expenditures and revenues of local governments in Cascade County were $914 and $1,227 in FY 1984, respectively. Per capita expenditures are forecast to grow slightly faster than per capita revenues, reaching $1,388 in FY 2000. Per capita revenues are expected to grow slightly, reaching $1,304 in FY 2000.

3.1.4.5 Minot Air Force Base

The Minot AFB ROI is an eight-county region in north-central North Dakota with a 1984 population of 111,300. The population is expected to increase to 127,300 in the year 2000, an average annual growth rate of 0.8 percent. The civilian labor force within the ROI increased to about 47,600 in 1984 and is expected to reach nearly 62,700 in the year 2000. The unemployment rate was 6.3 percent in 1984 and is estimated to average 5.5 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $12,700, amounting to 97.4 percent of the United States average in 1984. It is projected to increase gradually to $12,800 by the year 2000.

The MOB is in Ward County, which had a population of 62,100 in 1984 and is forecast to grow to 75,000 in the year 2000. The housing stock in Ward County was estimated at 22,000 units in 1984 and is projected to reach 26,600 units by the year 2000. The vacancy rate in 1984 was 3.9 percent, with about 850 available units. Hotel and motel rooms are expected to increase from about 900 to over 1,000 units between the years 1984 and 2000.

Local government employment in Ward County was 265 per 10,000 population, or 10.8 percent below the state average. Education employment in 1982 was 127 per 10,000 population, compared to the state average of 139. Police employment in 1982 was 16 per 10,000 population, about equal to the state average. School enrollments increased slowly from 10,300 in 1980 to 10,650 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Ward County were $959 and $1,013 in FY 1984, respectively. Per capita expenditures are expected to decrease slightly, reaching $937 in FY 2000. Per capita revenues are also expected to decrease slightly, reaching $996 in FY 2000.

3.1.4.6 Whiteman Air Force Base

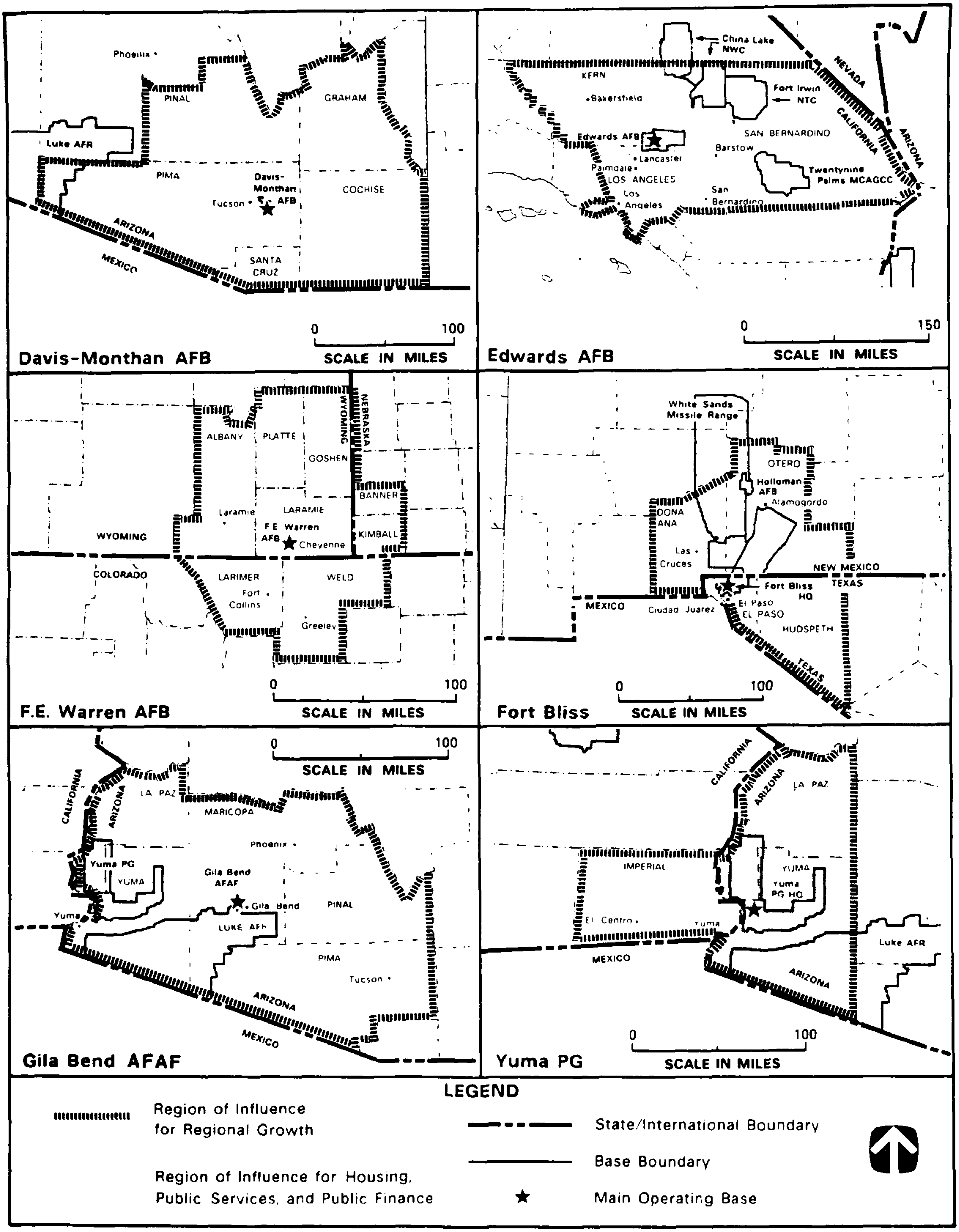
The Whiteman AFB ROI is an 18-county region of west-central Missouri with a 1984 population of 991,100. The population is expected to decline slightly to 971,700 by the year 2000, an average annual rate of -0.1 percent. The civilian labor force within the ROI increased to nearly 491,800 in 1984 and is expected to reach about 524,200 in the year 2000. The unemployment rate was 6.4 percent in 1984 and is estimated to average 6 percent per year during the late 1980s and through the year 2000. The ROI's per capita income was $12,200, amounting to 92.8 percent of the United States average in 1984. It is projected to grow 0.5 percent annually and reach $13,300 in the year 2000.

The MOB is located in Johnson County. In 1984, the county's population was 38,200, and by the year 2000 it is projected to be 42,800. The housing stock in Johnson County was estimated at 13,800 units in 1984 and is not projected to increase through the year 2000. The vacancy rate in 1984 was 11.6 percent, with about 1,600 available units. Hotel and motel rooms are expected to remain at the 1984 level (300 units) through the year 2000.

Local government employment in Johnson County was 287 per 10,000 population, which was 8 percent below the state average in 1982. Education employment in 1982 was 118 per 10,000 population, compared to the state average of 116. Police employment in 1982 was 13 per 10,000 population, compared to the state average of 24. School enrollments remained relatively constant at about 6,200 between 1980 and 1985, suggesting minimal current available capacity. Per capita public expenditures and revenues of local governments in Johnson County were $791 and $985 in FY 1984, respectively. Per capita expenditures are projected to reach $979 in FY 2000. Between FY 1984 and FY 2000, per capita revenues are projected to grow 0.9 percent annually, reaching $1,133 in FY 2000.

3.1.5 Existing and Projected Conditions for Hard Silo in Patterned Array

Figure 3.1.5-1 displays the ROI and MOB counties, and the principal population centers for the Hard Silo in Patterned Array basing mode locations. Table 3.1.5-1 provides summary data describing selected socioeconomic characteristics for each ROI.



03-S0/3 (L3-S0/3)

FIGURE 3.1.5-1 HARD SILO IN PATTERNED ARRAY REGIONS OF INFLUENCE COUNTIES

Table 3.1.5-1

SELECTED SOCIOECONOMIC CHARACTERISTICS, HARD SILO IN PATTERNED ARRAY ALTERNATIVES

Main Operating Bases Main Operating Base Counties	Davis-Monthan AFB Pima, AZ	Edwards AFB Los Angeles, CA	F.E. Warren AFB Laramie, WY	Fort Bliss El Paso, TX	Gila Bend AFAF Maricopa, AZ	Yuma PG Yuma/La Paz, AZ
Regional Growth						
Population (000)						
ROI and (MOB County) 1984	840 (603)	9,390 (7,888)	434 (72)	689 (525)	2,532 (1,731)	202 (99)
ROI and (MOB County) 1990	985 (723)	9,960 (8,165)	523 (81)	825 (632)	3,091 (2,156)	221 (105)
ROI and (MOB County) 2000	1,261 (942)	10,713 (8,539)	657 (97)	1,025 (791)	4,081 (2,883)	260 (125)
ROI-Projected Average Annual Population Growth (1984-2000)	2.6%	0.8%	2.6%	2.4%	3.0%	1.6%
ROI-Civilian Labor Force,(000) (Unemployment Rate)						
1984	336 (5.5%)	4,413 (8.1%)	219 (5.2%)	262 (9.2%)	1,236 (4.4%)	87 (25.5%)
1990	406 (6.0)	4,886 (7.0)	269 (5.0)	323 (8.0)	1,576 (5.0)	100 (17.0)
2000	533 (6.5)	5,417 (6.5)	347 (5.0)	417 (7.5)	2,203 (5.5)	120 (12.0)
ROI-Labor Force Participation Rate (%)						
1984	40.1%	47.0%	50.4%	38.0%	48.8%	43.0%
1990	41.2	49.1	51.5	39.2	51.0	45.3
2000	42.3	50.6	52.8	40.6	54.0	46.2
ROI-Personal Income (Bill. $84), (per Capital)						
1984	$9.1 ($10,800)	$126.8 ($13,500)	$5.3 ($12,100)	$5.9 ($8,600)	$31.2 ($12,300)	$2.1 ($10,400)
1990	10.7 (10,900)	138.4 (13,900)	6.6 (12,500)	7.5 (9,200)	37.8 (12,200)	2.5 (11,400)
2000	13.8 (10,900)	151.1 (14,100)	8.6 (13,100)	9.8 (9,800)	53.6 (13,100)	3.1 (12,000)
ROI-Projected Growth, Personal Income, (per Capital) ($/yr, $84)	2.6% (0.1%)	1.1% (0.3%)	3.1% (0.5%)	3.3% (0.7%)	3.4% (0.4%)	2.5% (0.9%)
Housing:						
MOB County-Total Year-Round Units (Available Units), 000						
1984	235.8 (14.1)	53.8 (2.2)[a]	29.7 (1.2)	159.3 (5.3)	1.8 (0.2)[a]	34.5 (1.8)
1990	282.7 (16.9)	69.0 (2.8)	32.1 (1.3)	191.9 (6.3)	2.2 (0.2)	36.5 (1.9)
2000	368.1 (22.1)	92.8 (3.8)	38.5 (1.5)	240.1 (7.9)	2.8 (0.3)	43.5 (2.3)
Vacancy Rate	6.0%	4.1%	4.0%	3.3%	10.7%[a]	5.3%
Hotel and Motel Rooms						
1984	5,800	700[a]	2,000	4,300	60[a]	850
2000	12,600	900	2,400	5,000	60	1,000

Table 3.1.5-1 Continued, Page 2 of 2

Main Operating Bases / Main Operating Base Counties	Davis-Monthan AFB / Pima, AZ	Edwards AFB / Los Angeles, CA	F.E. Warren AFB / Laramie, WY	Fort Bliss / El Paso, TX	Gila Bend AFAF / Maricopa, AZ	Yuma PG / Yuma/La Paz, AZ
Public Services						
Public Sector Jobs, Local Governments per 10,000 Population, 1982; MOB County (State)						
TOTAL:	316 (350)	356 (348)	446 (468)	370 (372)	346 (350)	352 (350)
Education	107 (129)	103 (110)	178 (183)	154 (152)	121 (129)	149 (129)
Police	21 (24)	28 (24)	24 (30)	19 (21)	24 (24)	21 (24)
No. Pupils, K-12, MOB County						
1980	90,400	26,000	13,700	117,000	650[a]	17,900
1985	97,500	28,800	13,600	120,700	750	21,800
Potential Additional Pupil Capacity	No	No	No	No	No	No
Public Finance						
Expenditures per Capita ($84), MOB County						
1984	$1,470	$2,059	$1,329	$1,074	$2,130	$1,347
1990	1,573	2,106	1,521	1,183	2,402	1,372
2000	1,690	2,164	1,826	1,290	2,876	1,431
Revenues per Capita ($84), MOB County						
1984	$1,494	$2,139	$1,680	$1,198	$2,016	$1,356
1990	1,556	2,186	1,860	1,432	2,473	1,563
2000	1,575	2,206	2,026	1,665	3,263	1,661

Note: [a]Data based on subcounty region adjacent to MOB.

3.1.5.1 Davis-Monthan Air Force Base

The Davis-Monthan AFB ROI is a five-county region of southern Arizona with a 1984 population of 839,500. The population is expected to increase by 2.6 percent annually, to 1.3 million in the year 2000. The civilian labor force within the ROI increased to about 336,000 in 1984 and is expected to reach over 533,000 in the year 2000. The unemployment rate was 5.5 percent in 1984 and is estimated to average 6.5 percent during the late 1990s and through the year 2000. The ROI's per capita income was $10,800, amounting to 82 percent of the United States average in 1984. It is projected to increase slightly and reach $10,900 in the year 2000.

The MOB is located in Pima County, with a 1984 population of 603,300 and a projected population of 942,100 in the year 2000. The housing stock in Pima County was estimated at 235,800 units in 1984 and is projected to reach about 368,100 units by the year 2000. The vacancy rate in 1984 was 6 percent, with about 14,100 available units. Hotel and motel rooms are expected to increase from 5,800 units in 1984 to nearly 13,000 units by the year 2000.

Local government employment in Pima County was 316 per 10,000 population, 9.7 percent below the state average in 1982. Education employment in 1982 was 107 per 10,000 population, compared to the state average of 129. Police employment in 1982 was 21 per 10,000 population, compared to the state average of 24. School enrollments increased from 90,400 in 1980 to a new high of 97,500 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Pima County were $1,470 and $1,494 in FY 1984, respectively. Per capita expenditures are forecast to grow at a slightly faster rate than per capita revenues and reach $1,690 in FY 2000. Per capita revenues are projected to grow 0.3 percent per year and reach $1,575 in FY 2000.

3.1.5.2 Edwards Air Force Base

The Edwards AFB ROI is a three-county region extending from metropolitan Los Angeles north to Bakersfield and east to the Nevada border. The ROI had a 1984 population of 9.4 million. The population is expected to increase by 0.8 percent annually, to 10.7 million in the year 2000. The civilian labor force within the ROI increased to about 4.4 million in 1984 and is expected to reach 5.4 million in the year 2000. The unemployment rate was 8.1 percent in 1984 and is estimated to average 6.5 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $13,500, about 2.7 percent above the United States 1984 average. It is projected to grow 0.3 percent annually and reach $14,100 in the year 2000.

The MOB encompasses portions of Los Angeles, Kern, and San Bernardino counties. The socioeconomic characteristics of these counties and the areas nearest the base are discussed in Section 3.1.3.5.

3.1.5.3 F.E. Warren Air Force Base

The F.E. Warren AFB ROI is an eight-county region in southeastern Wyoming, western Nebraska, and northern Colorado, which had a 1984 population of 434,000. The population is expected to increase by 2.6 percent annually, to 657,000 in the year 2000. The civilian labor force within the ROI increased

to about 219,000 in 1984 and is expected to reach over 347,000 in the year 2000. The unemployment rate was 5.2 percent in 1984 and is expected to average 5 percent per year during the 1990s and through the year 2000. The ROI's per capita income was $12,110, amounting to 92 percent of the United States average for 1984. It is projected to grow by 0.5 percent annually and reach $13,100 in the year 2000.

The MOB is located in Laramie County. The socioeconomic characteristics of the MOB county are discussed in Section 3.1.4.2.

3.1.5.4 Fort Bliss

The Fort Bliss ROI is a four-county region of west Texas and southeast New Mexico with a 1984 population of 689,100. The population is expected to increase to 1 million by the year 2000, an average annual gain of 2.4 percent. The civilian labor force within the ROI increased to about 262,000 in 1984 and is expected to reach over 416,500 in the year 2000. The unemployment rate was 9.2 percent in 1984 and is estimated to average 7.5 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $8,600, amounting to 65 percent of the 1984 United States average. It is projected to grow 0.7 percent annually and reach $9,700 in the year 2000.

The MOB is located in El Paso County, with a 1984 population of 524,800 and a projected population of 791,000 in the year 2000. The housing stock in El Paso County was estimated at 159,300 units in 1984 and is projected to reach over 240,000 units by the year 2000. The vacancy rate in 1984 was 3.3 percent, with about 5,300 available units. Hotel and motel rooms are expected to increase from about 4,300 to over 5,000 units between the years 1984 and 2000.

Local government employment in El Paso County was 370 per 10,000 population, about equal to the state average. Education employment in 1982 was 154 per 10,000 population, compared to the state average of 152. Police employment in 1982 was 19 per 10,000 population, compared to the state average of 21. School enrollments increased from 117,000 in 1980 to a new high of 121,000 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in El Paso County were $1,074 and $1,198 in FY 1984, respectively. Per capita expenditures are projected to increase 1.2 percent per year, reaching $1,290 in FY 2000. Per capita revenues are projected to increase 2.1 percent per year, reaching $1,665 in FY 2000.

3.1.5.5 Gila Bend Air Force Auxiliary Field

The Gila Bend AFAF ROI includes a five-county region in south-central and southwestern Arizona. Since the ROIs for Gila Bend AFAF and the Arizona Complex are the same, existing and projected conditions are discussed in Section 3.1.3.1.

3.1.5.6 Yuma Proving Ground

The Yuma PG ROI is a three-county region of southwestern Arizona and southeastern California with a 1984 population of 202,000. The population is expected to increase by 1.6 percent annually, reaching 260,100 by the year

2000. The civilian labor force within the ROI increased to about 87,000 in 1984 and is estimated to reach over 120,000 in the year 2000. The unemployment rate was 25.5 percent in 1984 and is expected to average 12 percent per year during the late 1990s and through the year 2000. The ROI's per capita income was $10,400, amounting to 79 percent of the United States average in 1984. It is projected to grow 0.9 percent annually and reach $12,000 in the year 2000.

Yuma PG, the MOB, is located in portions of Yuma and La Paz counties. Both counties are included in the analysis because they were recently formed by dividing Yuma County into two entities. Therefore, historical data exist for the two counties as a unit. Yuma/La Paz counties 1984 population totaled about 99,000 and is expected to grow to 125,000 by the year 2000. The housing stock in Yuma/La Paz counties was estimated at 34,500 units in 1984 and is projected to reach 43,500 units by the year 2000. The vacancy rate in 1984 was 5.3 percent, with about 1,800 available units. Hotel and motel rooms in the two counties are expected to increase from about 850 units to over 1,000 units between the years 1984 and 2000.

Local government employment in Yuma/La Paz counties was 352 per 10,000 population, almost identical to the state average. Education employment in 1982 was 149 per 10,000 population, compared to the state average of 129. Police employment in 1982 was 21 per 10,000 population, compared to the state average of 24. School enrollments increased from 17,900 in 1980 to a new high of 21,800 in 1985, suggesting no current available capacity. Per capita public expenditures and revenues of local governments in Yuma/La Paz counties were $1,347 and $1,356 in FY 1984, respectively. Per capita expenditures are projected to grow 0.4 percent per year, reaching $1,431 in FY 2000. Per capita revenues are projected to grow 1.3 percent per year, reaching $1,661 in FY 2000.

3.2 Utilities

A wide range of utility systems may be affected by deployment of the proposed Small Intercontinental Ballistic Missile (ICBM) system. These systems include the services and facilities that supply potable water treatment and distribution, wastewater treatment, solid waste disposal, and energy.

3.2.1 Resource Description

Potable Water Treatment and Distribution. The potable water treatment and distribution element includes those facilities that distribute water of a specific quality to meet municipal and industrial demands. Facilities in a water supply system may include those for diverting water from its natural state, those for treating water to obtain a desired quality, those for storing water, and those for water distribution.

Wastewater. The wastewater disposal system element includes those facilities that provide collection, treatment, and disposal of nonhazardous waterborne wastes generated by municipal and industrial water users.

Solid Waste. The solid waste disposal system element includes those facilities and systems that provide collection and disposal of solid waste products from municipal and industrial activities. Processing operations may range from open landfills to sophisticated facilities that recover valuable materials. Hazardous waste disposal locations are also included in this element.

Energy Utilities. The energy utilities element includes those regional facilities or operating systems that provide electricity, natural gas, or liquid fuels to municipal and industrial users. Facilities include generation, transmission line and pipeline, and distribution networks.

3.2.2 General Analysis Methodology

Region of Influence. Utility system impacts were derived from the projected increased demand resulting from an inmigrating population and direct project requirements; therefore, a substantial portion of impacts will occur at the Main Operating Base (MOB) and the surrounding communities. As a result, the utilities analysis focused on a Region of Influence (ROI) that encompasses the county and selected communities where the MOB is proposed or that were most likely to be affected by base activities.

Potable Water Treatment and Distribution. The adequacy of existing and projected water treatment facilities was determined by comparing existing capacities with demands for all services identified by public works officials. Where data concerning existing demand levels did not exist, current populations were multiplied by representative per capita use rates to provide an estimate of existing demand conditions. Future demands were taken from utility projections or were computed as functions of existing per capita use rates and projected populations. These demands were compared to existing or projected treatment facility capacities, and surpluses or deficits were identified.

Wastewater. The adequacy of existing and projected wastewater treatment facilities was determined using the methodology described for the potable water treatment and distribution element.

Solid Waste. The adequacy of existing and projected solid waste facilities was determined using the methodology described for the potable water treatment and distribution element.

Energy Utilities. Interviews with regional and local utility managers were the primary data sources for existing and projected electrical and natural gas supply systems. Qualitative assessments by utility managers were used to determine the adequacy and reliability of the existing and projected level of service. Data on the existing and projected availability of liquid fuels (gasoline and diesel) were obtained through records and projections developed by the Department of Energy (DOE), the Department of Transportation (DOT), and various state agencies. In some cases, companies that supply energy to the MOB may differ from those that supply energy to the ROI. In these instances, data for both the base and ROI have been discussed.

3.2.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

Table 3.2.3-1 provides summary data describing selected utility characteristics for each ROI.

3.2.3.1 Arizona Complex

The MOB for the Arizona Complex will be either Gila Bend Air Force Auxiliary Field (AFAF) in Maricopa County or Yuma Proving Ground (PG) in Yuma County. Five major municipal systems supply potable water to a majority of Maricopa County residents. In 1985, the total average daily demand of those systems was 334 million gallons per day (MGD). It is estimated that the total capacity of the systems in Maricopa County is 561 MGD, providing 40-percent excess capacity. The demand for treatment capacity for the entire county will rise to 576 MGD in 1990 and 770 MGD in the year 2000. About 140 MGD of additional capacity is planned for the 1990 to 2000 time period. The Town of Gila Bend supplied 0.65 MGD of potable water to 1,800 persons in 1984. By 1990, two new wells will be constructed in Gila Bend, increasing supply from 1 to 2 MGD. Average daily demands are projected to increase to 0.84 MGD in 1990 and 1.1 MGD in the year 2000. Gila Bend AFAF supplied 0.26 MGD from a system with a capacity of 1.25 MGD. A reverse osmosis system is being expanded to provide 27,000 gallons per day (gpd) consumptive use.

Wastewater flows in Maricopa County are processed at 17 municipal facilities with a total capacity of 194 MGD. Currently, flows are near capacity and are projected to increase to 226 MGD in 1990 and 303 MGD in the year 2000. Wastewater treatment capacity is projected to increase by 74.5 MGD; however, additional capacity will need to be developed to process flows after 1995. The Town of Gila Bend operates a lagoon system with a design capacity of 0.13 MGD. Flows in 1984 were 0.11 MGD or 85 percent of capacity. Wastewater flows are projected to be 0.14 MGD in 1990 and 0.19 MGD in the year 2000. Wastewater flows at Gila Bend AFAF are estimated to be 0.05 MGD. Capacity of the system is 1 MGD and expansion plans will increase capacity to 2 MGD by 1986. Solid waste is disposed at 15 landfill sites that contain 960 acres.

Table 3.2.3-1

SELECTED UTILITY CHARACTERISTICS, HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES

Complex	Arizona		Florida	Nevada		New Mexico			South-Central California		Washington
Main Operating Base	Gila Bend AFAF	Yuma PG	Eglin AFB	Indian Springs AFAF	Nellis AFB	Fort Bliss	Holloman AFB	White Sands Missile Range	Edwards AFB	Fort Irwin NTC	Yakima FC
County	Maricopa	Yuma	Okaloosa	Clark	Clark	El Paso	Otero	Dona Ana	Los Angeles	San Bernardino	Cascade
County Population (1984)	1,731,100	85,700	128,900	556,552	556,552	524,800	49,500	112,200	887,707	1,078,994	180,000
Potable Water											
County											
Service Population	1,371,060	72,526	110,308	544,052	544,052	492,800	41,800	71,950	80,000	55,460	76,300
Avg. Daily Demand (MGD)	334.00	14.86	15.86	136.00	136.00	91.00	8.62	16.31	20.2	16.8	22.5
Systems Capacity (MGD)	561.00	28.50	33.94	602.00	602.00	N/A	15.98	36.35	60.30	34.00	49.40
Excess Capacity (%)	40%	48%	53%77%	77%	N/A	46%	55%	66%	51%	54%	
Base											
Avg. Daily Demand (MGD)	0.26	0.73	4.60	0.25	2.74	6.10	2.67	1.68	4.50	1.4	0.20
System Capacity (MGD)	1.25	5.04	8.80	0.60	4.70	12.40	5.50	5.90	12.50	5.1	0.9
Excess Capacity(%)	79%	85%	48%58%	42%	51%	51%	72%	64%	72%	88%	
Wastewater											
County											
Service Population	1,731,100	72,526	91,900	555,852	535,852	524,800	41,800	109,600	93,000	60,000	88,864
Avg. Daily Flow (MGD)	193.25	7.00	11.28	81.00	81.00	53.50	4.50	5.57	8.60	6.50	19.4
Facilities Capacity (MGD)	193.75	12.25	17.74	136.00	136.00	57.00	5.00	9.10	7.60	9.5	28.30
Excess Capacity (%)	0.26%	43%	36%40%	40%	6%	10%	39%	-13%	32%	32%	
Base											
Avg. Daily Flow (MGD)	0.05	0.39	2.70.03	*	*	2.19	0.54	1.27	1.00	0.09	
Facility Capacity (MGD)	1.00	0.74	3.24	0.04	*	*	2.20	1.00	1.25	1.00	0.5
Excess Capacity (%)	95%	48%	17%25%	*	*	0.45%	46%	-2%	0%	92%	
Solid Waste											
Demand (cy/yr)	3,949,072	156,403	294,053	1,293,811	1,293,811	1,005,648	85,821	194,527	252,165	240,719	333,838
Available Acreage	960	160	180	1,162	1,162	752	110	336	320	600	70
Energy Utilities											
Electric Capacity (MW)	6,880	3,425	1,900	1,850	1,850	989	989	989	17,628	17,628	4,615
Peak Load	5,457	2,970	1,400	1,537	1,537	877	877	877	13,396	13,396	4,245
Reserve Margin (%)	21%	13%	26%17%	17%	11%	11%	11%	24%	24%	8%	
Service Pop. (cust.)	922,525	499,751	227,385	224,632	224,632	205,903	205,903	205,903	3,723,200	3,723,200	650,000

Table 3.2.3-1 Continued, Page 2 of 2

Complex Main Operating Base County	Arizona Gila Bend AFAF Maricopa	 Yuma PG Yuma	Florida Eglin AFB Okaloosa	Nevada Indian Springs AFAF Clark	 Nellis AFB Clark	New Mexico Fort Bliss El Paso	 Holloman AFB Otero	 White Sands Missile Range Dona Ana	South-Central California Edwards AFB Los Angeles	 Fort Irwin NTC San Bernardino	Washington Yakima FC Cascade
Base Consumption (kWh)	2,080,000	24,807,000	376,926,000	N/A	N/A	147,167,000	60,000,000	280,000,000	147,275,000	13,600,000	870,452
Per Capita Consumption	4,160	12,404	20,229	N/A	N/A	4,599	12,658	36,364	9,368	1,295	5,181
Annual Natural Gas Sales											
Service Pop. (cust.)	31,150	33,597	2,250	23,447	23,447	8,400	798	798	431,000	431,000	384
Service Pop. (cust.)	594,468	87,494	20,000	318,000	318,000	123,450	10,500	10,500	3,000,000	3,000,000	10,474
Avg. Customer Use (Mcf)	52	38	37 74	74	75	76	76	69	69	77	
Base Consumption (gal heating fuel)	84,000	150,000	* N/A	N/A	*	*	*	*	2,280,000	389,364	
Per Capita Use (gal)	168	75	* N/A	N/A	*	*	*	*	217	2,318	
Gasoline reqs. (gal)	839,583,500	41,564,500	61,614,200	298,888,050	298,888,050	276,044,800	76,086,500	59,129,400	3,555,232,128	483,389,312	83,779,650
Per Capita Use	485	485	478	527	527	526	527	527	448	448	458
Diesel reqs. (gal)	172,071,340	8,518,580	10,440,900	69,759,450	69,759,450	69,273,600	7,821,600	17,727,600	790,404,286	107,467,802	17,560,800
Per Capita Use	99	99	81 123	123	132	158	158	100	100	96	

Notes: *Not applicable.
N/A = data not available.

Wastes generated at Gila Bend AFAF are disposed at a county facility in Gila Bend. Hazardous waste solvent and sludge recycling facilities are available in Arizona; however, no commercial disposal facilities exist within the state.

The Arizona Public Service Company has a total electrical generating capacity of 3,425 megawatts (MW) and provides service to Maricopa County and other portions of Arizona. In 1984, peak demand reached 2,970 MW, with a reserve capacity of 13 percent. Peak demands for the company's service area are projected to be 3,672 MW in 1990 and 5,192 MW in the year 2000. The Salt River Project provided electricity to 422,774 municipal and industrial users in 1984. Total resources available were 3,455 MW, with a 28-percent reserve margin. Additional resources will be added to meet projected peak loads of 3,024 MW in 1990 and 4,476 MW in the year 2000. The company plans to add additional generation sources in 1990 to 1991 from the Palo Verde Nuclear Generating Station and other coal-fired facilities.

Natural gas is supplied to Maricopa County by the Southwest Gas Corporation. In 1985, total sales in the county were 31,150 million cubic feet (MMcf), with an average annual residential consumption of 52.4 thousand cubic feet (Mcf). Southwest Gas acquired the natural gas properties of Arizona Public Service Company in 1984 and added 339,000 customers and 6,400 miles of gas mains. They anticipate increasing natural gas sales through conversions from electricity and expansions of the distribution system. Based on population projections, natural gas sales in Maricopa County are expected to reach 36,490 MMcf in 1990 and 49,040 MMcf in the year 2000. Arizona's per capita gasoline use in 1984 was 485 gallons, 109 percent of the national average. Per capita diesel use was 99.4 gallons, 96 percent of the national average of 104 gallons.

A majority of Yuma County residents receive potable water from three municipal systems which had a total average daily demand of 14.86 MGD in 1984. Total capacity of these systems is estimated at 28.5 MGD, providing 48-percent excess capacity. Yuma County's demand for potable water will rise to 16.3 MGD in 1990 and 19.8 MGD in the year 2000. Yuma PG has an estimated average daily demand of 0.7 MGD with a system capacity of 5 MGD. A reverse electrodialysis plant is being constructed to provide water for consumptive uses.

Wastewater flows in Yuma County are processed by two major municipal facilities with a total capacity of 12.3 MGD and are operating at 55 percent of capacity. Wastewater flows will increase to 7.1 MGD in 1990 and 8.7 MGD in the year 2000. Wastewater flows at Yuma PG are processed by a number of facilities with an estimated capacity of 0.74 MGD. Average daily use is approximately 0.39 MGD. Solid waste is disposed at one landfill site that has a remaining capacity of 160 acres. Waste generated at Yuma PG is disposed at an onbase landfill. Future hazardous waste facilities for the Yuma PG ROI are the same as those identified for the Gila Bend AFAF ROI (Maricopa County).

Arizona Public Service Company provides electricity to Yuma County. In 1984, peak demand reached 2,970 MW, with a 13-percent reserve margin. The company projects service area peak demand to be 3,672 MW in 1990 and 5,192 MW in the year 2000. Yuma PG receives 90 percent of its electricity from the Western Area Power Administration, Boulder City Area Office, and the remainder from Arizona Public Service Company. Annual onbase consumption is approximately 24,807 megawatt hours (MWh). As a purchaser of electricity from the Parker-Davis project, Yuma PG is entitled to receive surplus and increased load power

when available. Allocations are granted on an annual basis with a renewal in 30 years. The present allocation contract will expire in May 1987. Yuma PG is required to file a projected-load growth statement; if surpluses are available, they are entitled to receive the power, or will possibly get rights to other power projects. The power is limited to what is presently being generated, and there are no plans for additional generating capacity.

Natural gas is supplied to Yuma County by Southwest Gas Corporation. Sales in 1985 were 33,597 MMcf, with an average residential customer use of 38.4 Mcf. Gas sales are projected to reach 38,017 MMcf in 1990 and 44,556 MMcf in the year 2000. Yuma PG's water and space heating needs are provided by fuel oil (propane), liquid petroleum gas (LPG), and electricity. Annual consumption of fuel oil averages between 100,000 and 150,000 gallons. Annual consumption of LPG averages 25,000 to 30,000 gallons. Annual consumption of electricity varies from 25,000,000 to 30,000,000 kilowatt-hours (kWh). Gasoline and diesel use for the Yuma PG ROI is the same as that identified for the Gila Bend AFAF ROI (Maricopa County).

3.2.3.2 Florida Complex

The MOB for the Florida Complex is Eglin Air Force Base (AFB), located in Okaloosa County. Potable water is supplied by seven major municipal systems and the facilities at Eglin AFB. Average daily demands for the municipal systems were 15.9 MGD in 1985, with demands forecast to reach 17.7 MGD in 1990 and 22.3 MGD in the year 2000. Current capacity of these systems is 33.94 MGD, and additional capacity will be developed over the next 10 years. Capacity of the system at Eglin AFB is 8.8 MGD, with average daily demands equaling about 4.6 MGD.

Wastewater treatment is provided by eight municipal facilities with a total capacity of 17.7 MGD. In 1985, average daily flows equaled 11.3 MGD or 64 percent of capacity. Wastewater flows are projected to increase to 13.5 MGD in 1990 and 17.1 MGD in the year 2000. Expansions are proposed at two facilities that will increase capacity by 3 MGD by 1990. Wastewater flows from Eglin AFB are treated at six major facilities with a total capacity of 3.2 MGD. Recent flow estimates equal 2.7 MGD. A new facility is being constructed that will replace an existing plant and increase capacity by 0.5 MGD. Solid waste, including that generated onbase, is disposed at two county facilities that have adequate capacity through the year 2000. Hazardous waste is disposed out-of-state since no commercial disposal facilities exist in Florida.

Gulf Power Company has a total capacity of 1,900 MW and supplies electrical power to the Florida Panhandle including Okaloosa County. In 1984, peak demand was 1,400 MW, with a 26-percent reserve margin. The company projects peak demand to rise to 1,703 MW in 1990 and to 1,887 MW in the year 2000, with reserve margins of 20 percent and 16 percent, respectively.

Natural gas is supplied to the region by the Okaloosa County Gas District. In 1985, total sales were 2,250 MMcf. Of this amount, Eglin AFB used 808,704 Mcf in fiscal year (FY) 1985. The district expects sales to increase by 3 percent through 1990 and by 5 percent between the years 1990 and 2000. Additional supplies will be available from United Gas Pipeline Company. Florida's per capita gasoline use in 1984 was 478 gallons, 107 percent of the national

average. Per capita diesel use was 81 gallons, 78 percent of the national average.

3.2.3.3 Nevada Complex

The MOB for the Nevada Complex will be either Indian Springs AFAF or Nellis AFB, both located in Clark County. The Las Vegas Valley Water District supplies potable water to the majority of Clark County. In 1984, the district provided an average daily demand of 136 MGD. Demands will rise to 207 MGD in 1990 and 281 MGD in the year 2000. Based on studies performed in 1979, the capacity of the system is 602 MGD, which should be adequate for demands through the year 2000. Indian Springs AFAF receives potable water from four wells with a capacity of 0.6 MGD. Average daily use is 0.25 MGD. Nellis AFB obtains its potable water from wells on base and had an average daily use in 1985 of 2.74 MGD. Capacity of the wells is estimated to be 4.7 MGD.

Four wastewater facilities in Clark County, with a total capacity of 136 MGD, are currently processing 81 MGD, which includes flows from Nellis AFB. Wastewater flows are projected to increase to 96 MGD in 1990 and 129 MGD in the year 2000. Flows are at, or near, capacity at three of the facilities; however, expansions are planned for an additional 81 MGD of capacity in the 1987 to 2000 time period. Wastewater flows at Indian Springs AFAF are processed through an Imhoff disposal system that is near capacity. Construction of a new onbase facility is being studied.

Solid waste is disposed at one major county facility that serves the urban areas of Clark County, including the cities of Las Vegas and North Las Vegas, and Indian Springs AFAF and Nellis AFB. Additional dumpsites serve the rural areas of the county. The Sunrise facility was expanded by 600 acres in 1985 and will be available for use through 1988; however, the county is planning a new landfill site to replace the Sunrise facility. Hazardous waste can be taken to a Nye County disposal site that has available capacity through the year 2000.

Nevada Power Company has a total electrical capacity of 1,850 MW and provides electrical power to a majority of Clark County. Peak demand in 1984 was 1,537 MW, with a 17-percent reserve margin. The company projects peak demand to increase 2.7 percent annually through the year 2000 and will develop additional coal-fired resources to increase capacity to 2,428 MW. Nellis AFB has made an application to the Western Area Power Administration to receive power allotments beginning in 1989. Southwest Gas Corporation supplies natural gas to Clark County. In 1985, total sales in Clark County were 23,447 MMcf, approximately 30 percent of the company's total natural gas sales. The company projects an 8-percent sales increase to 25,624 MMcf in 1986. Nevada's per capita gasoline use in 1984 was 527 gallons, 118 percent of the national average. Per capita diesel use was 128 gallons, 123 percent of the national average.

3.2.3.4 New Mexico Complex

The MOB for the New Mexico Complex will be either Fort Bliss in El Paso County, Texas; Holloman AFB in Otero County, New Mexico; or White Sands Missile Range Headquarters in Dona Ana County, New Mexico. A majority of El Paso County residents receive potable water from the City of El Paso.

Average daily demands for the city were 91 MGD in 1984. Projections indicate that demands will be 122 MGD in 1990 and 171 MGD in the year 2000. Fort Bliss receives potable water from the city and onbase wells. Capacity of the onbase wells equals 12.4 MGD while the city provides up to 4.2 MGD. Total capacity is 16.6 MGD and average daily demands equal 6.1 MGD. Future demands are expected to be supplied exclusively from onbase sources.

Wastewater flows in El Paso County, including flows from Fort Bliss, are currently 53.5 MGD and are projected to increase to 64.5 MGD in 1990 and to 80.7 MGD by the year 2000. Current capacity at the three municipal facilities is 57 MGD, with plans for an increase of 15 MGD by the early 1990s. Solid waste is disposed at six landfill sites that have a remaining capacity of 822 acres. The landfill at Fort Bliss has 70 acres remaining and is projected to be available through the year 2004. All other facilities are scheduled to close during the years 2000 to 2010. Hazardous waste disposal is not available within the county; licensed disposal facilities are located in other portions of Texas.

El Paso Electric Company has a total electrical generating capacity of 989 MW and provides service to El Paso County. In 1985, peak demand reached 877 MW, with a reserve capacity of 11 percent. The company is projecting a 4-percent annual increase in peak demand to 1,133 MW in 1990 and 1,364 MW in the year 2000. The increased demand will be met by new power supplies (totaling 600 MW) from the Palo Verde Nuclear Generating Station.

Natural gas is supplied to El Paso County by the Southern Union Gas Company. Total sales in the El Paso District in 1984 were 8,400 MMcf, with an average annual residential consumption of 75.4 Mcf. Southern Union Gas projects annual increases in demand between 2 and 3 percent through the year 2000. These demands will be met by current natural gas surpluses and by increases in productive holdings. Texas' per capita gasoline use in 1984 was 526 gallons, or 118 percent of the national average. Per capita diesel use equaled 132 gallons, 127 percent of the national average of 104 gallons.

Potable water is supplied to Otero County residents by 38 systems, including the Holloman AFB system. Average daily demand for the 37 municipal systems in 1985 was 8.6 MGD. Demands will reach 10.6 MGD in 1990 and 13.3 MGD in the year 2000. Capacity of the municipal systems equals 16 MGD. The Holloman AFB system has a capacity of 5.5 MGD, with an average daily demand of 2.7 MGD. New wells are being added to the system that will help meet future demands.

Wastewater flows in Otero County are processed at three municipal facilities with a total capacity of 5 MGD. Average daily flows are currently 4.5 MGD and are forecast to increase to 5.5 MGD in 1990 and 6.9 MGD by the year 2000. No expansion plans are presently forecast for these facilities. Wastewater flows at Holloman AFB are treated by a system with a capacity of 2.2 MGD. Recent flows have equaled 2.2 MGD. Solid waste is disposed at six landfills located throughout the county. Wastes generated onbase are disposed at the 160-acre onbase landfill. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in New Mexico.

El Paso Electric has a net electrical generating capacity of 989 MW and provides service to Otero County and the surrounding region. In 1985, peak load was 877 MW, with a reserve capacity of 11 percent. The company projects

a 4-percent annual increase in peak demand to 1,133 MW in 1990 and 1,364 MW in the year 2000, which will be met by existing and planned resources.

The Gas Company of New Mexico supplies natural gas to Otero County. In 1984, total sales were 798 MMcf, with an average annual residential use of 76 Mcf. The company projects sales to increase by 4 to 5 percent through the year 2000 to 1,740 MMcf; this will be supplied by El Paso Natural Gas Company from reserves in the Permian Basin. New Mexico's per capita gasoline use in 1984 was 527 gallons, 118 percent of the national average. Per capita diesel use equaled 158 gallons, or 152 percent of the national average.

Dona Ana County receives potable water from seven major municipal systems, which had a total average daily demand of 16.3 MGD in 1985. Growth in the county will drive water requirements to 18.8 MGD in 1990 and 22.8 MGD in the year 2000. The total system capacity is 36.4 MGD and is operating with 55-percent excess capacity. White Sands Missile Range obtains potable water from 11 wells with a capacity of 5.9 MGD. Water use in 1984 averaged 1.7 MGD. Additional supplies from Soledad Canyon are being considered for future development.

Wastewater flows are processed by two municipal facilities and averaged 5.6 MGD in 1985. Flows are projected to increase to 6.6 MGD in 1990 and 8 MGD in the year 2000. The total capacity is currently 9.1 MGD and will be increasing to 9.55 MGD to meet future demands. Wastewater flows at White Sands Missile Range are treated at a facility with a capacity of 1 MGD. Average daily demands equal 0.54 MGD. Solid waste is disposed at 13 landfills with a total of 336 acres available. Waste generated at White Sands Missile Range is disposed at one of the three onbase landfills. Adequate area is currently available for continued disposal at a 60-acre site near the White Sands Missile Range Headquarters. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in New Mexico.

Major suppliers of electrical power and natural gas to Dona Ana County are also suppliers to Otero County. Gasoline and diesel use for the White Sands Missile Range ROI is the same as that identified for the Holloman AFB ROI (Otero County).

3.2.3.5 South-Central California Complex

The MOB for the South-Central California Complex will be either Edwards AFB, located in the desert portion of Los Angeles County, or Fort Irwin National Training Center (NTC), located in the desert portion of San Bernardino County. Potable water is supplied to the desert portion of Los Angeles County by two major municipal systems that have a total average daily demand of 20.2 MGD. Total capacity of the systems is 60.3 MGD, providing 66 percent excess capacity. Plans for expansion will increase capacity to service projected demands of 33.1 MGD in 1990 and 38 MGD in the year 2000. Edwards AFB obtains potable water from nine wells with a total capacity of 12.5 MGD. Average daily demands equal 4.5 MGD.

Municipal wastewater is currently treated at two facilities with flows averaging 8.6 MGD or 13 percent over the existing capacity of 7.6 MGD. Flows are forecast to increase to 10 MGD in 1990 and 14 MGD in the year 2000. Treatment capacity will be increased to 10 MGD by 1990; however, there are no plans

for additional facilities. Wastewater flows at Edwards AFB are treated at a facility with a capacity of 1.25 MGD. Average daily flows equal 1.27 MGD. The existing facility is being upgraded to improve its performance. Solid waste is disposed at two landfills in the region at a rate of 630 tons per day. Although both facilities are scheduled to close during the 1988 to 1994 time period, expansion plans will provide additional disposal space through the year 2000. Wastes generated onbase are disposed at an onbase landfill with adequate disposal space. Hazardous waste disposal is not available within Los Angeles County; however, licensed commercial disposal facilities exist throughout California.

Southern California Edison, with a total electrical system capacity of 17,628 MW, supplies power to the desert portions of both Los Angeles and San Bernardino counties. In 1985, peak demand was 13,396 MW, with a 24-percent reserve margin. The company projects a 1.9-percent annual increase in peak demand to 17,583 MW in 1996, with a projected reserve margin of 19 percent. Peak demand in the year 2000 is projected to be 18,102 MW, with a 23-percent reserve margin. Edwards AFB receives electric power from Southern California Edison and the Western Area Power Administration. In 1984, consumption was 147,275,000 kWh, approximately 56 percent of the substation capacity. Edwards AFB maintains a contract with the Western Area Power Administration for 6,500 kilowatts (kW) (peak) supplied from the Parker-Davis Project. The Western Area Power Administration projects peak demands for this district to increase by 2.9 percent annually through 1995. Edwards AFB is required to file a projected-load growth statement, and if surpluses are available, they are entitled to receive surplus power, or possibly get rights to other power projects. The power is limited to what is presently being generated, and there are no plans for additional generating capacity.

Natural gas is supplied by Pacific Gas and Electric Company. In 1984, total sales were 433 billion cubic feet (Bcf), with sales projected to be 431 Bcf in 1985 because of conservation programs. Average annual residential customer use in 1984 was 70 Mcf. Natural gas is used for space heating at Edwards AFB. In 1984, consumption was 561.5 MMcf, approximately 50 percent of capacity. California's per capita gasoline use in 1984 was 448 gallons, 101 percent of the national average. Per capita diesel use in 1984 was 99.6 gallons, 96 percent of the national average.

Potable water is supplied to the desert portion of San Bernardino County by a major municipal system, a private company, and many rural wells. Average daily demand for the two major systems was 16.8 MGD in 1985, rising to 17.9 MGD in 1990 and 25.8 MGD in the year 2000. The systems' capacity is currently 34 MGD and is projected to increase with the addition of two new wells. Fort Irwin NTC obtains potable water from 12 wells that have a capacity of 5.1 MGD. Water use in FY 1983 equaled 1.4 MGD.

Wastewater flows to the two municipal facilities serving the region were 6.5 MGD in 1985 and will increase to 7.3 MGD in 1990 and 12.1 MGD in the year 2000. Present capacity equals 9.5 MGD and additional capacity will be available in 1988 increasing total capacity to 11 MGD. Wastewater flows at Fort Irwin NTC are treated at a facility with a capacity of 1 MGD. Flows are averaging 1.01 MGD and peak demands are overtaxing the plant. Solid waste is disposed at ten landfills in the desert region of San Bernardino County, with an estimated total remaining capacity of 4,642,000 cubic yards. The sites

will have available capacity for 5 to 25 years. Plans are being evaluated to consolidate some sites and to expand facilities that are near capacity. Wastes generated onbase are disposed at an onbase landfill that has adequate capacity through the year 2000. Hazardous waste disposal is not available within the county; however, licensed disposal facilities exist in central California.

Southern California Edison supplies electricity to the desert portion of San Bernardino County and Fort Irwin NTC. The characteristics of their generating and demand requirements are included in the Edwards AFB description. In 1984, Fort Irwin NTC's electrical consumption was approximately 13,600,000 kWh, a 24-percent increase from 1983. Substation overloads have been experienced; however, there are no plans for system expansion. Natural gas, gasoline, and diesel use for the Fort Irwin NTC ROI is the same as those identified for the Edwards AFB ROI. An LPG heating system serves the Fort Irwin NTC cantonment (housing) area. Average monthly consumption in FY 1983 was 190,000 gallons, which was met with supplies from local vendors.

3.2.3.6 Washington Complex

The MOB for the Washington Complex is Yakima Firing Center (FC), located in Yakima County. Six municipal systems with a total average daily demand of 22.53 MGD provide potable water to Yakima County. It is estimated that total capacity of the systems is 49.4 MGD, with 54-percent excess capacity. Demands will increase to 24.4 MGD in 1990 and 28.3 MGD in the year 2000. Yakima FC obtains potable water from three wells that have a total capacity of 0.9 MGD. Average daily demands equal 0.20 MGD. A 9-MGD treatment facility is programmed for FY 1988.

Wastewater treatment is available at six municipal facilities in Yakima County which have a total capacity of 28.3 MGD. In 1984, average daily flows were 19.4 MGD, or 68 percent of capacity. Wastewater flows for the entire county are forecast to increase to 20.6 MGD in 1990 and 23.9 MGD by the year 2000. Wastewater flows at Yakima FC are processed at a facility with a capacity of 0.5 MGD. Average daily flows are 0.09 MGD. Solid waste is disposed at six landfills in the region. The major county facilities have life spans of 15 to 20 years, but the City of Grandview's facility is scheduled to close in 1988. Yakima FC operates a 5-acre landfill that has an estimated available capacity of 5 years. An upgrade project is scheduled as part of the FY 1987 construction program. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in Washington.

Pacific Power Company has a total electrical capacity of 4,615 MW and provides power to Yakima County. In 1984, peak demand was 4,245 MW, with an 8-percent reserve margin. The company projects peak demand to rise to 4,601 MW in 1990 and to 5,455 MW in the year 2000, with power available for sale through 1995. The company plans to purchase additional power from the Bonneville Power Administration to meet projected peak loads.

Cascade Natural Gas Company provides natural gas to Yakima County. In 1984, total firm sales in Yakima County were 384.5 MMcf and interruptible sales were 35.3 MMcf. Average annual residential customer use was 77.2 Mcf. The company projects firm sales to increase to 398 MMcf in 1986. The company will be able to meet projected sales increases resulting from the expanded capacity of the

system. Washington's per capita gasoline use in 1984 was 458 gallons, 103 percent of the national average. Per capita diesel use was 96 gallons, 92 percent of the national average.

3.2.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

Table 3.2.4-1 provides summary data describing selected utility characteristics for each ROI.

3.2.4.1 Ellsworth Air Force Base

Potable water in Pennington County is provided by four municipal water systems. In 1985, the systems supplied a combined average flow of 10.1 MGD. Flows are projected to increase to 11.7 MGD in 1990 and 13.5 MGD in the year 2000. Total combined capacity of the present systems is 45.1 MGD, with excess capacity to treat the projected flows. Ellsworth AFB receives potable water from Rapid City through an 18-inch pipeline. Average daily demands are 1.2 MGD with the capacity of the pipe at 3.6 MGD.

Wastewater treatment is provided by two municipal systems in Pennington County. In 1985, the systems treated a combined flow of 6.5 MGD. Flows are projected to increase to 10.3 MGD in 1990 and 11.9 MGD in the year 2000. Recent additions to the municipal systems in Rapid City and Box Elder have increased the combined capacity to 14 MGD, providing excess treatment capacity through the year 2000. Wastewater flows at Ellsworth AFB are treated at a facility with a capacity of 3 MGD. Average daily flows equal 1 MGD. By 1987, flows will increase to 1.1 MGD as a result of the B-1B bomber program. Solid waste, including that generated onbase, is disposed at a regional facility that has a remaining capacity of 65 acres, which is sufficient for the population projected through the year 2000. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in South Dakota.

Black Hills Power and Light Company has a total electrical generating capacity of 270 MW and provides service to Pennington County. In 1985, peak demand reached 237 MW, with a reserve capacity of 12 percent. The company is projecting growth to occur at 3 percent annually, with peak demand at 273 MW in 1990. Firm power purchases will supplement generating capacity to meet increased demands. Ellsworth AFB was allotted 10,000 kW from the Western Area Power Administration and consumed 80 percent in 1983. In the last few years, Ellsworth AFB has exceeded the Western Area Power Administration allotment, and the base is now purchasing supplemental (10-20%) power from Hartland Consumer's Power District. The Western Area Power Administration can only provide what they presently supply to Ellsworth AFB, based on 1977 load allotments. The Western Area Power Administration projects demand in this district to increase about 3 percent per year for the next 10 years. Present construction plans include the 105-MW rewind of existing units in South Dakota, and there are plans for siting new power plants and rewinds of existing plants.

Natural gas is supplied to Pennington County by Montana-Dakota Utility Company. Total sales in 1984 were 41,102 MMcf, with an average annual residential consumption of 118 Mcf. The company projects sales to be maintained at current rates and can service additional customers with gas reserves

Table 3.2.4-1

SELECTED UTILITY CHARACTERISTICS, HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES

Main Operating Base County	Ellsworth AFB Pennington	F.E. Warren AFB Laramie	Grand Forks AFB Grand Forks and East Grand Forks	Malmstrom AFB Cascade	Minot AFB Ward	Whiteman AFB Johnson & Pettis
County Population (1984)	74,716	72,300	80,564	81,610	62,082	55,800
Potable Water						
County						
Service Population	53,990	55,470	50,500	73,100	54,998	50,103
Average Demand (MGD)	10.1	13.9	8.5	12.0	5.9	5.3
System Capacity (MGD)	45.1	35.0	14.0	48.0	12.5	10.0
Excess Capacity (%)	78%	60%	39%	75%	53%	47%
Base						
Average Demand (MGD)	1.2	*	1.1	1.1	1.8	0.7
System Capacity (MGD)	3.6	*	2.6	2.6	2.5	1.5
Excess Capacity (%)	67%	*	58%	58%	28%	53%
Wastewater						
County						
Service Population	59,208	62,901	61,777	62,250	46,719	69,500
Average Flow (MGD)	6.5	8.8	6.7	9.7	5.1	7.0
Facilities Capacity (MGD)	14.0	11.0	10.3	21.2	9.5	12.2
Excess Capacity (%)	54%	20%	35%	54%	47%	43%
Base						
Average Flow (MGD)	1.0	*	0.8	*	1.0	0.6
Facility Capacity (MGD)	3.0	*	1.1	*	1.3	1.0
Excess Capacity (%)	67%	*	30%	*	13%	40%
Solid Waste						
Demand (cy/yr)	170,446	167,902	147,029	148,938	115,878	101,835
Available Acreage	65	1,100	160	186	90	N/A
Energy Utilities						
Electric Capacity (MW)	270	114	750	1,508	1,584	912
Peak Load (MW)	237	104	628	1,295	230	741
Reserve Margin (%)	12%	9%	16%	14%	85%	19%
Service Population (customers)	47,413	30,184	100,536	203,830	60,000	140,713

Table 3.2.4-1 Continued, Page 2 of 2

Main Operating Base County	Ellsworth AFB Pennington	F.E. Warren AFB Laramie	Grand Forks AFB Grand Forks and East Grand Forks	Malmstrom AFB Cascade	Minot AFB Ward	Whiteman AFB Johnson & Pettis
Base Consumption (kWh)	111,622,000	30,000,000	126,754,000	40,438,800	69,537,112	54,869,000
Per Capita Consumption	11,275	8,333	20,745	4,758	10,379	16,139
Annual Natural Gas Sales (MMcf)	41,000	12,992	72,503	4,920	41,000	12,168
Service Population (customers)	179,000	24,310	301,019	22,518	179,000	59,539
Average Customer Use (Mcf)	118	122	128	115	118	90
Base Consumption (MMcf)	2,650	330	*	550	280	360
Average Customer Use	118	122	*	115	118	90
County Gasoline Requirements (gal)	40,271,924	55,421,553	44,713,020	44,722,280	35,239,725	28,625,400
Per Capita Use	544	753	555	548	555	513
County Diesel Requirements (gal)	18,155,988	23,699,522	25,530,788	19,668,010	20,127,915	6,807,600
Per Capita Use	243	322	317	241	317	122

Notes: *Not applicable.
N/A = data not available.

in excess of 934 Bcf. South Dakota's per capita gasoline use in 1984 was 544 gallons, 122 percent of the national average. Per capita diesel use was 243 gallons, 233 percent of the national average.

3.2.4.2 F.E. Warren Air Force Base

Two municipal systems and private rural systems provide potable water to Laramie County. The average daily demand for the Cheyenne Board of Public Utilities in 1985, including demands at F.E. Warren AFB, was about 13.9 MGD and will increase to 15 MGD in 1990 and 17.9 MGD by the year 2000. Capacity of the two systems is estimated to be 35 MGD. Present use equals 40 percent of capacity and will increase to 46 percent in 1990 and 57 percent in the year 2000.

Wastewater flows in Laramie County are processed at three facilities that have a total capacity of 11 MGD. Currently, average daily flows, including flows from the base, are 8.8 MGD and are forecast to increase to 10.2 MGD in 1990 and 12.2 MGD in the year 2000. Additional capacity will be needed to process flows anticipated by 1996. Solid waste, including that generated onbase, is disposed at a regional landfill in Cheyenne that has capacity through 1990. A new facility will need to be developed to handle flows after 1990. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in Wyoming.

The Cheyenne Light, Fuel and Power Company provides electrical power and natural gas to a majority of Laramie County residents. In 1985, electric peak demand was 104 MW, an increase of 12 percent from 1984. The company projects peak demand to rise to 119 MW in 1990 and to 145 MW in the year 2000. It will meet these demands with supplies available for purchase from Pacific Power Company and other electric utilities in the Western Systems Coordinating Council. Major electricity suppliers to F.E. Warren AFB are the Western Area Power Administration (Loveland-Fort Collins Area Office) and the Rocky Mountain Generation Cooperative. Under an annual contracted rate of delivery, the base receives 3,300 kW (summer and winter) through the Western Area Power Administration. In addition, Rocky Mountain supplies excess power to supplement the Western Area Power Administration allotment. As of April 1986, approximately 20 percent of the base's 2,000,000 kWh used per month was supplied by the Rocky Mountain Generation Cooperative.

The Western Area Power Administration projects annual increases in demand of 2.5 percent for the next 10 years in this district. Its firm generation capacity, fully committed to existing users, will have to be increased or supplemented to meet projected demand. Rocky Mountain will continue to supply supplemental power to F.E. Warren AFB. In 1985, Cheyenne Light, Fuel and Power delivered 12,992 MMcf of natural gas to the region. It experienced a 7.5-percent decline in natural gas sales from 1984, attributable to the state's low economic growth. The company purchases supplies from Colorado Interstate Gas Company and projects sales to increase only slightly through 1995. Wyoming's per capita gasoline use in 1984 was 753 gallons, 169 percent of the national average. Per capita diesel use was 322 gallons, 310 percent of the national average.

3.2.4.3 Grand Forks Air Force Base

Potable water is provided to a majority of Grand Forks County, including Grand Forks AFB, by the City of Grand Forks, and the City of East Grand Forks, Minnesota supplies potable water to its resicents. Average daily demands for both systems in 1985 equaled 7.8 MGD, includ ng 1.1 MGD used by Grand Forks AFB. Capacity of the two systems is 13 MGD, and the Grand Forks system will be upgraded with an additional 7 MGD by 198,. Demands are projected to increase to 9.3 MGD in 1990 and 10 MGD by the year 2000. Grand Forks AFB receives potable water through a 14-inch, 15-mile pipeline. Current demands equal 1.1 MGD and capacity equals 2.6 MGD.

Eight facilities provide wastewater treatment in Grand Forks County, with a total capacity of 10.3 MGD. Flows are currently about 6.7 MGD, 65 percent of capacity, with plans for expansion in 1986. The East Grand Forks system receives daily flows of 1 MGD, with capacity to service approximately three times the existing population through the year 2000. Wastewater flows at Grand Forks AFB are processed at a facility with a capacity of 1.1 MGD. Current flows equal 0.77 MGD. Wastewater flows are estimated to increase to 7.2 MGD in 1990 and 7.8 MGD in the year 2000. Solid waste, including that generated onbase, is disposed in the City of Grand Forks' landfill. Although the remaining acreage is limited to 1 to 2 years, the city has acquired additional space to extend the facility's capacity through the year 2010. Hazardous waste is disposed out-of-state since no licensed disposal sites exist in North Dakota.

Northern States Power Company and the Minnkota Power Cooperative provide electrical power to the two-county region, with a combined capacity of 750 MW. In 1985, Northern States Power experienced a peak demand of 125 MW in the Grand Forks area with a 17-percent reserve margin; Minnkota Power had a 15-percent reserve margin over peak demand. Both Minnkota Power and Northern States Power purchase electricity from the Western Area Power Administration. Minnkota Power has an annual contract for 75,800 kW of firm power and Northern States Power purchases 805,000 kW for peaking purposes. The companies project increases in peak demand between 2 and 3 percent annually through the year 2000, creating the need for increased supply to the region. Grand Forks AFB purchases electrical power from the Nodak Rural Electric Cooperative, and as a member it receives all needed power.

Northern States Pov r provides natural gas to the Grand Forks area. In 1984, total sales were 72,503 MMcf, with an average annual residential use of 128 Mcf. Approximately 900 Mcf per hour will be available for the first time to Grand Forks AFB in 1986. North Dakota's per capita gasoline use in 1984 was 555 gallons, 124 percent of the national average. Per capita diesel use was 317 gallons, 305 percent of the national average.

3.2.4.4 Malmstrom Air Force Base

Potable water is provided to a majority of the residents of Cascade County by either the City of Great Falls or by private rural systems. Average daily demand in 1985 was 12 MGD; 1.1 MGD was used by Malmstrom AFB. Demands will be 14.8 MGD in 1990 and 15.7 MGD in the year 2000. The existing treatment facility has a capacity of 48 MGD, providing excess capacity of 75 percent.

Wastewater treatment is available at four municipal facilities in Cascade County with a total capacity of 21.2 MGD. Wastewater flows, including those from Malmstrom AFB, are about 9.7 MGD and are projected to increase to 10.3 MGD in 1990 and 12 MGD in the year 2000. Solid waste, including that generated onbase, is disposed at four landfills, including two county sites that have adequate capacity through the years 1996 and 2006. The City of Great Falls has leased an additional 40 acres for its site, extending its use beyond the 1996 projected capacity. A private landfill has a remaining capacity of 40 years, through the year 2026. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in Montana.

Montana Power Company has a total electrical capacity of 1,508 MW and serves the Great Falls area. In 1985, peak load was 1,295 MW with a 14-percent reserve margin. The company projects a 7-percent increase in peak load between 1985 and 1990 to 1,384 MW in 1996, and a 14-percent increase between the years 1990 and 2001 to 1,621 in the year 2000. The company's electric system will not meet peak-load requirements by 1989, which will require the purchase of capacity from other sources. By the year 2001, the company will add 226 MW of generating capacity.

The Great Falls Gas Company supplies natural gas. Total sales in FY 1985 were 4,920 MMcf, approximately 40 percent of the system's capacity. The company projects growth in the residential, commercial, and industrial sectors in FY 1986, except for a 50-percent loss at Malmstrom AFB, representing 6 percent of the entire system sales. Gas sales for the company have never approached total system capacity, and supply will be adequate through the year 2010. Montana's per capita gasoline use in 1984 was 548 gallons, 123 percent of the national average of 445 gallons. Per capita diesel use equaled 241 gallons, or 232 percent of the national average of 104 gallons.

3.2.4.5 Minot Air Force Base

Potable water treatment is supplied to the majority of Ward County by the City of Minot; this includes Minot AFB. Average daily demands in 1985 equaled 5.9 MGD. Demands are forecast to increase to 6.2 MGD in 1990 and 7.1 MGD in the year 2000. Currently, treatment capacity is 18 MGD; however, only 12.5 MGD can be distributed. Minot AFB receives its supply of potable water through a 14-inch pipeline with a 2.5-MGD capacity. Current use equals 1.8 MGD.

Wastewater treatment in Ward County consists of ten municipal lagoon systems, totaling 760 acres, with a capacity of 9.5 MGD. In 1980, wastewater flows required 365 acres of lagoons for adequate processing. Flows are projected to require 527 acres or 5.7 MGD in 1990 and 597 acres or 6.4 MGD in the year 2000. Adequate capacity will remain through the year 2000, and no expansions are planned. Wastewater flows at Minot AFB are treated at a facility with a capacity of 1.3 MGD. Recent flows equaled 1 MGD. Improvements to the collection system and an additional lagoon are planned for the base. Solid waste, including that generated onbase, is disposed at two landfills consisting of 90 acres. Capacity should be available through 1990. Expansion of the City of Minot's site should provide capacity through the year 2000. Hazardous waste is disposed out-of-state since no licensed disposal sites exist in North Dakota.

Northern States Power Company and two rural electric cooperatives supply electrical power to Ward County. In 1985, peak demands reached 5 MW in Ward County for Northern States Power and 169 MW for the Central Power Electric Cooperative, with reserve margins of 91 and 89 percent, respectively. Peak demand for the Upper Missouri Generating and Transmission Cooperative was at capacity (56 MW). Northern States Power projects peak demand to increase by 2 percent per year through the year 2000. Central Power Electric projects a decrease in demand to a peak load of 150 MW.

Natural gas is supplied to Ward County by the Montana-Dakota Utility Company. Total sales in 1984 were 41,000 MMcf, with an average annual residential consumption of 118 Mcf. The company projects sales to be maintained at present levels, and can service additional customers with gas reserves in excess of 934 Bcf. North Dakota's per capita gasoline use in 1984 was 555 gallons, 125 percent of the national average. Per capita diesel use was 317 gallons, or 305 percent of the national average.

3.2.4.6 Whiteman Air Force Base

Potable water treatment is provided to Johnson and Pettis counties by four major municipal systems. In 1985, these systems supplied a total average daily demand of 5.27 MGD; projections indicate demands will reach 5.34 MGD in 1990 and 5.51 MGD in the year 2000. Currently, capacity of the four systems equals 10 MGD; there are no expansions planned. Whiteman AFB obtains its potable water from a wellfield with a 1.5-MGD capacity. Current use equals 0.71 MGD.

Four municipal facilities that have a total daily flow of 7 MGD provide wastewater treatment. Present capacity is estimated to be 12.17 MGD. Wastewater flows are projected to increase to 7.1 MGD in 1990 and to 7.3 MGD in the year 2000. Wastewater flows at Whiteman AFB are treated at a facility with a capacity of 1 MGD. Recent flows equaled 0.6 MGD. Solid waste, including that generated onbase, is disposed at three landfills in the region. One site has capacity available through 1995 and the other two will close in the near future. Hazardous waste is disposed out-of-state since no licensed commercial facilities exist in Missouri.

Missouri Public Service Company has a total electrical generating capacity of 912 MW and provides electrical power to Johnson and Pettis counties. In 1984, peak demand was 741 MW, with a 19-percent reserve capacity. The company's projection of 2 to 3-percent annual increases in peak demand will create the need for additional generating capacity.

Natural gas is provided to Johnson and Pettis counties by Missouri Public Service Company. In 1984, total sales were 12,168 MMcf, with an average residential customer use of 90.2 Mcf. The company projects consumption to remain stable, with surpluses available to supply increases in demand. Kansas Power and Light Gas Service supplies natural gas to Whiteman AFB. Peak demand is approximately 56,000 Mcf per month and average use is approximately 30,600 Mcf per month. Missouri's per capita gasoline use in 1984 was 513 gallons, 115 percent of the national average. Per capita diesel use was 122 gallons, 117 percent of the national average.

3.2.5 Existing and Projected Conditions for Hard Silo in Patterned Array

Table 3.2.5-1 provides summary data describing selected utility characteristics for each ROI.

3.2.5.1 Davis-Monthan Air Force Base

Davis-Monthan AFB is located in Pima County, Arizona. A majority of Pima County residents receive potable water from the City of Tucson's system, which had a 1984 average daily demand of 78 MGD. The system's capacity is 165 MGD, providing excess capacity of 53 percent. Demands will increase to 90 MGD in 1990 and to 120 MGD in the year 2000. To meet these demands, a 50-MGD treatment plant is planned by 1992 to process water delivered by the Central Arizona Project. Davis-Monthan AFB obtains its potable water from a wellfield with a capacity of 5.9 MGD. Average daily demands equal 2.1 MGD. Three new wells and new distribution mains are being constructed. Wastewater flows are processed at 12 county facilities with a total capacity of 60 MGD. Currently, average daily flows, including flows from the base, equal 48 MGD or 81 percent of capacity. Wastewater flows will increase to 58 MGD in 1990 and 75 MGD in the year 2000. Wastewater facility planning will provide for 11 MGD of additional capacity by 1990, and alternative plans are being developed for the 1990 to 2000 time period. Solid waste, including that generated onbase, is disposed at seven landfills with a total of 492 acres. Only one of these sites will be available by the year 2000; however, plans are being developed for a large county site. Hazardous waste solvent and sludge recycling facilities are available in Arizona; however, no commercial disposal facilities exist within the state.

Tucson Electric Power Company has a total electrical generating capacity of 1,342 MW and provides service to the Tucson metropolitan area. In 1985, peak demand reached 1,118 MW with a 17-percent reserve capacity. The company projects peak demands of 1,391 MW in 1990 and 2,109 MW in the year 2000, with reserve capacities of 22 and 12 percent, respectively.

Natural gas is supplied to Pima County by Southwest Gas Corporation. Total sales in the county for 1985 were 19,629 MMcf, with an average annual residential use of 51.5 Mcf. The company projects sales to increase by 2 percent in 1986, and anticipates increases in demand relative to population changes in Pima County. Arizona's per capita gasoline use in 1984 was 485 gallons, 109 percent of the national average of 445 gallons. Per capita diesel use in 1984 was 99.4 gallons or 96 percent of the national average of 104 gallons.

Along Interstate 10, which extends from Phoenix to the New Mexico border, there is a series of natural gas pipelines and electrical transmission lines. In addition, a natural gas pipeline and electrical transmission line follow Interstate 19 from Tucson to Nogales. Other transmission facilities exist throughout the northern portion of the deployment area. Two proposed crude oil pipelines would traverse the area north of the base.

3.2.5.2 Edwards Air Force Base

Edwards AFB is located in the desert portion of Los Angeles County in California. A discussion of the utility systems is presented in Section 3.2.3.5.

Table 3.2.5-1

SELECTED UTILITY CHARACTERISTICS, HARD SILO IN PATTERNED ARRAY ALTERNATIVES

Main Operating Base County	Davis-Monthan AFB Pima	Edwards AFB Los Angeles	F.E. Warren AFB Laramie	Fort Bliss El Paso	Gila Bend AFAF Maricopa	Yuma PG Yuma
County Population (1984)	603,300	7,887,707	72,300	524,800	1,731,100	85,700
Potable Water						
County						
Service Population	474,436	80,000	55,470	492,800	1,371,060	72,526
Average Daily Demand (MGD)	78.0	18.4	13.9	91.0	334.0	14.86
Systems Capacity (MGD)	165.0	60.3	35.0	N/A	561.0	28.50
Excess Capacity (%)	53%	69%	60%	N/A	40%	48%
Base						
Average Daily Demand (MGD)	2.1	4.5	*	6.1	0.26	0.73
System Capacity (MGD)	5.9	12.5	*	12.4	1.25	5.04
Excess Capacity (%)	64%	64%	*	51%	79%	85%
Wastewater						
County						
Service Population	603,300	94,631	62,901	524,800	1,731,100	72,526
Average Daily Flow (MGD)	48.1	8.6	8.8	53.5	193.25	7.00
Facilities Capacity (MGD)	59.5	7.6	11.0	57.0	193.75	12.25
Excess Capacity (%)	19%	-13%	20%	6%	0.26%	43%
Base						
Average Daily Flow (MGD)	*	1.27	*	*	0.05	0.39
Facility Capacity (MGD)	*	1.25	*	*	1.00	0.74
Excess Capacity (%)	*	-2%	*	*	95%	47%
Solid Waste						
Demand (cy/yr)	1,101,023	252,165	167,902	1,005,648	3,949,072	156,403
Available Acreage	492	320	1,100	752	960	160
Energy Utilities						
Electric Capacity (MW)	1,342	17,628	114	989	6,880	3,425
Peak Load (MW)	1,118	13,396	104	877	5,457	2,970
Reserve Margin (%)	17%	24%	9%	11%	21%	13%
Service Population (customers)	223,183	3,723,200	30,184	205,903	922,525	499,751
Base Consumption (kWh)	57,057,846	147,275,000	30,000,000	147,167,000	2,080,000	24,807,000
Per Capita Consumption	4,616	9,368	8,333	4,599	4,160	12,404

Table 3.2.5-1 Continued, Page 2 of 2

Main Operating Base County	Davis-Monthan AFB Pima	Edwards AFB Los Angeles	F.E. Warren AFB Laramie	Fort Bliss El Paso	Gila Bend AFAF Maricopa	Yuma PG Yuma
Annual Natural Gas Sales (MMcf)	19,629	431,000	12,992	8,400	31,150	33,597
Service Population (customers)	381,149	3,000,000	24,310	123,450	594,468	87,494
Average Customer Use (Mcf)	52	69	122	75	52	38
Base Consumption-Natural Gas (MMcf)/ heating fuel (gal)	268 MMcf	561 MMcf	330 MMcf	1,240 MMcf	84,000 gal	150,000 gal
Average Customer Use/Per Capita Use	52 Mcf	69 Mcf	122 Mcf	75 Mcf	168 gal	75 gal
County Gasoline Requirements (gal)	292,600,500	3,555,232,128	55,421,553	276,044,800	839,583,500	41,564,500
Per Capita Use	485	448	753	526	485	485
County Diesel Requirements (gal)	59,968,020	790,404,286	23,699,522	69,273,600	172,071,340	8,518,580
Per Capita Use	99.4	100.0	322.0	132.0	99.4	99.4

Notes: *Not applicable.
N/A = not applicable.

Utility corridors in the deployment area run from San Bernardino to Barstow along Interstate 15 and the Southern Pacific Railroad. Two natural gas pipelines and two 500-kilovolt (kV) alternating current (AC) electrical transmission lines occur in this corridor. A third transmission line is proposed. Paralleling California State Highway 58 to Bakersfield are two natural gas pipelines and an oil pipeline, and another natural gas pipeline runs east-west along Interstate 40. A 230-kV powerline follows U.S. 395 from Interstate 15 north toward Ridgecrest. A proposed crude oil pipeline would run north of the base, and a 500-kV powerline is proposed east of the base.

3.2.5.3 F.E. Warren Air Force Base

F.E. Warren AFB is located in Laramie County, Wyoming. A discussion of the utility systems for Laramie County is presented in Section 3.2.4.2.

Utility corridors in the deployment area are found primarily along Interstates 25 and 80. Traveling east-west along the Union Pacific Railroad, Interstate 80, and U.S. 30, are three electrical transmission lines and two natural gas pipelines. One oil pipeline, two petroleum product pipelines, a natural gas pipeline, and an electrical transmission line travel north-south along Interstate 25 and U.S. 87. A 115-kV transmission line parallels U.S. 85 between Cheyenne and Meridan.

3.2.5.4 Fort Bliss

Fort Bliss is located in El Paso County, Texas. A discussion of the utility systems for El Paso County is presented in Section 3.2.3.4.

Utility corridors in the deployment area are located in two areas: adjacent to the Rio Grande River, U.S. 80, and U.S. 85, where there are three electrical transmission lines and two natural gas and two petroleum product pipelines; and following the Southern Pacific Railroad in an east-west direction, where there are five natural gas pipelines, one electrical transmission line, and two petroleum product pipelines. Two proposed crude oil pipelines would traverse the north side of Fort Bliss.

3.2.5.5 Gila Bend Air Force Auxiliary Field

Gila Bend AFAF is located in Maricopa County, Arizona. A discussion of the utility systems for Maricopa County is presented in Section 3.2.3.1.

Two utility corridors are found within the deployment area. An electrical transmission line, a natural gas pipeline, and a petroleum product pipeline are located along Arizona State Highway 85. In addition, an electrical transmission line, a petroleum pipeline, and three oil pipelines parallel Interstate 10. Two proposed crude oil pipelines and a proposed transmission line would traverse areas north of the base along Interstate 8.

3.2.5.6 Yuma Proving Ground

Yuma PG is located in Yuma County, Arizona. A discussion of the utility systems for Yuma County is presented in Section 3.2.3.1.

Utility corridors in the deployment area follow Interstate 8 and U.S. 95. Two electrical transmission lines and one petroleum products pipeline travel along Interstate 8. Adjacent to U.S. 95 and south of Interstate 8 are two natural gas pipelines and an electrical transmission line. Two proposed transmission lines would traverse areas south of Yuma PG.

3.3 Transportation

Transportation resources, particularly the level of service (LOS) provided by the regional primary road systems, could be adversely affected by project-induced demands. Potential issues include increased travel and shipment times and the decreased safety, comfort, and convenience that accompany increased congestion. The modes of transportation considered in this analysis are highways, railroads, and commercial airports.

3.3.1 Resource Description

The transportation resource includes all facilities used to move personnel or materials from place to place, the traffic on those facilities, and the ancillary facilities required for efficient operation. Road, rail, air, water, and pipeline are major transportation modes. For this regional analysis, impacts to traffic on primary road networks were determined to be the key discriminator. Primary roads are the main roads important to regional, interstate, and statewide travel. They include all interstate highways and other designated U.S. and state-numbered routes. Rail and air transportation are also considered. Impacts to water transportation and pipelines are not expected.

3.3.2 General Analysis Methodology

Region of Influence. The Regions of Influence (ROIs) for transportation are the geographic areas where project-related traffic (primarily commuting) could be generated on primary roads. The ROIs were based on the criterion that workers will normally tolerate no more than an approximate 1-hour (or 55-mi) commute. The places where workers assemble were assumed to be at the Main Operating Bases (MOBs) and at locations accessible by primary roads and convenient to potential Hard Silo or Hard Mobile facility construction sites. Larger communities (5,000 or more, 1980 population) were included in the ROI if they were at a slightly greater commuting distance than 55 miles because they could be sources of appreciable traffic.

Highways. Highways were identified by their physical features and estimated LOS. Interstate highways are all four-lane, divided, limited access roads except where noted otherwise. The LOS letter scores, which range from A to F, describe the ability of roadways to accommodate the peak-hour imposed traffic. Figure 3.3.2-1 presents photographs showing the operational characteristics for the six LOS scores A to F on a basic freeway segment, and Table 3.3.2-1 lists typical conditions for each level. The estimated LOS values were based on historic traffic volumes, including both passenger cars and heavy vehicles, and available road descriptions only; these are not representative of detailed, site-specific engineering analyses. Future conditions were projected by considering traffic changes to be proportional to statewide population changes. Population changes were derived from the socioeconomics resource. The potential effects of high-probability roadway improvements or new construction were also included.

Railroads. Railroads are described in terms of general availability within the ROIs. Future conditions were not specifically examined for railroads. The possibility of abandonment of specific sections, where indicated in state railroad plans, is noted where pertinent.

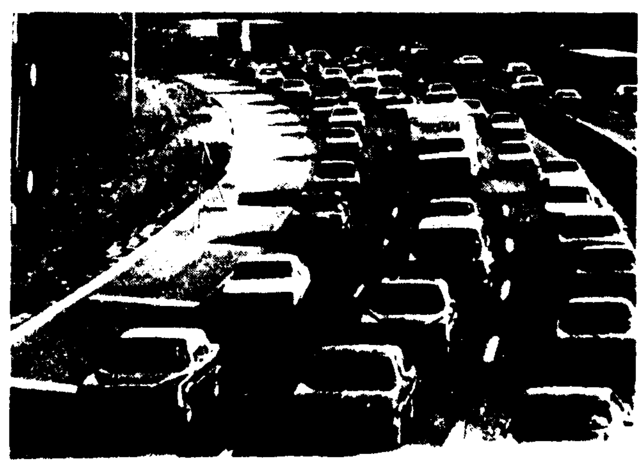
LEVEL OF SERVICE A

LEVEL OF SERVICE B

LEVEL OF SERVICE C

LEVEL OF SERVICE D

LEVEL OF SERVICE E



LEVEL OF SERVICE F

Source: Transportation Research Board 1985.

FIGURE 3.3.2-1 OPERATIONAL CHARACTERISTICS AT VARIOUS LEVELS OF SERVICE

Table 3.3.2-1

OPERATIONAL CONDITIONS WITHIN A TRAFFIC STREAM
AT VARIOUS LEVELS OF SERVICE

LOS	Characteristics
A	Free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist or passenger is excellent.
B	Stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than that of LOS A, because the presence of others in the traffic stream begins to affect individual behavior.
C	Stable flow, but marks the beginning of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
D	High-density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.
E	Operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult and is generally accomplished by forcing a vehicle to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.
F	Forced or breakdown flow. This condition exists whenever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop, in a cyclic fashion. LOS F is used to describe the operational features within the queue, as well as the point of the breakdown. Operating conditions of vehicles discharged from the queue may be better.

Source: Transportation Research Board 1985.

Commercial Airports. Commercial airports are described by location and general type of service, based on current schedules. Future traffic was not projected. Service levels are unstable at many of the smaller commuter airports, and future conditions are uncertain. Only those airports with currently scheduled passenger service were included.

3.3.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

The transportation ROIs for the areas suitable for the Hard Mobile Launcher in Random Movement basing mode are indicated in Figure 3.3.3-1.

3.3.3.1 Arizona Complex

Basing in the Arizona Complex could influence transportation within the general area of southwestern Arizona and southeastern California outlined in Figure 3.3.3-1. The regional primary road system is a widely spaced network that includes substantial lengths of two east-west interstate highways (I-8 and I-10) and two north-south, two-lane roads (U.S. 95 and Arizona State Highway 85). The MOB at Gila Bend Air Force Auxiliary Field (AFAF) is reached via Interstate 8 and State Highway 85. The MOB at Yuma Proving Ground (PG) is reached via Interstate 8 and U.S. 95. Most rural primary roads in the ROI are at higher LOS values (A or B). However, the stretch of two-lane State Highway 85 between Interstates 8 and 10 is currently estimated to provide service at LOS D. In and near urban areas, lower LOS values occur, reaching LOS F on stretches of Interstate 10 through Phoenix. A section of Interstate 10, immediately west of Interstate 17 in Phoenix, has recently been completed, and a section to the east of that junction is scheduled for completion by 1989. This is the only incomplete section of Interstate 10 from coast to coast. Its completion could potentially reduce congestion on parallel routes such as State Highway 85. Regional growth through the year 2000 is not estimated to result in LOS changes by more than one or, at most, two levels. Roadways currently at LOS A or B are likely to remain at those levels. State Highway 85 north of Gila Bend, a major access road to Gila Bend AFAF, is estimated to reach LOS E by the year 2000. Rail service is available in the southern and east-central parts of the area, including the vicinities of Gila Bend AFAF and Yuma PG. Major airline service is available at Phoenix, Arizona, and commuter service from Blythe and El Centro, California and Yuma, Arizona. Communities in the ROI likely to be sources of commuters include Phoenix and Yuma, Arizona and El Centro, California, with 1980 populations of 789,704; 42,433; and 23,996; respectively. Numerous additional communities west of Phoenix could also be sources of project-induced workers.

3.3.3.2 Florida Complex

Basing in the Florida Complex could influence transportation within the general area of the northwestern Florida Panhandle outlined in Figure 3.3.3-1. The primary road network in the area includes four major east-west highways (I-10, U.S. 90 and 98, and Florida State Highway 20) and seven major north-south routes. Three of the latter (U.S. 331 and Florida State Highways 85 and 87) transect Eglin Air Force Base (AFB); the main base is reached via State Highway 85. Service on Interstate 10 is LOS A in rural areas, but may reach an estimated LOS C in Pensacola, Florida, and LOS D in parts of Mobile,

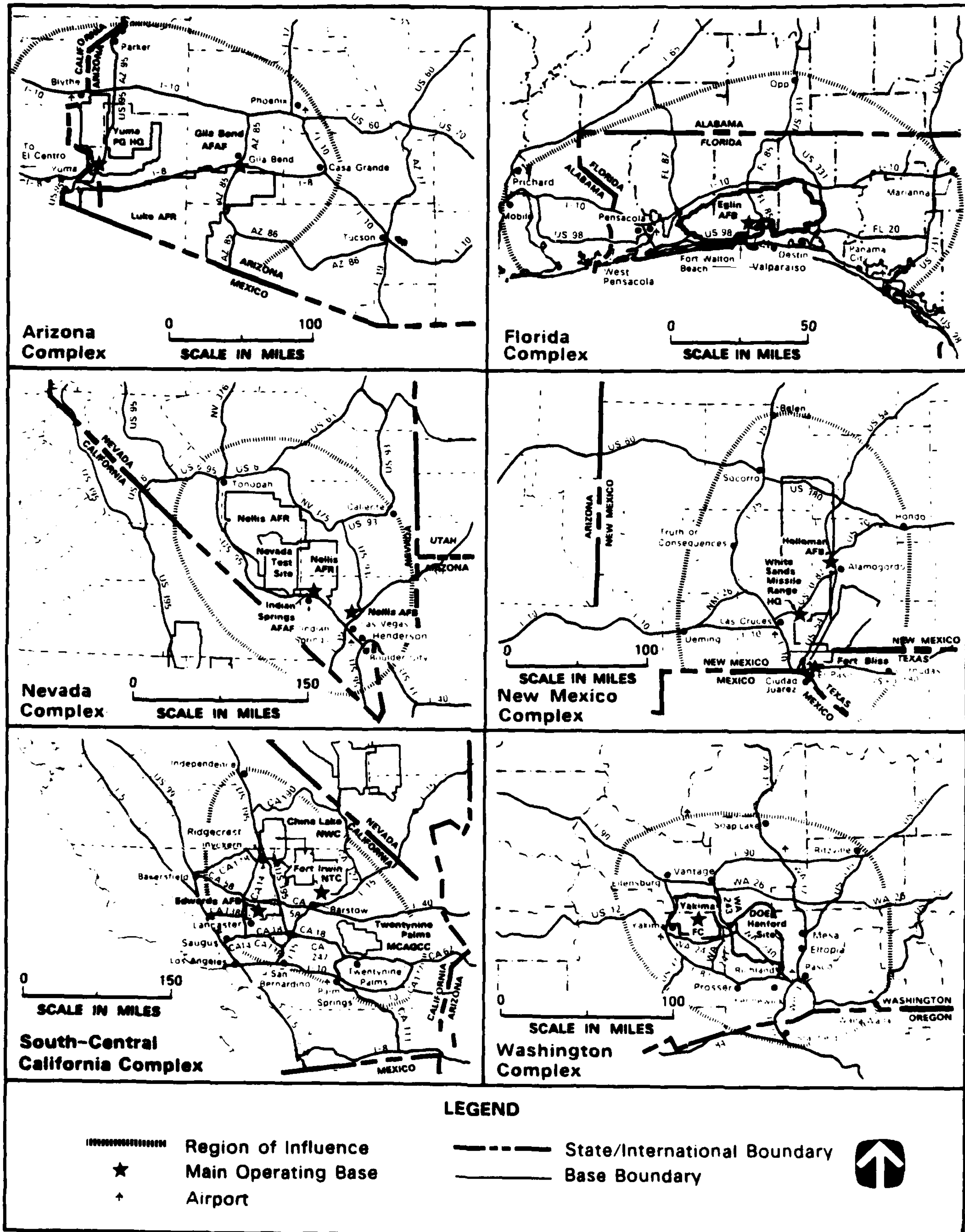


FIGURE 3.3.3-1 HARD MOBILE LAUNCHER IN RANDOM MOVEMENT TRANSPORTATION REGIONS OF INFLUENCE

Alabama. Much of U.S. 90, predominantly two lane and partially four lane, is at LOS B or C. U.S. 98, the main coastal route, is four lanes from Pensacola east to beyond Fort Walton Beach, and predominantly two lanes thereafter; it provides LOS B to D service. Many of the rural north-south primary roads provide LOS A service, and few are below LOS C. A notable exception is multi-lane State Highway 85 south of Valparaiso, estimated at LOS D. A number of widening and resurfacing projects have been planned for the regional highways within the ROI. Specifically, State Highway 85 between Fort Walton Beach and Eglin AFB is being widened to six lanes, sections of U.S. 98 between Pensacola and Panama City have been programmed for additional lane construction and repaving, and sections of U.S. 90 have been recommended for widening. Projected service levels are expected to drop by one or, at most, two levels by the years 1990 and 2000 on many regional roads, except those being upgraded. Rail service is available east, west, and north of Eglin AFB, with main line service along its northern border. Commercial airports at Pensacola, Panama City, and Fort Walton Beach, Florida are served by major airlines. Communities in the area likely to be sources of commuters include Pensacola/West Pensacola (1980 census populations of 57,619 and 24,371), Fort Walton Beach (20,829), and Panama City (33,346), Florida; and Mobile (200,452) and Prichard (39,541), Alabama.

3.3.3.3 Nevada Complex

Basing in the Nevada Complex could influence transportation within the general area of southern Nevada outlined in Figure 3.3.3-1. The regional primary road network radiates from Las Vegas, Nevada and includes Interstate 15 and U.S. 93 and 95. The MOB at Indian Springs AFAF is reached via U.S. 95, a divided four-lane road from Las Vegas, and the MOB at Nellis AFB is accessed regionally via Interstate 15. Except for short stretches in metropolitan Las Vegas where service may drop to LOS C or D, these roadways operate at LOS A. U.S. 93 and 95 overlap on a four-lane route joining Las Vegas and Boulder City, with service at LOS C. Beyond Boulder City, the highways diverge and both provide service at LOS B within the ROI, except for a stretch of U.S. 93 near Hoover Dam estimated at LOS E. Other primary roads in the region operate at LOS A. No major construction is planned for the rural roads within the ROI except for the addition of two travel lanes on sections of Interstate 15 and U.S. 95 within Las Vegas. Projected service levels are expected to remain the same or drop by no more than one level by the years 1990 and 2000. Rail service is available only in the southeast portion of the area, including Nellis AFB. No rail service is available to Indian Springs AFAF or to Nellis Air Force Range (AFR) and the Nevada Test Site. Major airline service is available at Las Vegas. Communities in the area likely to be sources of commuters include metropolitan Las Vegas (which includes several large unincorporated census-designated places), with a 1980 population in excess of 370,000; Henderson (24,363); and Boulder City (9,590).

3.3.3.4 New Mexico Complex

Basing in the New Mexico Complex could influence transportation within the general area of south-central New Mexico and northwest Texas outlined in Figure 3.3.3-1. The regional primary road system is centered on El Paso, Texas and includes Interstates 10 and 25 and U.S. 62, 70, 82, 180, and 380. Fort Bliss is reached via Interstate 10, U.S. 54, and U.S. 180; Holloman AFB via U.S. 54 and U.S. 70/82 (which overlap); and White Sands Missile Range

Headquarters via U.S. 70/82. Except where influenced by adverse terrain or proximity to El Paso, most of the primary roads provide service at LOS A. Capacity upgrades are planned for three sections of Interstate 10 and two sections of U.S. 54 in the vicinity of Fort Bliss. This should improve service by one or more levels in the area. In general, LOS values for the years 1990 and 2000 will remain unchanged or drop by one or, at most, two levels for urban sections already at LOS D. El Paso is the center of the regional rail network, with connections to the west via Deming, New Mexico; to the north via Las Cruces and, alternatively, via Alamogordo, New Mexico; and to the southeast through Sierra Blanca, Texas. Major airline service within the area is available at El Paso, Texas, with commuter service at Alamogordo and Las Cruces, New Mexico. Communities in the area likely to be sources of commuters include El Paso, Texas (1980 census population of 425,259); and Las Cruces (45,086) and Alamogordo, New Mexico (24,024).

3.3.3.5 South-Central California Complex

Basing in the South-Central California Complex could influence transportation within the general area of southern California outlined in Figure 3.3.3-1. The regional primary road system includes five major north-south roads (I-15, U.S. 395, and California State Highways 14, 111, and 247) and eight major east-west roads (I-10, I-40, and California State Highways 18, 58, 62, 138, 178, and 190). The regional roadways tend to be heavily traveled. Although many stretches of primary road provide service at LOS A or B, service at LOS C or D is relatively common. Principal access to the MOB at Edwards AFB is via State Highways 14 and 58. Principal access to the MOB at Fort Irwin National Training Center (NTC) is via Interstate 15 and State Highway 58. State Highway 58, predominantly a four-lane road, has two lanes between its intersection with U.S. 395 and Barstow. Fifteen miles of this stretch are scheduled to be upgraded to four lanes. Additional conversions from two to four lanes are scheduled for 11 miles of State Highway 14 between Mojave and its intersection with U.S. 395, and for stretches of U.S. 395 north of Olancha. Projected service levels within the ROI for the years 1990 and 2000 will remain the same or, at most, drop by one level. Rail service is available throughout the complex, with main line service to Edwards AFB and adjacent to Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC) and Fort Irwin NTC. Spur service is also available adjacent to China Lake Naval Weapons Center (NWC). Major airline service is available from Palm Springs, California, with commuter service available at Palmdale/Lancaster and Inyokern (China Lake), California. Communities in the area likely to be sources of commuters include Lancaster (1980 census population of 48,027), Palm Springs (32,271), Barstow (17,690), Saugus-Bouquet Canyon census-designated place (16,283), and Ridgecrest (15,929), all in California.

3.3.3.6 Washington Complex

Basing in the Washington Complex could influence transportation within the general area of south-central Washington outlined in Figure 3.3.3-1. The primary road network in the area includes four major east-west highways (I-90, U.S. 12, and Washington State Highways 24 and 26) and seven major north-south highways (I-82, U.S. 97 and 395, and Washington State Highways 17, 240, 241, and 243). The MOB at Yakima Firing Center (FC) is reached via Interstate 82. State Highway 240 transects the Department of Energy (DOE) Hanford Site. Most regional roads provide a higher service level. Levels as low as LOS D occur

on stretches of State Highway 24 near Yakima, on U.S. 12 and State Highway 240 near Richland, and on U.S. 395 south of Ritzville and Mesa. Interstate 82 from Prosser south to the Oregon border, and Interstate 182 (a spur to Pasco), are in the final construction phases. Additional lanes are planned for 8 miles of Interstate 90 between Ellensburg and Vantage and for 15 miles of U.S. 395 between Pasco and Eltopia. Projected service levels for the years 1990 and 2000 are expected to remain the same or decrease/increase by one level depending upon construction of the improvements previously described. Rail service is available in the eastern, southern, and western portions of the ROI, with service adjacent to the western border of Yakima FC and at the DOE Hanford Site. Major airline service is available at Yakima, Wenatchee, Pasco, and Walla Walla, with commuter service available at Moses Lake, Washington. Communities in the area likely to be sources of commuters include Yakima (1980 census population of 49,826), Kennewick (34,397), Richland (33,578), and Walla Walla (25,618), Washington.

3.3.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

The transportation ROIs for the areas suitable for the Hard Mobile Launcher at Minuteman Facilities basing mode are outlined in Figure 3.3.4-1.

3.3.4.1 Ellsworth Air Force Base

Basing at Ellsworth AFB, 11 miles from Rapid City, South Dakota, could influence transportation within the general areas of western South Dakota, northeastern Wyoming, and southeastern Montana outlined in Figure 3.3.4-1. The primary road network in this area includes five major east-west roads (I-90, U.S. 14 and 212, and South Dakota State Highways 34 and 44) and four major north-south roads (U.S. 85 and 385 and South Dakota State Highways 73 and 79). The MOB at Ellsworth AFB is reached via Interstate 90 and U.S. 14. Operation on most regional primary roads is at LOS A. Exceptions occur on U.S. 16 near Mount Rushmore National Monument (LOS D-E), and on U.S. 14 and 85 south of Lead, South Dakota (LOS C-D). No major upgrades in capacity are scheduled. Service levels for the years 1990 and 2000 in the rural areas will remain unchanged. In the urban area of Rapid City, service levels on a few roads are projected to drop by no more than one level by the year 2000. Rail freight service is available only in the southern part of the area, including Ellsworth AFB. Major airline service is available at Rapid City and Pierre, South Dakota. Communities likely to be sources of commuters include Rapid City (1980 population of 46,492), Pierre (11,973), Spearfish (5,251), and Sturgis (5,184).

3.3.4.2 F.E. Warren Air Force Base

Basing at F.E. Warren AFB, adjacent to Cheyenne, Wyoming, could influence transportation in the general areas of southeast Wyoming, southwest Nebraska, and northeast Colorado outlined in Figure 3.3.4-1. The primary road network in this area includes six east-west roads (I-76 and I-80; U.S. 26, 30, and 34; and Colorado State Highway 14) and five north-south routes (I-25; U.S. 85, 287, and 385; and Colorado/Nebraska State Highway 71). Principal access to the MOB at F.E. Warren AFB is via Interstates 25 and 80 (U.S. 30 overlaps I-80 near the base). Most regional primary roads provide service at LOS A or B; none are estimated to provide service at less than LOS C. No major capacity

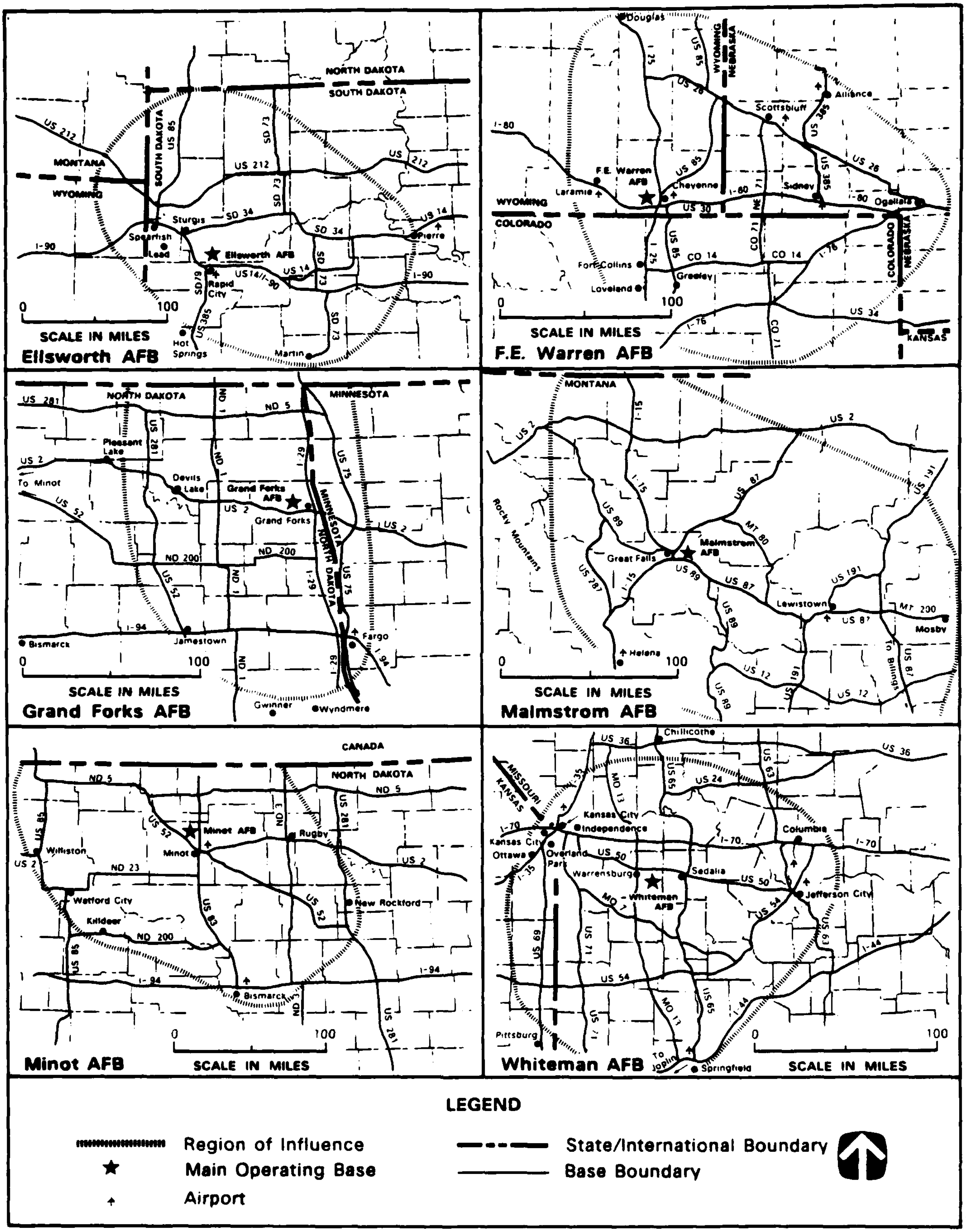


FIGURE 3.3.4-1 HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES TRANSPORTATION REGIONS OF INFLUENCE

upgrades are scheduled. Service levels for the years 1990 and 2000 will generally remain unchanged. Service on a few roads will decrease by one or two levels. Rail freight service is available throughout the area. Commuter airline service is available from Cheyenne and Laramie, Wyoming and from Scottsbluff, Alliance, and Sidney, Nebraska. Communities likely to be sources of commuters include Cheyenne (1980 population of 47,283) and Laramie (24,410), Wyoming; Scottsbluff (14,156), Nebraska; and Fort Collins (65,092), Greeley (53,006), and Loveland (30,244), Colorado.

3.3.4.3 Grand Forks Air Force Base

Basing at Grand Forks AFB, 16 miles west of Grand Forks, North Dakota, could influence transportation in the general areas of east-central North Dakota and northwest Minnesota outlined in Figure 3.3.4-1. The regional primary road system includes seven east-west roads (I-94, U.S. 2, and North Dakota State Highways 5, 15, 17, 46, and 200) and eight north-south routes (I-29; U.S. 75 and 281; North Dakota State Highways 1, 18, 20, and 32; and Minnesota State Highway 220). The MOB at Grand Forks AFB is reached via U.S. 2, a four-lane divided highway in the vicinity of the base. With minor exceptions, all regional primary roads provide service at LOS A; none are below LOS B. No major capacity upgrades are scheduled. Service levels on most roads are projected to remain unchanged through the year 2000. Rail service is extensive throughout the region and is available at the MOB. Major scheduled airline service is available at Grand Forks International Airport and at Hector Airport near Fargo, North Dakota. Commuter service is available at Devils Lake and Jamestown municipal airports. Communities likely to be sources of commuters include Fargo (1980 population of 61,383), Grand Forks (43,765), and Jamestown (16,280), all in North Dakota.

3.3.4.4 Malmstrom Air Force Base

Basing at Malmstrom AFB, 1.5 miles east of Great Falls, Montana, could influence transportation in the general area of north-central Montana outlined in Figure 3.3.4-1. The primary road network in this area includes four east-west roads (U.S. 2 and 12 and Montana State Highways 81 and 200) and nine north-south routes (I-15; U.S. 87, 89, 191, and 287; and Montana State Highways 3, 19, 44, and 80). The MOB at Malmstrom AFB is reached regionally via U.S. 87/89 and State Highway 200, which follow a common four-lane road in the vicinity of the base. Most of the primary roads in the area provide service at LOS A or B; none are currently estimated to be below LOS C. No major capacity upgrades are scheduled. Service levels on virtually all roads are projected to remain unchanged through the year 2000. Rail service is available throughout much of the region and is provided at the MOB. Major scheduled airline service is available at Great Falls International, Billings' Logan Field, and Helena Municipal airports. Intrastate commuter service is available at Lewistown Municipal Airport. Communities likely to be sources of commuters include Billings (1980 population of 66,798), Great Falls (56,725), and Helena (23,938), all in Montana.

3.3.4.5 Minot Air Force Base

Basing at Minot AFB, 13 miles north of Minot, North Dakota, could influence transportation in the general area of north-central North Dakota outlined in Figure 3.3.4-1. The primary road network in the area includes five major

east-west highways (U.S. 2 and North Dakota State Highways 5, 23, 50, and 200) and nine major north-south roads (U.S. 52, 83, and 85 and North Dakota State Highways 3, 8, 14, 22, 40, and 41). The MOB at Minot AFB is reached via U.S. 83, a four-lane divided road in the vicinity. With minor exceptions, all regional primary roads provide service at LOS A; none are below LOS B. No major capacity upgrades are planned. Service levels on most roads are projected to remain unchanged through the year 2000. Rail service is extensive throughout the region and is available at the MOB. Major scheduled airline service is available from Bismarck Municipal and Minot International airports. Commuter service is available from Williston Airport. Communities likely to be sources of commuters include Bismarck (1980 population of 44,485), Minot (32,843), and Williston (13,336), North Dakota.

3.3.4.6 Whiteman Air Force Base

Basing at Whiteman AFB, 1.5 miles south of Knob Noster and approximately 68 miles east of Kansas City, Missouri, could influence transportation in the general area of west-central Missouri and east Kansas outlined in Figure 3.3.4-1. The primary road network in the area includes seven major east-west roads (I-70; U.S. 24, 50, 54, and 160; and Missouri State Highways 7 and 52) and eight major north-south roads (I-35; U.S. 63, 65, 69, 71, and 169; and Missouri State Highways 5 and 13). Many of the regional roads provide service at LOS A or B, though LOS C is not uncommon. Roadways with service estimated at LOS D or E occur only in areas influenced by urban Kansas City traffic. No LOS F service is expected. No planned major capacity upgrades are known. Service levels for the years 1990 and 2000 will generally remain unchanged. A few will decrease by one level; none are projected to decrease by two or more levels. Rail service is extensive throughout the area and is available at the MOB. Major scheduled airline service is available at Kansas City and Springfield, Missouri; commuter service is available at Columbia, Jefferson City, and Joplin, Missouri. Larger communities that are likely to be sources of commuters include Kansas City (448,159), Springfield (133,116), Independence (111,806), and Columbia (62,061), Missouri and Kansas City (161,087) and Overland Park (81,784), Kansas.

3.3.5 Existing and Projected Conditions for Hard Silo in Patterned Array

The transportation ROIs for the areas suitable for the Hard Silo in Patterned Array basing mode are shown in Figure 3.3.5-1.

3.3.5.1 Davis-Monthan Air Force Base

Basing at Davis-Monthan AFB, immediately adjacent to Tucson, Arizona, could influence transportation within the general area of southeastern Arizona outlined in Figure 3.3.5-1. The primary road network in this area includes five major east-west highways (I-8 and I-10, U.S. 60 and 80, and Arizona State Highway 86) and five major north-south highways (I-19, U.S. 666 and 89, and Arizona State Highways 77 and 90). The MOB at Davis-Monthan AFB is reached regionally via Interstate 10. Service levels on regional primary roads are generally at LOS A to C, but may range as low as LOS E in hilly or mountainous rural areas, and to LOS F in parts of Phoenix and Tucson. Extensive maintenance and upgrading programs (e.g., interchange improvements and resurfacing) are planned for Interstate 10 and other roads in the region, but no major new construction is forecast. Projected service levels for the

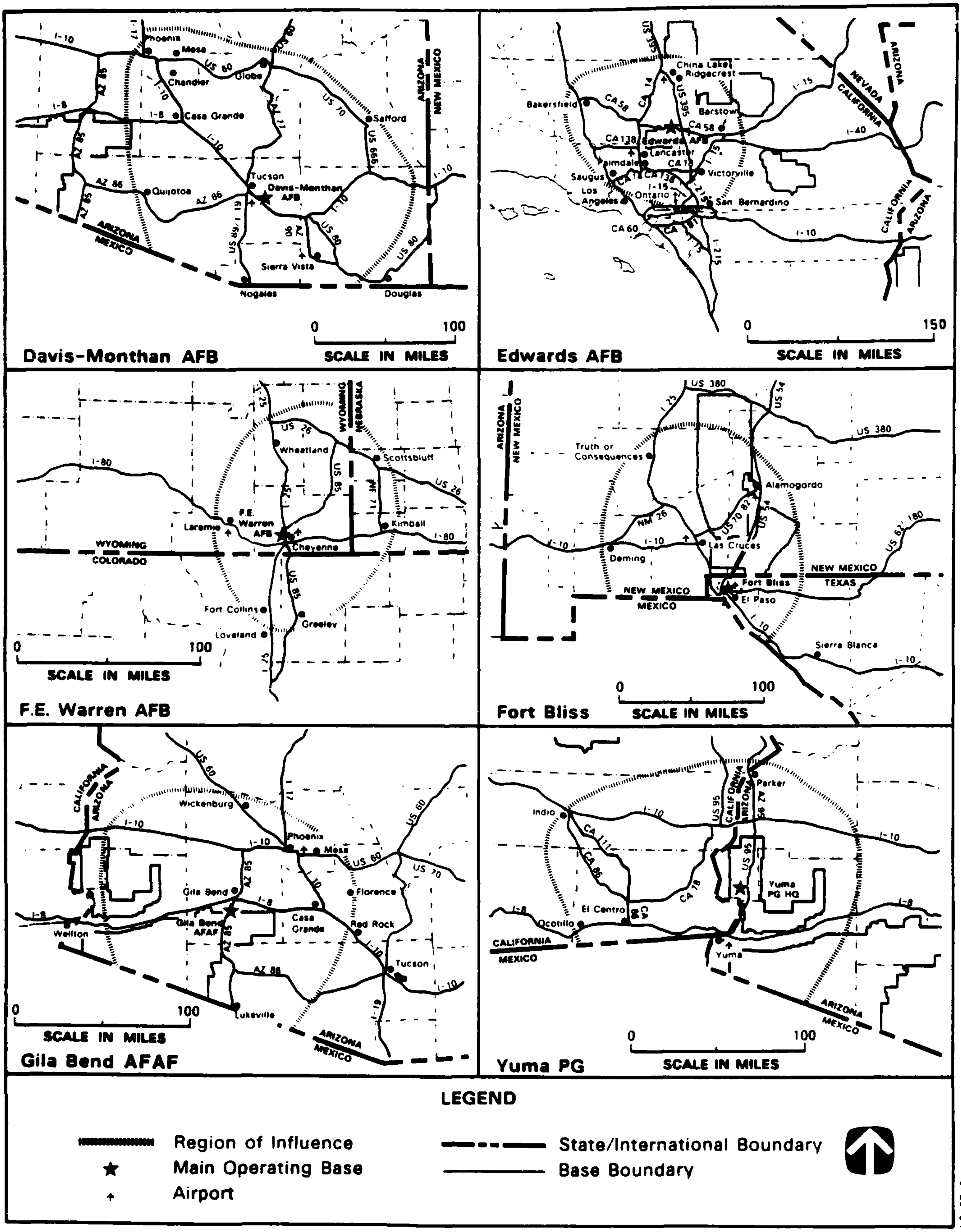


FIGURE 3.3.5-1 HARD SILO IN PATTERNED ARRAY TRANSPORTATION REGIONS OF INFLUENCE

years 1990 and 2000 should remain the same or drop by one or, at most, two levels. Exceptions are in the Phoenix and Tucson vicinity along Interstate 10, where service levels are expected to drop three LOS levels by the year 2000. Rail service is available through the center of the area from east to west, including the MOB. Major commercial airline service is available at Tucson, with commuter service in the southeast at Sierra Vista and Douglas, Arizona. Communities that are likely sources of commuters include Tucson (1980 census population of 330,537), Sierra Vista (24,937), Nogales (15,683), Casa Grande (14,971), and Douglas (13,058). Phoenix, Mesa, and Chandler are located at the extreme northwest corner of the area, with 1980 census populations of 789,704; 152,453; and 29,673; respectively.

3.3.5.2 Edwards Air Force Base

Basing at Edwards AFB, 20 miles east of Rosamond, California in the Mojave Desert north of the greater Los Angeles area, could influence transportation within the general area of south-central California outlined in Figure 3.3.5-1. The primary road network in this area is described in Section 3.3.3.5. The potentially influenced area, which is a smaller area than the South-Central California Complex, extends farther west and south to include parts of Interstates 5 and 10 and California State Highway 60. The MOB at Edwards AFB is reached via California State Highways 14 and 58; both are four-lane divided highways in the vicinity. Service levels, rail service, and airline service are described in Section 3.3.3.5.

3.3.5.3 F.E. Warren Air Force Base

Basing at F.E. Warren AFB, adjacent to Cheyenne, Wyoming, could influence transportation in the general areas of southeast Wyoming, southwest Nebraska, and northeast Colorado outlined in Figure 3.3.5-1. The transportation network in this area is described in Section 3.3.4.2.

3.3.5.4 Fort Bliss

Basing at Fort Bliss, adjacent to El Paso, Texas, could influence transportation in the general areas of south-central New Mexico and northwest Texas outlined in Figure 3.3.5-1. The primary road network for this area is similar to the southern portion of the larger New Mexico Complex (Section 3.3.3.4), but extends farther to the southeast. Rail and airline service are also described in Section 3.3.3.4. Communities that are likely sources of commuters include El Paso, Texas (1980 census population of 425,259) and Las Cruces (45,086) and Alamogordo (24,024), New Mexico.

3.3.5.5 Gila Bend Air Force Auxiliary Field

Basing at Gila Bend AFAF, which is approximately 4 miles south of Gila Bend and 58 miles southwest of Phoenix, Arizona, could influence transportation within the general area of southwestern Arizona outlined in Figure 3.3.5-1. The primary road network in this area is similar to the eastern portion of the larger Arizona Complex (Section 3.3.3.1). Rail and airline service are also the same as the Arizona Complex. Communities that are likely sources of commuters include the city of Phoenix (1980 census population of 789,704) and Casa Grande (14,971), Arizona. The many smaller communities that are included in metropolitan Phoenix could also be sources of project-induced workers.

3.3.5.6 Yuma Proving Ground

Basing at Yuma PG, with its headquarters approximately 24 miles north of Yuma, Arizona, could influence transportation within the general areas of southeast California and southwest Arizona outlined in Figure 3.3.5-1. The primary road network in the area is similar to that described in Section 3.3.3.1 for the western portion of the Arizona Complex, but also includes portions of California State Highways 86 and 111. Rail and airline service are also described in Section 3.3.3.1. Communities that are likely sources of commuters include Yuma, Arizona (1980 census population of 42,433) and El Centro, California (23,996). El Centro is the largest of a group of adjacent communities (including Brawley, Calexico, Calipatria, Holtville, and Imperial) with a combined 1980 population of 63,840.

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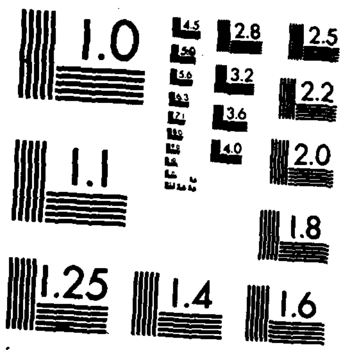

ICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

3.4 Land Use

Deployment of the Small Intercontinental Ballistic Missile (ICBM) could directly affect existing land uses that may be important to the local economy and general welfare, or alter existing visual characteristics of the natural environment. Population increases as a result of the proposed project could also indirectly change existing land use and recreation patterns of a region. The land use resource consists of three elements: land use and status, regional recreation, and visual resources.

3.4.1 Resource Description

Land Use and Status. The land use and status element consists of five subelements: onbase land use, onbase land status, offbase land use, offbase land status, and offbase plans and policies. The onbase land use analysis evaluated the existing land uses on the potential Main Operating Bases (MOBs) for all three basing modes, and the deployment installations for the Hard Mobile Launcher in Random Movement basing mode, particularly lands outleased for nonmilitary uses. The onbase land status analysis evaluated the ownership status of installation lands including lands owned in fee, leased, or withdrawn from the public domain (i.e., Bureau of Land Management [BLM] land) for military purposes, and fee and withdrawn lands of other federal agencies. Agricultural land use was used as an indicator of the overall impact to offbase land use. The offbase land use analysis evaluated land uses in four categories: irrigated agriculture, nonirrigated agriculture, rangeland, and urban disturbed land. The offbase land status analysis evaluated ownership status in six categories: private land, military land, American Indian reservation land, public domain land, other federal land (e.g., National Park Service [NPS] or U.S. Forest Service [USFS]), and state, local, and other lands. Onbase land currently managed under co-use agreements between the Department of Defense/Department of Energy (DOD/DOE) and other federal and state agencies, and offbase land managed by other federal agencies for national purposes with the exception of BLM public domain land not under consideration for wilderness designation, were evaluated as special status lands. These lands include national wildlife refuges, state wildlife areas and ecological reserves, agricultural experimental ranges, and national forests. The BLM and USFS lands under consideration for wilderness designation (i.e., wilderness study areas and proposed wilderness areas) were identified. The offbase plans and policies analysis evaluated local plans describing preferred locations for various types of land use (e.g., residential, industrial, commercial, and open space), and the local policies describing the means for accomplishing the spatial relationships proposed in the plans.

Regional Recreation. For this analysis, regional recreation is defined as participation in outdoor activities dependent upon or enhanced by natural surroundings or resources (e.g., lakes or forests). Recreation use at developed sites, specifically public campground facilities, was used as an indicator of the overall impact to regional recreation. Dispersed recreation (i.e., recreation that occurs outside of developed sites) was not specifically analyzed, but was considered in the evaluation of the overall availability of regional recreation opportunities.

Visual Resources. For this analysis, visual resources are defined as the characteristics or qualities of the environment and landscape in the vicinity of the deployment areas that can be seen by people traveling on public highways. A broad overview of the visual environment within defined viewshed areas is provided for each region.

3.4.2 General Analysis Methodology

Region of Influence. The Region of Influence (ROI) for the land use and status element consists of the base or bases under consideration for each basing mode location. For the Hard Mobile Launcher at Minuteman Facilities and Hard Silo in Patterned Array basing modes, the ROI also includes the counties where offbase deployment is proposed. Land use plans and policies were reviewed for those counties and cities where the MOB is located or where a majority of the project-induced population could be expected to reside. The ROI for the regional recreation element includes federal, state, and regionally managed recreation areas within an approximate 150-mile travel distance from the population centers projected to receive a majority of the project-induced inmigration. The ROI for the visual resources element consists of those portions of the Random Movement Areas (RMAs) (for the Hard Mobile Launcher in Random Movement basing mode), Minuteman facilities (for the Hard Mobile Launcher at Minuteman Facilities basing mode), or Suitable Deployment Areas (SDAs) (for the Hard Silo in Patterned Array basing mode) that are within 5 miles on either side of state and federal highways.

Land Use and Status. Onbase land use data sources included tabular information, use descriptions, and maps showing the location of onbase land uses. Existing and projected conditions for onbase land use and land status were determined from base master plans and real property utilization surveys, which were obtained from base civil engineering and real property offices. Onbase land status data were used to determine the acreage and percentage breakdowns for ownership of land within each base, including special status lands.

Offbase land use data were acquired to determine the acreage, percentage, and distribution of irrigated agricultural land, nonirrigated agricultural land, rangeland, and urban disturbed land adjacent to the transporter/erector (T/E) routes for the Hard Mobile Launcher at Minuteman Facilities basing mode or within a 50-mile radius of the MOB for the Hard Silo in Patterned Array basing mode. Locations and boundaries of agricultural land were determined through interpretation of Multi-Spectral Scanning and Thematic Mapping imagery. Prime and important farmland information was evaluated, but because of its relationship to soil associations, is discussed in Section 3.9, Geology and Soils. Offbase land status data were collected for the Hard Silo in Patterned Array basing mode on a countywide basis for all counties whose boundaries included any SDA lands. Baseline data were obtained from the BLM, Bureau of Reclamation, and state agency reports and statistical abstracts. Land status data were quantified into the six categories, each detailing acreages, and county and ROI percentages. Offbase land use plans and policies for local jurisdictions in the MOB counties were reviewed to identify how the plans and policies will affect future land use patterns, and how potential offbase effects of the proposed project may conflict with them. Not all of the jurisdictions in each region have adopted land use plans and policies, and some plans are more comprehensive than others.

To provide a general overview of the land use patterns in each region, the discussions include descriptions of the sizes of the communities within each region. Towns and cities are described as small (populations less than 2,500), medium (populations 2,500 to 50,000), and large (populations greater than 50,000). Likewise, rural population densities are described as low (less than 5 persons per square mile [sq mi]), moderate (5-10 persons per sq mi), and high (over 10 persons per sq mi).

Regional Recreation. Regional recreation information pertaining to available facilities (e.g., number of campsites) and visitation data were collected for each ROI from federal, state, and regional park and recreation agencies. The ratio of current campground use (in campsite-nights) to the existing theoretical campsite-night capacity (i.e., use-to-capacity ratio) was determined for each ROI. A campsite-night is the use of one campsite by a camping party overnight. The use-to-capacity ratio represents a measure of campground occupancy on an annual basis or, for those areas where campgrounds are not open year-round, during the managed use season. Since the temporal distribution of recreation use generally is uneven (i.e., concentrated on weekends, particularly holiday weekends, and low during the middle of the week), a use-to-capacity ratio of 35 to 40 percent would represent near capacity or capacity use on weekends (Friday through Sunday) and lower use on weekdays. Generally, it can be assumed that recreation areas with use-to-capacity ratios greater than 35 to 40 percent will be less capable of absorbing increased usage, since the additional recreation use will most likely occur seasonally and on holiday weekends. Dispersed recreation was analyzed to determine the availability of such recreation opportunities, and is reported as an estimate of the total camping (i.e., dispersed and developed) that occurs within each ROI. To determine projected conditions, it was assumed that recreation use will increase at a rate proportional to regional population growth. Campsite-night capacity was assumed to remain constant throughout the analysis period.

Visual Resources. The visual resources analysis concentrated on the exposure of the deployment areas to public view within specified viewshed areas, and the sensitivity of these areas to potential project-related visual intrusions. Viewshed areas in each region were determined by measuring the amount of land suitable for proposed project deployment (or number of Minuteman facilities) within 5 miles of either side of federal and state highways. Scenic highways (as identified in various atlases) and areas of special visual quality in the deployment areas were identified and measured. Special visual quality areas include landscapes consisting of landforms and/or vegetation that display dramatic quality or variety, richness in detail and texture, and that may be unusual or interesting within a region. The number of potential highway viewers of the viewshed areas was developed in the transportation analysis through calculations of average annual daily traffic (AADT). Because no other projects of sufficient size that could affect the existing visual landscape are proposed in the various ROIs, it was assumed that the visual environment in these areas will remain essentially unchanged. However, the AADT does change from year to year. Because these estimated changes in future AADT are all low (0.3-2.9%), and because the increases would have a nearly equal effect on all locations for each basing mode, the AADT values used in this study are for the most recent (1983) commonly available data.

3.4.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

Existing and projected conditions are described in the following sections for each Hard Mobile Launcher in Random Movement alternative location. Table 3.4.3-1 provides a summary of land use and status and regional recreation data for each location.

3.4.3.1 Arizona Complex

The Arizona Complex, located in southwest Arizona, is characterized by typical Sonoran Desert topography with wide, flat valleys transected by deep washes and low, rocky mountain ranges. Vegetation in the valleys is predominantly creosote bush, white bursage, and other varieties commonly found in areas with a dry climate and gravelly soil. Only about 20 percent of the land in the area is privately owned; ranches are generally large and the rural population density is low. Most of the towns are located near Interstate 8 and have populations under 500. Gila Bend Air Force Auxiliary Field (AFAF), located south of the town of Gila Bend in southwestern Maricopa County, consists of approximately 1,900 acres of withdrawn public domain land and is primarily used for emergency aircraft service for the adjacent Luke Air Force Range (AFR). Luke AFR, located in portions of Maricopa, Pima, and Yuma counties, contains approximately 2,669,200 acres (98% DOD withdrawn public domain land and 2% leased land) and is primarily used for bombing and gunnery ranges. Special status lands include the Cabeza Prieta National Wildlife Refuge, portions of which are under consideration for wilderness designation by the U.S. Fish and Wildlife Service (USFWS). The refuge, located in the south-central portion of Luke AFR, occupies approximately 31 percent (825,000 acres) of the range. In addition to this area, plans to expand the wildlife refuge to the west and to the north have been proposed, but no definitive action has been taken. Yuma Proving Ground (PG), located in Yuma and La Paz counties about 20 miles northeast of the city of Yuma, occupies approximately 838,200 acres (99% DOD withdrawn public domain land and 1% leased land) and is primarily used for weapons testing. No future onbase land use changes are proposed for Gila Bend AFAF.

Future onbase land uses at Luke AFR include construction of an outlying airfield in the western portion of the range and the installation of the Luke Air Combat Maneuvering Instrumentation System in the eastern portion. Congress has approved the transfer of approximately 27,000 acres of withdrawn public domain land at Yuma PG back to the BLM. Although Maricopa County has not adopted a land use plan for the area around Gila Bend, zoning restricts lot sizes to 1 acre. The town has recently adopted a general plan that provides for growth from the current population of approximately 2,000 to over 22,000. The growth will primarily be directed to the area between Interstate 8 and Arizona State Highway 85. Yuma County is currently in the process of developing a general plan. The City of Yuma has already adopted such a plan which directs most future lower density residential development to the west side of the city, and higher density development several miles east of the city in the Arizona Western College area.

Table 3.4.3-1

SUMMARY OF LAND USE DATA
FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT
ALTERNATIVES

	Complex					
	Arizona	Florida	Nevada	New Mexico	South-Central California	Washington
Land Use and Status						
Complex Area (acres)[1]	3,507,400	463,600	3,865,800	3,045,300	2,076,700[a]	620,500
Special Status Lands (acres)[2]	825,400	0	1,422,850	283,850	0	151,400
Regional Recreation						
Campgrounds	49[b]	42	38	36	258	233
Campsites	2,020[b]	2,010	4,030	1,090	8,970	7,050
Campsite-Night Capacity[3]	653,600[b]	730,400	1,080,600	301,700	2,542,300	1,523,200
Campsite-Night Use[4]	175,200[b]	219,800	289,300	102,100	720,300	433,200
Use-to-Capacity Ratio (%)	26.8%	30.1%	26.8%	33.8%	28.3%	28.4%

Notes: [1]Total acreage of all deployment installations in complex. Data derived from base real property offices.

[2]Total acreage of special status lands within deployment installations.

[3]Number of campsites available on an annual basis (campsites x managed use season days).

[4]Number of campsites used on an annual basis (based on 4 persons per campsite).

[a]With Edwards AFB as the MOB, the complex consists of China Lake NWC, Edwards AFB, and Fort Irwin NTC. With Fort Irwin NTC as the MOB, the complex area is 2,672,900 acres, consisting of China Lake NWC, Edwards AFB, Fort Irwin NTC, and Twentynine Palms MCAGCC.

[b]Number of campgrounds and campsites, and campsite-night capacity and use for the Gila Bend AFAF ROI. For the Yuma PG ROI, there are 16 campgrounds and 2,260 campsites, and campsite-night capacity and use values are 802,100 and 178,800, respectively. The use-to-capacity ratio is 22.3 percent.

All data (except campgrounds) have been rounded to nearest 100 or 10, and all percentages to the nearest one-tenth of 1%.

With Gila Bend AFAF as the MOB, regional recreation areas in the ROI include Organ Pipe Cactus National Monument; portions of the Coronado, Prescott, and Tonto national forests; and six state parks and recreation areas in Arizona and California, including Painted Rocks State Park near Gila Bend. The current campground use-to-capacity ratio is 26.8 percent and is projected to be 41.1 percent in 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 50 percent of the total camping in the ROI. With Yuma PG as the MOB, regional recreation areas in the ROI include the Cleveland National Forest, two BLM recreation sites, four California state parks and recreation areas, and four Arizona state parks. The current campground use-to-capacity ratio is 22.3 percent and is projected to be 27.8 percent in 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 75 percent of the total camping in the ROI.

Areas of special visual quality in the Gila Bend AFAF area are found in the vicinity of Painted Rocks State Park, north of Interstate 8. There are no designated scenic highways in the area. Transmission line corridors traverse the deployment area, primarily along Interstates 8 and 10 and Arizona State Highways 85 and 95. In the Yuma PG area, areas of special visual quality are found in the vicinity of the Colorado River, the Muggins and Castle Dome mountains north of Interstate 8, and Wellton Valley, south of Interstate 8. There are no scenic highways in the area. Transmission line corridors traverse the central portion of the deployment area along Arizona State Highway 95.

3.4.3.2 Florida Complex

The Florida Complex, located in the Florida Panhandle, is characterized by gently rolling terrain that is heavily wooded with hardwood and pine forests and interspersed by many lakes and streams. Approximately 86 percent of Eglin Air Force Base (AFB) is forestland. The area adjoins the Pensacola and Choctawhatchee bays on the Gulf of Mexico; therefore, most land is at, or near, sea level. Most of the land is privately owned and the area has many small to medium-sized towns. Eglin AFB, located about 40 miles east of the city of Pensacola (population about 58,000), occupies portions of Okaloosa, Santa Rosa, and Walton counties. The base consists of approximately 463,600 acres (71% DOD fee-owned and 29% DOD withdrawn public domain land) and is used for weapons testing and evaluation and air-sea rescue operations. Proposed future onbase land uses include testing of sea-launched cruise missiles and development of the Strategic Defense Initiative. Okaloosa County's comprehensive plan was adopted in 1981 and contains an analysis of existing conditions, goals, and objectives. The cities of Fort Walton Beach, Niceville, Crestview, Mary Esther, and Valparaiso have also adopted land use plans. These cities encourage development at Eglin AFB and the plans provide for the continued expansion of each city's infrastructure to absorb population increases.

Regional recreation areas in the ROI include Gulf Islands National Seashore, the Apalachicola and Conecuh national forests, an Army Corps of Engineers (COE) water resources project, and 18 state parks, recreation areas, and forests in Florida, Alabama, and Georgia. The current campground use-to-capacity ratio is 30.1 percent and is projected to be 37.7 percent in 1998. Dispersed recreation accounts for an estimated 2 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of Choctawhatchee Bay, east of Eglin AFB. The only scenic highway in the area is U.S. 98 with an AADT range from 13,400 between Navarre and Mary Esther to 24,350 near Pensacola.

3.4.3.3 Nevada Complex

The Nevada Complex, located in south-central Nevada, is characterized by typical basin and range topography and is dominated by creosote bush. Because of the minimal amount of privately owned land and the presence of only a few small towns in the area, the population density around the bases (other than Nellis AFB) is low. Indian Springs AFAF, located approximately 40 miles northwest of the Las Vegas metropolitan area (population about 370,000) in northwest Clark County, provides aircraft emergency service, gunnery range maintenance, and associated support facilities for the adjacent Nellis AFR. The base consists of 2,300 acres (90% DOD withdrawn public domain land and 10% DOD fee-owned land). Nellis AFB, located near Las Vegas in east-central Clark County, is used for tactical fighter training and contains 11,300 acres (59% DOD withdrawn public domain land and 41% DOD fee-owned land). Nellis AFR, located in portions of Clark, Lincoln, and Nye counties, is used primarily for training combat air crews and weapons testing and occupies approximately 3,001,800 acres (over 99% DOD withdrawn public domain land). Special status lands include portions of the Desert National Wildlife Range, a proposed wilderness area managed by the USFWS located within the South Range, and the Nevada Wild Horse Range, under the administration of the U.S. Air Force and jurisdiction of the BLM, located primarily in the North Range. The wildlife range consists of approximately 946,600 acres and the wild horse range contains approximately 476,250 acres. The Nevada Test Site, located in southeastern Nye County, is used for nuclear and nonnuclear weapons testing and occupies approximately 864,000 acres of DOE withdrawn public domain land. A portion of the Nevada Wild Horse Range (approximately 20,000 acres) is within the northern portion of the Pahute Mesa area. No future onbase land use changes are proposed for Indian Springs AFAF. Proposed onbase land use changes at Nellis AFB include the construction and upgrade of various support facilities; at Nellis AFR, the proposed designation of a portion of the Desert National Wildlife Range as a wilderness area, the renewal of the temporary withdrawal of 89,600 acres of the Groom Mountain Range, and the proposed withdrawal of 47,476 acres within the Desert National Wildlife Range; and at the Nevada Test Site, the addition of a Liquefied Gaseous Fuels Spill Test facility and a device assembly building. In addition, the Yucca Mountain Site, located in portions of Nellis AFR and the Nevada Test Site, is one of three candidates under investigation as a site for a commercial spent nuclear fuel and high-level radioactive waste repository. Clark County has adopted a comprehensive general plan for the private land in the unincorporated parts of the county that maximizes use of existing public services and assures land use patterns that will result in the most efficient use of fiscal resources. Both the BLM and USFS have developed land resource management plans for the areas of the county under their jurisdictions. The City of Las Vegas has also adopted a comprehensive general plan.

Regional recreation areas in the ROI include Lake Mead National Recreation Area, Zion National Park, Death Valley National Monument, the Toiyabe and Dixie national forests, and five Nevada state parks. The current campground use-to-capacity ratio is 26.8 percent and is projected to be 41 percent

in 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 40 percent of the total camping in the ROI.

No areas of special visual quality are found in the vicinity of the Nevada Complex. The only scenic highway in the area is U.S. 95, with an AADT range from 1,360 south of Goldfield to 3,140 near Indian Springs. A transmission line corridor traverses U.S. 93 near Nellis AFR.

3.4.3.4 New Mexico Complex

The New Mexico Complex, located in south-central New Mexico and west Texas, is characterized by broad desert basins and high mountain ranges. Typical vegetation includes yucca, mesquite, and creosote bush. Land use in the area is characterized by large ranches and a low rural population density. Approximately one-third of the land in the area is privately owned. Except for El Paso and Las Cruces (populations of 425,000 and 45,000, respectively), towns in the region are small to medium-sized and are mainly located near Interstate 10. Fort Bliss, located in portions of El Paso County in Texas and Dona Ana and Otero counties in New Mexico, consists of approximately 1,119,800 acres (75% DOD withdrawn public domain land, 21% DOD fee-owned land, 2% leased land, and 2% USFS land) and is primarily used for field training and maneuver areas. Special status lands include a portion of the Lincoln National Forest (18,004 acres), located in the northeast part of McGregor Range. Approximately 515,000 acres in the eastern portion of McGregor Range are presently co-used by BLM, of which 271,000 acres are outleased for livestock grazing. Holloman AFB, located in west-central Otero County, consists of approximately 50,886 acres (82% DOD withdrawn public domain land, 12% leased land, and 6% DOD fee-owned land) and contains support facilities for a Tactical Air Command (TAC) mission. White Sands Missile Range, located in portions of Dona Ana, Otero, Lincoln, Sierra, and Socorro counties, occupies approximately 1,874,700 acres (70% DOD withdrawn public domain land, 4% leased land, 6% USFWS and U.S. Department of Agriculture [USDA] land, and 20% DOD fee-owned land) and is primarily used for firing ranges and impact areas. Special status lands include the eastern portion of the Jornada Experimental Range (84,000 acres), which is administered by the USDA and located in the southwestern portion of the range; the San Andres National Wildlife Refuge (57,200 acres), administered by the USFWS and located in the southwestern part of the range; and White Sands National Monument (142,650 acres), administered by the NPS and located in the south-central part of the range. Proposed future onbase land use changes include the construction of new facilities within the cantonment areas at each of the New Mexico Complex installations. Otero County does not have a general plan, but the City of Alamogordo does. It designates appropriate locations for city expansion and future land uses. The plan proposes annexation of land outside the city before development begins. El Paso and Dona Ana counties, the respective locations of Fort Bliss and White Sands Missile Range Headquarters, have adopted general plans that encourage the continuation of agriculture and infilling of urban areas. Although the City of El Paso has not adopted a citywide comprehensive general plan, the plan that is proposed would direct urban growth toward the north side of the city and to the eastern mesa land. The City of Las Cruces (Dona Ana County) has adopted a general plan that promotes retention of the community's image as a small town.

Regional recreation areas in the ROI include the Lincoln and Gila national forests, Three Rivers Petroglyph and Aguirre Springs national recreation areas, Guadalupe Mountains National Park, and ten state parks in New Mexico and Texas, including Elephant Butte Lake and Caballo Lake state parks, north of Las Cruces. The current campground use-to-capacity ratio is 33.8 percent and is projected to be 48.1 percent by 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 40 percent of the total camping in the ROI.

Areas of special visual quality are located in the vicinity of White Sands National Monument and the Sacramento and Organ mountains, between Alamogordo and Las Cruces. Scenic highways in the area include U.S. 54 and 70/82, with AADTs ranging from 3,300 along U.S. 70/80 near Las Cruces to 11,900 on U.S. 54 near Alamogordo. Transmission line corridors traverse the central portion of the region along Interstate 10, U.S. 54, and U.S. 70.

3.4.3.5 South-Central California Complex

The South-Central California Complex is characterized by the rolling terrain of the Mojave Desert and surrounded by high, barren mountains. Typical vegetation includes Joshua tree forests, creosote, and saltbush. Cropland is primarily found near riverbeds, and most of the area is low-density rangeland. Less than half of the land in the area is privately owned, and ranches are generally large. Most towns are medium-sized (2,500-50,000), and the rural population density is high. China Lake Naval Weapons Center (NWC), located in portions of Inyo, Kern, and San Bernardino counties, contains approximately 1,096,500 acres (92% DOD withdrawn public domain land and 8% DOD fee-owned land) and is mainly used for research, development, testing, and evaluation of air warfare and missile weapon systems. Over 98,000 acres of outleased land are available for livestock grazing within the southern portion of the Mojave B South Range. The leases are presently inactive. A review is being conducted concerning the continuation of grazing leases in the northern portion of the China Lake Complex, but, as yet, there has been no decision made. Edwards AFB, located in portions of Kern, Los Angeles, and San Bernardino counties, consists of approximately 300,700 acres (73% DOD fee-owned land and 27% DOD withdrawn public domain land) and is primarily used for the testing of aircraft and related avionics and weapon systems. Fort Irwin National Training Center (NTC), located in San Bernardino County adjacent to China Lake NWC, occupies approximately 679,500 acres (91% DOD withdrawn public domain land, 6% outgranted DOD withdrawn public domain land, and 3% leased land) and is primarily used for ground combat training and air-to-ground training. Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC), located in San Bernardino County, consists of approximately 596,300 acres (79% DOD withdrawn public domain land and 21% DOD fee-owned land) and is primarily used for ground combat training and air-to-ground training. Proposed onbase land use changes at China Lake NWC include the withdrawal of 8,320 acres of BLM land adjacent to the Randsburg Wash Test Range for use as a security zone; at Edwards AFB, the technical modification and improvement of the Edwards Flight Test Range; at Fort Irwin NTC, the acquisition of 226,000 acres of BLM and private land for an additional combat-maneuver area and the purchase of approximately 22,000 acres of California state school lands within the installation; and at Twentynine Palms MCAGCC, the construction of administrative, housing, and community support facilities. The four counties where the installations are located have

adopted plans and policies for the development of land in the vicinity of the respective bases. Plans for the nearby cities of Barstow, Lancaster, and Palmdale encourage use of already-serviced vacant land and acreage-sized lots at their city limits. Portions of the RMAs, located on the east boundary of Fort Irwin NTC, the east boundary of Twentynine Palms MCAGCC, and the south boundary of China Lake NWC, adjoin areas designated by the BLM California Desert Conservation Area Plan for limited multiple uses. Limited-use class lands are managed to provide for generally lower intensity uses to protect sensitive, natural, scenic, ecological, and cultural resource values.

Regional recreation areas in the ROI include portions of six national forests (Angeles, Cleveland, Inyo, Los Padres, San Bernardino, and Sequoia), two Army COE water resources projects, Joshua Tree National Monument, and eight California state parks and recreation areas. The current campground use-to-capacity ratio is 28.3 percent and is projected to be 32.7 percent by 1998. Dispersed recreation on BLM, national forest, and state park lands accounts for an estimated 50 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of the Los Angeles Aqueduct, west of U.S. 395 near China Lake NWC. Scenic highways in the area have AADTs ranging from 5,300 on U.S. 395 north of Inyokern to 20,000 on California State Highway 58 near Mojave. Transmission line corridors traverse the entire region, primarily along Interstates 15 and 40, U.S. 395, and California State Highways 14, 18, 58, and 138. The Analytical/Environmental Assessment Report, National Training Center, Fort Irwin, California (U.S. Army COE 1984) states that the northeast slopes of the Avawatz Mountains (northeast portion of the base) should not be used by tracked or wheeled vehicles (except on established roads) in order to avoid possible conflict with the BLM California Desert Conservation Area Plan recommendations relating to the visual resources of both the Avawatz Mountains and the Death Valley National Monument.

3.4.3.6 Washington Complex

The Washington Complex, located in south-central Washington, is characterized by rolling grassland and farmland. Most of the land is privately owned and the rural population density is moderate. Towns in the area are generally located near Interstate 82/U.S. 12 and are medium-sized, with agriculture forming the economic base. The DOE Hanford Site, located north of the city of Richland in portions of Adams, Benton, Franklin, and Grant counties, occupies approximately 359,100 acres (82% DOE fee-owned land, 17% BLM land, and 1% Bureau of Reclamation withdrawn public domain land) and is used primarily for nuclear research and materials production. Special status lands include the Wahluke Slope State Wildlife Recreation Area (54,000 acres), managed by the Washington State Department of Game, and the Saddle Mountain National Wildlife Refuge (32,000 acres), managed by the USFWS. Both are located north of the Columbia River. In addition, the Arid Lands Ecology Reserve (75,400 acres), managed by the DOE, is located in the western portion of the installation. Yakima Firing Center (FC), located near the city of Yakima in portions of Kittitas and Yakima counties, contains approximately 261,500 acres (89% DOD fee-owned land and 11% DOD withdrawn public domain land) and is used primarily for military training and troop maneuver areas. In addition, Yakima FC outleases approximately 200,000 acres for livestock grazing. Proposed onbase land use changes at the DOE Hanford Site include the siting of a hazardous

waste disposal facility in the south-central portion of the installation on State of Washington fee-owned land. The DOE Hanford Site is also one of three designated candidate sites under consideration for a commercial spent nuclear fuel and high-level radioactive waste repository. The repository is proposed to be located in the west-central portion of the installation on DOE fee-owned and withdrawn public domain land. At Yakima FC, proposed onbase land use changes include development of a multipurpose range complex. Both Yakima County and the cities of Yakima and Union Gap have general plans that promote the preservation of agriculture and encourage future development where public services already exist.

Regional recreation areas in the ROI include Mount Rainier National Park, Coulee Dam National Recreation Area, portions of 4 national forests (Wenatchee, Mount Baker-Snoqualmie, Mount Hood, and Gifford Pinchot), 4 Army COE water resources projects, 3 Oregon state parks, and 21 Washington state parks, including Yakima Sportsman State Park near Yakima. The current campground use-to-capacity ratio is 28.4 percent and is projected to be 33.3 percent in 1998. Dispersed recreation on BLM, national forest, and state land accounts for an estimated 50 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of the Saddle Mountain National Wildlife Refuge, north of Washington State Highway 24. The only scenic highway in the area is Interstate 82, with an AADT of approximately 13,400 north of Yakima. A transmission line corridor traverses the western portion of the deployment area along Interstate 82.

3.4.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

Existing and projected conditions are described in the following sections for each Hard Mobile Launcher at Minuteman Facilities alternative location. Table 3.4.4-1 provides a summary of land use and status and regional recreation data for each location.

3.4.4.1 Ellsworth Air Force Base

The Ellsworth AFB deployment area, located in western South Dakota, is characterized by relatively flat grassland used for grazing, with deciduous trees found in riparian areas. Most of the land is privately owned with moderately large farms (500 to 1,500 acres), and the rural population density is low. Except for Rapid City (population about 46,000), the towns in the area are small and generally located near Interstate 90. Ellsworth AFB, occupying 4,858 acres northeast of Rapid City in Meade and Pennington counties, is responsible for the maintenance and support of 150 Minuteman II launch facilities and 15 launch control facilities scattered over approximately 13,500 sq mi. Land onbase is entirely DOD fee owned. The base outleases approximately 1,750 acres for agricultural uses. Land uses adjacent to the base are primarily agricultural with some residential and commercial development. Offbase land use in the vicinity of the Minuteman facilities is predominantly agricultural. Future onbase land use changes include the introduction of the B-1B bomber mission. Although Pennington County does not have a general plan, it controls development with zoning. In 1981, Rapid City adopted a comprehensive plan that applies to the city as well as to unincorporated areas within 3 miles of the city's limits. A 1960s plan covering the

Table 3.4.4-1

SUMMARY OF LAND USE DATA FOR THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES

	Main Operating Bases					
	Ellsworth AFB	F.E. Warren AFB	Grand Forks AFB	Malmstrom AFB	Minot AFB	Whiteman AFB
Land Use and Status						
Base Area (acres)[1]	4,858	5,866	4,830	3,659	5,381	3,737
ROI Land Area (sq mi)	15,900	15,600	12,900	23,600	14,200	9,500
ROI Farmland (sq mi)	13,400	14,000	12,100	17,600	12,600	7,000
Regional Recreation						
Campgrounds	51	103	50	61	35	71
Campsites	2,120	3,310	2,050	1,628	1,520	7,940
Campsite-Night Capacity[2]	356,600	653,100	290,700	208,600	225,900	1,557,600
Campsite-Night Use[3]	91,300	202,600	64,500	38,700	54,900	459,800
Use-to-Capacity Ratio (%)	25.6%	31.0%	22.2%	18.6%	24.3%	29.5%

Notes: [1] Data derived from base real property offices.

[2]Number of campsites available on an annual basis (campsites x managed use season days).

[3]Number of campsites used on an annual basis (based on 4 persons per campsite).

All data (except base area and campgrounds) have been rounded to nearest 100 or 10, and all percentages to the nearest one-tenth of 1%.

city itself is being updated. Although some growth has taken place in the direction of Ellsworth AFB, the plans propose that future residential/commercial development be located south and east of the city, away from the base.

Regional recreation areas in the ROI include the Black Hills National Forest, Badlands National Park, Wind Cave National Park, two Army COE water resources projects, and ten state parks and recreation areas located in South Dakota, Nebraska, and Wyoming, including Custer State Park and Angostura State Recreation Area near Rapid City. The current campground use-to-capacity ratio is 25.6 percent and is projected to be 29.7 percent in 1998. Dispersed recreation accounts for an estimated 2 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of Badlands National Park and the Black Hills National Forest. Scenic highways in the area include Interstate 90, U.S. 85, and South Dakota State Highway 240, with AADTs ranging from 600 along U.S. 85 near Spearfish to 6,360 on Interstate 90 near Sturgis. Transmission line corridors traverse the western and southern portions of the deployment area near Interstate 90 and U.S. 14 and 85.

3.4.4.2 F.E. Warren Air Force Base

The F.E. Warren AFB deployment area, located in southeastern Wyoming, southwestern Nebraska, and northern Colorado, is characterized by rolling to moderately steep terrain covered with native, short grassland used primarily for grazing. Deciduous trees are found in riparian areas, with conifers found in the western higher elevations. Most of the land is privately owned with relatively large farms and ranches (over 1,500 acres). The rural population density is low and most towns, generally located near Interstates 25 and 80, are small, with the exception of Cheyenne (population about 50,000). F.E. Warren AFB, consisting of 5,866 acres located in Laramie County, is responsible for the maintenance and support of 200 Minuteman III launch facilities and 20 launch control facilities scattered over approximately 12,600 sq mi. Fifty Minuteman missiles are in the process of being replaced by Peacekeeper missiles. Land onbase is entirely DOD fee owned. Approximately 2,500 acres of the base is used for horse grazing areas. Offbase land to the west is used for grazing, and there are residential areas to the east. Offbase land use in the vicinity of the Minuteman facilities is predominantly agricultural. Current onbase land use changes include the addition of 15 structures associated with the Peacekeeper missile program. Laramie County's general plan supports continued agriculture in its unincorporated areas. The City of Cheyenne's plan gives emphasis to infill development and maintenance of agriculture on land best suited for this purpose.

Regional recreation areas in the ROI include portions of the Medicine Bow, Routt, and Roosevelt national forests; Rocky Mountain National Park; and 13 state parks and recreation areas in Wyoming, Colorado, and Nebraska, including Curt Gowdy State Park near Cheyenne. The current campground use-to-capacity ratio is 31 percent and is projected to be 44.9 percent in 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 30 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of the Pawnee National Grassland in northeast Colorado and the Wildcat Hills, north of Nebraska State Highway 71. Scenic highways in the area include U.S. 26 and 30, Nebraska State Highway 71, and Wyoming State Highways 34 and 210, with AADTs ranging from 680 along Wyoming State Highway 34 near its intersection with Interstate 25 to 4,830 on U.S. 26 west of Scottsbluff, Nebraska. Transmission line corridors traverse the Nebraska and Colorado portions of the deployment area along Interstate 80, U.S. 85, Nebraska State Highway 19, and Colorado State Highway 118 (southerly extension of Nebraska State Highway 19).

3.4.4.3 Grand Forks Air Force Base

The Grand Forks AFB deployment area, located in northeastern North Dakota, is characterized by rolling terrain with short grassland and cropland. Most of the land is privately owned with medium-sized farms and ranches (500 to 1,500 acres). Grand Forks (population about 45,000) is the only large urban area in the region. Most towns are small and located near U.S. 2. Grand Forks AFB, occupying 4,830 acres west of Grand Forks in Grand Forks County, is responsible for the maintenance and support of 150 Minuteman III launch facilities and 15 launch control facilities scattered over approximately 7,500 sq mi. Land onbase is entirely DOD fee owned. The base outleases

approximately 1,100 acres for agricultural uses. Offbase land use is predominantly agricultural, both adjacent to the base and in the vicinity of the Minuteman facilities. Future onbase land use changes include the introduction of the B-1B bomber mission. Although Grand Forks County does not have a general plan, the City of Grand Forks adopted a plan in 1980. Most residential and commercial development is directed toward the southwest part of the city.

Regional recreation areas in the ROI include the Chippewa National Forest, four Army COE water resources projects, nine Minnesota state parks, three Minnesota state forests, and three North Dakota state parks, including Turtle River State Park near Grand Forks. The current campground use-to-capacity ratio is 22.2 percent and is projected to be 26.0 percent in 1998. Dispersed recreation accounts for an estimated 2 percent of the total camping in the ROI.

No areas of special visual quality are found in the vicinity of the Grand Forks AFB deployment area. Scenic highways in the area include Interstate 94, U.S. 2, and North Dakota State Highways 17, 18, and 32, with AADTs ranging from 600 on North Dakota State Highway 32 in the vicinity of Fordville to 5,990 along Interstate 94 east of Valley City. Transmission line corridors traverse the central portion of the deployment area between Grand Forks and Cooperstown, and between Devils Lake and Langdon in the northwest portion.

3.4.4.4 Malmstrom Air Force Base

The Malmstrom AFB deployment area, located in west-central Montana, is characterized by gently rolling terrain covered with native, short grassland used for grazing, with steeper slopes toward the southwest. Vegetation includes short grassland and dispersed stands of deciduous and coniferous trees. The rural population density is low and most of the land is privately owned with many large farms and ranches. Great Falls (population about 57,000) is the only large city in the region. Most towns are small and generally located near Interstate 15 and U.S. 2, 87, and 89. Malmstrom AFB, consisting of 3,659 acres located east of the city of Great Falls in northeastern Cascade County, is responsible for the maintenance and support of 150 Minuteman II and 50 Minuteman III launch facilities and 20 launch control facilities scattered over approximately 23,000 sq mi. Three Minuteman launch facilities are located within the Lewis and Clark National Forest. Approximately 86 percent of the land onbase is DOD fee owned, with the remainder leased/easement lands. The base outleases approximately 280 acres for a horse stables area, with an additional 100 acres proposed for use as grazing land. Offbase land use is predominantly agricultural, both adjacent to the base and in the vicinity of the Minuteman facilities. Some potential for commercial and industrial development exists north and south of the base. Future onbase land use changes include the introduction of a KC-135R tanker squadron mission. General plans for both the City of Great Falls and Cascade County describe goals and policies related to community development, including preservation of good agricultural soils and avoidance of flood zones.

Regional recreation areas in the ROI include portions of the Lewis and Clark, Deerlodge, Helena, and Lolo national forests, one Montana state park, and seven Montana state recreation areas. The current campground use-to-capacity ratio is 18.6 percent and is projected to be 20.7 percent in 1998. Dispersed

recreation on BLM, national forest, and state lands accounts for an estimated 50 percent of the total camping in the ROI.

Areas of special visual quality include the Little Belt Mountains southeast of Great Falls. Scenic highways in the area include Interstate 15, and U.S. 2, 87, and 89, with AADTs ranging from about 330 on U.S. 89 between the towns of Belt and Monarch to 24,600 on U.S. 87 east of Great Falls. Transmission line corridors traverse the entire deployment area, primarily along Interstate 15 and U.S. 87, 89, and 191.

3.4.4.5 Minot Air Force Base

The Minot AFB deployment area, located in northwestern North Dakota, is characterized by relatively flat to rolling terrain with native, short grassland and some small-grain cropland. The area is interspersed with lakes and streams in low-lying areas. Most of the land is privately owned, farms are medium-sized, and the rural population density is low. Most towns are small and located near Interstate 2 and U.S. 52 and 83. Minot AFB, consisting of 5,381 acres north of Minot in Ward County, is responsible for the maintenance and support of 150 Minuteman III launch facilities and 15 launch control facilities scattered over 8,000 sq mi. Approximately 88 percent of the land onbase is DOD fee owned, with the remainder easement lands. The base outleases approximately 1,100 acres for agricultural uses. Offbase land use is predominately agricultural, both adjacent to the base and in the vicinity of the Minuteman facilities. No future onbase land use changes are anticipated. Ward County does not have a general plan, but zoning restricts urban encroachment near Minot AFB. The City of Minot's general plan was adopted in 1969 and encourages new residential and commercial development in the city's northwest quadrant.

Regional recreation areas in the ROI include two Army COE water resources projects, Theodore Roosevelt National Park, a portion of the Custer National Forest, two North Dakota state forests, and six North Dakota state parks. The current campground use-to-capacity ratio is 24.3 percent and is projected to be 27.5 percent in 1998. Dispersed recreation accounts for an estimated 2 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of Lake Sakakawea and the Upper Souris National Wildlife Refuge. The scenic highways in the area include U.S. 83 and North Dakota State Highway 5, with AADTs ranging from 850 along North Dakota State Highway 5 in the vicinity of the Canadian border to about 2,600 along U.S. 83 near Minot. Transmission line corridors traverse the western portion of the deployment area along North Dakota State Highways 8 and 23, and in the eastern portion along North Dakota State Highway 41.

3.4.4.6 Whiteman Air Force Base

The Whiteman AFB deployment area, located in west-central Missouri, is characterized by rolling terrain with native, long grassland and hardwood forests in the riparian valleys. Cropland is found on the more level areas. Most of the land is privately owned, farms are relatively small, and the rural population density is low. Most of the towns are small to medium-sized and dispersed throughout the area. Whiteman AFB, consisting of 3,737 acres near Knob Noster in Johnson County, is responsible for the maintenance and support

of 150 Minuteman II launch facilities and 15 launch control facilities scattered over approximately 10,000 sq mi. Land onbase is approximately 90 percent DOD fee owned, with the remainder leased land. Offbase land use adjacent to the base and in the vicinity of the Minuteman facilities is predominantly agricultural. Future onbase land use changes include construction of dormitories, a missile maintenance complex heating plant, and a wing-consolidated control center. Johnson County does not have a general plan; however, the nearby cities of Knob Noster, Warrensburg, and Sedalia have adopted general plans. Warrensburg projects future growth to take place mainly to the north and east of the city.

Regional recreation areas in the ROI include 7 Army COE water resources projects, the Mark Twain National Forest, 3 Kansas state parks, and 16 Missouri state parks, including Knob Noster State Park adjacent to Whiteman AFB. The current campground use-to-capacity ratio is 29.5 percent and is projected to decrease to 29.0 percent in 1998. Dispersed recreation accounts for an estimated 5 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of U.S. 65, south of Sedalia. Scenic highways in the area include U.S. 24, 54, and 65, and Missouri State Highway 83, with AADTs ranging from 1,230 on Missouri State Highway 83 south of Warsaw to about 6,050 on U.S. 65 north of Sedalia. Transmission line corridors traverse the deployment area, primarily along U.S. 50 and Missouri State Highways 7 and 13.

3.4.5 Existing and Projected Conditions for Hard Silo in Patterned Array

Existing and projected conditions are described in the following sections for each Hard Silo in Patterned Array alternative location. Table 3.4.5-1 provides a summary of land use and status and regional recreation data for each location.

3.4.5.1 Davis-Monthan Air Force Base

The Davis-Monthan AFB region, located in south-central Arizona, is characterized by rugged mountains and high desert valleys with dense desert vegetation. The rural population density is low and ranches are generally large. Except for Tucson (population about 330,000), the region generally consists of small towns, mainly near Interstate 19. Davis-Monthan AFB, occupying 10,763 acres near Tucson in Pima County, is a multimission base used primarily for combat crew training by TAC, ground-launched cruise missile training operations, and DOD surplus aircraft storage. Davis-Monthan AFB is approximately 43 percent leased land, 36 percent DOD fee-owned land, and 21 percent DOD withdrawn public domain land. No special status lands exist within the base area. Future onbase land use changes at Davis-Monthan AFB include the possible disposal of approximately 160 acres of military land located along the southwestern boundary of the base. Offbase land use in the ROI is primarily rangeland with some irrigated cropland (approximately 3% of the total area), mainly along the Santa Cruz River. Within 50 miles of Davis-Monthan AFB, over 95 percent of the surrounding land is rangeland, with the remainder equally divided between irrigated cropland and urban disturbed land. A decrease in irrigated cropland is projected. Major land status categories within the ROI include American Indian and state, local, and other lands, accounting for approximately 50 percent of the area. Federal lands

Table 3.4.5-1

SUMMARY OF LAND USE DATA FOR THE HARD SILO IN PATTERNED ARRAY ALTERNATIVES

	Main Operating Bases					
	Davis-Monthan AFB	Edwards AFB	F.E. Warren AFB	Fort Bliss	Gila Bend AFAF	Yuma PG
Land Use and Status						
Onbase Area (acres)[1]	10,763	300,723	5,866	1,119,772	1,885	838,174
ROI Land Area (acres)[2]	17,064,600	20,744,700	2,818,600	10,254,700	18,754,000	9,362,300
Total Cropland[3] (%)	3.0%	5.4%	30.6%	1.7%	5.9%	8.1%
ROI Land Status (%)						
Private	21.1%	45.5%	89.7%	35.5%	18.3%	19.4%
Public Domain (BLM)	11.0	36.9	0.4	20.4	16.3	30.4
Military	1.0	6.0	0.2	18.4	11.9	19.9
Other Federal	18.8	7.3	0	8.3	19.2	19.7
Indian Reservation	25.0	0	0	4.5	18.5	2.6
State, Local, and Other	23.1	4.3	9.7	12.9	15.8	8.0
Regional Recreation						
Campgrounds	53	258	103	36	49	16
Campsites	1,690	8,970	3,310	1,090	2,020	2,260
Campsite-Night Capacity[4]	554,700	2,542,300	653,100	301,700	653,600	802,100
Campsite-Night Use[5]	153,500	720,300	202,600	102,100	175,200	178,800
Use-to-Capacity Ratio (%)	27.7%	28.3%	31.0%	33.8%	26.8%	22.3%

Notes: [1]Data derived from base real property offices.

[2]Total acreage of counties that contain SDA.

[3]Includes both irrigated and nonirrigated cropland.

[4]Number of campsites avai' le on an annual basis (campsites x managed use season days).

[5]Number of campsites used on an annual basis (based on 4 persons per campsite).

All data (except campgrounds) have been rounded to nearest 100 or 10, and all percentages to the nearest one-tenth of 1 percent.

within 50 miles of the base include portions of the Coronado National Forest, the USDA Santa Rita Experimental Range, five BLM wilderness study areas, one NPS and four USFS wilderness areas. Both the City of Tucson and Pima County have adopted land use plans. These plans restrict development to low-density residential use east of the base, to industrial use south of the base, and to medium-density residential development (about 5 units per acre) north of the base. The area west of the base is already urbanized.

Regional recreation areas in the ROI include the Coronado and Tonto national forests, Organ Pipe Cactus and Chiricahua national monuments, and six Arizona state parks, including Catalina State Park near Tucson. The current campground use-to-capacity ratio is 27.5 percent and is projected to be 39.3 percent in 1998. Dispersed recreation on BLM and national forest lands accounts for an estimated 60 percent of the total camping in the ROI.

Areas of special visual quality are found in the vicinity of the Saguaro National Monument; the Picacho Mountains, south of Florence; and the Coronado National Forest. Scenic highways in the area include Interstates 10 and 19, U.S. 80 and 89, and Arizona State Highway 82, with AADTs ranging from 1,100 on Arizona State Highway 82 near Patagonia to about 24,730 along Interstate 10 in the vicinity of Tucson. Transmission line corridors traverse the northwest and southeast portions of the deployment area along Interstates 8 and 10, U.S. 89, and Arizona State Highway 82.

3.4.5.2 Edwards Air Force Base

Onbase land use and status and regional recreation are discussed in Section 3.4.3.5. Offbase land use in the ROI is primarily rangeland, with scattered irrigated cropland along the Mojave River. Within 50 miles of Edwards AFB, approximately 93 percent of the land is rangeland, 5 percent is irrigated cropland, and 2 percent is urban disturbed land. A decrease in irrigated cropland is projected. Major land status categories within the ROI include private and BLM land, accounting for approximately 82 percent of the area. Federal lands within 50 miles of the base include the Sequoia, Angeles, and San Bernardino national forests, ten BLM wilderness study areas, and three USFS wilderness areas. Local plans and policies adopted by Los Angeles and Kern counties encourage the continuation of low-density residential development and growth in already urbanized areas. The SDA lands located northeast of Kramer Junction (intersection of U.S. 395 and California State Highway 58) consist of approximately 50 percent BLM land and are designated for limited-multiple use by the BLM California Desert Conservation Area Plan. Limited-use class lands are managed to provide for generally lower intensity use to protect sensitive, natural, scenic, ecological, and cultural resource values.

No areas of special visual quality are found in the vicinity of the deployment area. Scenic highways in the area include Interstate 15, U.S. 395, and California State Highways 2, 14, 18, and 58, with AADTs ranging from about 1,700 on California State Highway 138 west of Pinon Hills to about 39,500 on Interstate 15 in the vicinity of its intersection with U.S. 395. Transmission line corridors traverse most of the deployment area, primarily along Interstate 15, U.S. 395, and California State Highways 14 and 58.

3.4.5.3 F.E. Warren Air Force Base

Onbase land use and status, offbase plans and policies, and regional recreation are discussed in Section 3.4.4.2. Offbase land use in the ROI is predominately agricultural, with nonirrigated cropland and rangeland the two primary land uses. Within 50 miles of F.E. Warren AFB, approximately 73 percent of the land is rangeland, 17 percent is nonirrigated cropland, 9 percent is irrigated cropland, and 1 percent is urban disturbed land. Total cropland is projected to decrease slightly. Approximately 90 percent of the land is privately owned, with the remainder state owned. Federal lands within 50 miles of the base include portions of the Medicine Bow and Roosevelt national forests, the Pawnee National Grassland, the Central Plains Experimental Range, the Cache la Poudre Wilderness, and the Hutton Lake and Bamforth national wildlife refuges. No areas of special visual quality or scenic highways are found in the vicinity of the deployment area. Transmission line corridors traverse the northeast portion of the deployment area along Interstate 25 and U.S. 85 and 87.

3.4.5.4 Fort Bliss

Onbase land use and status, offbase plans and policies, and regional recreation are discussed in Section 3.4.3.4. Offbase land use in the ROI is primarily rangeland, with irrigated cropland located along the Rio Grande River. Within 50 miles of Fort Bliss, approximately 92 percent of the land is rangeland, 6 percent is irrigated cropland, and 2 percent is urban disturbed land. Total cropland within the New Mexico portion of the ROI is projected to remain relatively stable, with a decreasing trend projected for the Texas portion of the ROI. Major land status categories within the ROI include private and BLM land, accounting for approximately 56 percent of the area. Federal lands within 50 miles of the base include the San Andres National Wildlife Refuge, White Sands National Monument, Jornada Experimental Range, a portion of the Lincoln National Forest, and four BLM wilderness study areas. Areas of special visual quality are found in the vicinity of the Hueco Mountains northeast of El Paso and the Organ Mountains east of Las Cruces. Scenic highways in the area include Interstate 10 and U.S. 70/82 and 85, with AADTs ranging from 7,920 along U.S. 70/82 near Hacienda to about 13,630 on U.S. 85 between El Paso and Las Cruces. Transmission line corridors traverse the northwest portion of the deployment area along Interstate 10 and U.S. 54, 70, 80, and 85.

3.4.5.5 Gila Bend Air Force Auxiliary Field

Onbase land use and status, offbase plans and policies, regional recreation, and visual resources are discussed in Section 3.4.3.1. Offbase land use in the ROI is primarily rangeland, with some irrigated cropland along the Salt River Valley. Within 50 miles of Gila Bend AFAF, approximately 91 percent of the land is rangeland, with the remaining 9 percent irrigated cropland. A decrease in irrigated cropland is projected. Major land status categories within the ROI include other federal land, private land, and Indian land, accounting for 56 percent of the area. Federal lands within 50 miles of the base include the Organ Pipe Cactus National Monument, the Cabeza Prieta National Wildlife Refuge, and 12 BLM wilderness study areas. The Organ Pipe Cactus National Monument contains a designated wilderness area, and a portion of the Cabeza Prieta National Wildlife Refuge is a proposed wilderness area.

Areas of special visual quality are found in the vicinity of the Painted Rock Mountains, north of Interstate 10, and the Phoenix South Mountain Park area, southwest of Phoenix.

3.4.5.6 Yuma Proving Ground

Onbase land use and status, offbase plans and policies, regional recreation, and visual resources are discussed in Section 3.4.3.1. Offbase land use in the ROI is primarily rangeland, with some irrigated cropland located along the Colorado and Gila rivers. Within 50 miles of Yuma PG, approximately 93 percent of the land is rangeland, with the remaining 7 percent irrigated cropland. Although agricultural land has increased between 1974 and 1982 as a result of new water supplies available in the region, it is projected that total cropland will decrease within the ROI because of increasing water demands by nonagricultural users. Major land status categories within the ROI include BLM, private land, military land, and other federal land, accounting for approximately 89 percent of the land area. Federal lands within 50 miles of the base include the Cabeza Prieta, Kofa, Cibola, and Imperial national wildlife refuges, and 11 BLM wilderness study areas. Portions of the Cabeza Prieta, Imperial, and Kofa national wildlife refuges are proposed wilderness areas.

3.5 Cultural and Paleontological Resources

An evaluation of the resources of a region is necessary to determine whether the proposed undertaking will have an adverse effect on important cultural and paleontological materials, particularly properties that are eligible for or listed in the National Register of Historic Places (NRHP). Cultural resources are protected by a number of federal, state, and local laws and regulations such as the Antiquities Act of 1906, the Historic Sites Act of 1935, the National Historic Preservation Act of 1966, as amended, the Archeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1979, Executive Order 11593 of 1971, and the American Indian Religious Freedom Act of 1978. Cultural resources include prehistoric resources, historic and architectural resources, and American Indian resources.

3.5.1 Resource Description

Prehistoric Cultural Resources. Prehistoric cultural resources are physical properties predating written records. They may represent a culture, subculture, or community, and may range in size from an isolated artifact, to a site, to a geographic district. Sites may contain artifacts (stone tools, ceramics, basketry, and other manufactured implements), features (hearths, tipi rings, and other material that cannot be moved), and faunal and floral materials.

Historic and Architectural Resources. Historic and architectural resources consist of physical properties postdating written records. Historic resources include archival records, architectural structures, and archaeological features such as building foundations and trash pits.

American Indian Cultural Resources. American Indian cultural resources include districts, sites, structures, biota, objects, and other evidence of human use considered culturally valuable and important to American Indians for traditional, religious, curatorial, or other reasons. These resources may be prehistoric sites and artifacts, historic American Indian areas of occupation, contemporary sacred sites and areas, materials used for the production of sacred objects and traditional implements, hunting and gathering areas, and other botanical, biological, and geological resources of importance to American Indians.

Paleontological Resources. Paleontological resources consist of the physical remains of extinct life-forms or extinct species that may still have living relatives. These include fossilized remains of animals and plants or parts thereof, casts or molds of the same, or trace fossils such as impressions, burrows, and tracks.

3.5.2 General Analysis Methodology

Region of Influence. The Region of Influence (ROI) for the Hard Mobile Launcher in Random Movement basing mode is generally the boundary of the deployment installations. The ROI for the Hard Mobile Launcher at Minuteman Facilities basing mode is the boundary of the Main Operating Base (MOB) and the perimeter of the Minuteman facilities deployment area. The ROI for the Hard Silo in Patterned Array basing mode is generally defined as a circle with a radius of approximately 50 miles from the MOB. However, emphasis is placed on Suitable Deployment Areas (SDAs) where direct impacts will probably occur.

Prehistoric and Historic Cultural Resources. Prehistoric and historic cultural resources data were obtained from regional overviews, survey reports, state historic preservation plans, management plans, and publications within the public domain. Additionally, interviews were conducted with archaeologists working for state and federal agencies, cultural resource management and research units affiliated with universities and museums, and private companies. The analysis methodology consisted of summarizing knowledge about the cultural resources of an area, assessing data using NRHP criteria, and estimating densities of prehistoric cultural resources in each ROI using known resource locations and information about the physical environment of the region. Projected prehistoric cultural resource densities were plotted on maps to evaluate existing distributions of resources and to facilitate comparisons with MOBs and proposed deployment areas.

American Indian Cultural Resources. Public documents were used to identify American Indian cultural resources in the region. Baseline conditions were estimated using information on past and present tribal distributions, traditional floral and faunal resources, traditional sacred areas, ethnohistory and historic occupation of areas, and location and kinds of minerals.

Paleontological Resources. Paleontological resources were estimated using baseline data from federal and state agencies, documents within the public domain, and analysis of geologic maps.

3.5.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

3.5.3.1 Arizona Complex

The cultural resource base includes prehistoric and historic archaeological sites, historic structures, historic trails, railroads, mines, and wells. Previous research on Luke Air Force Range (AFR) and Yuma Proving Ground (PG) includes field surveys and archival and literature searches. No cultural resource projects have been carried out on Gila Bend Air Force Auxiliary Field (AFAF), but site types and densities are expected to be similar to Luke AFR and Yuma PG because of physiographic similarities among the bases and because they were occupied by the same groups of people. Over 500 prehistoric sites have been recorded in the ROI including villages, trails, campsites, lithic scatters, rock alignments, ceramic scatters, hearths, pictograph sites, milling stations, and cremation sites. Resources range in age from approximately 10,000 B.C. to A.D. 1500. Highest site densities are in upper bajada zones and playa zones adjacent to washes, springs, and other potential water sources. Historic resources include trails, mines, settlements, and homesteads. Several historic structures have been determined eligible for or are listed in the NRHP. American Indian groups formerly inhabiting the ROI include the Cocopa, Maricopa, Tohono O'odham (formerly Papago), Quechan, and Yavapai. Indian reservations adjacent to the ROI include the Tohono O'odham, Gila Bend, West Cocopa, East Cocopa, Fort Yuma, and Colorado River reservations. Quaternary vertebrate assemblages are exposed in terrestrial deposits between mountains, and late Pleistocene paleontological assemblages occur in cave deposits throughout Yuma County.

3.5.3.2 Florida Complex

The cultural resource base includes prehistoric and historic archaeological sites, historic trails, and cemeteries. Recent cultural resource investigations include data synthesis, field reconnaissance, development of predictive models of site location, and assessment of eligibility for the NRHP. Over 300 prehistoric sites have been recorded on Eglin Air Force Base (AFB) including lithic and ceramic scatters, shell middens, burial mounds, and village sites. Initial occupation began approximately 8000 B.C., but the most intensive prehistoric occupation dates from A.D. 500 to Spanish contact (ca. A.D. 1513). No prehistoric resources are listed in the NRHP, but 34 sites and the Basin Bayou Historic District, containing 15 prehistoric sites, have been recommended for nomination. Environmental zones with highest site densities include coastal zones along bays and strand beaches, ecotones at the juncture of upland/lowland landforms in river and bay settings, and areas within 150 meters of potable water sources. Over 140 historic resources have been recorded including cemeteries, turpentine stills, rum stills, lakes, farmsteads, camps, trails, roads, railroads, and townsites. American Indian groups who occupied or traversed the area include the Apalachee, Cherokee, Choctaw, Creek, Yamasse, and Seminole. American Indian cultural resources may consist of burial and ceremonial areas. No American Indian reservations are located near the ROI. At least one paleontological locality, which covers 60 acres, has been recorded. Miocene invertebrate assemblages occur in several exposed localities east of the ROI. Floral assemblages and sparse invertebrate materials occur in the Pleistocene Citronelle Formation west of the ROI.

3.5.3.3 Nevada Complex

Cultural resources include prehistoric and historic archaeological sites, historic trails, mining camps and districts, and railroads. Cultural resource investigations include overviews, field surveys, and excavations at selected sites. Only small portions of Indian Springs AFAF, Nellis AFR, and the Nevada Test Site have been studied, but work completed to date provides adequate information to make general statements about cultural resources. Nellis AFB has not been studied for cultural resources. Approximately 1,900 prehistoric sites and isolates have been recorded in the Nevada Complex. At least one site is listed in the NRHP (the Tim Springs site), and a number of others are considered potentially eligible. Recorded sites range in age from the Paleoindian (before ca. 8000 B.C.) to the beginning of historic times (ca. A.D. 1800). Site types include lithic and ceramic scatters, temporary habitation sites, hearths, stone features, rockshelters, caves, petroglyphs, lithic quarry sites, and milling sites. Prehistoric land use patterns were related to the proximity of water and lithic sources. Approximately 100 historic sites dating from initial Mormon settlement (1851) and later mining and ranching periods are recorded including homesteads, rock walls, mining pits and tailings, mining camps, trails and roads, spring developments for livestock, corrals, cisterns, and dugout living quarters. A portion of the Emigrant Trail on the Nevada Test Site is listed in the NRHP. American Indian groups known to have occupied the area are the Western Shoshone and Southern Paiute. Paiutes currently occupy reservations in Las Vegas and the Moapa Valley near the ROI. Paleontological material may be found along Pleistocene lakeshores in the form of late Pleistocene megafauna, and limestone deposits near the ROI contain a variety of Late Cambrian trilobites and other fossilized molluscan species.

3.5.3.4 New Mexico Complex

Known resources include prehistoric and historic archaeological sites, historic structures, and a segment of the Butterfield Stage Line on Fort Bliss. Over 10,000 prehistoric sites on Fort Bliss and 2,000 on White Sands Missile Range have been recorded in the ROI, dating from the Paleoindian period (ca. 11,000 B.C.) to the Late Prehistoric period (ca. A.D. 1450). Site types include temporary open camps, fire pits, lithic and ceramic scatters, burials, kill sites, pictograph/petroglyph sites, and pithouse and pueblo villages. Site locations are patterned relative to landform, with most sites located on basin floors and alluvial fans, and fewer sites in mountain areas. Historic sites on Fort Bliss and White Sands Missile Range include military buildings and civilian settlement and ranch buildings, barns, stables, line camps, "Saltero" (salt gatherers and traders) trails, sawmills, mines, and railroads. Fort Bliss historic sites have been inventoried and are being categorized and evaluated for eligibility for inclusion in the NRHP. American Indian groups who lived in or used the ROI include Mansos, Sumas, Jumanos, Comanche, and Lipan and Mescalero Apache. Three sacred areas have been identified within the Mescalero homeland on White Sands Missile Range. The Tiguex Indian Reservation is located in El Paso, and the Mescalero Apache Reservation is 17 miles northeast of Holloman AFB, outside of the ROI. Previous work in this area has identified numerous geological formations in the ROI with comparatively rare paleontological resources of moderate to high scientific importance, including diverse Permian marine invertebrate assemblages, mammalian and invertebrate assemblages in late Pleistocene cave deposits, and Pleistocene pluvial Lake Otero sediments with extinct megafauna.

3.5.3.5 South-Central California Complex

The cultural resource base includes prehistoric and historic archaeological sites, historic structures, mines, trails, and American Indian sacred and economic sites. Some installations (e.g., Fort Irwin National Training Center [NTC] and China Lake Naval Weapons Center [NWC]) have had a large amount of archaeological work, while others (e.g., Twentynine Palms Marine Corps Air-Ground Combat Center [MCAGCC]) have had none. Approximately 1,100 prehistoric sites have been recorded in the complex, ranging in age from 10,000 B.C. to European contact (ca. A.D. 1770). Site types include caves and rockshelters, petroglyphs, obsidian quarries, open habitation sites, milling stations, lithic scatters, rock alignments, and roasting pits. Rogers Dry Lake on Edwards AFB is listed as a National Historic Landmark and is also listed in the NRHP under the Man in Space theme. Big and Little Petroglyph canyons located on China Lake NWC are National Historic Landmarks and are also listed in the NRHP. Prehistoric site densities are highest around natural water sources such as springs and playa shorelines. Playa areas in the Great Basin and Mojave Desert areas are the focus of research into the earliest inhabitants of North America. Later sites near water tend to be large habitation sites with a wider range of artifact types. Site densities also tend to be greater in Joshua tree and pinyon-juniper areas or in areas containing other important food resources. Approximately 300 historic sites have been recorded or are known in the ROI including structures, features, and artifacts related to mining, ranching, homesteading, travel, resort activities at Coso Hot Springs, railroad construction and use, and military activities. The resort at Coso Hot Springs on China Lake NWC was built in the early twentieth century and is listed in the NRHP for architectural and historic values. Historic

sites or structures date from the early exploration period (1830s-1850s). American Indian groups known to have occupied or traversed the ROI are the Panamint Shoshone, Northern Paiute, Kitanemuk, Serrano, Kawaiisu, Tataviam, Gabrielino, Mojave, Vanyume, and Chemehuevi. A focal point of American Indian traditional concerns is Coso Hot Springs, which has been listed in the NRHP partly for its cultural value to American Indians. Known paleontological resources in the ROI are fossils exposed along Pleistocene shorelines including many examples of Rancholabrean fauna (e.g., mammoth, bison, camel, horse, dire wolf, cat, and avian and reptilian species). Other paleontological deposits that may occur within the ROI are the middle Miocene Barstow Formation, currently known near Barstow, and Cambrian trilobites near Twentynine Palms MCAGCC.

3.5.3.6 Washington Complex

The resource base includes prehistoric and historic archaeological sites, historic districts, historic structures, American Indian sacred areas, and an important paleontological formation. A small percentage of the Washington Complex has been studied using archival sources, field surveys, and excavation techniques. Over 300 prehistoric sites have been recorded within the ROI including pithouse villages, lithic scatters at hunting and gathering locations, burial sites, quarry sites, and pictograph/petroglyph sites. Prehistoric use of the region began approximately 8000 B.C. and continued uninterrupted until Euroamerican contact in the early 1800s. Two prehistoric sites, nine archaeological districts containing a total of 44 sites, and a prehistoric Wanapum village site, Wa-pai-xie, have been listed in the NRHP; numerous other sites are potentially eligible. Highest site densities occur along floodplains of the Columbia and Yakima rivers and their tributaries. Numerous deep, stratified sites are situated along the Columbia River floodplain. Lower site densities occur in foothill landforms away from streams and rivers. Most Euroamerican land use in the ROI is related to transportation, farming and ranching, and energy and military activities, which began in the early 1800s. Historic resources include mines, trails, farmsteads, townsites, abandoned roadbeds, old ferry crossings, schools, and industrial structures and sites related to atomic energy development located near river and stream floodplains. The Hanford B-Reactor is listed as a National Historic Mechanical Engineering Landmark. The Kittitas, Wanapum, and Yakima Indians traditionally used portions of the ROI. Members of the Wanapum Indian tribe currently live near Priest Rapids Dam, adjacent to the eastern boundary of Yakima Firing Center (FC), and continue to use portions of the installation for sacred and economic purposes. The Ginkgo Petrified Forest State Park, one of the most important exposures of fossilized plant assemblages in the United States, is directly north of Yakima FC. The same fossil-bearing formation extends onto the northeastern corner of Yakima FC.

3.5.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

3.5.4.1 Ellsworth Air Force Base

The resource base includes prehistoric and historic archaeological sites, American Indian burial and sacred areas, and paleontological localities. Previous research in the area consists of small block inventories and larger surveys along the Belle Fourche River. Prehistoric cultural resources include

approximately 300 recorded prehistoric archaeological sites dating from the Paleoindian period (ca. 9000 B.C.) through the Post-Contact period (ending ca. A.D. 1850). Fortified sites, kill/butchering sites, habitations, stone circles, cairns, lithic scatters, and isolated finds are represented. Highest site densities occur along the Belle Fourche River west of Crow Creek, and near other major drainages. Historic cultural resources include approximately 75 recorded Euroamerican sites such as homesteads, water supply systems, military sites, trails and roads, refuse disposal sites, stone alignments, and gravel quarry sites. Historic structures listed in the NRHP occur primarily in and around the Black Hills. Rapid City, Spearfish, and Fort Meade each contain NRHP historic districts. A number of American Indian groups occupied or passed through the area including the Arikara, Hidatsa, Mandan, Cheyenne, Arapaho, Ponca, Teton and Yankton Dakota (Sioux), Kiowa, Comanche, Kiowa-Apache, Crow, and Shoshone. American Indian cultural resources may consist of sacred and ceremonial areas (such as Bear Butte), burials, and traditional flora and fauna used in ceremonies or as medicines. Two American Indian reservations border the ROI: the Cheyenne River Reservation to the northeast and the Pine Ridge Reservation to the south. Areas considered sacred by these groups may be identified in the ROI. Paleontological materials occur in Butte, Haakon, Jackson, Meade, and Pennington counties, and consist of marine invertebrates in the Pierre and Carlile shales, and outcrops of the White River Formation (Oligocene) containing reptiles, birds, rodents, insectivores, rabbits, carnivores, and a wide variety of ungulates.

3.5.4.2 F.E. Warren Air Force Base

Known resources include prehistoric and historic archaeological sites and paleontological localities. Previous research in the area consists of small block surveys or linear inventories. Prehistoric cultural resources include approximately 900 prehistoric archaeological sites recorded in the ROI counties dating from the Paleoindian period (ca. 9000 B.C.) to the Protohistoric period (ca. A.D. 1850). Site types consist of campsites; stone circle sites; lithic, ceramic, and fire-cracked rock scatters; rock shelters; quarries; kill/butchering sites; burials; rock alignments; cairns; and pictograph/petroglyph sites. Highest known site densities for most time periods occur in wooded scarp and butte areas and stream valleys. Upland contexts away from major drainages have the lowest densities, and dissected uplands at the heads of arroyos have higher site densities than flat or rolling upland zones. Historic resources include approximately 800 recorded Euroamerican sites such as homesteads, trails and roads, railroads, agricultural features, water supply systems, utility and communication networks, refuse disposal sites, and military sites. Historic resource distributions are determined by the location of major drainages and by the patterning of the original land patent surveys. Architectural resources listed in the NRHP occur throughout the ROI. Cheyenne has a designated NRHP historic district, and approximately 200 buildings are included in the F.E. Warren AFB Historic District/National Landmark. A number of American Indian groups occupied or passed through the ROI including the Shoshone, Cheyenne, Comanche, Crow, Plains Apache, Kiowa, Arapaho, and Teton Dakota. American Indian resources consisting of sacred areas, burials, trails, and traditional use areas may occur. No American Indian reservations are located near the ROI. Paleontological resources have been reported at approximately 160 localities within the ROI and include dinosaur and turtle faunas and late Pleistocene mammalian assemblages. Fossils are associated with most geologic formations in the ROI.

3.5.4.3 Grand Forks Air Force Base

Cultural resources include prehistoric and historic archaeological sites and historic structures. American Indian cultural resources and paleontological materials may also occur. Previous research includes small block surveys adjacent to perennial streams and inventories of large areas for major water projects. Prehistoric cultural resources include approximately 200 recorded archaeological sites ranging in age from the Paleoindian period (ca. 10,000 B.C.) to the Plains Village period (ending A.D. 1750). Site types include earthlodge villages, campsites, mounds and earthworks, stone circles, burials, and kill sites. Prehistoric site distribution has not been analyzed in the ROI; however, broad trends indicate higher site densities near perennial streams. Historic cultural resources consist of approximately 80 recorded Euroamerican sites in the ROI counties including farmsteads, trading posts, transportation sites, townsites, and military sites. Four historic sites listed in the NRHP occur in the ROI. Architectural resources are concentrated along the Red River Valley directly east of the ROI. A number of Indian groups occupied or passed through the ROI including the Assiniboine, Yanktonai Dakota, Chippewa, Cree, and Cheyenne. American Indian resources may consist of sacred and ceremonial areas, burials, and traditional flora and fauna used in ceremonies or as medicines. No American Indian reservations occur within the ROI; however, the Fort Totten (Santee and Yanktonai Dakota) Reservation is located directly to the west. Paleontological materials have been found in all counties except Steele and Pembina. Gastropods and pelecypods are recorded in a Pleistocene glacial deposit in Grand Forks County, and fish bones and scales, baculites, and ammonites have been found in Pierre Shale deposits. The Niobrara and Carlile formations also contain fossiliferous material.

3.5.4.4 Malmstrom Air Force Base

The resource base includes prehistoric and historic archaeological sites, American Indian sacred areas, and paleontological localities. Numerous small block inventories have been conducted throughout the region, and at least three large-scale inventories have been prepared. More than 300 sites have been recorded in the ROI including lithic scatters, quarries, individual and mass kill/butchering sites, drive alignments, cairns, pictograph/petroglyph sites, rockshelters, tipi rings, and campsites. Sites date from the Paleoindian (ca. 10,000 B.C.-5500 B.C.) and Archaic (ca. 5500 B.C.-A.D. 1800) periods. Prehistoric land use was determined by subsistence needs and can be generally related to landform zones. Habitation sites tend to be on higher ground on the edges of bluffs or escarpments, and on knolls and ridges. Hearth scatters and butchering areas occur on terraces of larger drainages. Bison kill sites are in areas where breaks and bluffs (which were needed for impoundments, traps, and jumps) exist, usually along principal drainages of the region. Historic cultural resources include more than 200 recorded Euroamerican sites such as mines and their associated structures; homesteads, ranches, sheep camps, line shacks, and corrals associated with agriculture; sawmills and camps associated with the timber industry; military posts; residences and public buildings in towns and cities; trails, roads, railroad construction camps, and railroad grades associated with exploration and transportation; and fur trading posts. Approximately 24 historic sites and 4 districts in the ROI have been listed in the NRHP. American Indian groups who occupied or hunted in the area include the Shoshone, Bannock, Northern Paiute, Kutenai, Blackfeet (Piegan and Blood), Flathead (Salish), Nez Perce,

Crow, Atsina or Gros Ventre, Chippewa-Cree, Assiniboine, Arapaho, and Cheyenne. The northwestern boundary of the ROI is near the Blackfeet Indian Reservation. A Piegan sun dance site is located west of Great Falls, just outside the ROI, and other ceremonial areas may exist within the ROI. Paleontological localities occur in several geological formations within the ROI. Invertebrate fossils are found in the Madison Formation, the greatest acreage of all fossiliferous deposits within the ROI. The Great Falls coal beds of the Kootenai Formation are important because of floral communities and potential insect, amphibian, and reptile fossils.

3.5.4.5 Minot Air Force Base

Known resources include prehistoric and historic archaeological sites and paleontological localities. Previous research in the area includes several large inventories for flood control or water projects and energy development, and many small parcel surveys for oil and gas development. Prehistoric resources include approximately 500 recorded archaeological sites dating from the Paleoindian period (ca. 9500 B.C.) to the Protohistoric or Equestrian Nomadic Tradition (A.D. 1850). Site types include stone rings and rock features, earthlodge villages, earthworks, mounds and burials, hearth sites, bison kill sites, artifact scatters, and pictograph/petroglyph sites. Prehistoric site distribution in the ROI is related to regional physiography, with highest site densities occurring along the Missouri River Trench and other major perennial streams. Stone ring sites are more frequent away from the Missouri River Trench, particularly around lakes and sloughs on the Missouri Coteau. Historic cultural resources include approximately 130 recorded Euroamerican sites such as townsites, farmsteads, and transportation-related sites; commercial sites such as trading posts and mills; Civilian Conservation Corps work camps; and cemeteries. Four historic sites in the ROI are listed in the NRHP. American Indian groups who occupied or passed through the ROI include Assiniboine, Arikara, Hidatsa, Mandan, Chippewa, and Yanktonai Dakota. Potential American Indian cultural resources may consist of sacred sites and traditional use areas. Part of the Fort Berthold Reservation (Arikara, Hidatsa, and Mandan) is in the southwestern portion of the ROI. Paleontological materials occur in all of the eight ROI counties. The Coleharbor Formation contains a variety of invertebrates. Leaf and tree trunk impressions, invertebrates, fish, turtles, crocodiles, and insectivores occur in the Tongue River and Sentinel Butte formations. The Cannonball Formation contains invertebrates, worm casts, shark's teeth, and foraminifera.

3.5.4.6 Whiteman Air Force Base

The cultural resource base includes prehistoric and historic archaeological sites, historic structures, trails, battlefields, and paleontological localities. Previous research includes field surveys, reports from amateur archaeologists, and documentary studies. Over 2,700 sites have been recorded by the Missouri Archaeological Survey in the ROI counties. Only two prehistoric sites and one archaeological district within the ROI have been listed in the NRHP, but hundreds more may be potentially eligible. Site types include large villages with mounds, ceramics, and lithic artifacts; caves and rockshelters; surface lithic scatters; quarries; special activity camps; and rock cairns, burial mounds, and mound complexes. Highest site densities are along river and stream floodplains and bluffs, and at higher elevations adjacent to floodplains. Initial occupation dates to the Paleoindian (11,000 B.C.)

hunting and gathering groups and continues to Protohistoric cultures (ca. A.D. 1650). Historic resources in the ROI include trails, various kinds of standing structures, archaeological sites, battlefields, and military camps. Historic American Indian, French, Spanish, and Euroamerican groups used the region and early historic records date to the late 1600s. Twenty-four historic sites in the ROI are listed in the NRHP. High densities of historic sites and structures can be expected in other areas of the ROI near rivers and streams. American Indian groups formerly inhabiting the ROI include the Osage, Missouri, and Kickapoo. Descendants of all three American Indian groups currently live in Oklahoma, and there are no reservations near the ROI. Historic American Indian villages and trails have been identified in the ROI. Paleontological localities with high scientific importance occur in spring and marsh settings in the Osage and Pomme de Terre River floodplains, where well-preserved late Pleistocene floral and faunal assemblages have been found.

3.5.5 Existing and Projected Conditions for Hard Silo in Patterned Array

3.5.5.1 Davis-Monthan Air Force Base

The resource base includes prehistoric and historic archaeological sites, historic structures, mines, trails, American Indian sacred and traditional areas, and paleontological localities. The region has been used traditionally by American Indian groups still living on reservations in the area. A cultural resources overview has been written for Davis-Monthan AFB, and many other areas in the vicinity have been investigated. Several hundred prehistoric sites have been recorded in the ROI including complex village sites with ball courts and platform mounds, habitation sites, lithic and ceramic scatters, rock alignments, quarries, water control features, agricultural features, pictograph/petroglyph sites, and lithic sites. Earliest recorded sites date to the Paleoindian period (ca. 10,000 B.C.); later groups occupied the region until approximately A.D. 1450. Prehistoric site distribution for all periods is related to available water sources. Paleoindian sites are recorded in exposed, deeply stratified alluvial deposits in the San Pedro Valley. Hohokam settlements occur most frequently on river terraces and the interface between floodplain and lower bajada landforms. Later Hohokam sites occur in all environmental and landform zones, with highest site densities in the floodplain. Prehistoric site densities are lower along the smaller washes and creeks and in the desert foothills. Numerous historic resources have been recorded in the ROI including early settlements, ranches, mining camps, stage stations, military sites, religious sites, roads, railroads, water control features, and refuse disposal sites. Thirty-four historic sites have been nominated to the NRHP or are potentially eligible. The most famous NRHP structure is the Mission San Xavier del Bac, located directly southwest of Tucson. Highest historic site densities occur adjacent to the Santa Cruz and San Pedro rivers. Architectural resources include a number of individual structures and historic districts nominated for the NRHP. Most of the ROI falls within the region traditionally used by the Tohono O'odham Nation, whose reservation is in the western portion of the ROI. The Sobaipuris, riverine-oriented gatherers, hunters, and horticulturalists, lived at Bac on the Santa Cruz River and along the San Pedro River, and are now located on the San Xavier Reservation, southwest of Tucson. Chiricahua Apache groups ranged through the upper San Pedro River Valley as part of their traditional territory. The San Pedro Valley is one of the most important localities in the United States for late Pleistocene extinct megafauna. Late Pleistocene

cave deposits also occur throughout the ROI. Important Oligocene and Miocene mammalian assemblages and Tertiary assemblages occur in the middle and lower Santa Cruz and San Pedro valleys. The entire Santa Cruz-San Pedro River system has a high potential for important late Pleistocene assemblages at considerable depth. The importance of these assemblages lies in their rarity in paleontological records.

3.5.5.2 Edwards Air Force Base

Cultural resources include prehistoric and historic archaeological sites, American Indian sacred and economic areas, and paleontological localities. Many surveys of widely diverse quality have been conducted in the vicinity of Edwards AFB. Approximately 1,000 prehistoric archaeological sites have been recorded, but fewer than 100 historic sites have been documented. Many portions of the area are still used by American Indians for traditional activities. Paleontological localities occur throughout the general area. Prehistoric site types include villages, temporary campsites, rockshelters, milling stations, lithic and ceramic scatters, quarries, burials, pictograph/petroglyph sites, stone alignments, trails, rock cairns, and roasting pits. Sites date from the late Pleistocene/early Holocene period (10,000 B.C.-6000 B.C.) to the Late Prehistoric (A.D. 1300-ca. A.D. 1770) period. Site density estimates for areas within and near the ROI indicate the potential for up to 25 archaeological sites per square mile in some areas. Highest site densities occur near natural springs and seeps along the Mojave River Valley, and near playa shorelines (dry Pleistocene lakebeds), where earlier sites are found. Other areas of higher site densities include desert pavement-covered terraces and mountain/valley interfaces. Historic cultural resources within the ROI include trails and wagon roads, railroads, home and farmsteads, ranching-related sites, mines and related features, military sites, abandoned townsites, and refuse disposal sites. Twenty sites within the ROI are listed in the NRHP, and others may be potential NRHP properties. Rogers Dry Lake on Edwards AFB is listed as a National Historic Landmark and is also listed in the NRHP under the Man in Space theme. American Indian groups who may have inhabited or traversed the ROI include the Vanyume, Serrano, Kitanemuk, Kawaiisu, Mohave, Tataviam, Chemehuevi, Inland Chumash, Gabrielino, and Fernandeno. The El Paso Mountain area, with its rich pictograph/petroglyph resources, may have special significance for American Indians. Black Mountain, near the El Paso Mountains, has also been identified as having sacred or traditional values. Paleontological resources are known at a number of localities. Rainbow Basin, an important paleontological locality outside the ROI, has been designated as an Area of Critical Environmental Concern by the Bureau of Land Management (BLM). Similar formations may occur within the ROI, especially since Rainbow Basin is immediately outside the ROI boundary. Vertebrate fossil localities have been recorded in the El Paso Mountains, the Tehachapi Mountains, and near Cajon Pass.

3.5.5.3 F.E. Warren Air Force Base

The cultural resource base includes numerous prehistoric and historic sites and paleontological localities. A number of linear surveys and small block surveys have been conducted in the area. Because all inventories were for small areas or rights-of-way, the results are not statistically representative of the kinds and densities of resources. Prehistoric cultural resources recorded in the ROI counties include approximately 1,400 prehistoric archaeol-

ogical sites dating from the Paleoindian period (ca. 9000 B.C.) to the Protohistoric period (ca. A.D. 1850). Over 40 sites are listed in, or are potentially eligible for, the NRHP. Site types include open camps, stone circles and alignments, lithic and ceramic scatters, rockshelters, cairns, burials, quarries, kill sites, and pictograph/petroglyph sites. Highest site densities for all time periods occur in wooded scarp and butte areas and stream valleys. Stratified sites occur more frequently on stream terraces and away from the edges of escarpments. Sites occurring only as surface exposures are situated on eroding knolls and bluffs, on the edges of escarpments, and in eroding upland plain and hill topography. Historic cultural resources recorded in ROI counties include approximately 1,100 Euroamerican sites such as homesteads, trails, roads, railroads, agricultural features, water supply systems, mines, utility and communications networks, refuse disposal sites, military sites, and standing structures. Historic structures listed in the NRHP occur throughout the ROI. Cheyenne and Fort Collins have designated NRHP historic districts, and approximately 200 buildings are included in the F.E. Warren AFB Historic District/National Landmark. American Indian groups who occupied or passed through the ROI include the Shoshone, Cheyenne, Comanche, Crow, Plains Apache, Kiowa, Arapaho, and Teton Dakota. No American Indian reservations are located near the ROI and ceremonial sites have not yet been identified. Paleontological resources have been reported at approximately 200 localities within the ROI. Of these, only six assemblages were identified as having considerable scientific importance. Recorded paleontological materials include dinosaur and turtle faunas and a variety of mammalian assemblages. Fossils are associated with most geologic formations in the ROI.

3.5.5.4 Fort Bliss

The cultural resource base includes prehistoric and historic archaeological sites, historic structures, trails, mines, American Indian sacred and traditional areas, and paleontological localities. Previous research in the vicinity of Fort Bliss includes sample surveys, inventories, and archival and literature searches, with most investigations concentrated on military installations. Prehistoric cultural resources include over 11,000 sites recorded in the ROI dating from the Paleoindian period (ca. 10,000 B.C.) to the Late Prehistoric period (ca. A.D. 1400). Site types include small open camps, fire pits (roasting pits, ovens, hearths, and campfires), lithic and ceramic scatters, burials, kill sites, pictograph/petroglyph sites, and large nucleated villages. Site locations appear to relate to landform. Most sites are small, temporary camps on basin floors. Adobe village complexes and other long-term habitations are located on alluvial fans. Mountain areas contain the fewest number of known sites, which are typically short-term camp or processing sites. Historic sites in the ROI include buildings on the Fort Bliss Main Post, abandoned mines, ranch buildings, spring houses, line camps, corrals, windmills, early military remains, and a segment of the Butterfield Stage Line. Historic sites on Fort Bliss have been inventoried and are being categorized and evaluated for eligibility for inclusion in the NRHP as individual sites, districts, or Multiple Resource Areas, and 27 historic sites in the ROI have been nominated to the NRHP. Several different American Indian groups have lived in or passed through the ROI historically, beginning with the Jumano in the early seventeenth century in the Rio Grande Valley and Apache and Comanche bands in western Texas and southern New Mexico. Potential sacred sites or traditional use areas are likely to be related to Apache groups, some of whom live on the Mescalero Reservation just northeast of the

ROI. Types of paleontological materials include diverse Permian marine invertebrate assemblages, Cretaceous marine invertebrates, Miocene mammalian assemblages, Pleistocene horse and mastodon material, and mammalian and invertebrate assemblages in late Pleistocene cave deposits. These deposits are located in and near the Franklin Mountains, where outcrops of Silurian to Lower Permian age have been recorded.

3.5.5.5 Gila Bend Air Force Auxiliary Field

The resource base includes prehistoric and historic archaeological sites, historic structures, railroads, early trails, stagecoach lines, potential American Indian traditional use areas, and paleontological localities. Previous research around Gila Bend AFAF includes small field surveys and archival and literature searches. No cultural resources projects have been carried out on Gila Bend AFAF. Approximately 100 sites have been reported, ranging in age from the Paleoindian period (ca. 10,000 B.C.) to about A.D. 1400. Site types include lithic and ceramic scatters, rock circles, ball courts, irrigation canals, trails, petroglyphs, and platform mounds. Physiographic zones are similar throughout the ROI, and because site location is determined to a great extent by landform and availability of water, it is expected that a large number of unrecorded sites occur in the ROI. Site densities of 3 to 18 sites per square mile have been recorded, with densities highest on terraces, lower on floodplains, and negligible on bajada landforms. Historic resources in the ROI include wells, mine shafts, camps, Tohono O'odham ceramic scatters, homesteads, adobe buildings, corrals, refuse disposal areas, and ranch buildings. Areas within the ROI are used traditionally by the Maricopa, Tohono O'odham, Pima, and Yavapai. Western Apache raiding parties also sporadically crossed eastern portions of the ROI. Sections of the Gila River and Tohono O'odham reservations, and all of the Ak-Chin and Gila Bend Indian reservations, are in the ROI. Paleozoic marine fossils, Mesozoic vertebrate fossils, fossil-bearing sedimentary deposits of Triassic and Jurassic age, and Miocene and Pliocene sediments from the Cenozoic and late Pleistocene fossil beds have been identified in the ROI.

3.5.5.6 Yuma Proving Ground

Known resources include prehistoric and historic archaeological sites, historic structures, trails, American Indian sacred and economic areas, and paleontological sites. Previous research includes field surveys, overviews, and archival and literature searches. Site types in the ROI include rock alignments, quarries, intaglios, lithic and ceramic scatters, villages, trails, pictograph/petroglyph sites, milling stations, and cremation sites. Sites date from the Paleoindian period (ca. 10,000 B.C.), with prehistoric settlement continuing to approximately A.D. 1540. Highest site densities in the Colorado Desert are within 1 mile of the Colorado or Gila rivers, along the shoreline of Pleistocene Lake Cahuilla, at springs, at mountain-valley interfaces, and in areas of desert pavement. Historic resources in the ROI include ranch and settlement structures, wells, mines, military structures and features, and travel routes. Fifty-two Arizona historic properties have been listed in the NRHP (most are in Yuma), and more are potentially eligible. Eight archaeological, historical, or American Indian areas have been designated as Areas of Critical Environmental Concern by the BLM within the California portion of the ROI. These areas include intaglios, petroglyphs, villages, trails, cleared circles, an American Indian sacred area, and

remnants of the Plank Road, an automobile road constructed of wooden planks across the sand dunes of Imperial County. Portions of the Yuma PG ROI were traditionally used by the Yavapai, Quechan, Mojave, Halchidhoma, and Cocopa. The Cocopa and Fort Yuma Indian reservations are within the ROI, and the Colorado River Indian Reservation is approximately 5 miles north of the ROI. Late Pleistocene vertebrate assemblages are exposed in terrestrial deposits between mountains, and late Pleistocene vertebrate and invertebrate assemblages occur in cave deposits throughout Yuma County. Sedimentary deposits of the Triassic and Jurassic epochs of the Mesozoic era occur in southern Yuma County and include vertebrate fossil material.

3.6 Biological Resources and Threatened and Endangered Species

Direct impacts to biological resources and threatened and endangered species could result from project-related surface and habitat disturbance. Indirect impacts could result from disturbance of habitats and species due to project-induced growth and development in the area and to recreational activities of project-related inmigrants. Biological resources are important because of their inherent value, their value as aesthetic and recreational resources, and as indicators of the condition of the environment. For this biological resources analysis, terrestrial ecosystems are divided into vegetation and wildlife elements. Because of their special protected status, three other major biological features are addressed as separate elements: aquatic habitats (including wetlands), unique and sensitive habitats, and threatened and endangered species (plant and animal).

3.6.1 Resource Description

Vegetation. The vegetation element addresses major vegetation types, limited to the formation, region, series, and association levels. The formation level is primarily controlled by major climatic patterns and reflects a distinctive overall aspect or appearance (physiognomy) such as the grassland, woodland, or forest formations. The region level reflects a regional climate difference or an elevational difference such as the montane forest region or the subalpine forest region. The series level denotes several genera or species that are dominant within the local flora of the region, for example, the pinyon-juniper series. The association level reflects a grouping of plants, usually two or three at the species level, such as the creosote bush-tarbush association. Vegetation types of local or regional importance that occur in areas where they could be affected by the proposed project are also addressed.

Vegetation described in the analysis is restricted to terrestrial types; wetland vegetation (species strictly dependent upon the aquatic habitat) is addressed in the aquatic habitats element. Riparian (water-edge) vegetation and phreatophytes (plants with long roots reaching to the water table), such as mesquite and saltcedar, which are not strictly dependent on the aquatic habitat, are discussed in this element. In areas where native vegetation has been largely removed for agriculture or grazing, the historical or potential native vegetation is described.

Wildlife. The wildlife element focuses on species or groups of species of high public, management, or scientific interest. Greatest emphasis has been placed upon big game, furbearers, upland game, waterfowl, and raptors (birds of prey), because impacts to these types of wildlife are most likely to be of concern. Outstanding characteristics of nongame fauna are noted as appropriate (e.g., exceptional numbers or high diversity of migratory birds and exceptional diversity of small mammals or reptile species). Habitat types that are of exceptional value or importance to wildlife and that could be affected by the proposed project are identified in this section.

Aquatic Habitats. Aquatic habitats include all lakes, streams, and wetlands that occur in the study areas. Aquatic habitats that received greatest emphasis are those that support recreational or commercial fisheries, substantial native fish populations, or provide habitat for important waterfowl populations (waterfowl are covered in the wildlife element), and are likely to

receive direct physical effects from proposed project deployment (e.g., habitat loss, physical alteration, or changes in water quality or supply). Wetlands are a subelement of aquatic habitats with special federal protection status. Regionally important wetlands likely to be affected by proposed project deployment, such as major riparian corridors and marshes, and those with regionally important native floristic composition, received the greatest attention. All flora and fauna that are strictly dependent upon aquatic habitats, such as fish and aquatic plants, are included in this portion of the analysis.

Unique and Sensitive Habitats. Unique and sensitive habitats were identified on a regional basis as areas designated as having special biological importance. In many cases, these areas are specifically designated by agencies such as the Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), or state game departments. In other instances, they represent habitats that do not bear any official status but have biological importance because they possess characteristics that make them unique. These habitats often support especially diverse communities of plants and animals. Protection of such habitats increases the survivability and quality of existence of all species involved. In other instances, habitats are considered unique because they represent pristine or undisturbed remnants of habitats that are threatened by future environmental modification. These habitats are considered unique because of the sum or a particular combination of their characteristics. They may also have notable aspects of vegetation, wildlife, aquatic resources, or contain threatened and endangered species and are, therefore, addressed under other elements where appropriate.

Threatened and Endangered Species. This section deals with federally listed threatened and endangered species, species proposed for federal listing (both groups are protected by the Endangered Species Act), federal-candidate species, and state-listed rare, threatened, or endangered species (protected by state law). Wildlife species that are rare or particularly sensitive to disturbance but not protected by law are discussed in the wildlife element.

3.6.2 General Analysis Methodology

The baseline assessment for biological resources relied almost exclusively on existing information. The principal sources of this information were publications and files of federal and state natural resource management agencies, interviews with agency scientists, state natural diversity data bases, environmental impact statements and reports (EISs/EIRs) for projects in the regions under consideration, and environmental reports for and by the affected installations. Appropriate information was combined in a geographic information system (GIS) including mapped and tabular data. All information was retained in the GIS in detail appropriate for mapping at a scale of 1:500,000. Baseline conditions for biological resources are described at the regional overview level for each element of biological resources.

Region of Influence. The Region of Influence (ROI) for each potential project deployment area was defined as the area where biological resources could potentially be affected by deployment and operations of the proposed project. The factors used in defining each ROI were (1) the location of the Main Operating Base (MOB) and the principal population centers of the area; (2) the location of recreational facilities, biological resources of special interest

or sensitivity, and other resources likely to attract visitors; and (3) the assumption that numbers of inmigrants sufficient to affect biological resources are not likely to travel more than 150 road miles or 3 driving hours from home to pursue short-term recreational or other outdoor activities. Each resulting ROI was approximately circular and centered on the MOB and/or principal population centers, with a radius of approximately 150 road miles or a 3-hour driving time. This area deviated from a circle according to the layout and type of roads in the area, and the location of recreational facilities and biological resources of special sensitivity or interest.

For biological resources, it was important to distinguish between areas (and resources) potentially subject to direct surface disturbance and impacts (from proposed project construction and operations), and those areas where only indirect disturbance and impacts could occur (e.g., from increased recreational use). For the Hard Mobile Launcher in Random Movement basing mode, the potential direct impact area was defined as that portion of each installation in the complex where Small Intercontinental Ballistic Missile (ICBM) facilities may be built, plus the Random Movement Area (RMA). For the Hard Mobile Launcher at Minuteman Facilities basing mode, the potential direct impact area was the area of each MOB where Small ICBM facilities may be built, as well as the Hard Mobile Launcher (HML) vehicle transit routes that may be upgraded. For the Hard Silo in Patterned Array basing mode, the potential direct impact area was defined as the MOB where Small ICBM facilities may be built, plus the Suitable Deployment Areas (SDAs). For each basing mode, the indirect impact area was the remainder of the ROI (exclusive of the potential direct impact area).

Vegetation. The vegetation discussion focuses on the most common vegetation types found in the potential direct impact area, identifying the dominant species associated with each type. The vegetation types common to the indirect impact area are also listed; types unique to this area are also briefly described. Sensitive plant species that have the potential to be directly or indirectly affected are also listed. Data sources included vegetation maps, reports, EISs, planning documents from state fish and game agencies, the BLM, the USFS, the U.S. Geological Survey (USGS), the U.S. Soil Conservation Service (SCS), and military installations and universities. Scientific journals and EISs for nongovernment projects were also used. The minimum mapping unit in the GIS was limited to 1,500 acres for general vegetation. Units less than 1,500 acres were included with the surrounding vegetation type. Occasionally, smaller units with distinctive cultural or land use characteristics were delineated. Vegetation was not mapped for the Hard Mobile Launcher at Minuteman Facilities basing mode because most of the native vegetation at these locations has been removed for agriculture or other uses, and because vegetation impacts were not expected to be significant for this basing mode. In these locations, vegetation was characterized by determining the approximate percent cover of region-level vegetation types (Section 3.6.1) in the deployment area and MOB. This was done using USGS land cover/land use maps (1:250,000) and interpretation of satellite imagery.

Wildlife. The wildlife of each ROI was determined by using the same types of data sources as for the vegetation element. The most common mammals, birds, and herpetofauna (reptiles and amphibians) were identified and listed for the direct and indirect impact areas. Greatest attention was given to big game, furbearers, upland game, waterfowl, and raptors. Where relatively few habitat

types exist, associations were made between wildlife species and their preferred habitat or vegetations types. Highly sensitive wildlife species that have the potential to be affected by the proposed project were also identified. Distribution maps for key game and other wildlife species and general distribution and habitat information were derived from wildlife distribution maps and game harvest reports from state fish and game departments, standard references in the field, environmental reports for the military installations under consideration for system deployment, and EISs for other projects in the ROI. Important characteristics of nongame species (e.g., exceptional numbers or concentrations of migratory birds and small mammals) were noted and incorporated into the evaluation process where appropriate.

Aquatic Habitats. Aquatic habitats and their present conditions were identified from maps, photographs, reports, technical literature, and personal communication. The major sources of maps included the USFWS (National Wetlands Inventory), the USGS, the BLM, the Army Corps of Engineers (COE), and technical reports. Other important data sources included the Bureau of Reclamation, the USFWS's Western Energy and Land Use Team, state game and fish departments, libraries, and experts in the study areas. Major aquatic habitats were determined based on information from regulatory agencies (e.g., stocking rates, nesting, and fishing use). Several minor habitats were included because of their local importance (e.g., their location and recreational use). Wetlands with an area less than one-half section (320 acres) were not mapped in the GIS unless they were indicated as a resource of special interest to an agency or other knowledgeable source. Wetlands were mapped as points if their area was between 320 and 640 acres and conformed to an area of approximately one-half section. Polygon wetlands in the GIS represent resources greater than 640 acres. Riverine wetlands were mapped as polygons if they appeared as polygons and as lines if they appeared as lines on USGS 1:250,000-scale topographic maps. Because of their importance in arid regions, all perennial streams were mapped in the GIS if they were greater than 0.25 inch (approximately 2 mi) in length when mapped at a scale of 1:500,000.

Unique and Sensitive Habitats. Unique and sensitive habitats were identified and described from various reports, technical literature, maps, and personal communication. The BLM, the USFS, the USFWS, and state heritage programs were the primary sources of information. State game and planning agencies, libraries, and local experts were also helpful. Major habitats included were those with official status or designation (e.g., wilderness study areas). Minor habitats included were those representing a locally important habitat that was likely to receive an impact (e.g., by recreational use). Unique and sensitive habitats were mapped in the GIS as polygons if their area was greater than 640 acres and as points if their area was less than 640 acres. In some cases, exact locations or boundaries of a unique habitat could not be determined. These habitats were shown as points where the exact boundary was unknown and were included as tabular data in the GIS if it was not possible to assign an exact location to the habitat.

Threatened and Endangered Species. Information was collected on federally listed threatened and endangered species, proposed and candidate species for federal listing, and species listed by states as rare, threatened, or endangered and protected by state law. The Federal Register, publications and

files of various offices of the USFWS and the BLM, state fish and game departments, state natural diversity data bases, and state heritage programs were the principal information sources. Information was collected and assessed on the location of occurrences (varying in precision from point sightings to presence/absence within counties), population status, existing threats, and projected population trends for these species. Information is presented on the number of species of each category known or expected to occur in the direct and indirect impact areas. Species of special importance or species likely to be affected by the proposed project are also noted.

3.6.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

3.6.3.1 Arizona Complex

The vegetation and wildlife in the direct impact area of the Arizona Complex are representative of the Sonoran Desert. The desert vegetation is characterized by paloverde-saguaro or paloverde-cactus communities on rocky slopes and ranges, and creosote bush-bursage communities typically in valleys and basins. River floodplains and low-lying, poorly drained areas may support communities of saltbush, desert thorn, and mesquite. A variety of birds, mammals, amphibians, and particularly reptiles, inhabit the Sonoran Desert. The fauna of the desert uplands is especially diverse and includes a range of game species: Gambel's quail, whitewing and mourning doves, desert bighorn sheep, mule deer, and javelina. Nongame species include the roadrunner, cactus wren, desert kangaroo rat, desert pocket mouse, desert iguana, and sidewinder. Wildlife experience disturbance from low-flying aircraft in some portions of the RMA.

Aquatic habitats are rare but ecologically important in this desert area. Springs, seeps, and tanks provide aquatic resources in the potential direct impact area. The Colorado River provides wetlands and fisheries, and the Gila River has several marsh habitats. Other aquatic resources in the ROI occur near Phoenix and Tucson, Arizona, and in the Cleveland National Forest, California. The Cabeza Prieta National Wildlife Refuge, most of which is proposed wilderness area, is within the potential direct impact area. Four research natural areas are located on Cabeza Prieta National Wildlife Refuge, and four Arizona-designated natural areas occur on Luke Air Force Range (AFR). Additional unique habitats in the indirect impact area include Kofa, Cibola, and Imperial national wildlife refuges, and several BLM wilderness study areas. Numerous other special management areas occur throughout the ROI.

Approximately 85 to 90 endangered Sonoran pronghorn occur within the potential direct impact area. The remainder of the world's population of Sonoran pronghorn occurs in Mexico and is estimated at 200 to 300. The following species of special concern may also occur in the direct impact area: the endangered American peregrine falcon and wood stork; 1 endangered plant, Tumamoc globeberry; 1 federally proposed plant species (*Mammillaria thornberi*); 6 federal-candidate plant species; 7 candidate animal species; 12 state-protected plant species; and 2 state-protected animal species. Occurring elsewhere in the ROI are 7 federally listed animal species (Yuma clapper rail, Gila topminnow, brown pelican, Colorado squawfish, Mexican wolf, masked bobwhite, and jaguarundi), 2 federally listed plant species (Arizona

agave and Nichol's turk's head cactus), 12 federal-candidate wildlife species, and 15 state-protected wildlife species. Twenty-two federal-candidate plant species and 12 state-protected plants occur in the Arizona ROI; 31 candidate plants occur in the California ROI. The considerable growth and development projected for the proposed project region is expected to result in increased impacts to biological resources of the area, regardless of whether the project is implemented.

3.6.3.2 Florida Complex

The predominant vegetation types of Eglin Air Force Base (AFB) and its surroundings are southern mixed forests and southern floodplain forests. Typical dominant trees of the forests include longleaf pine, slash pine, and various hardwoods such as turkey oak and live oak. Numerous mesic communities, such as bayheads, streambanks, fluvial swamps, and ponds, support titi, black titi, sweetbay, and bald cypress. Much of the base is under forest management. The upland and wetland habitats on Eglin AFB and in the ROI support a diverse assemblage of wildlife species. The most abundant big game species is the white-tailed deer; other game species present include the wild hog, wild turkey, black bear, bobwhite, and eastern cottontail. The area also serves as both a permanent residence and winter home for hundreds of bird species, including waterfowl, other waterbirds, raptors, and songbirds, and supports a variety of nongame mammals and herpetofauna.

Aquatic habitats are abundant on Eglin AFB and include streams, marshes, riparian forests, and coastal marine resources. Fifty-two species of fish are known to occur onbase. Numerous aquatic resources (including recreational waters) are found throughout the remaining ROI, associated with several major rivers and marine systems along the coast. Thirteen areas (primarily wetlands, but also including several upland sites) within the RMA are maintained in their natural state by Eglin AFB. Basin Bayou State Recreation Area is adjacent to the RMA. Two Outstanding Florida Waters are near the base. Numerous other sensitive habitats, most associated with freshwater and marine wetlands, occur throughout the ROI.

Two federally listed endangered species (Okaloosa darter and red cockaded woodpecker) and one threatened species (eastern indigo snake) inhabit the potential direct impact area. Six other federally listed threatened or endangered species (peregrine falcon, bald eagle, brown pelican, wood stork, Florida Everglade kite, and Bachman's warbler) may also reside in the area as permanent residents or migrants. Two species proposed for federal listing (Choctawhatchee beach mouse and Perdido beach mouse), as well as three wildlife candidate species (interior least tern, southeastern American kestrel, and snowy plover), occur in the direct impact area. Six federal-candidate plant species and 16 plants listed by the Florida Department of Agriculture and Consumer Services which are not under consideration for federal listing, and three state-listed wildlife species, may occur in the direct impact area. Four federally listed plants, 61 additional federal-candidate plants, 26 plants listed by the State of Florida, and 9 plants listed by the State of Georgia may occur in the indirect impact area. Twelve additional federally listed wildlife species are thought to occur in the indirect impact area.

Eighteen state-protected wildlife species and 18 federal-candidate species may also occur in the indirect impact area. The proposed project area is expected

to experience minor development and population growth if the project is not implemented. This will likely result in little new impact to biological resources.

3.6.3.3 Nevada Complex

The Nevada Complex is located in a transitional area between the Mojave Desert and the Great Basin. Biota of the area are representative of both major deserts and of transitional communities between them. In the direct impact area, extensive creosote bush communities occur on bajadas and valleys, and other areas support blackbrush, shadscale or sagebrush-dominated communities, pinyon-juniper woodlands, or Joshua tree woodlands. The diverse plant communities of the area provide a variety of valuable wildlife habitat. Game species present on the complex include mule deer, desert bighorn sheep, pronghorn, chukar, Gambel's quail, and mourning dove. A large number of bird species use the direct impact area and the ROI, either as seasonal or year-long habitat. The area also provides habitat for numerous nongame mammals and for reptiles, including the desert iguana and collared lizard. Wildlife experience disturbance from low-flying aircraft in some portions of the RMA.

Ponds and springs are important aquatic resources in the potential direct impact area. Ash Meadows, the Pahranagat Valley, and the Amargosa River provide habitat for sensitive fish communities in the indirect impact area. Major recreational opportunities and aquatic resources are found in the Colorado River and Lake Mead. A large portion of the potential direct impact area overlaps proposed wilderness area in the Desert National Wildlife Range. Pahranagat National Wildlife Refuge, Ash Meadows, Las Vegas Wash, and several BLM special management areas are nearby. Death Valley National Monument, Zion National Park, and other natural areas are located at the boundary of the ROI.

Two federally listed endangered animal species (bald eagle and peregrine falcon) are transients in the complex area. Four federal-candidate wildlife species (Amargosa vole, desert tortoise, ferruginous hawk, and spotted bat) may occur in the RMA. Four state-protected animal species, including the prairie falcon, sparrow hawk, Cooper's hawk, and red-tailed hawk, are likely to occur within installation boundaries and in potential direct impact areas. Twelve federal-candidate plants, including two species, *Arctomecon californica* and *Astragalus beatleyae*, that are also state-listed (Nevada), are known to occur within the Nevada Complex. Nine federally listed plant species and 37 candidate plants are present elsewhere in the ROI. An additional 17 federally listed wildlife species, as well as 8 federal-candidate and 5 state-protected species, occur in the indirect impact area. The proposed project area is expected to receive considerable development and population growth, regardless of whether the project is implemented. Increased pressure on biological resources of the area is likely.

3.6.3.4 New Mexico Complex

The vegetation and wildlife of the direct impact area of the New Mexico Complex are those common to the Chihuahuan Desert. Lower elevations of this desert support grassland and desertscrub communities. Predominant vegetation types are the sand dune mesquite, salt flat, and creosote bush scrub types. Desert grasslands of the area consist primarily of tobosa, sacaton, dropseed, and grama grasses. Some areas of the complex and possibly the RMA have been

disturbed by previous military exercises and activities. Wildlife of the area include a variety of mammals, birds, and herpetofauna. Game species include mule deer, pronghorn, oryx (an exotic antelope), scaled quail, and mourning dove. Bighorn sheep and mountain lions inhabit the more mountainous areas. Typical nongame species are the white-necked raven, black-throated sparrow, roadrunner, spotted ground squirrel, and round-tailed horned lizard.

Salt Creek, Malpais Spring, Lost River, and several playas lie in the potential direct impact area. The Rio Grande, the Pecos River, and mountain streams provide the major aquatic resources in the ROI. Large wetlands and sport fisheries are associated with Elephant Butte Reservoir and other lakes in the study area. The San Andres National Wildlife Refuge, White Sands National Monument, and a portion of the Jornada Experimental Range are within the boundaries of White Sands Missile Range. Several national wildlife refuges, wilderness areas, and special management areas occur in the remaining ROI.

The federally listed bald eagle and peregrine falcon are migratory in the complex area; in addition, the peregrine falcon may reside or nest on the complex. The White Sands pupfish (a candidate for federal listing) occurs in Salt Creek, Mound Springs, and Malpais Spring in the direct impact area. Nine additional federal-candidate species (Penasco chipmunk, spotted bat, Swainson's hawk, ferruginous hawk, White Sands woodrat, long-billed curlew, Organ Mountain chipmunk, white-faced ibis, and Sacramento Mountain salamander) and ten state-protected wildlife species also occur in the direct impact area. Three federally listed plant species (*Hedeoma todsenii*, *Echinocereus fendleri* var. *kuenzleri*, and *Coryphantha sneedii* var. *sneedii*), six federal-candidate plants (*Oenothera organensis*, *Argemone pleiacantha* ssp. *pinnatisecta*, *Penstemon alamosensis*, *Rosa stellata*, *Toumeya papyracantha*, and *Perityle cernua*), and seven additional state-listed plants not considered for federal listing may occur in the direct impact area. Four federally listed plants (*Eriogonum gypsophilum*, *Hedeoma apiculatum*, *Echinocereus lloydii*, and *Coryphantha sneedii* var. *leei*) and one proposed plant (*Cirsium vinaceum*) occur elsewhere in the ROI. Fourteen federal-candidate plants and nine species listed by the State of New Mexico but not considered for federal listing also occur in the New Mexico ROI. Four federal-candidate plants are known to occur in the ROI in Texas. Five federally listed wildlife species (whooping crane, wood stork, Socorro isopod, Chihuahua chub, and Gila trout), 14 federal-candidate species, and 41 state-protected species also occur in the ROI. The proposed project area is expected to experience modest development and population growth, regardless of whether the project is implemented. This will likely result in increased pressure on biological resources of the area.

3.6.3.5 South-Central California Complex

The vegetation and wildlife of the direct impact area of the South-Central California Complex are primarily representative of the Mojave Desert. Much of the area is covered by vast expanses of creosote bush and a common associate, bursage. Blackbush scrub, Joshua tree woodlands, shadscale scrub, and saltbush scrub may be locally dominant. Pinyon-juniper woodlands are found at higher elevations of the desert mountains. The vegetation and wildlife habitat on substantial areas of the complex is currently disturbed because of previous and ongoing military exercises and activities. The vegetation types present provide a variety of wildlife habitats. Game species include desert

bighorn sheep (which has special protected status), mule deer, desert cottontails, chukar, quail, dove, and various waterfowl. Coyotes, kit foxes, and, in mountain habitats, the mountain lion, are also known to inhabit the area. Many nongame mammals, birds such as LeConte's thrasher and the horned lark, and particularly reptiles, including the desert iguana, sidewinder, and chuckwalla, are also residents of the area. Wildlife experience disturbance from low-flying aircraft in some portions of the RMA.

One area of ponds and marsh habitat (Piute Ponds) that supports abundant wildlife exists on Edwards AFB in the potential direct impact area. Sport fisheries are found in the mountains of the ROI, the Colorado River, and the Kern River. Sensitive aquatic habitats occur along the Mojave and Amargosa rivers. Springs and temporary waters occur in the direct impact area and are important throughout the ROI. Unique mountain habitats occur in the potential direct impact area on China Lake Naval Weapons Center (NWC), and desert tortoise habitat occurs on Fort Irwin National Training Center (NTC), on Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC), and several areas on Edwards AFB. Death Valley National Monument, Lake Havasu National Wildlife Refuge, wilderness areas in national forests, and BLM land and numerous special management areas occur throughout the ROI.

The federally listed bald eagle and peregrine falcon migrate through the area and may occasionally be found in the direct impact area. The Inyo brown towhee, desert tortoise, Panamint alligator lizard, Swainson's hawk, ferruginous hawk, spotted bat, Mojave ground squirrel, southern rubber boa (all federal-candidate species), and the least Bell's vireo (proposed for federal listing), are known to or may occur within the direct impact area. Five candidate plant species (*Dudleya saxosa* ssp. *saxosa*, *Coryphantha vivipara* var. *alversonii*, *Eriophyllum mohavense*, *Pholisma arenarium*, and *Cordylanthus eremicus* ssp. *eremicus*) occur or are likely to occur in the direct impact area. Six federally listed plants and 134 federal-candidate plants, many also protected by the California Native Plant Protection Act, occur elsewhere in the ROI. The Mohave chub, a federally listed endangered species, occurs in one marsh system (Lark Seep Lagoon) and associated drainages in the indirect impact area of China Lake NWC. Twelve additional federally listed, 18 federal-candidates (including 2 proposed for listing), and 7 state-protected wildlife species occur elsewhere in the ROI. Increased impacts to the biological resources of the ROI are expected regardless of whether the proposed project is implemented, since considerable development and population growth is expected in the coming years.

3.6.3.6 Washington Complex

The Washington Complex lies within the shrub-steppe region of the Columbia River Basin. Much of the native vegetation of the region has been converted to agriculture. Previous and ongoing military exercises and activities have disturbed the vegetation and wildlife habitat of some areas of the complex. The most extensive natural vegetation type of the direct impact area is big sagebrush-dominated shrubland. Other locally dominant shrubs include bitterbrush, rabbitbrush, greasewood, and winterfat. Riparian habitat occurs along the Columbia River and its tributaries. A diverse group of wildlife inhabits the shrub-steppe, shrub, and riparian habitats of the direct impact area and the region. The most common large game animal is the mule deer. Additional game animals in the general area include pronghorn, cottontails, chukar, Hungarian partridges, and pheasants.

The complex, including the direct impact area, provides important wetland and riparian habitat for aquatic-dependent furbearers, migratory and resident waterfowl, and other waterbirds. Several marshes, three perennial streams without major fisheries, and two ponds stocked with trout exist on Yakima Firing Center (FC). The Hanford Reach of the Columbia River provides important pristine aquatic habitat. Anadromous (e.g., salmon) and freshwater fisheries and wetlands are abundant in the Columbia River system within the ROI. Potential direct impact area on the Department of Energy (DOE) Hanford Site overlaps portions of the Saddle Mountain National Wildlife Refuge, the Wahluke Slope State Wildlife Recreation Area, and the Arid Lands Ecology Reserve. Several sensitive wetland habitats occur on Yakima FC. National wildlife refuges, wilderness areas, and other special management areas occur throughout the ROI.

The federally listed bald eagle occurs in the direct impact area during migration; four additional threatened or endangered species (peregrine falcon, grizzly bear, gray wolf, and Columbian white-tailed deer) may occur in areas adjacent to the direct impact area. Four federal-candidate animal species, the ferruginous hawk, sage grouse, long-billed curlew, and Swainson's hawk, and four animal species listed by the State of Washington (white pelican, sandhill crane, pygmy rabbit, and spotted owl) occupy the direct impact area. Five federal-candidate plants and nine State of Washington proposed sensitive plants are known to occur within the complex. Thirty-eight additional candidate plants and over 100 Washington state-listed plants of special status are believed to occur elsewhere in the ROI. In addition, four federal-candidate and eight state-listed wildlife species occur elsewhere in the ROI. This area is expected to experience little additional development and population growth in the coming years if the proposed project is not implemented. This is likely to result in little additional pressure to and degradation of biological resources.

3.6.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

3.6.4.1 Ellsworth Air Force Base

Ellsworth AFB lies on the western edge of the Great Plains. Although large areas of native prairie have been converted to agriculture, much of western South Dakota still maintains natural grassland. The native vegetation throughout the area is characterized as mixed prairie of mid and short-grasses. The wheatgrass-grama grass type occurs extensively in the area. Four diverse wildlife habitat types occur in the area: agricultural land, grassland, grassland/shrubland, and riparian. In addition, coniferous forest occurs in the nearby Black Hills and Pine Ridge Escarpment. Huntable populations of pronghorn, mule deer, white-tailed deer, elk, and bison occur in the region. Rocky Mountain bighorn sheep and mountain goats have been introduced into several mountainous areas. Upland game birds, waterfowl, shorebirds, furbearers, and a variety of nongame mammals, birds, and herpetofauna are common in the ROI.

Three fishing lakes and minor areas of emergent vegetation occur on Ellsworth AFB. The Belle Fourche and Cheyenne rivers drain the deployment area. Streams in the Black Hills provide coldwater fisheries, and lowland streams and lakes provide warmwater fisheries. Wetlands are primarily associated with

riparian zones along major drainages. The Badlands and Wind Cave national parks; Jewel Cave, Mount Rushmore, and Devils Tower national monuments; Black Elk Wilderness and Sage Creek Wilderness; Lacreek National Wildlife Refuge; and several special management areas occur in the ROI.

No federally listed threatened or endangered species are known to inhabit the direct impact area; however, four endangered bird species (bald eagle, American peregrine falcon, Arctic peregrine falcon, and whooping crane) are transients in the area and may occur on Ellsworth AFB occasionally. The federal-candidate northern swift fox may also occur onbase and in the deployment area. Four additional federal-candidate bird species (interior least tern, ferruginous hawk, Swainson's hawk, and long-billed curlew) occur within the deployment area. Two federal-candidate plants (Eriogonum visheri and Astragalus barrii) and one plant (Gentiana affinis) listed by the South Dakota National Heritage Program occur in counties in the deployment area. Only one state-protected wildlife species (osprey) occurs in the direct impact area. Six federal-candidate animal species and 17 state-listed species inhabit the ROI. The extremely rare black-footed ferret may also occur in the ROI. Forty-one additional state-listed plant species occur in the ROI outside the deployment area. This area is expected to experience little growth and development in the coming years if the proposed project is not implemented. Little additional impact to biological resources of the area should occur as a result.

3.6.4.2 F.E. Warren Air Force Base

The native vegetation of F.E. Warren AFB and vicinity is predominantly short-grass prairie. Blue grama and buffalograss are dominant, but tall grass species are also prominent in less-grazed grasslands. Much of the native short-grass prairie is used for rangeland or has been converted to agriculture. Meadows, riparian areas, ponderosa pine and introduced woodlands, and shrub types provide additional habitat in the area. Big game species typical of the area include mule deer, white-tailed deer, and pronghorn. Upland game birds also occur in the area including pheasant, bobwhite, sharp-tailed grouse, and mourning dove. The prairie provides habitat for typical grassland animals such as the black-tailed prairie dog, which is a potential indicator species for the federal-endangered black-footed ferret, and plains pocket gopher. Amphibians and aquatic reptiles inhabit meadow and riparian communities.

Crow and Diamond creeks and two lakes occur on F.E. Warren AFB. Lodgepole, Diamond, and Horse creeks flow through the deployment area. These resources contain mainly nongame fisheries and narrow riparian zones, though the lakes onbase are stocked with trout. Mountain streams support coldwater fisheries, and waters at lower elevations support warmwater fisheries. Several narrow riparian zones occur near the potential direct impact area. The remaining ROI contains four national wildlife refuges, two national monuments, several wilderness areas, and areas under special management.

No federally listed threatened or endangered species are known to inhabit the base; however, three endangered species are transients in the area (bald eagle, peregrine falcon, and whooping crane) and may occur onbase for short periods. In addition, the federal-candidate listed northern swift fox occurs in the deployment area and may occur onbase. Three additional federal-

candidate wildlife species occur onbase (long-billed curlew, white-faced ibis, and mountain plover), and the state-listed (Wyoming) sharp-tailed grouse, burrowing owl, osprey, and pale milk snake occur in the deployment area. The Colorado butterfly plant (federal-candidate species) occurs onbase and in the deployment area, and one plant species (Astragalus mollissimus) listed by Wyoming as rare occurs in the area. A conservation plan has recently been prepared for the Colorado butterfly plant, and areas on F.E. Warren AFB have been designated for the protection of this species. One federally listed plant species (Phacelia formosula), 10 federal-candidate plants, over 70 species listed by the Wyoming Natural Heritage Program, and 11 species considered imperiled, critically imperiled, or rare in Colorado occur elsewhere in the ROI. Six Nebraska state-listed species occur in the ROI in that state. Two additional federally listed wildlife species (greenback cutthroat trout and piping plover), five federal-candidate, and ten state-protected wildlife species occur in the ROI. The endangered black-footed ferret also may occur in the ROI. This area is expected to experience modest development and population growth in the coming years, regardless of whether the proposed project is implemented. Some continued impacts to and degradation of biological resources can be expected in the region regardless of the proposed project.

3.6.4.3 Grand Forks Air Force Base

The predominant native vegetation of Grand Forks AFB and vicinity is grassland. Tall-grass prairie once dominated the eastern North Dakota portion of the ROI while a transition grassland dominated the western part. Floodplain or riparian forests of cottonwoods, willows, and elms occur along major rivers and streams. Much of the native grassland has been converted to agricultural land. Some of the native grassland has been modified by extensive historical and present grazing. The Grand Forks AFB ROI historically supported diverse and abundant wildlife characteristic of prairie, forest, and wetland habitats. Game species in the area today include white-tailed deer, pheasants, ruffed grouse, sharp-tailed grouse, and wild turkey. The region also provides habitat for numerous furbearers and nongame mammals, birds, and herpetofauna.

The famous prairie pothole region, characterized by prairie dotted with thousands of ponds and marshes providing important waterfowl habitat, extends through much of the area. The Devils Lake complex, Ashtabula Reservoir, and the Red, Turtle, Sheyenne, and James rivers are close to the deployment area. The HML transit routes intersect 58 major aquatic habitats, and wetland habitats occur on and near the MOB. Streams and wetlands in the ROI provide major fisheries. Fourteen national wildlife refuges are located in the ROI. These refuges and numerous other special management areas protect wetland habitats. Other unique and sensitive habitats include designated remnant prairie habitats.

The potential direct impact area does not contain any known federally listed threatened or endangered plant or animal species; however, adjacent areas are occasionally frequented by three endangered migratory species (bald eagle, peregrine falcon, and whooping crane). Three endangered animal species (black-footed ferret, piping plover, and gray wolf) may inhabit areas in the rest of the ROI. No federal-candidate animal species or state protected species are known to occur within the direct impact area. One federal-candidate plant species (Platanthera leucophaea) and 67 plant species

considered threatened or endangered by the North Dakota Chapter of the Wildlife Society may occur in the deployment area. Thirty-four additional plants considered threatened or endangered by the Wildlife Society occur elsewhere in the ROI in North Dakota. Nineteen plants listed as threatened or endangered and 40 plants considered of special concern by the State of Minnesota (including 3 plants that are also federal candidates) occur in the ROI in Minnesota. Two federal-candidate wildlife species (long-billed curlew, northern swift fox, and ferruginous hawk) and 12 state-protected wildlife species occur in the ROI. This area is expected to experience little development and growth in the coming years if the proposed project is not implemented. This is likely to result in little new impact to biological resources of the area.

3.6.4.4 Malmstrom Air Force Base

Much of the native vegetation of Malmstrom AFB and the ROI is mixed and short-grass prairie. Dominant species of the grasslands include needle-and-thread grass, western and thickspike wheatgrass, green needlegrass, bluebunch wheat-grass, and blue grama. Foothills grasslands, dominated by fescues, bluebunch wheatgrass, and needle-and-thread grass, occur extensively in the foothills and more mountainous areas. Sagebrush is often associated with these types. Much of the area, once covered by native grassland, has been converted to agriculture. The ROI provides diverse habitats for the area's abundant wild-life. Common game animals in the area include mule and white-tailed deer, pronghorn, Rocky Mountain elk, mountain goat, bighorn sheep, moose, black bear, grouse, gray partridge, wild turkey, pheasant, and mourning dove. Waterfowl are attracted to the glaciated prairie region of northern Montana, and to other aquatic habitats in the area. Numerous nongame mammals, birds, and herpetofauna occur throughout the ROI.

Wetlands occur throughout the ROI along narrow riparian zones and in scattered potholes. Prairie potholes and riparian wetlands occur near some of the silos and HML transit routes. One fishing pond is located onbase. Excellent fisheries are found in the rivers of the study area (e.g., the Yellowstone, Missouri, Smith, Musselshell, Judith, Teton, and Shields). Three national wildlife refuges, the Giant Springs, and the Wild and Scenic River portion of the Missouri River are located near the base and deployment area. The greater study area includes numerous wilderness and special management areas, two national wildlife refuges, and Glacier National Park.

Two federally listed endangered species, the bald eagle and peregrine falcon, are known to occur in the area and may occasionally be found in the direct impact area. Two threatened species (grizzly bear and gray wolf) and three endangered species (black-footed ferret, Arctic peregrine falcon, and whooping crane) are found elsewhere in the ROI. Nine federal-candidate wildlife species and four state-listed species occur in the direct impact area. One Category 2 candidate plant species (*Antennaria aromatica*), 14 plants listed as imperiled or critically imperiled by the Montana Natural Heritage Program are likely to occur near silos in the deployment area. Eight candidate plants and 12 plants listed by the Montana Natural Heritage Program may occur in the indirect impact area. Seven federal-candidate and five state-protected wildlife species occur in the ROI.

This area is expected to experience little development and growth in the coming years if the proposed project is not implemented. This is likely to result in little new impact to biological resources of the area.

3.6.4.5 Minot Air Force Base

The native vegetation of the Minot AFB ROI consists largely of two major grassland types: mixed-grass prairie and transition grassland. Woodland types include floodplain forests along major rivers and streams, a juniper type in the Badlands, and hardwood draws. These types provide valuable habitat for many wildlife species. Nearly two-thirds of the area once occupied by native grassland in the silo area has been converted to agriculture. White-tailed deer are the most common big game species in the ROI. Other game species in the region include pronghorn, moose, elk, bighorn sheep, pheasant, sharp-tailed grouse, wild turkey, and sandhill cranes.

Although land use changes have resulted in the conversion of thousands of acres to farmlands and pasture lands, the abundant prairie pothole wetlands in the ROI still provide important nesting, feeding, and production areas for thousands of waterfowl and shorebirds. Many of these wetlands and several large streams (e.g., the Souris and Des Lacs rivers) occur in the deployment area and provide excellent fisheries resources. The HML transit routes intersect 88 major aquatic habitats. Eight of 20 national wildlife refuges in the ROI occur near the deployment area (1 silo is located in Lostwood National Wildlife Refuge). These refuges and the majority of the other special management areas in the study region are associated with wetland habitats and waterfowl production areas.

Two migratory bird species that are federally listed as endangered (bald eagle and peregrine falcon) may occur onbase for short periods. In addition, the piping plover, which is federally listed, may occur onbase and/or in the deployment area. The federal-candidates interior least tern and northern swift fox may also occur in the direct impact area. The endangered black-footed ferret may occur within the ROI. The State of North Dakota also lists 16 endangered animal species which possibly inhabit the deployment area. One federal-candidate plant species (Eriogonum visheri) and 62 additional species considered threatened or endangered by the North Dakota Chapter of the Wildlife Society occur in counties in the deployment area. Fifty-two additional plant species listed by the Wildlife Society are believed to occur elsewhere in the ROI. Two federal-candidate wildlife species (long-billed curlew and sicklefin chub) and 25 state-protected species are thought to occur in the ROI. This area is expected to experience little growth or development in the coming years if the proposed project is not implemented. This is likely to result in little new impact to biological resources of the region.

3.6.4.6 Whiteman Air Force Base

The native vegetation of Whiteman AFB and vicinity is primarily tall-grass prairie and oak-hickory forest of the Ozark region. Much of the forest, particularly in the larger river bottoms where more fertile soils occur, has been cleared and cultivated. Some areas have been logged or burned. The prairie region, which covers much of western and northern Missouri, has experienced similar conversions to agriculture. The native prairie is a bluestem prairie dominated by big and little bluestems, switchgrass, and Indian grass.

The two structurally contrasting vegetation types in the region, the prairie and the forest, and the diversity created by present land uses, provide habitat for animals characteristic of both open land and forest, and for animals requiring two or more types of habitats. A large number of wildlife species occur on Whiteman AFB and the ROI, including game species such as the northern bobwhite, greater prairie chicken, turkey, eastern cottontail, and white-tailed deer.

Ponds and streams are common onbase, near the missile fields, and in the remaining ROI. The major rivers in the ROI are the Missouri, Kansas, and Osage (including Harry S Truman Reservoir). Warmwater species comprise most of the fisheries in this area. Wetlands consist primarily of bottomland forests in floodplains and oxbow lakes. The State of Missouri has designated 47 natural areas (11 are near the missile fields) in the ROI. Swan Lake, Squaw Creek, and Flint Hills national wildlife refuges also occur in the study area. These and other special management areas are divided equally among prairie and wetland habitats.

No federally listed endangered or threatened species are known to reside on Whiteman AFB; however, three endangered animal species (bald eagle, American peregrine falcon, and Arctic peregrine falcon) are migratory in the area and may occasionally occur onbase for short periods. A fourth federally listed species, the Indiana bat, may also occur onbase occasionally since its summer range includes Whiteman AFB. In addition, caves that have been designated as critical habitat for the Indiana bat occur in the southeastern part of the ROI. No federal-candidate wildlife species occur in the direct impact area. The greater prairie chicken (Missouri-rare) occurs onbase and eight additional state-protected species occur in the deployment area. One proposed species, _Geocarpon minimum_; 2 federal-candidate plant species (_Asclepias meadii_ and _Platanthera leucophaea_); and 28 additional special status species that are listed by the State of Missouri but are not under consideration for federal listing occur or occurred historically in counties in the deployment area. One federally proposed plant (_Lesquerella filiformis_), 5 plants under consideration for federal listing, and 120 additional state-listed (Missouri) special status plants occur or occurred historically elsewhere in the ROI. Four federally listed wildlife species (gray bat, whooping crane, eskimo curlew, and piping plover), as well as 9 federal-candidate and 23 state-protected species, occur in the ROI. This area is expected to experience little growth or development in the coming years if the proposed project is not implemented. This is likely to result in little new impact to biological resources of the region.

3.6.5 Existing and Projected Conditions for Hard Silo in Patterned Array

3.6.5.1 Davis-Monthan Air Force Base

The native vegetation and wildlife of Davis-Monthan AFB and much of the lower elevations of the ROI are characteristic of the Sonoran Desert. Communities dominated by paloverde-saguaro or paloverde-cactus occupy bajadas and mountain slopes and are common at the MOB. Lower, more arid parts of the direct impact area support communities dominated by creosote bush and its major associate, bursage. Desert grassland and Chihuahuan desertscrub also occur in the direct impact area. Despite the harsh desert environment, the area supports many birds, mammals, and herpetofauna. Typical species associated with the Sonoran

Desert are described in Section 3.6.3.1. Additional species characteristic of the grassland types, such as the meadowlark and horned lark, and Chihuahuan Desert species, also occur in the area. Common game animals include mule deer, javelina, scaled and Gambel's quail, and mourning dove.

The SDA overlaps portions of the San Pedro and Santa Cruz rivers and Altar and Babocomari washes; Sonoita Creek borders SDA. These areas support desert, riparian, marsh, and sensitive fish habitat. Mountain streams near Tucson provide habitat for sensitive fish species, while major game fisheries occur northeast of Phoenix. Several unique habitats occur on or near SDA. These habitats include USFWS unique ecosystems, Arizona-designated natural areas, the Saguaro National Monument, BLM wilderness study areas, and USFS wilderness areas. In the remaining ROI, the mountains and desert contain numerous special management areas.

No federally listed threatened or endangered species are known to occur on Davis-Monthan AFB, but four endangered animal species (Yuma clapper rail, masked bobwhite, jaguarundi, and Gila topminnow) occur in the SDA. Eight animal species that are federal-candidate wildlife species, in addition to nine state-protected wildlife species, also occur in SDA. One federally listed endangered plant species, Tumamoca macdougalii; nine federal-candidate plants, three of which are also protected by the Arizona Native Plant Protection Act; and ten additional species protected by the Act but not under consideration for federal listing may occur in the direct impact area. Three federally listed endangered plants, 2 species proposed as threatened, 27 federal-candidate plants, and 17 plants protected by the State of Arizona are likely to occur in the indirect impact area. Nine federally listed wildlife species (bald eagle, northern aplomado falcon, peregrine falcon, Mexican wolf, jaguar, yaqui chub, yaqui catfish, yaqui beautiful shiner, and Apache trout) and four federal-candidate species (desert pupfish, Sonora chub, loach minnow, and flat-tailed horned lizard) occur elsewhere in the ROI. Seven state-protected animals occur in the ROI. Considerable development and growth are expected in southern Arizona in the coming years, regardless of whether the proposed project is implemented. This growth is likely to place additional pressure on biological resources.

3.6.5.2 Edwards Air Force Base

The vegetation and wildlife of Edwards AFB and the SDA are characteristic of the Mojave Desert and are described in Section 3.6.3.5. Common vegetation types of the direct impact area are the creosote bush scrub, saltbush scrub, and Joshua tree woodland. Creosote bush scrub is the most extensively occurring type in the area. Animals typical of the Mojave Desert include LeConte's thrasher, roadrunner, Merriam kangaroo rat, kit fox, and Mojave rattlesnake. The feral burro also occurs in the area. No major aquatic habitats occur in the direct impact area.

The Mojave River provides habitat near SDA for several sensitive species. Springs and ponds in the ROI are also important resources. Major aquatic and recreational resources occur in the mountain regions (including the Kern River and many regional reservoirs). Unique habitats on or near SDA include BLM, California Fish and Game, and USFWS special management (or interest) areas. Edwards AFB and several additional areas near SDA have been identified as significant ecological areas by Los Angeles County. The remaining ROI contains numerous BLM and USFS special management areas.

No federal ˛ listed species are residents within the direct impact area; two endangered bird species (peregrine falcon and bald eagle) are transients in the area. Additional federally listed threatened and endangered species that occur in the ROI are the Mohave chub, blunt-nosed leopard lizard, unarmored three spine stickleback, San Joaquin kit fox, Little Kern golden trout, and California condor. Eight federal-candidate plant species, as well as the desert tortoise and Mojave ground squirrel (both federal-candidate and state-protected species), are likely to occur in the direct impact area. Three federally listed plant species and 87 additional candidate plant species occur or are likely to occur in the indirect impact area. Twenty-two federal-candidate and one state-protected wildlife species occur in the ROI. This area is expected to experience considerable growth and development in the coming years, even if the proposed project is not implemented. Increased impacts to the biological resources of the area are expected to result from development.

3.6.5.3 F.E. Warren Air Force Base

The vegetation and wildlife of F.E. Warren AFB and vicinity are characteristic of the short-grass prairie and are described in Section 3.6.4.2. Lodgepole, Crow, and Diamond creeks, and one lake, occur in the potential direct impact area. These habitats do not support important game fish species. Wetlands are largely restricted to narrow riparian zones along these streams and throughout the ROI. Major aquatic resources in the ROI provide warmwater and coldwater fisheries depending upon their elevation. Several national wildlife refuges, wilderness areas, national monuments, and other special management areas exist within the ROI, though most of these are not near SDA.

Three federally listed migratory bird species (bald eagle, peregrine falcon, and whooping crane), may occur within the SDA. Two additional federally listed wildlife species also exist in the ROI (greenback cutthroat trout and piping plover). The federally listed black-footed ferret may also occur in the ROI. Four federal-candidate animals (long-billed curlew, northern swift fox, white faced ibis, and mountain plover) and four state-listed animals (sharptail grouse, burrowing owl, pale milk snake, and osprey) are likely to occur in SDA or onbase. Unique habitat for the Colorado butterfly plant, a Federal Category 1 species, occurs on F.E. Warren AFB in the Crow and Diamond Creek riparian zones. One species listed as unique (*Notholaena fendleri*) and seven species listed as rare in Wyoming, and one species listed as threatened in Nebraska (*Lesquerella ovalifolia* ssp. *ovalifolia*), may occur in the deployment area. One federally listed plant species (*Phacelia formosula*), ten federal-candidate plant species, 68 species considered rare in Wyoming, 11 species considered imperiled or critically imperiled in Colorado, and 6 species considered threatened in Nebraska are likely to occur elsewhere in the ROI. In addition, five federal-candidate and ten state-protected wildlife species occur in the ROI. This area is expected to experience modest development and population growth in the coming years, regardless of whether the proposed project is implemented. Therefore, some continued impacts to and degradation of biological resources of the region can be expected.

3.6.5.4 Fort Bliss

The vegetation and wildlife of Fort Bliss and the associated SDA are characteristic of the Chihuahuan Desert and are described in Section 3.6.3.4. Palustrine emergent and riparian shrub vegetation occur in two arroyos in the

parcel of SDA southeast of El Paso. Tanks and seeps provide the only additional aquatic habitats in the direct impact area. The Rio Grande (including reservoirs), Gila River, and perennial streams of the Sacramento Mountains provide wetland, fisheries, and recreational resources in the ROI. Roderick Ecological Plot (BLM) occurs on SDA southwest of Las Cruces. Unique habitats in the remaining ROI include sensitive wetland zones and other special management areas (BLM, USFS, USFWS, State of New Mexico, and State of Texas).

Bald eagles are migratory in the region and may occasionally occur on Fort Bliss or the SDA. The peregrine falcon is a resident in the area, as well as possibly nesting on Fort Bliss or in the SDA. The wood stork and whooping crane may occasionally occur onbase during migration. Seven federal proposed/candidate species (Organ Mountain chipmunk, Swainson's hawk, ferruginous hawk, snowy plover, mountain plover, western yellow-billed cuckoo, and interior least tern) also occur in the direct impact area. Three federally listed species (Chihuahua chub, Gila trout, and Socorro isopod) and 14 candidate animal species are found in the indirect impact areas of the ROI. Seven state-listed species (Trans-Pecos rat snake, rock rattlesnake, black-tailed prairie dog, Baird's sparrow, Colorado chipmunk, Sonora Mountain king snake, and gray vireo) inhabit the direct impact area, and 35 additional state-listed wildlife species occur in the ROI. One plant federally listed as endangered, Coryphantha sneedii var. sneedii, may occur in or near SDA on the western boundary of Fort Bliss. Two federal-candidate plants (Cereus greggii and Opuntia arenaria) and three additional species listed by New Mexico as endangered (Coryphantha scheeri, Mammillaria wrightii var. wrightii, and Talinum longipes) may occur in the direct impact area. Five federally listed plants, 1 federally proposed plant species, 18 additional candidate plants, and 11 plant species considered endangered in New Mexico occur or are likely to occur in the indirect impact area. The ROI is expected to experience modest development and population growth in the coming years, regardless of whether the proposed project is implemented. As a result, biological resources are likely to receive minor increased pressure and degradation.

3.6.5.5 Gila Bend Air Force Auxiliary Field

The vegetation and wildlife of Gila Bend Air Force Auxiliary Field (AFAF) and the SDA are typical of those of the Sonoran Desert and are described in Section 3.6.3.1. The Lower Colorado subdivision, where vegetation is characterized by creosote bush and bursage-dominated communities, is the most extensive Sonoran Desert subdivision in the SDA.

Springs and tanks provide important water sources in the direct impact area. The Gila River receives irrigation return water and treated wastewater, supporting patches of marsh. Painted Rock Reservoir supports riparian shrubs and limited fisheries. Major fisheries occur in the Colorado River and reservoirs, and in streams northeast of Phoenix and Tucson. Several Arizona-designated natural areas and BLM special management areas occur in or near SDA. The Fred J. Weiler Green Belt covers a large section of the Gila River near SDA. The remaining ROI contains numerous national wildlife refuges, national monuments, wilderness areas, and BLM special management areas.

The Sonoran pronghorn, a federally listed endangered species, inhabits potential SDA. An additional endangered migratory species (peregrine falcon) may exist within SDA occasionally. Two additional endangered species (jaguarundi

and Yuma clapper rail) occur in the ROI. The razorback sucker, desert tortoise, spotted bat, Sonora green toad, and black rail are federal wildlife candidates that occur within the direct impact area. In addition, four animal species protected by the State of Arizona (desert bighorn sheep, desert fringe-toed lizard, osprey, and tropical kingbird) occur within the direct impact area. One federally listed plant species (*Echinocactus horizonthalonius* var. *nicholii*), one federally proposed species (*Mammillaria thornberi*), one federal-candidate plant species (*Neolloydia erectocentra* var. *acunensis*), and ten species protected by the Arizona Native Plant Act may occur in the direct impact area. Two federally listed endangered plants (*Agave arizonica* and *Tumamoca macdougalii*), 21 federal-candidate species, and 14 additional state-listed plants are likely to occur elsewhere in the ROI. In addition, nine federal-proposed/candidate and nine state-protected wildlife species are thought to occur in the ROI. This area is expected to experience considerable development and growth in the coming years, regardless of whether the proposed project is implemented. This is expected to result in increased pressure on biological resources.

3.6.5.6 Yuma Proving Ground

The vegetation and wildlife of Yuma Proving Ground (PG) and the SDA are typical of the Sonoran Desert and are described in Section 3.6.3.1. Other locally common communities include sand dune communities, and where alkaline or salty soils occur, saltbush scrub communities.

Springs and tanks are important resources in the potential direct impact area. The Colorado River system provides extensive wetland and fisheries resources near SDA. Additional fisheries and recreational aquatic habitats occur near Phoenix, Arizona and in the Cleveland National Forest and Salton Sea, California. Several Arizona-designated natural areas, BLM special management areas, and California Fish and Game management areas occur in Arizona and California.

Three federally listed endangered animal species, the Sonoran pronghorn, American peregrine falcon, and wood stork, inhabit potential direct impact areas. Six federal-candidate animal species (spotted bat, Swainson's hawk, desert tortoise, black rail, flat-tailed horned lizard, and razorback sucker) and six candidate plants also exist within the direct impact area. Three state-listed animal species (Colorado fringe-toed lizard, desert bighorn sheep, and tropical kingbird), four plants protected by the Arizona Native Plant Law but not under consideration for federal listing (*Rhus kearneyi*, *Triteleiopsis palmeri*, *Carnegia gigantea*, and *Washingtonia filifera*), and one plant species protected by the California Native Plant Protection Act (*Croton wigginsii*) may occur in the direct impact area. Three additional federally listed wildlife species are thought to occur in the ROI: bald eagle, brown pelican, and Yuma clapper rail. In addition, three federal-candidate wildlife species and five state-listed animal species occur elsewhere in the ROI. One endangered plant species (*Tumamoca macdougalii*), 1 proposed species (*Mammillaria thornberi*), 34 federal-candidate plants, and 4 state-protected (Arizona and California) plants occur elsewhere in the ROI. The proposed project area is expected to experience little additional development and population growth in the coming years, regardless of whether the project is implemented. This is likely to result in little additional pressure to and degradation of biological resources.

3.7 Air Quality and Noise

Construction and operation of the Small Intercontinental Ballistic Missile (ICBM) system may result in the emission of various air contaminants and potential noise level increases at the Main Operating Bases (MOBs), Suitable Deployment Areas (SDAs), and deployment installations. Air quality regulations applicable to the proposed project are established by the Environmental Protection Agency (EPA) according to the Clean Air Act of 1963 and the environmental agencies of the various states. The air quality resource baseline descriptions describe general conditions. Specific site or local variations will be described in detail later in the Environmental Impact Analysis Process (EIAP).

Project-related increases in noise levels may occur as a result of construction of facilities and increases in traffic during the construction and operations phases. The EPA, in response to congressional direction, has published information regarding levels of environmental noise consistent with protection of public health and welfare (Noise Control Act of 1972). Similarly, the Federal Highway Administration (FHWA) has established standards for highway traffic noise, and the Federal Aviation Administration (FAA) has jurisdiction over regulating airport noise. In addition, some states and localities have published guidelines for evaluating land use compatibility with various noise environments. Since noise is related to specific events, conditions, and locations, only very general data are presented for baseline conditions.

3.7.1 Resource Description

Air Quality. Air quality is defined as the descriptive summation of health and welfare-related pollutant effects, including quantitative measures of the amount of certain pollutants in the air, and related aesthetic concerns such as visibility and environmental damage. Both long-term climatic factors and short-period weather fluctuations that control pollution dispersion conditions and affect concentration levels are considered part of the air quality resource. Physical effects of ambient air quality within an area depend on the characteristics of the receptors and the type, amount, and duration of exposure. Air quality standards specify upper limits of concentrations and durations of pollutants in the ambient air that are consistent with the national goal of preventing harmful effects.

Noise. Noise, defined as any sound that is undesirable because of total energy content (loudness) or frequency content (pitch or tone), is considered with respect to its effect on people. The noise resource includes attenuation effects caused by the atmosphere, and barriers (natural and/or manmade) that may occur between the noise source and the receptors.

3.7.2 General Analysis Methodology

Region of Influence. Each air quality Region of Influence (ROI) consists of portions of air quality control regions (AQCRs), the local county jurisdictions expected to be influenced by activities of the proposed project, and areas where resultant community and general population growth may occur. Proposed project noise sources in the ROI include the MOB, SDA/deployment installation construction and operations sites, and related transportation and logistics networks. Affected areas in the noise ROI also include the communities and other receptors that are located in the proposed project vicinity.

Air Quality. Upon determination of the areas to be studied, air quality monitoring data were obtained from federal and state sources. These were compiled into baselines for two pollutants: carbon monoxide (CO) and dust (total suspended particulates [TSP]). The CO levels were chosen as readily available indicators of potential transportation and urban effects (fuel consumption), and TSP as a measure of the amount of ground disturbance from proposed construction and operations. Increasing or decreasing pollutant trends were then determined and extrapolated through the proposed project period to establish estimates of change that could occur without project implementation. This included the addition of potential new sources and the elimination of discontinued sources, when such planned activities were known.

Areas within the ROI that show attainment, nonattainment, or unclassified status for air quality under current EPA rules were identified. As designated by EPA, nonattainment areas do not meet the National Ambient Air Quality Standards (NAAQS). Areas where no measured data are available are defined by EPA as unclassified; all other areas are designated as attainment areas.

Prevention of Significant Deterioration (PSD) requirements for areas in attainment status were first introduced as part of the 1977 Amendments to the Clean Air Act. These PSD requirements set limits for increases in ambient TSP levels and established a system for preconstruction review of potential new major sources. Three PSD classes (I, II, and III) have been established. Class I allows the annual TSP value to increase by 5 micrograms per cubic meter ($\mu g/m^3$), Class II allows an increase of 19 $\mu g/m^3$, and Class III allows the annual average to increase by 37 $\mu g/m^3$. Class I is designed for "pristine" areas where almost any deterioration would be important. Congress established several types of mandatory Class I areas: international parks, wilderness areas and national memorial parks larger than 5,000 acres, and existing national parks larger than 6,000 acres. All other areas of the country are classified as Class II or III.

Atmospheric dust, sulfates, and nitrates contribute to measured TSP levels. These particulates become airborne as a result of wind and man's activities. Existing levels of TSP were determined and used to establish baseline values from the state and county-operated monitoring stations. Consistent with EPA rural fugitive dust policy, background levels of naturally occurring fugitive dust were not included in determining the attainment or nonattainment status of air quality regions. The replacement of the NAAQS for TSP with a fine particulate matter standard was proposed on March 20, 1984, but final actions have not yet occurred.

Noise. Noise determinations were made using generally available survey data. Values for construction equipment noise, highway noise levels, and noise levels for typical urban and rural areas (U.S. EPA 1982) were used to estimate baselines for areas that may be of concern and to establish probable future noise levels.

Noise levels are expressed in units of decibels on the A-weighted scale (dBA). These noise levels are used in environmental noise studies because they are closely correlated with the human perception of noise. Noise levels in a community fluctuate during the day and night. To account for these fluctuations, the statistical distribution of noise levels with time was considered. Noise exceedance levels are denoted by L_{10}, L_{50}, and L_{90} (e.g., L_{10} denotes a

noise level exceeded 10% of the time). In addition, environmental noise can be characterized by computing average levels, such as the energy-equivalent continuous noise levels (L_{eq}), or the day/night equivalent noise level (L_{dn}), which incorporates a 10-dB penalty for nighttime noise between 10 P.M. and 7 A.M. to reflect the added likelihood of annoyance during this period.

The FHWA has established a generally accepted noise abatement level of 65 dBA for highway projects located near parks, residences, and schools. The guidelines as usually applied account for noise-sensitive activities that occur both outdoors and indoors. Also recognized is the amount of outdoor-to-indoor noise reduction provided by typical structures.

The Air Force has developed an Air Installation Compatible Use Zone (AICUZ) concept that delineates land use districts and provides guidelines for compatibility of land areas for various types of use. The AICUZ identifies Noise Zones developed by computerized L_{dn}-level technology. The Noise Zones and other data are combined to create Compatible Use Districts, which are the basic planning units of the AICUZ program and are useful in the evaluation of the existing noise environment in a given area surrounding an air base.

3.7.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

3.7.3.1 Arizona Complex

The air quality ROI for the Arizona Complex consists of all of Yuma County and portions of Pima, La Paz, Maricopa, and Pinal counties (Figure 3.7.3-1). Standards for TSP are exceeded in several areas within the ROI. Standards for CO are exceeded in Phoenix (which is close to, but outside the study area), but not in Yuma. No major pollutant sources exist on either Yuma Proving Ground (PG) or Luke Air Force Range (AFR). Yuma and La Paz counties are in attainment status for all criteria pollutants. The Ajo area in Pima County is in nonattainment status for TSP. Maricopa County, except for the Phoenix metropolitan area, is in attainment status for all criteria pollutants. Within the ROI, air quality monitoring data are taken at several locations where the potential exists for exceedance of one or more of the criteria pollutant standards. Air quality is generally good, with only a few TSP values exceeding the secondary standard. Typically, the primary standard is exceeded only one or two times per year. The TSP and CO data from Ajo in Pima County, Stanfield in Pinal County, and Yuma in Yuma County for 1984 provide a sample of the air quality for typically active areas within the ROI (Table 3.7.3-1). The CO values are low everywhere, usually measuring about 25 percent or less of the standard. Visibility within the area ranges from 45 to 70 miles, but is occasionally reduced to less than 1 mile by wind-borne dust.

Ambient noise levels within the region are low. The major manmade noise sources are military and commercial aircraft, vehicular traffic, and railroad traffic. Average noise levels near 60 dBA (day and night) were recorded in a monitored area on Luke AFR when aircraft operations were being conducted. In areas remote from transportation corridors, estimated noise levels were in the 25 to 35-dBA range.

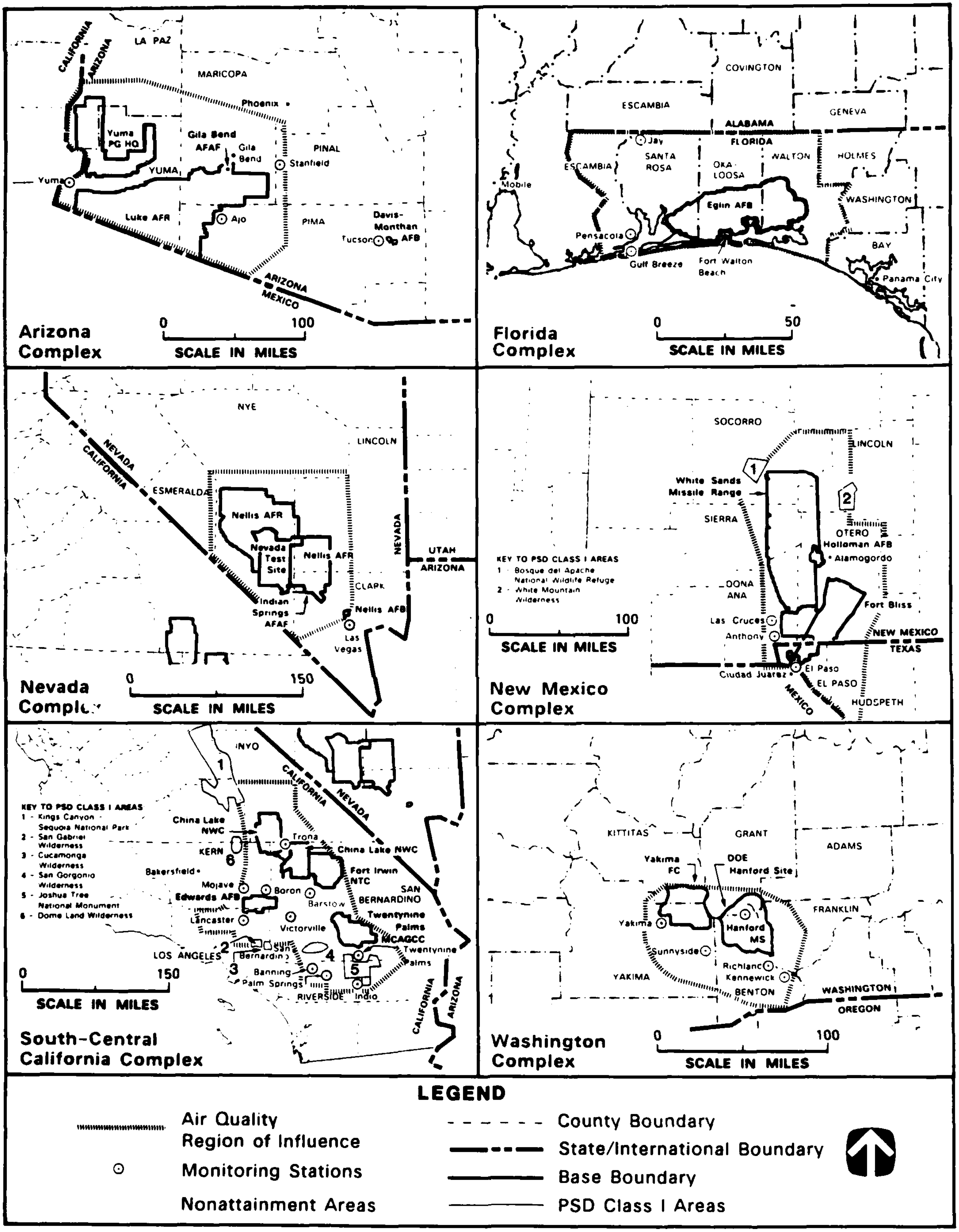

FIGURE 3.7.3-1 HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVE LOCATIONS

D3-AN/1 (L3-AN/1)

Table 3.7.3-1

AIR QUALITY MONITORING DATA WITHIN THE REGION OF INFLUENCE
FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES
1984

	TSP ($\mu g/m^3$)		CO (mg/m^3)		No. of Exceedances of 24-hour Standards TSP		No. of Exceedances of Standards CO	
	24-hour	Annual Geometric Mean	1-hour	8-hour	Primary	Secondary	1-hour	8-hour
Arizona Complex								
Ajo, Pima Co.	528	52	-	-	1	5	-	-
Stanfield, Pinal Co.	239	115	-	-	0	11	-	-
Yuma, Yuma Co.	571	100	11	6	1	9	0	0
Florida Complex								
Pensacola, Escambia Co.	191	38	-	-	0	0	-	-
Pensacola (Downtown)			26	10	-	-	0	0
Gulf Breeze, Santa Rosa Co.	135	33	-	-	0	0	-	-
Jay Station, Santa Rosa Co.	94	44	-	-	0	0	-	-
Nevada Complex								
Fire Station No. 2, Clark Co.	196	101	-	-	0	10	-	-
SMAP, Clark Co.	217	99	-	-	0	14	-	-
Sunrise Power, Clark Co.	310	95	-	-	1	8	-	-
East Charleston, Clark Co.	-	-	23	18	-	-	0	36
New Mexico Complex								
Las Cruces, Dona Ana Co.	174	71	-	-	0	2	-	-
Anthony, Dona Ana Co.	287	100	-	-	1	15	-	-
Las Cruces (Holiday Inn)	-	-	15	10	-	-	0	0
El Paso, El Paso Co.	585	116	-	-	1	1	-	-
El Paso (Downtown)	-	-	27	16	-	-	0	2
El Paso (East)	-	-	23	18	-	-	0	2
South-Central Calif. Complex								
Mojave, Kern Co.	290	80	-	-	2	4	-	-
Victorville, San Bernardino Co.	338	90	-	-	1	3	-	-
Trona, San Bernardino Co.	341	97	-	-	3	10	-	-
Banning, Riverside Co.	277	70	-	-	1	4	-	-
Indio, Riverside Co.	280	90	-	-	1	10	-	-

Table 3.7.3-1 Continued, Page 2 of 2

	TSP ($\mu g/m^3$)		CO (mg/m^3)		No. of Exceedances of 24-hour Standards TSP		No. of Exceedances of Standards CO	
	24-hour	Annual Geometric Mean	1-hour	8-hour	Primary	Secondary	1-hour	8-hour
Washington Complex								
Kennewick, Benton Co.	489	56	-	-	3	5	-	-
Yakima, Yakima Co.	259	72	26	18	0	8	0	5
Sunnyside, Yakima Co.	181	53	-	-	0	2	-	-
Yakima, Jade Tree Restaurant	-	-	22	18	-	-	0	4
EPA and State Standards								
Primary	260*	75	40*	10*				
Secondary	150*	60	40*	10*				

Notes: - No ambient monitoring.
*Not to be exceeded more than once per year.

3.7.3.2 Florida Complex

The air quality ROI for the Florida Complex covers an area in federal AQCR No. 5 and consists of Walton, Okaloosa, Santa Rosa, and Escambia counties (Figure 3.7.3-1). Ambient air quality data for the criteria pollutants measured within the ROI at the Pensacola, Gulf Breeze, and Jay monitoring stations in 1984 were used to represent the ambient air quality of the proposed project area. Data were obtained from the State of Florida and are presented in Table 3.7.3-1. Both Santa Rosa and Escambia counties are designated as TSP attainment areas. The other areas of AQCR No. 5 in Florida are unclassified for TSP. The Pensacola monitoring station is the only station that reports CO concentrations. Visibility is usually 10 to 25 miles, with fog and precipitation reducing this to 1 to 2 miles about 20 percent of the time. The 65-L_{dn} noise contour at Hurlburt Field falls less than 900 feet from either side of the runway and 4,000 feet inside the east boundary of the range. Aircraft traffic patterns for Eglin Air Force Base (AFB) runways are specially designed to comply with Air Force Noise Abatement Directives. Noise abatement has been hampered by the introduction of more aircraft, but flights over populated areas adjacent to Eglin AFB have been minimized. No community annoyance problems are known to exist.

3.7.3.3 Nevada Complex

The air quality ROI for the Nevada Complex covers areas within federal AQCRs Nos. 13 and 147 and consists of the northwestern third of Clark County, the southern half of Nye County, the eastern quarter of Esmeralda County, and the western half of Lincoln County (Figure 3.7.3-1). Air quality monitoring records show routine TSP standards violations in some areas, with CO violations occurring in the urbanized Las Vegas area. Air quality data from selected Las Vegas stations are provided in Table 3.7.3-1. No major air quality changes are expected in the future, though control measures have been instituted. As with other air quality parameters, visibility in remote regions of the Southwest is good. Measurements made east and south of the Nevada Complex in the Grand Canyon and the southern California desert range between 35 and 220 miles. Lower values are associated with southerly winds, while higher values occur with northerly and westerly winds. Visibility is better during winter than summer.

Baseline noise levels have not been measured in the remote areas of Nevada. For those areas with little wind, baseline noise levels are estimated to be around 22 dBA, increasing to about 38 dBA for regions with relatively strong surface winds. Rural community noise levels, based on EPA estimates, are 50 dBA for communities such as Indian Springs and Mercury.

3.7.3.4 New Mexico Complex

The air quality ROI for the New Mexico Complex covers areas in federal AQCRs Nos. 153 and 156 and consists of the eastern half of Dona Ana County, the eastern half of Sierra County, the southeastern third of Socorro County, the western quarter of Lincoln County, part of Otero County in New Mexico, and all of El Paso County and the western quarter of Hudspeth County in Texas (Figure 3.7.3-1). Parts of the city of El Paso are in nonattainment status for either the primary or secondary TSP standard. In addition, a large area along the south edge of El Paso is in nonattainment status for CO. All these

nonattainment status areas lie within the ROI. The PSD Class I areas within the ROI are Bosque del Apache National Wildlife Refuge and the White Mountain Wilderness in New Mexico. There are seven air quality monitoring stations in New Mexico, including five sites in Las Cruces. The El Paso metropolitan area has 24 monitoring stations within the ROI. Air quality data from selected New Mexico stations and three of the El Paso, Texas stations are provided in Table 3.7.3-1. Visibility, which averages 30 to 50 miles, is generally excellent in the region. Strong northerly winds may cause gypsum particles to become airborne at the White Sands National Monument. When this occurs, prevailing visibility is lowered to 6 to 9 miles in the Fort Bliss (El Paso) area.

Ambient noise level measurements taken at a remote site on the edge of Otero Mesa on McGregor Range show sound pressure levels below 30 dBA.

3.7.3.5 South-Central California Complex

The air quality ROI for the South-Central California Complex covers parts of federal AQCRs Nos. 23 and 33 and consists of the northeastern third of Los Angeles County, the eastern quarter of Kern County, the southwestern quarter of Inyo County, the western three-quarters of San Bernardino County (except for that portion in California's South Coast Air Basin), and the western half of the southeast desert portion of Riverside County (Figure 3.7.3-1). The Kern County portion of the Southeast Desert Air Basin is unclassified or in attainment status for all pollutants. Western San Bernardino County and portions of Los Angeles County in the Southeast Desert Air Basin are unclassified for TSP. The Inyo County portion of the Great Basin Valleys Air Basin is unclassified or in attainment status for all pollutants. The PSD Class I areas include Kings Canyon-Sequoia National Park, Dome Land Wilderness, San Gabriel Wilderness, Cucamonga Wilderness, San Gorgonio Wilderness, and Joshua Tree National Monument, all located adjacent to or within the ROI. Air quality data for Victorville, Barstow, Trona, Boron, Mojave, Lancaster, Twentynine Palms, Banning, Palm Springs, and Indio, all within the ROI, were examined. Data from five of these monitoring stations are shown in Table 3.7.3-1. Windblown fugitive dust is a major source of ambient particulate concentrations in the proposed project area. Values in excess of federal TSP guidelines for the 24-hour primary and secondary standards were recorded in 1984 at stations in Mojave, Indio, and Banning. There were no violations of the 1-hour or 8-hour standards for CO. Visibility in the ROI tends to be 60 miles or more on the average in northern areas, while in the southern low desert areas, median visual range values are between 40 and 45 miles. However, Edwards AFB has had declining visibility in recent years which has hampered test activities. Visibility is measured at Edwards AFB by two methods. A distinction can be made between observed visual range, which has been measured at Edwards AFB for approximately 34 years, and optical range, which, at Edwards AFB, is indicated by the clarity of the pictures from the tracking cameras.

The median visibility at Edwards AFB over the period recorded was 27 miles, and the mean visibility was 33 miles. The conditions have varied over the years (and by month and day), depending on atmospheric conditions and the amount of suspended particulates in the air. While visual range is not easily related to optical range, as one decreases, the other will almost certainly decrease. Experience has shown that the photo-optical instrumentation data

recording distance is approximately one-half the base weather station's observed visibility values. The mean visibility of 33 miles at Edwards AFB corresponds to an approximate 16.5-mile data range for tracking cameras. When visibility is reduced to 20 miles, the tracking range is reduced to 10 miles.

China Lake Naval Weapons Center (NWC), Edwards AFB, and Fort Irwin National Training Center (NTC) ground-based and airborne noise sources affect ambient noise levels. Recent noise measurements near China Lake NWC showed L_{dn} levels of 55 dBA at Rose Valley Ranch and 45 dBA at Coso Basin. At Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC), undisturbed ambient conditions are about 40 dBA, with levels of 60 to 65 dBA observed during training operations.

3.7.3.6 Washington Complex

The primary air quality ROI for the Washington Complex covers areas in federal AQCRs Nos. 62 and 230. It consists of the northeastern half of Yakima County, the southeastern third of Kittitas County, the southern portion of Grant County, the western quarter of Adams County, the western half of Franklin County, and portions of Benton County (Figure 3.7.3-1). Concentrations of TSP and CO from the monitoring stations at Kennewick in Benton County, Yakima and Sunnyside in Yakima County, and the city of Yakima (Jade Tree restaurant) are given in Table 3.7.3-1. The Yakima station recorded eight readings that violated the TSP 24-hour secondary standard in 1984. In Yakima, a nonattainment area, both stations recorded values greater than the 8-hour maximum federal CO standard. Air quality in the vicinity of the Department of Energy (DOE) Hanford Site is generally good. The Benton-Franklin-Walla Walla counties Air Pollution Control Authority routinely monitors TSP concentrations at the Hanford meteorological station. No other criteria pollutants are routinely monitored. In Kennewick at the Columbia Center, a monitor recorded five violations of the state 24-hour TSP standard in 1984. The Washington state area has good visibility, with the standard visual range averaging about 60 miles. Fog is observed in every month, but 99 percent occurs during November through February.

The major noise sources in the vicinity of Yakima Firing Center (FC) are airports, highways, and railroad lines; artillery fire also produces noise. During training operations, noise levels from large trucks and tanks range from 80 to 90 dBA at 50 feet from the source. Noise from the firing of large-caliber weapons is confined within Yakima FC. Ambient noise levels outside of the urbanized areas are expected to be typical of rural regions, with low levels of 35 to 45 dBA.

3.7.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

3.7.4.1 Ellsworth Air Force Base

The air quality ROI for Ellsworth AFB and its Minuteman sites consists of seven contiguous counties: Butte, Haakon, Jackson, Lawrence, Meade, Pennington, and Perkins, South Dakota (Figure 3.7.4-1). The only TSP nonattainment status area within the ROI is located along the eastern edge of the Black Hills and includes the metropolitan area of Rapid City. In the past, TSP concentrations in this area have exceeded both the state standard and the

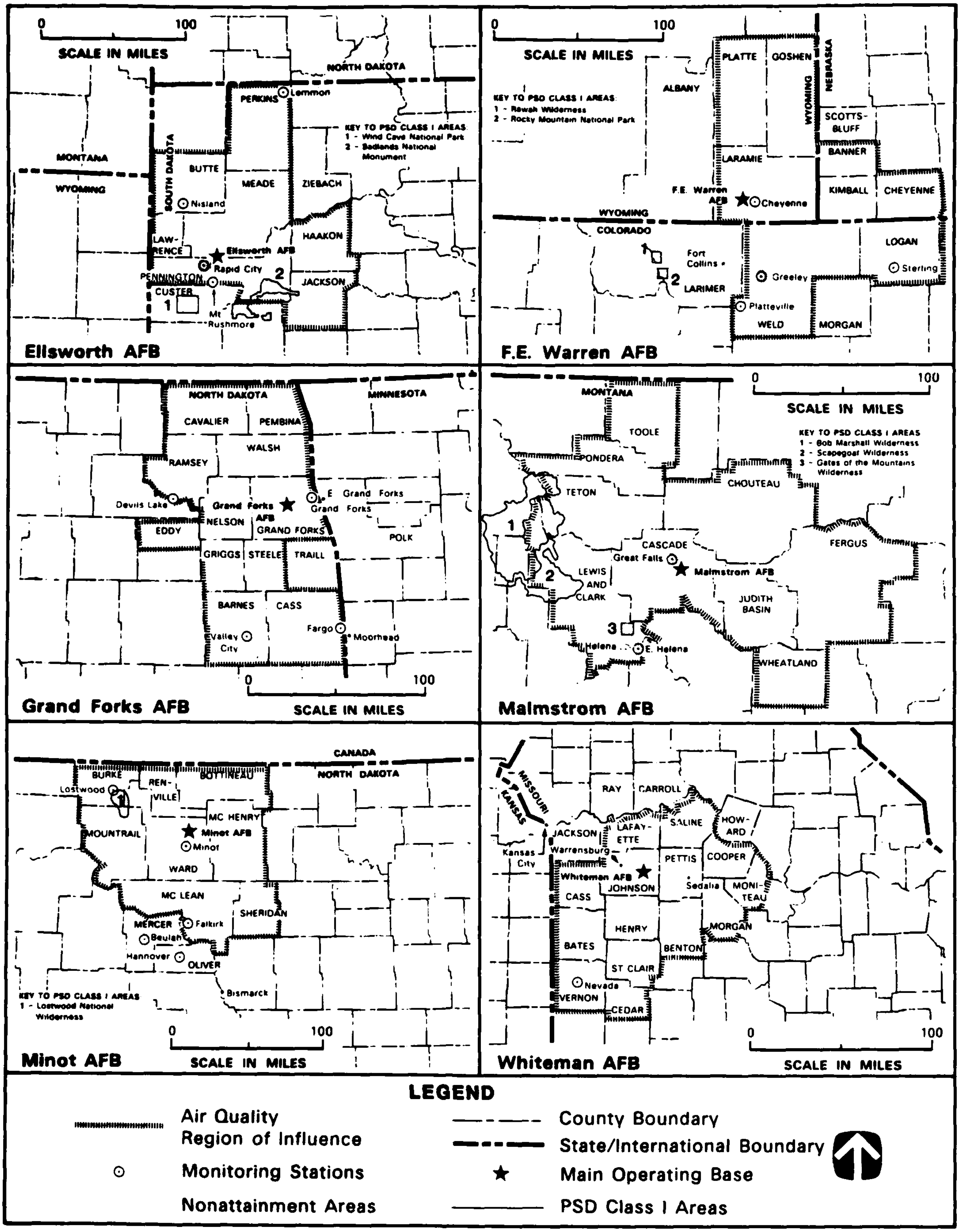

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FIGURE 3.7.4-1 HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE LOCATIONS

national primary standards; however, from April 1982 through December 1984, no violations of the primary standard occurred. The rest of the ROI is in attainment status for all criteria pollutants. Two PSD Class I areas border the ROI: Wind Cave National Park and the Badlands National Monument. Mount Rushmore, in the Black Hills, is currently designated as a Class II air quality area; however, there is interest in having this designation changed to Class I. While air quality is not monitored on the base, several locations within the ROI have monitoring stations. The 1984 data available from Nisland in Butte County, Rapid City and Mount Rushmore National Monument in Pennington County, and Lemmon in Perkins County are shown in Table 3.7.4-1. The highest 24-hour average TSP concentration was recorded at the Lemmon station in Perkins County. To characterize visibility throughout the western United States, a regional visibility monitoring network has been established. The Wind Cave monitoring station at the south end of the ROI is part of this network. Data from the Wind Cave station show a mean visual range of 85 miles. Little air pollution is transported into the area by storm systems since much of the air arrives by way of the pristine areas of the Rocky Mountains and Canada.

The noise contours prepared for flight operations at Ellsworth AFB indicate that a level of 75 dBA extends 10 miles northwest and about 10 miles southeast from Interstate 90. Parts of Box Elder township and several small housing developments lie in the 70 to 80-dBA range. The deployment area is mainly agricultural land with scattered residences. Background noise levels for this type of land use are between 33 and 35 dBA, varying with location and distance from roads, rail lines, and other urban noise centers. Under current operations, complaints in the vicinity of Ellsworth AFB are minimal.

3.7.4.2 F.E. Warren Air Force Base

The air quality ROI for F.E. Warren AFB and its Minuteman sites consists of eight counties in three states: Goshen, Laramie, and Platte in Wyoming; Banner, Cheyenne, and Kimball in Nebraska; and Logan and Weld in Colorado (Figure 3.7.4-1). F.E. Warren AFB and the deployment area are located within the Metropolitan Cheyenne Intrastate AQCR No. 242, Nebraska Intrastate AQCR No. 146, and Pawnee Intrastate AQCR No. 037. In 1984, air quality measurements within the AQCRs were taken at Cheyenne in Laramie County, Greeley and Platteville in Weld County, and Sterling in Logan County (Table 3.7.4-1). The only nonattainment status area within the ROI is Greeley in Weld County, where the primary 8-hour CO standard is frequently exceeded. Another nonattainment area that is close to, but outside the ROI, is Fort Collins, Colorado, where the primary 8-hour CO standard is also frequently exceeded.

The closest PSD Class I areas are the Rocky Mountain National Park and Rawah Wilderness in Colorado, about 60 miles southwest of F.E. Warren AFB. Annual windblown dust, which restricts visibility to less than 7 miles, occurs 0.2 percent of the time. The median annual visual range averages 64 miles.

Highway, aircraft, and railroad noise levels were measured during 1983 in Cheyenne. The results show a range from 51 to 71 dBA for a wide variety of roadway segments measured from the edge of the right-of-way to about 200 feet away. For railroad and aircraft operations, 65-dBA contours (using the L_{dn} system of computation) were determined. About 800 people in residential areas are within these envelopes.

Table 3.7.4-1

AIR QUALITY MONITORING DATA WITHIN THE REGION OF INFLUENCE
FOR THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES
1984

	TSP ($\mu g/m^3$)		CO (mg/m^3)		No. of Exceedances of 24-hour Standards TSP		No. of Exceedances of Standards CO	
	24-hour	Annual Geometric Mean	1-hour	8-hour	Primary	Secondary	1-hour	8-hour
Ellsworth AFB (South Dakota)								
Nisland, Butte Co.	96	23	-	-	0	0	-	-
Rapid City, Pennington Co.	237	64	-	-	0	1	-	-
Mt. Rushmore Nat. Mon., Pennington Co.	63	11	-	-	0	0	-	-
Lemmon, Perkins Co.	433	26	-	-	1	0	-	-
F.E. Warren AFB (Wyoming)								
Cheyenne, Laramie Co.	92	32	-	-	0	0	-	-
Greeley, Weld Co.	265	48	33	19	1	0	0	9
Platteville, Weld Co.	210	67	-	-	0	1	-	-
Sterling, Logan Co.	176	64	-	-	0	1	-	-
Grand Forks AFB (North Dakota)								
Devils Lake, Ramsey Co.	248	40	-	-	0	0	-	-
Grand Forks, Grand Forks Co.	180	N/A	-	-	0	0	-	-
Valley City, Barnes Co.	162	N/A	-	-	0	0	-	-
Fargo, Cass Co.	165	39	-	-	0	0	-	-
Malmstrom AFB (Montana)								
Great Falls, Cascade Co.	175	63	22	17	0	1	0	1
Helena, Lewis & Clark Co.	248	42	-	-	0	0	-	-
East Helena, Lewis & Clark Co.	326	70	-	-	1	1	-	-
Minot AFB (North Dakota)								
Minot, Ward Co.	230	47	-	-	0	0	-	-
Falkirk, McLean Co.	188	N/A	-	-	0	0	-	-
Beulah, Mercer Co.	150	35	-	-	0	0	-	-
Hannover, Oliver Co.	43	N/A	-	-	0	0	-	-
Whiteman AFB (Missouri)								
Nevada, Vernon Co.	114	52	-	-	0	0	-	-
EPA and State Standards								
Primary	260*	75	40*	10*				
Secondary	150*	60	40*	10*				

Notes: - No ambient monitoring.
*Not to be exceeded more than once per year.
N/A Data not reported.

3.7.4.3 Grand Forks Air Force Base

The air quality ROI for Grand Forks AFB and its Minuteman sites consists of 11 counties: Barnes, Cass, Cavalier, Eddy, Grand Forks, Griggs, Nelson, Pembina, Ramsey, Steele, and Walsh, North Dakota (Figure 3.7.4-1). The deployment area is within the North Dakota Intrastate AQCR No. 172 and Metropolitan Fargo-Moorehead Interstate AQCR No. 130. The 1984 data available from Devils Lake in Ramsey County, Grand Forks in Grand Forks County, Valley City in Barnes County, and Fargo in Cass County are shown in Table 3.7.4-1. The ROI is currently in attainment status for all criteria pollutants, and Grand Forks AFB and vicinity have good air quality. There are no PSD Class I areas within the ROI. Ambient CO data are not collected in North Dakota because this pollutant is not considered a problem. Normally, visibility throughout the region ranges from 65 to 75 miles.

Noise contours have been prepared for flight operations at Grand Forks AFB. Under current operations, 75-dBA levels exist in the base housing area because of the jet engine test cell, which is located 1,600 feet to the west. An approximate daytime noise level of 33 dBA was estimated for the deployment area, based on available data for similar land uses and undeveloped rural areas.

3.7.4.4 Malmstrom Air Force Base

The air quality ROI for Malmstrom AFB and its Minuteman sites consists of nine counties: Cascade, Chouteau, Fergus, Judith Basin, Lewis and Clark, Pondera, Teton, Toole, and Wheatland, Montana (Figure 3.7.4-1). Air quality monitoring data are available for Great Falls in Cascade County and Helena and East Helena in Lewis and Clark County (Table 3.7.4-1). In 1984, Great Falls data showed TSP values within the primary standard, but CO values were about 50 percent above the standard. At Helena, the maximum 24-hour TSP value exceeded the primary standard. The only nonattainment status areas within the ROI are East Helena in Lewis and Clark County (nonattainment status for TSP) and Great Falls in Cascade County (nonattainment status for the secondary TSP standard and CO). The remainder of the ROI is either in attainment status or unclassified for the criteria pollutants. The PSD Class I areas within the ROI are the Bob Marshall, Scapegoat, and Gates of the Mountains wildernesses. The visual range within the area averages from 45 to 65 miles.

At Malmstrom AFB, the L_{dn} system was used to depict the noise environment. The deployment area is primarily agricultural with scattered residential development. Daytime noise levels of 35 dBA are representative of this type of area.

3.7.4.5 Minot Air Force Base

The air quality ROI for Minot AFB and its Minuteman sites consists of eight counties: Bottineau, Burke, McHenry, McLean, Mountrail, Renville, Sheridan, and Ward, North Dakota (Figure 3.7.4-1). Minot AFB and the deployment area are located within the North Dakota Intrastate AQCR No. 172. Table 3.7.4-1 shows 1984 data from Minot in Ward County, Falkirk in McLean County, Beulah in Mercer County, and Hannover in Oliver County. Ambient CO data are not collected in North Dakota because this pollutant is not considered a problem. All areas in the ROI are currently in attainment status for the criteria

pollutants. The only PSD Class I area within the ROI is the Lostwood Wilderness in the northwest corner of the region. The Theodore Roosevelt National Memorial Park (south unit) monitoring station, located southwest of the ROI, is part of a national visibility monitoring network. Data from this station show a mean visual range of 79 miles during the summer.

Noise contours based on the L_{dn} system provide local noise envelope definition using the 65-dBA criteria. The affected areas are primarily agricultural. Background noise levels in the deployment area are estimated to be 35 dBA. Somewhat higher average levels may occur at locations near major roads or highways.

3.7.4.6 Whiteman Air Force Base

The air quality ROI for Whiteman AFB and its Minuteman sites consists of 14 counties: Bates, Benton, Cass, Cedar, Cooper, Henry, Johnson, Lafayette, Moniteau, Morgan, Pettis, Saline, St. Clair, and Vernon, Missouri (Figure 3.7.4-1). Air quality at Whiteman AFB and within the deployment area is good. The data for TSP and CO for the Southwest Missouri Intrastate AQCR No. 139 are monitored at Nevada in Vernon County and shown in Table 3.7.4-1. The only pollutant currently monitored is TSP. The study area is in unclassified status for all criteria pollutants and there are no PSD Class I areas in or near it. Visibility ranges between 17 and 20 miles, with haze, fog, and precipitation being the primary causes for occasional restriction.

Background noise levels are low, ranging from 25 to 35 dBA throughout the area, with higher levels near major roads and highways.

3.7.5 Existing and Projected Conditions for Hard Silo in Patterned Array

3.7.5.1 Davis-Monthan Air Force Base

The air quality ROI for the Davis-Monthan AFB deployment area covers areas in three federal AQCRs and consists of the southwestern quarter of Graham County, the western half of Cochise County, all of Santa Cruz County, the eastern half of Pima County, and the southeastern half of Pinal County, Arizona (Figure 3.7.5-1). Davis-Monthan AFB and the deployment area are located in the Sonoran Desert at elevations ranging from 2,500 to 2,900 feet. Visibility is good, but in Tucson, the number of days a year when visibility is 60 miles or better has been reduced to one-quarter of what it was in the past. Monitoring data show TSP and CO standards are violated frequently in Tucson (Table 3.7.5-1). In other parts of the area, the sparse data indicate no problems except for occasional TSP excursions. Continued population growth in Tucson will allow for minimal improvement in future air quality. There are three PSD Class I areas within the ROI. All three sites are wilderness areas. One is the Galiuro Wilderness Area in the Coronado National Forest, in the extreme southwestern portion of Graham County. The other two sites are geographically distinct portions of the Saguaro National Monument that lie east and west of the Tucson metropolitan area.

Urban noise levels are not high and are expected to stay within normal limits. In areas away from population concentrations, noise levels are low (20-30 dBA).

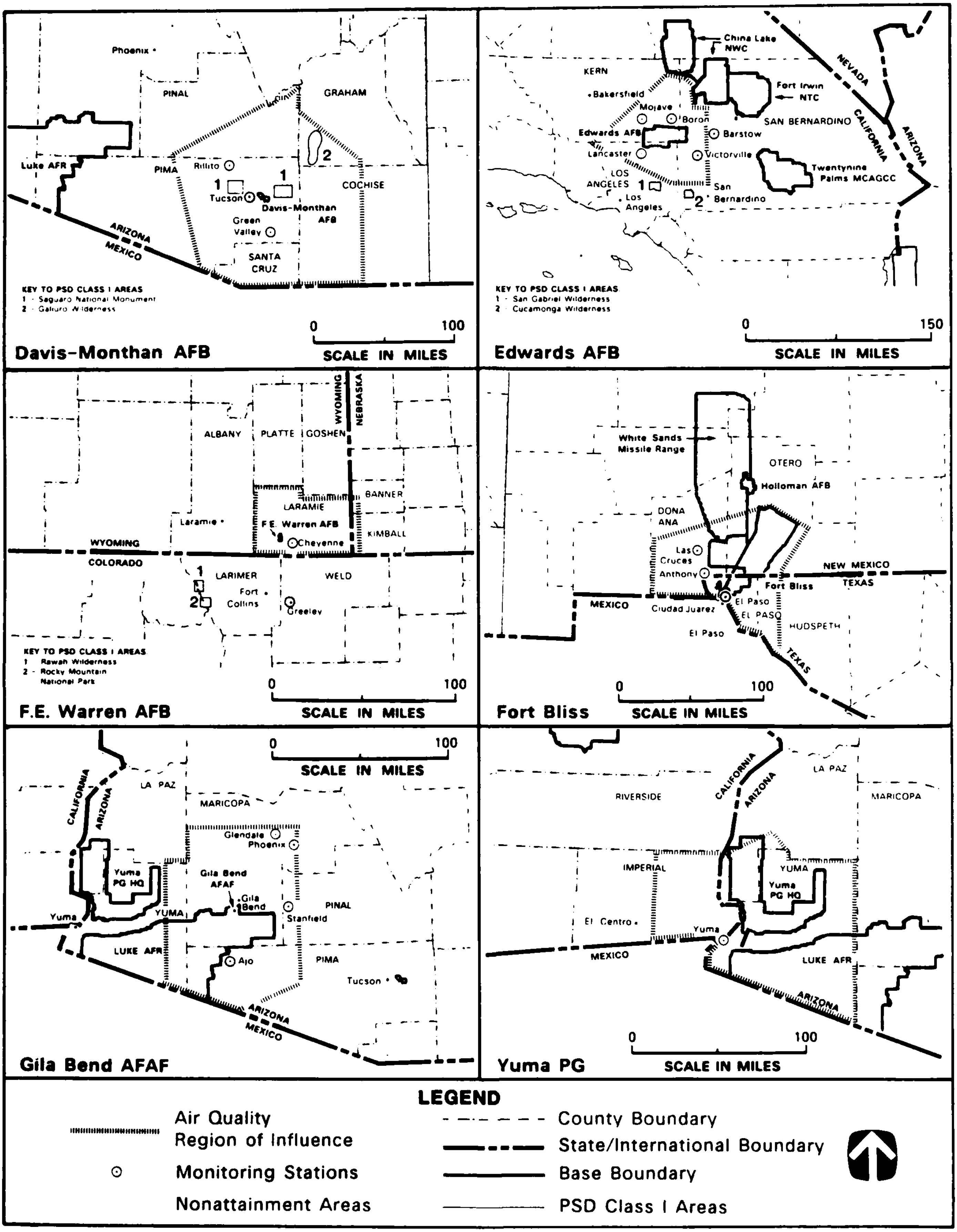

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FIGURE 3.7.5-1 HARD SILO IN PATTERNED ARRAY ALTERNATIVE LOCATIONS

Table 3.7.5-1

AIR QUALITY MONITORING DATA WITHIN
THE REGION OF INFLUENCE FOR THE HARD SILO IN PATTERNED ARRAY ALTERNATIVES
1984

	TSP ($\mu g/m^3$)		CO (mg/m^3)		No. of Exceedances of 24-hour Standards TSP		No. of Exceedances of Standards CO	
	24-hour	Annual Geometric Mean	1-hour	8-hour	Primary	Secondary	1-hour	8-hour
Davis-Monthan AFB (Arizona)								
Tucson, Pima Co.	494	74	-	-	3	12	-	-
Green Valley, Pima Co.	427	39	-	-	1	1	-	-
Rillito, Pima Co.	328	101	-	-	1	9	-	-
Tucson (22nd & Alverton)	-	-	24	12	-	-	0	5
Edwards AFB (California)								
Mojave, Kern Co.	290	80	-	-	2	4	-	-
Victorville, San Bernardino Co.	338	90	-	-	1	3	-	-
Lancaster, Los Angeles Co.	-	-	11	6	-	-	0	0
F.E. Warren AFB (Wyoming)								
Cheyenne, Laramie Co.	92	32	-	-	0	0	-	-
Fort Bliss (Texas)								
Las Cruces, Dona Ana Co.	174	71	-	-	0	2	-	-
Anthony, Dona Ana Co.	281	100	-	-	1	15	-	-
Las Cruces (Holiday Inn)	-	-	15	10	-	-	0	0
El Paso, El Paso Co.	585	116	-	-	1	1	-	-
El Paso (Downtown)	-	-	27	16	-	-	0	1
Gila Bend (Arizona)								
Ajo, Pima Co.	528	52	-	-	1	5	-	-
Stanfield, Pinal Co.	239	115	-	-	0	11	-	-
Glendale, Maricopa Co.	244	100	11	8	0	9	0	0
Yuma PG (Arizona)								
Yuma, Yuma Co.	571	100	11	6	1	9	0	0
EPA and State Standards								
Primary	260*	75	40*	10*				
Secondary	150*	60	40*	10*				

Notes: - No ambient monitoring.
*Not to be exceeded more than once per year.

3.7.5.2 Edwards Air Force Base

The air quality ROI for Edwards AFB and the deployment area covers an area within federal AQCR No. 33 and consists of the northeastern third of Los Angeles County, the eastern third of Kern County, and the western quarter of San Bernardino County, California (Figure 3.7.5-1). Ambient data within the ROI were measured at Victorville, Boron, Mojave, and Lancaster during 1984. Selected stations are shown in Table 3.7.5-1. Federal TSP standards for the 24-hour primary and secondary limits were violated at the Mojave station and at Victorville. There are no violations of the 1-hour or 8-hour standards for CO. The major portion of Kern County in the Southeast Desert Air Basin is unclassified or in attainment status for all pollutants.

The portions of San Bernardino County that are within the ROI are unclassified for TSP. Two PSD Class I areas fall within the ROI: the San Gabriel and the Cucamonga wildernesses. Median visibility ranges from 40 to 45 miles on the average; a few days a year it is 60 miles or more. However, Edwards AFB has had declining visibility in recent years and this has hampered test activities. Projected future increases in population along the southern portions of the Mojave Desert indicate little probability that air quality will improve, and it is likely that both TSP values and visibility will continue to be a concern. Occasionally, periods of blowing dust have caused visibility to be reduced to a few miles or less throughout the ROI. CO levels may also rise as the number of vehicles increases.

Noise levels from aircraft testing are high in some onbase areas, but noise sources, sound propagation, and general community acceptance are not presently a problem in the deployment area.

3.7.5.3 F.E. Warren Air Force Base

The air quality ROI for the F.E. Warren AFB deployment area covers an area within Laramie County and a small area along the western boundaries of Banner and Kimball counties in Nebraska (Figure 3.7.5-1). The proposed project area lies within the Metropolitan Cheyenne Intrastate AQCR No. 242 and Nebraska Intrastate AQCR No. 146. Air quality monitoring data from Cheyenne, Wyoming are presented in Table 3.7.5-1. CO is not monitored in the Cheyenne area since the background concentrations are minimal. The region is classified as being in attainment status. The closest nonattainment status areas, Greeley and Fort Collins, Colorado, are approximately 50 miles south and 40 miles south-southwest of the deployment area, respectively. Both areas are in nonattainment status for the primary 8-hour CO standard and the secondary annual TSP standard. The closest PSD Class I areas, Rocky Mountain National Park and Rawah Wilderness in Colorado, are located approximately 60 miles southwest of F.E. Warren AFB. Annual windblown dust, which restricts visibility to less than 7 miles, occurs 0.2 percent of the time. The median yearly visual range approaches an average of 64 miles.

Noise levels measured in Cheyenne show a range from 51 to 71 dBA for a wide variety of roadway segments. For railroad and aircraft operations, 65-dBA contours (using the L_{dn} system of computation) were determined. About 800 people in residential areas are within those envelopes.

3.7.5.4 Fort Bliss

The air quality ROI for the Fort Bliss deployment area is within federal AQCR No. 153 and consists of the southern two-thirds of Dona Ana County and the southwestern third of Otero County in New Mexico, along with the western quarter of Hudspeth County and all of El Paso County in Texas (Figure 3.7.5-1). This deployment area lies within the northern part of the Chihuahuan Desert at an elevation of about 4,000 feet. Air quality data for selected stations in New Mexico and Texas are provided in Table 3.7.5-1. Strong winds in the spring cause blowing dust that may reduce visibility to 1 mile or less. With light winds, visibility is 50 miles or better. Standards for TSP are not met on many occasions in populated areas. CO also tends to be high in downtown El Paso.

For typical daytime desert, ambient noise level measurements, taken at a remote site on the edge of Otero Mesa on McGregor Range, show sound pressure levels below 30 dBA.

3.7.5.5 Gila Bend Air Force Auxiliary Field

The air quality ROI for the Gila Bend Air Force Auxiliary Field (AFAF) deployment area covers an area that consists of the northwestern quarter of Pima County (Pima Intrastate AQCR), the southern two-thirds of Maricopa County (Maricopa Intrastate AQCR), the western quarter of Pinal County (central Arizona AQCR), and the eastern third of Yuma County (Mojave-Yuma AQCR) in Arizona (Figure 3.7.5-1). This deployment area is in the Sonoran Desert in south-central Arizona. The TSP levels are high in some areas and monitoring data show that standards are frequently exceeded in some communities. Air quality data from selected stations in Ajo, Stanfield, and Glendale are shown in Table 3.7.5-1. Although Glendale shows no exceedance of standards in 1984, it lies in the Phoenix metropolitan area which is in nonattainment status for TSP and CO. No PSD Class I areas are within the region. Strong winds, which occur ahead of thunderstorms, can cause dust storms that reduce visibility to near zero. Average annual wind speeds are about 5 miles per hour, indicating that extended periods of light winds occur. Visibility is 50 to 60 miles except during dust storms. Air quality in Phoenix will be a continuing concern.

Noise sources, sound propagation, and community sensitivity are not problems. Noise levels are currently 45 to 65 dBA. Little change in air quality or noise is projected for the future since little population growth is expected outside of the Phoenix metropolitan area.

3.7.5.6 Yuma Proving Ground

The air quality ROI for the Yuma PG deployment area is in federal AQCRs Nos. 13 and 33 and consists of the southwestern third of La Paz County and all of Yuma County, Arizona, and the eastern half of Imperial County, California (Figure 3.7.5-1). The Yuma station, AQCR No. 13, is the only air quality monitoring station within the ROI. The air quality measurements from this station are shown in Table 3.7.5-1. Yuma and La Paz counties are in attainment status for all criteria pollutants. Imperial County AQCR No. 33, which is located in portions of the Southeast Desert Air Basin, has areas in either attainment status or unclassified for TSP and CO. Visibility within the

region ranges from 45 to 70 miles, and is 10 miles or greater more than 95 percent of the time at Yuma. Visibility may be reduced because of blowing dust and sand, and may be as low as 1 mile or less.

Yuma PG is located in an isolated, sparsely populated area. Noise sources on Yuma PG include the traffic on base roads and occasional firing from artillery and tanks. The noise from these sources is higher than the background noise levels, which range from 29 to 36 dBA.

3.8 Water Resources

The Small Intercontinental Ballistic Missile (ICBM) program will require water for construction and project-induced growth. The quality and availability of water are fundamental concerns since many of the alternatives are located in desert areas or other water-limited regions where available ground and surface water is scarce or is fully allocated to existing users. For purposes of this analysis, water resources are divided into surface water hydrology and quality and groundwater hydrology and quality. In addition, summaries of water use are also presented for each study area.

3.8.1 Resource Description

Surface Water Hydrology and Quality. This element addresses the flow and water quality characteristics and trends of rivers, major streams, and lakes, and the capacities of major reservoirs within the study areas.

Groundwater Hydrology and Quality. This element addresses the storage capacities, groundwater reserves, water table fluctuations, and water quality conditions and trends of the groundwater aquifers of the study area.

Summary of Water Use. This summary addresses the amount of water diverted from surface and groundwater systems and the major uses of that water. An evaluation of the regional supply sources used to meet the water demands is included.

3.8.2 General Analysis Methodology

The baseline assessment concentrated on evaluating the major groundwater and surface water basins. A summary of the methods used to generate and analyze the data to define the existing and projected conditions for water resources is given in the following sections. Table 3.8.2-1 gives a summary of the water resource characteristics for the areas under consideration.

Region of Influence. The Region of Influence (ROI) for water resources includes the physical boundaries of the surface and groundwater basins that provide water supplies to meet project-related requirements. The ROIs for the Hard Mobile Launcher alternative locations encompass the hydrologic basins influenced by the military installations or the Minuteman missile deployment areas, as appropriate. The ROIs for the Hard Silo in Patterned Array alternative locations encompass all hydrologic basins located within a 50-mile radius of the Main Operating Base (MOB). For all deployment modes, the ROI also encompasses the water resource base of the major support community or communities.

Surface Water Hydrology and Quality. National water data bases were reviewed for current information on surface water quality and quantity at key sites within the ROIs. To assist in the analysis, key hydrologic data within each ROI were mapped and digitized at a regional level. Summaries of the flow and flood characteristics and the water quality of the major lakes and streams in each ROI were prepared. Water importation and other major, existing, or proposed water development projects are presented.

Table 3.8.2-1

SUMMARY OF CURRENT WATER RESOURCE CHARACTERISTICS BY REGION OF INFLUENCE
(1,000 acre-ft/yr, unless otherwise noted)

Region of Influence	Mean Flow of Major Streams	Surface Water Diversions	Imported Water	Groundwater Pumpage	Regional Groundwater Overdraft	Maximum Groundwater Decline (ft)	Current Irrigation Use	Current Municipal-Industrial Use	Water Quality Limitations[1]
Arizona Complex	9,531	2,669	1,000[d]	2,782[e]	1,343	400	4,562	814	b-c
Florida Complex	11,455	376	0	174	0	240	14	144	a
Nevada Complex	9,900	127	0	93	0	300	12	205	a-b
New Mexico Complex	720	730	2.3	272	177	150	790	201	b-c
South-Central California Complex	60	0[f]	67	546	260	200	515	62	b
Washington Complex	132,000	5,058	0	106	0	200	4,560	82	a
Ellsworth AFB	990	129	0	41	0	200	147	16	b
F.E. Warren AFB	1,450	865	12	396	Unk	50	1,175	88	a-b
Grand Forks AFB	2,934	32	0	47	0	200	26	34	b
Malmstrom AFB	6,803	2,268	0	30	0	0	2,264	26	a-b
Minot AFB	18,314	22	0	20	0	12	23	7	b
Whiteman AFB	50,969	706	0	104	0	300[a]	17	292	a-b
Davis-Monthan AFB	78	0	0	630	480	350	440	185	b
Edwards AFB	4	0	67	411	210	200	386	58	b
F.E. Warren AFB	90	33	12	60	Unk	50	80	18	a-b
Fort Bliss	700	622	0	215	175	150	640	187	b-c
Gila Bend AFAF	278	1,021	0	2,476	223	160	2,632	795	c
Yuma PG	8,720	1,648	0	552[e]	0	0	2,105	24	b

Notes: [1] a = Minor: Water quality is suitable for *all* uses in most portions of the ROI.
b = Moderate: Water quality across the ROI is highly variable, but adequate quality water is generally available to meet most needs.
c = Major: Poor water quality limits water use across extensive portions of the ROI.

[d] Approximate value.
[e] 141,000 acre-ft was pumped for *drainage only*.
[f] Where "0" appears, overdraft may be occurring in one or more groundwater basins or aquifers within the region.

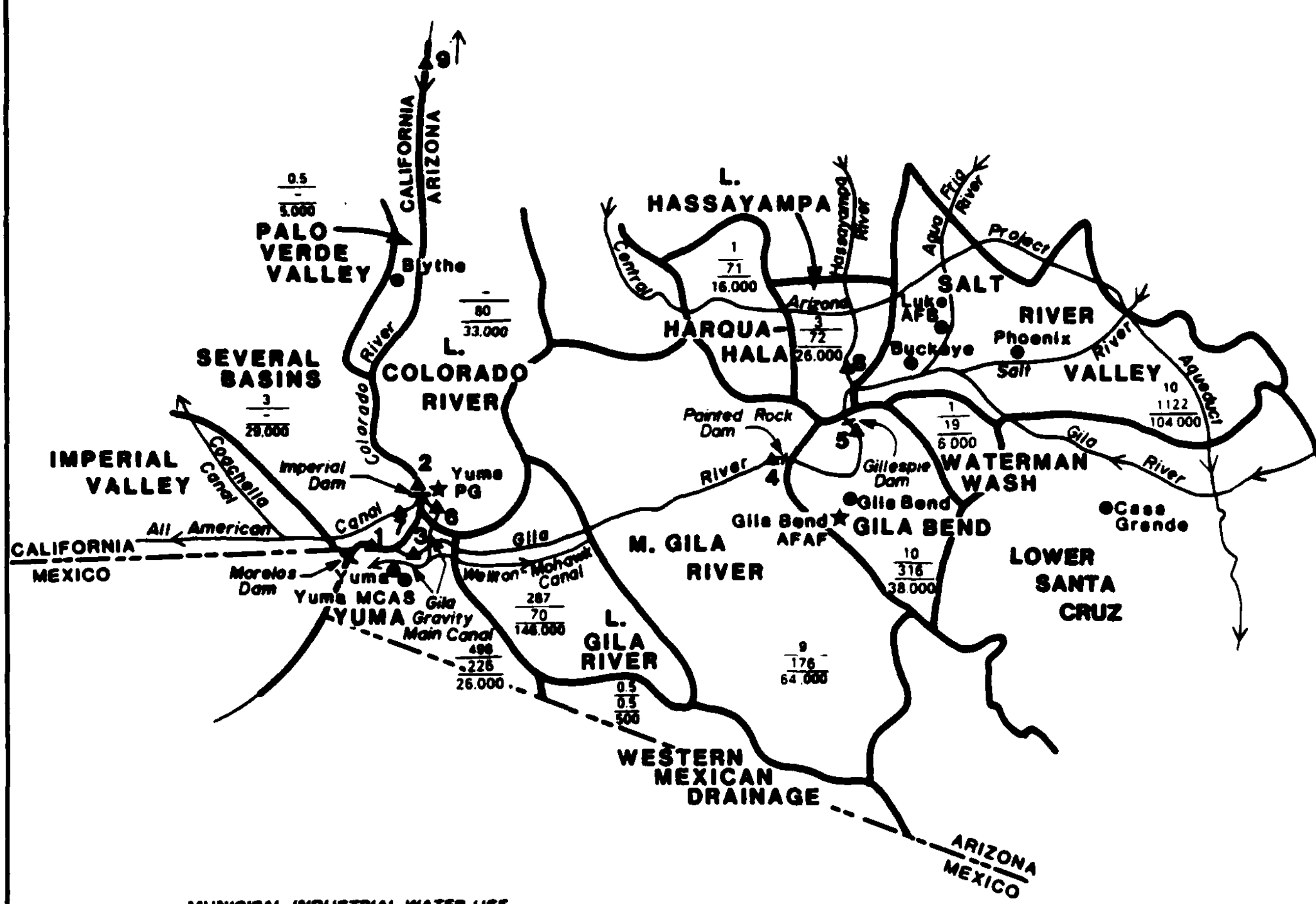
Groundwater Hydrology and Quality. The major groundwater aquifers and special groundwater management areas were delineated for each proposed project area. Major withdrawals and the sustained yield of the groundwater basins were tabulated. Overdrafted basins and trends in the regional water table level were identified. Groundwater quality trends were summarized. Emphasis was placed on total dissolved solids (TDS), fluorides, and nitrates, three criteria of concern in groundwater supply.

Summary of Water Use. Quantities of water were identified for the following user groups: municipal and industrial, agricultural irrigation, and military. Existing and future water supply sources and their capability to meet water demands were summarized based on existing data and water development plans, and were updated, as needed, through interviews with state and local officials. Any existing or projected water supply shortages were highlighted.

3.8.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

3.8.3.1 Arizona Complex

Prominent surface water features in the Arizona Complex include the Lower Colorado River and the Lower Gila and Salt rivers (Figure 3.8.3-1). The Salt River Project supplies the Salt River Valley and the Phoenix area with about 1 million acre-feet per year (acre-ft/yr) of surface and groundwater. The Colorado River has an annual average flow below Imperial Dam of 3.2 million acre-ft. Diversions from the Colorado River by users in Arizona amounted to 1.1 million acre-ft in 1983. Arizona will be using a larger share when the Central Arizona Project becomes fully operational. This new, major source of surface water will substantially augment the existing supply. Salinity concentrations vary greatly throughout the ROI, with the Colorado River and the upper reaches of the Gila and Salt rivers containing the highest quality surface water. The nine major groundwater basins in the ROI contain alluvial aquifers; seven are in various conditions of overdraft. The maximum decline in groundwater levels has been about 400 feet in the Phoenix area, where extensive groundwater pumping has occurred since the early 1900s. About 2,780,000 acre-ft of groundwater was extracted in the ROI in 1983. With the importation of Colorado River water and the formation of an Active Management Area in the Salt River Valley to control groundwater withdrawals, the severe groundwater depletion is projected to be less in the future. However, overdraft conditions will still predominate in the ROI. Groundwater quality varies greatly in the ROI, being poorest at and adjacent to the downstream reaches of the Gila River. Total water use from all sources in 1983 was about 5,450,000 acre-ft. About 84 percent was used for agriculture and 15 percent for municipal and industrial uses. Municipal water use is expected to increase 26 percent by the year 2000, while agriculture demands will lessen slightly as urbanization and higher water costs cause a decrease in irrigated acreages. With the recently constructed Central Arizona Project supplying large quantities of surface water to the region, the ROI will be able to meet most projected needs.



MUNICIPAL-INDUSTRIAL WATER USE
(acre-ft/yr)

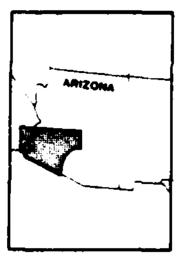
ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Yuma PG	820	1,000
Gila Bend AFAF	290	290
Luke AFB	1,600	1,600
Yuma MCAS	2,000	2,000
Phoenix	257,000	386,000
Mesa	52,100	113,000
Glendale	28,800	49,800
Tempe	34,700	53,000
Gila Bend	700	1,000
Yuma	16,600	21,100

GROUNDWATER BASIN CONDITIONS

Recharge ($x10^3$ acre-ft/yr)
Pumpage ($x10^3$ acre-ft/yr)
Storage ($x10^3$ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	09522000	3,173,000	1,145
2	09429500	7,900,000	752
3	09520700	450,000	2,659
4	09519800	278,000	1,169
5	09519500	257,000	3,508
6	Gila Gravity	565,000	752
7	All-American	2,596,000	752
8	09516500	11,000	-
9	09427520	8,600,000	752



LEGEND

GROUNDWATER BASIN
STREAM
INTERNATIONAL BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 25 50

FIGURE 3.8.3-1 HYDROLOGIC FEATURES OF THE ARIZONA COMPLEX

L3-WR/11 (D3-WR/11)

3.8.3.2 Florida Complex

The Florida Complex receives abundant rainfall and contains several of the larger rivers in Florida (Figure 3.8.3-2). These rivers drain to the Gulf of Mexico through two large estuaries: Choctawhatchee and Pensacola bays. Water quality in the central portion of the bays is generally good, though natural causes periodically create conditions of low dissolved oxygen. Some bayous associated with the bays have degraded water quality caused by storm runoff. About 11 million acre-ft/yr of generally good quality water are discharged into the bays by the major rivers in the ROI, and water use is minor. Low pH values and discoloration are the only water quality problems in the rivers. The potable water supply in the region is derived in about equal amounts from two major aquifers present in the ROI: the Floridan and the sand and gravel. Water quality is excellent in the Floridan Aquifer; however, groundwater from the sand and gravel aquifer has a low average pH and can be corrosive. Potentiometric levels have declined 240 feet in the Floridan Aquifer near the Fort Walton Beach area. These declines have raised concerns about the possibility that seawater intrusion may contaminate potable water aquifers. A plan has been proposed to import groundwater from Eglin Air Force Base (AFB) to the Fort Walton Beach area to help alleviate overpumpage. Total water use in the ROI in 1980 was 550,000 acre-ft. Thermoelectric power generation is the largest demand for surface water in the ROI, accounting for 68 percent of the total use; however, most of the water used is returned to the river and little consumption occurs. Municipal and industrial demands accounted for 26 percent of the water used, and agricultural, rural, and military water demands used the remainder. Population increases are expected along the Gulf Coast and, by the year 2000, projected public supply demands will more than double in portions of the coastal area. This increase will probably be supplied from groundwater sources. While local declines of groundwater levels have occurred, the ROI has abundant groundwater supplies available for use. Large quantities of groundwater are present at Eglin AFB.

3.8.3.3 Nevada Complex

Because the climate in this area is extremely dry, little runoff is generated locally and the only major, natural perennial stream in the ROI is the Colorado River (Figure 3.8.3-3). Nevertheless, the ROI can be characterized as having substantial good-quality surface water because of Lake Mead on the Colorado River, which provides most of the regional supply. Lake Mead is impounded by Hoover Dam and has a capacity of 26 million acre-ft. The Las Vegas Valley, where Nellis AFB and the major support community of Las Vegas are located, imports about two-thirds of its water supply from Lake Mead. The Las Vegas Wash conveys treated wastewater from several plants in the valley into Lake Mead, which has caused localized water quality degradation. The groundwater resources of the region generally have excellent quality, though they may lie at considerable depth. Groundwater levels in the Las Vegas Valley have declined as much as 300 feet as a result of extensive overdrafting. Currently, groundwater sources account for only 37 percent of the water supply to the valley and they are used primarily to meet summer peak demands. The Nevada State Engineer has set a goal of achieving a withdrawal rate of no more than 50,000 acre-ft/yr. Deep, regional carbonate aquifers underlie the central portion of the ROI and receive very limited recharge. Total water use in the ROI is 220,000 acre-ft/yr. Over 90 percent is municipal and industrial use, which occurs in the Las Vegas Valley. Las Vegas

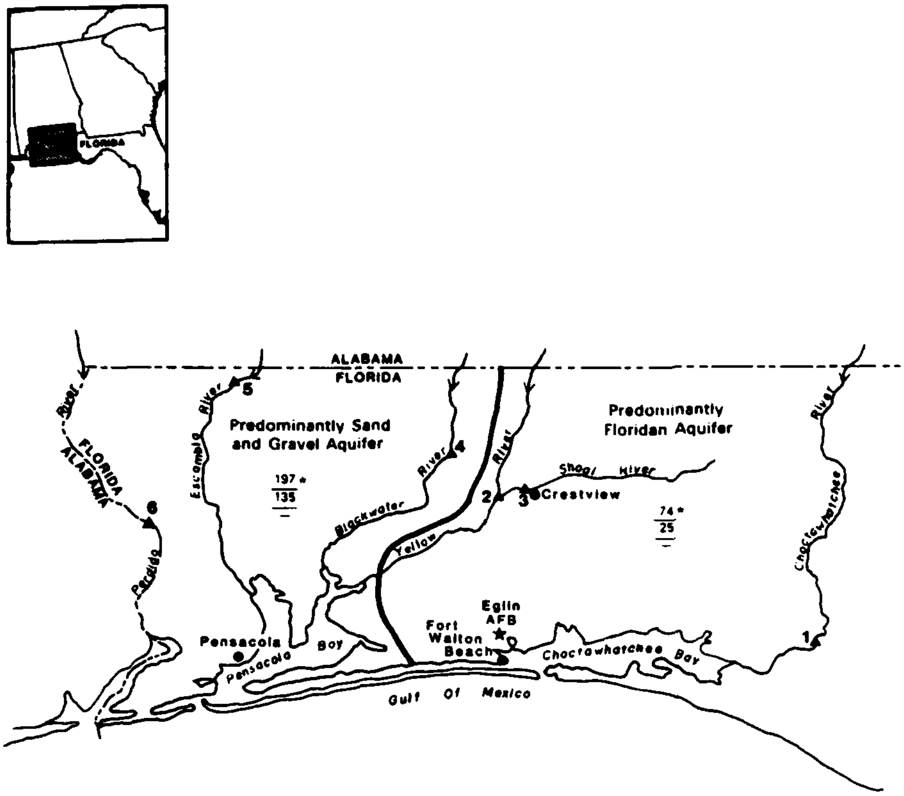


FIGURE 3.8.3-2
HYDROLOGIC FEATURES OF THE FLORIDA COMPLEX

MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Southern Okaloosa County	15,330	19,480
Pensacola	28,050	38,500
Crestview	2,470	3,140
Eglin AFB	5,150	5,150

GROUNDWATER BASIN CONDITIONS

Recharge (x10³ acre-ft/yr)
Pumpage (x10³ acre-ft/yr)
Storage (x10³ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	02366500	5,170,000	61
2	02368000	846,000	41
3	02369000	792,000	19
4	02370000	248,000	23
5	02375500	4,573,000	64
6	02376500	558,000	25

*This recharge value does not include base flow from streams originating in the sand and gravel aquifer.

LEGEND

STREAM
STATE BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 10 20

L3-WR/15 (03-WR/15)

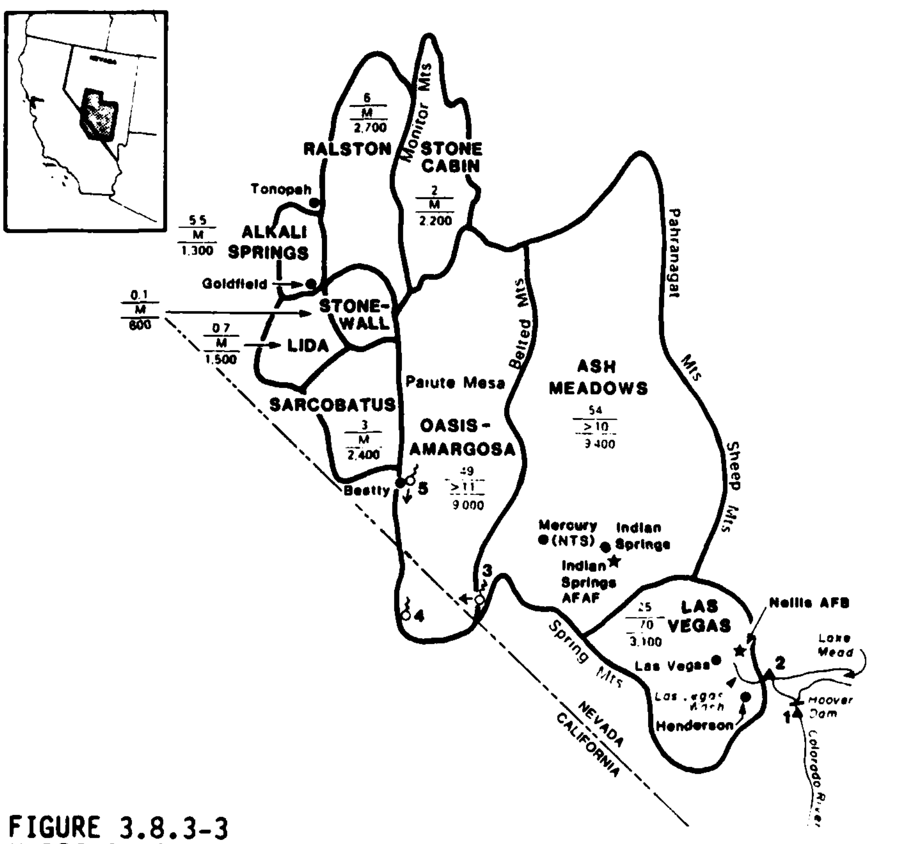


FIGURE 3.8.3-3
HYDROLOGIC FEATURES OF THE NEVADA COMPLEX

MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Nellis AFB	4,400	6,000
Indian Springs AFAF	280	500
Las Vegas	200,000	330,000
Indian Springs	120	a*
Beatty	190	a*
Goldfield	25	a*
Tonopah	240	a*

* a = Little or no increase over recent use

GROUNDWATER BASIN CONDITIONS

Recharge (x10³ acre-ft/yr)
Pumpage (x10³ acre-ft/yr)
Storage (x10³ acre-ft)

M = Minor Pumpage (< 1,000 acre-ft/yr)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	09421500	9,850,000	720
2	09419800	85,000	2,300
	Regional Springs		
3	Ash Meadows	17,000	440
4	Furnace Creek	5,000	650
5	Oasis Valley	2,000	580

LEGEND

GROUNDWATER BASIN
STREAM
STATE BOUNDARY
SPRING
★ MAIN OPERATING BASE

SCALE IN MILES
0 15 30

L3-WR/4 (03-WR/4)

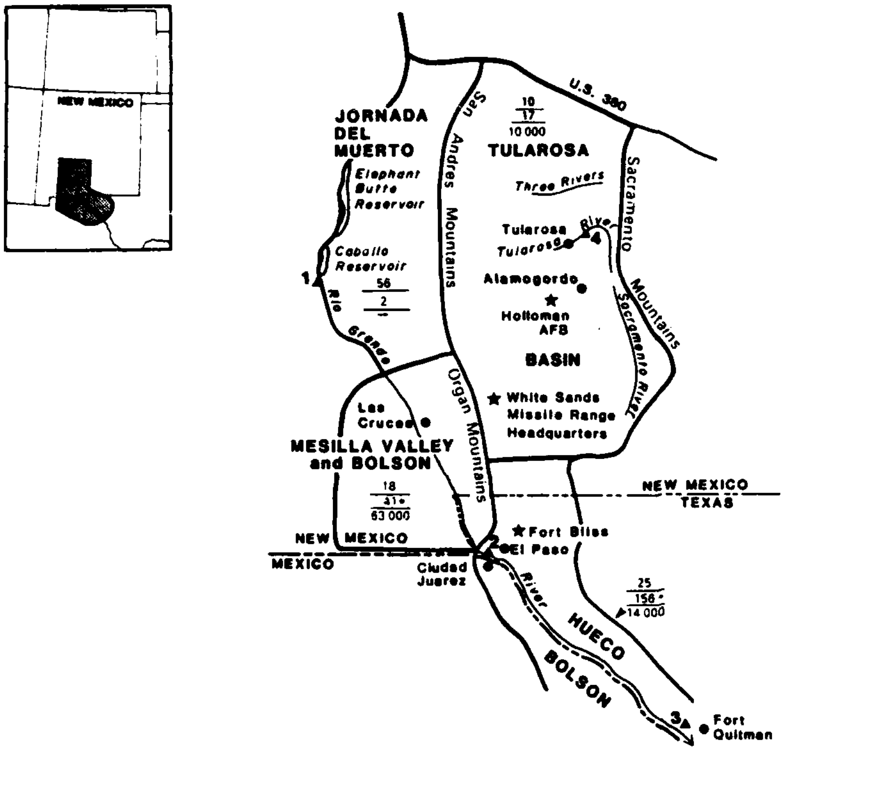
Valley and Nellis AFB have adequate water supplies to meet future demands. Large increases in municipal and industrial use will occur in the future in Las Vegas Valley. Increased diversions from the Colorado River will meet this demand. Little change in water use or groundwater pumpage is projected for the remainder of the ROI.

3.8.3.4 New Mexico Complex

Desert conditions prevail throughout this area, and there are few perennial streams. The dominant surface water feature is the Rio Grande River, which provides most of the regional water supply. Virtually all flow in the river has been appropriated, and water quality deteriorates steadily downstream because of irrigation returns and discharges of treated wastewater. The flow of the river is controlled by two upstream reservoirs, Caballo and Elephant Butte, which provide irrigation to 180,000 acres in the Mesilla and El Paso valleys (Figure 3.8.3-4). Groundwater resources in the region are abundant, though recharge is limited. Adequate quality water for most uses can be obtained throughout much of the ROI except in the Tularosa Basin, where fresh water is limited to the mountainous margins. Groundwater sources supply 84 percent of the municipal and industrial needs in the ROI, and groundwater is occasionally pumped to meet seasonal irrigation needs in the Rio Grande Valley. As a result, portions of the area have had substantial groundwater declines. The Tularosa Basin, which supplies water to White Sands Missile Range and Holloman AFB, experiences declines of 1 to 5 feet per year. Should groundwater levels fall sufficiently, highly saline water from the interior of the basin will eventually be drawn to the wells and degrade water quality. The Hueco Bolson, which supplies Fort Bliss and the cities of El Paso and Ciudad Juarez, has experienced widespread groundwater declines of 1 to 3 feet per year, which may accelerate with the demands of a rapidly growing population. Total water use in the ROI is about 1 million acre-ft/yr, with irrigation accounting for three-quarters of the total. The bases and support communities are expected to meet their water demands during the projected period, though long-term declines in groundwater levels and quality will continue. Large increases in municipal and industrial water use are projected. Irrigation will decrease in the southern portion of the ROI.

3.8.3.5 South-Central California Complex

The South-Central California Complex lies almost entirely within the western part of the Mojave Desert, and is an area of very dry climate with few perennial streams (Figure 3.8.3-5). The major surface stream in the region is the Mojave River, yet its surface flows are rarely used because of its intermittent nature. Some minor impoundments of runoff from the local mountains support small agricultural users. Good-quality surface water is found in the mountainous areas of the region. Imported water from the State Water Project makes up about one-third of the region's total water supply, and groundwater currently supplies the majority of demands. The major groundwater basins in the area are the Antelope, Indian Wells, and the Upper and Middle Mojave River valleys. Overdraft conditions are found in all four basins, with the Antelope Valley exhibiting the greatest decline (200 ft) in groundwater levels. Groundwater quality ranges from excellent near the mountains to saline at or near the dry lakes scattered throughout the region. High levels of fluorides, nitrates, and boron are found at many isolated locations. The region's dependence on groundwater will decrease in the future as irrigated agriculture



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Fort Bliss	6,900	7,000
White Sands Missile Range	2,100	2,100
Holloman AFB	3,100	3,200
Alamogordo	4,600	5,400
Tularosa	560	600
Las Cruces	14,600	25,000
El Paso	102,000	157,000
Ciudad Juarez	65,000	107,000

GROUNDWATER BASIN CONDITIONS

Recharge ($\times 10^3$ acre-ft/yr)
Pumpage ($\times 10^3$ acre-ft/yr)
Storage ($\times 10^3$ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	08362500	615,000	500
2	08364000	361,500	960
3		102,400	3,280
4	08481500	7,400	1,000

*Does not include 50-60,000 acre-ft of irrigation-related pumpage and subsequent recharge in the Rio Grande alluvium during water-short years

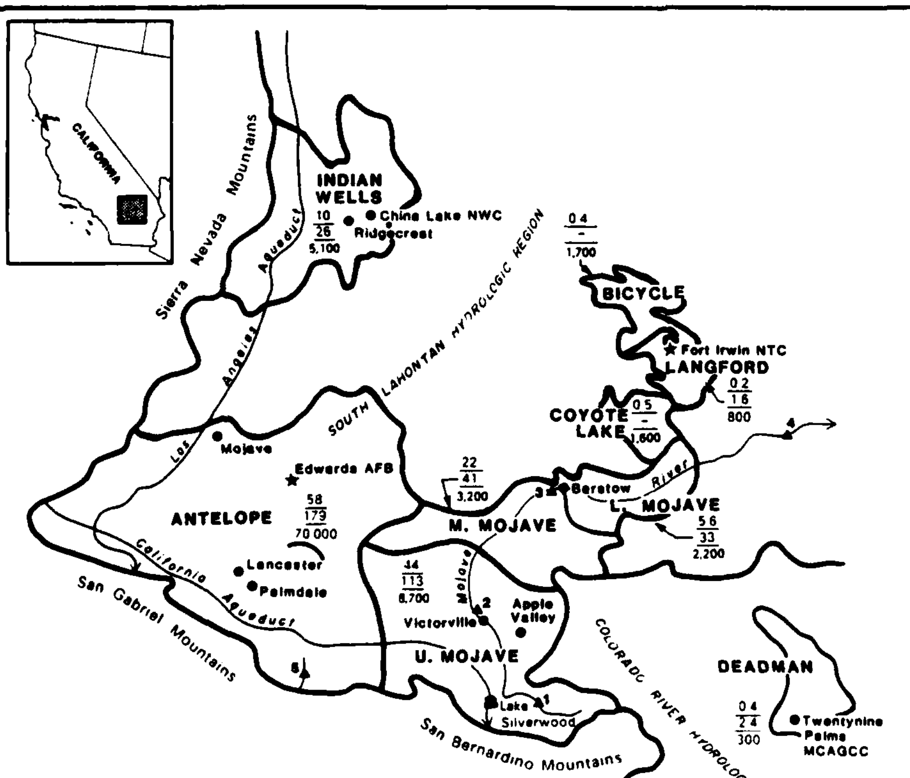
LEGEND

GROUNDWATER BASIN
STREAM
STATE BOUNDARY
INTERNATIONAL BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 15 30

FIGURE 3.8.3-4
HYDROLOGIC FEATURES OF THE NEW MEXICO COMPLEX

L3-WR/2 (D3-WR/2)



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Edwards AFB	5,270	5,710
China Lake NWC	4,730	5,920
Fort Irwin NTC	2,120	2,960
Twentynine Palms MCAGCC	2,900	4,450
Barstow	10,300	9,300
Victorville	5,800	12,900
Ridgecrest	4,300	6,380
Lancaster	14,150	26,900
Apple Valley	4,330	9,600
Mojave	1,300	2,000
Palmdale	7,630	13,460

GROUNDWATER BASIN CONDITIONS

Recharge ($\times 10^3$ acre-ft/yr)
Pumpage ($\times 10^3$ acre-ft/yr)
Storage ($\times 10^3$ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	10260500	53,700	200
2	10261500	55,900	280
3	10262500	19,500	-
4	10263000	5,500	900
5	10264000	11,800	240
Los Angeles Aqueduct		482,000 (1984)	210
California Aqueduct		240,408 (1983)	306

LEGEND

GROUNDWATER BASIN
STREAM
★ MAIN OPERATING BASE

SCALE IN MILES
0 20 40

FIGURE 3.8.3-5
HYDROLOGIC FEATURES OF THE SOUTH-CENTRAL CALIFORNIA COMPLEX

L3-WR/1 (D3-WR/1)

declines one-third by the year 2000 because of higher water costs. Increased deliveries of imported water are also expected. Municipal demand is expected to double. These combined effects will lower overall water use in the region. Of the 613,000 acre-ft/yr of water currently used in the region, 84 percent was for agricultural uses. Municipal and industrial water use was 10 percent. Local groundwater is used to supply China Lake Naval Weapons Center (NWC), Edwards AFB, Fort Irwin National Training Center (NTC), and Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC). If the population at the last three bases increases greatly, new water sources will be needed. Overall, the water supplies of the ROI will be sufficient to meet most projected demands primarily because of the availability of imported water from the State Water Project. Groundwater will continue to be used as the principal water supply source.

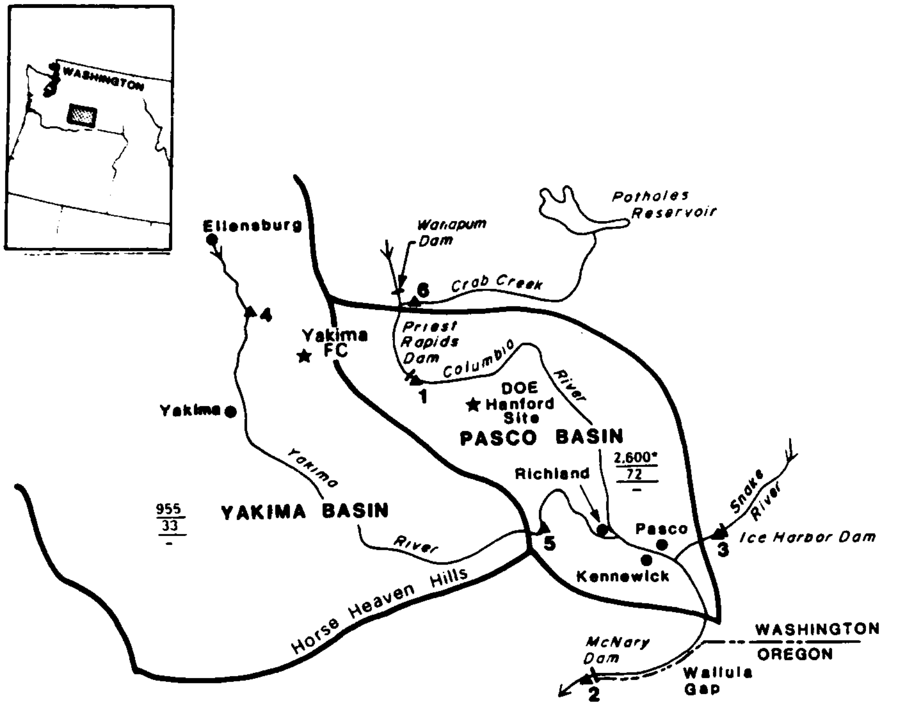
3.8.3.6 Washington Complex

Most of the ROI has a semiarid climate that generates little runoff. Nevertheless, the area has abundant surface water of excellent quality from the Snake, Columbia, and Yakima rivers (Figure 3.8.3-6). An extensive system of dams has been constructed on all three rivers. Salient existing facilities are the Columbia Basin and the Yakima projects, each irrigating about 500,000 acres. The Snake and Columbia rivers provide the largest source of hydroelectric power in the nation and support 5 million tons per year of waterborne shipping. The smaller Yakima River drains the majority of the ROI and is largely depleted from seasonal irrigation diversions. Good quality groundwater is generally available, though at considerable depth in some areas. However, groundwater sources provide only 3 percent of the total water supply because large quantities of surface water are available. Even so, irrigation pumpage has caused groundwater declines in excess of 40 feet in the central portion of the Yakima Basin. In the Pasco Basin, historical pumpage caused declines of 200 feet west of the Department of Energy (DOE) Hanford Site. More recent pumpage has resulted in declines of up to 40 feet east and south of the Potholes Reservoir, prompting the State of Washington to establish several groundwater management areas in the vicinity of the reservoir. Total water use in the ROI is 5.2 million acre-ft/yr, with irrigation accounting for 89 percent of the total. Yakima Firing Center (FC), the DOE Hanford Site, and the major towns in the ROI all have adequate water supplies to meet future needs. A large increase in water use for irrigation will occur in the 1990s because of the planned expansion of the Columbia Basin Project. Moderate increases in municipal and industrial use will also occur. Groundwater use will probably continue to increase.

3.8.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

3.8.4.1 Ellsworth Air Force Base

The ROI is located in southeastern South Dakota between the Black Hills and the Missouri River. The larger rivers, Cheyenne and Belle Fourche, originate in the Great Plains to the west of the ROI. A number of locally important streams, such as Rapid Creek, have their headwaters in the Black Hills and augment the flow of the larger rivers (Figure 3.8.4-1). Many secondary streams are intermittent because of the semiarid climate of the region. Water quality is excellent for those streams that begin in the Black Hills. Quality



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Yakima FC	220	220
DOE Hanford Site	35,000	35,000
Yakima	11,800	14,100
Richland	15,000	22,400
Kennewick	8,100	9,900
Pasco	6,100	9,800

GROUNDWATER BASIN CONDITIONS

Recharge ($\times 10^3$ acre-ft/yr)
Pumpage ($\times 10^3$ acre-ft/yr)
Storage ($\times 10^3$ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	12472800	86,160,000	75
2	14105700	132,100,000	-
3	13353000	40,565,000	140
4	12484500	1,900,000	80
5	12510500	1,600,000	150
6	12472600	80,000	

* Much of this recharge is probably derived from underflow from adjacent basins.

LEGEND

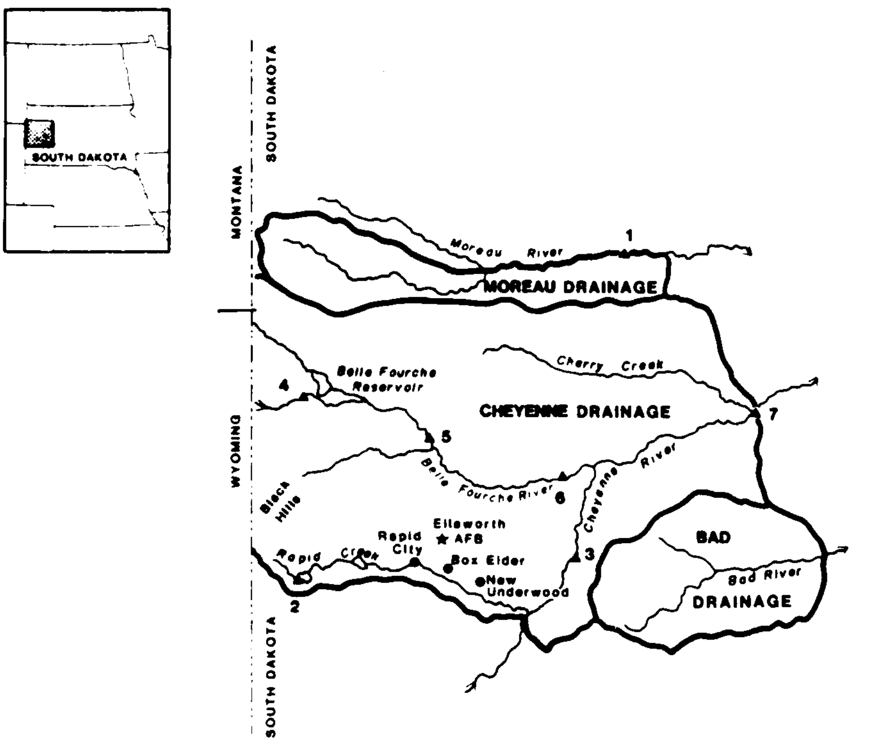
SURFACE WATER BASIN
STREAM
STATE BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES

0 15 30

FIGURE 3.8.3-6
HYDROLOGIC FEATURES OF THE WASHINGTON COMPLEX

L3-WR/3 (D3-WR/3)



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Rapid City	10,400	12,300
Ellsworth AFB	1,400	1,460
Box Elder	210	1,030
New Underwood	610	1 120

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	06359500	97,810	-
2	06409000	7,680	254
3	06423500	251 400	-
4	06434500	120 300	980
5	06437000	202,100	1,690
6	06438000	263 700	2 266
7	06439300	605 700	1 606

LEGEND

SURFACE WATER BASIN
STREAM
STATE BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES

0 50 100

FIGURE 3.8.4-1
HYDROLOGIC FEATURES OF THE ELLSWORTH AFB DEPLOYMENT AREA

L3-WR/13 (D3-WR/13)

tends to deteriorate as the streams flow through the eastern plains as a result of flow depletions and inflows of higher salinity groundwater. Groundwater is available throughout most of the ROI from the bedrock aquifers, which are under considerable artesian pressure. Wells penetrating them will often flow freely at the surface. The great majority of the groundwater is of marginal quality for most uses, with TDS concentrations typically greater than 1,000 milligrams per liter (mg/l). Groundwater supplies approximately 24 percent of the water used in the ROI, and no major changes in groundwater development are expected to occur during the projected period. Total water use in the ROI is about 170,000 acre-ft/yr. Irrigation accounts for about 86 percent of this use. The Belle Fourche Irrigation Project is the largest in the ROI, but it is very inefficient because only one-third of the water diverted is actually delivered to the field as a result of losses in the system. Approximately $40 million have been allocated to upgrade the project and its rehabilitation is expected to be completed in 1994. Municipal and industrial uses account for about 10 percent. The largest community in the ROI, Rapid City, draws 75 percent of its water from the Minelusa-Madison Aquifer and the remaining 25 percent from Rapid Creek. The city supplies water to Ellsworth AFB, and the available supply appears adequate for the projected needs of both entities. Several proposals to pipe water from the ROI to coal-producing areas in Wyoming have been considered in recent years, though none are currently active. If one of these proposals should ultimately proceed, a pipeline would pass through the ROI about 5 miles north of Ellsworth AFB and may ultimately result in water import to the area.

3.8.4.2 F.E. Warren Air Force Base

This ROI has a semiarid climate that generates little runoff, and most of the streams within it are ephemeral. However, it is bounded by two sizable rivers, the North and South Platte, which originate on the Continental Divide (Figure 3.8.4-2). A number of lesser streams originate within the ROI, including Crow Creek. All of the streams in the ROI are extensively used for irrigation and undergo considerable flow depletion or complete desiccation during the summer. Although water quality is excellent in the upstream reaches of the streams, deterioration occurs in the downstream reaches as a result of irrigation return flows and wastewater discharges. Good quality groundwater is abundant in the ROI, which is underlain by the productive High Plains Aquifer. However, substantial depths to water and low well yields may discourage groundwater development in some areas. Extensive development of groundwater resources is relatively recent (since the 1950s). Groundwater table declines of 20 to 40 feet have occurred in limited areas. Total water use in the ROI is 1.25 million acre-ft/yr; about 90 percent is used by irrigation. Cheyenne supplies F.E. Warren AFB and obtains its water from three sources: city wellfields, Crow Creek, and imported water from the Medicine Bow Mountains. Additional water supplies are being developed by the city, particularly expansion of imported water capacity. Considerable additional groundwater development can be expected to occur in parts of the ROI to support agriculture.

3.8.4.3 Grand Forks Air Force Base

The ROI is in a water-short area where smaller tributaries experience highly erratic discharges. Periods of no flow are almost annual events, making these streams unreliable water supply sources. Most of the streams in the area are

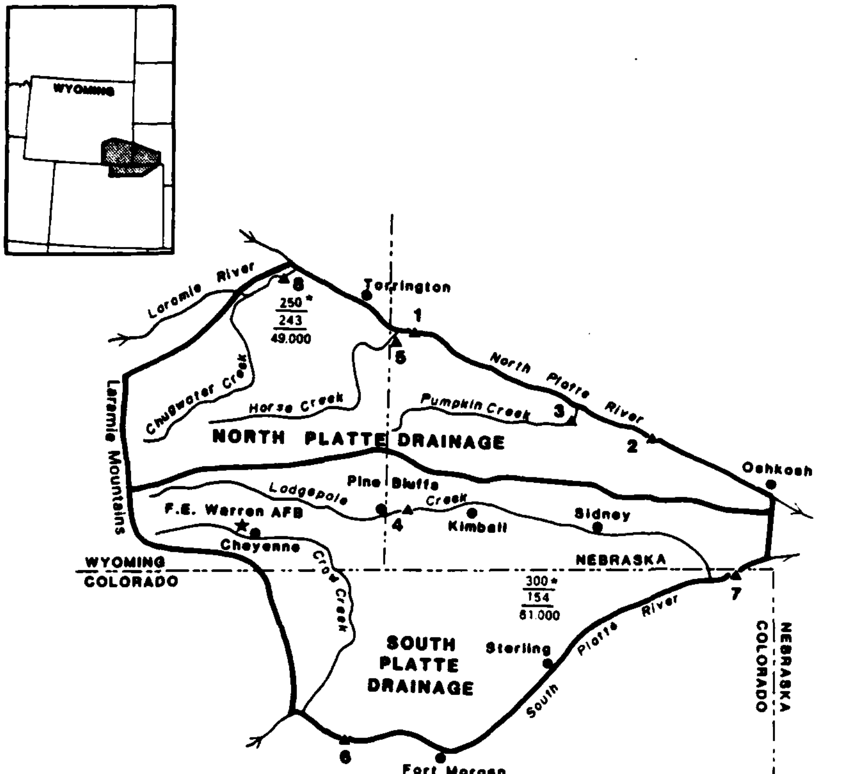


FIGURE 3.8.4-2
HYDROLOGIC FEATURES OF THE
F.E. WARREN AFB DEPLOYMENT AREA

MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Cheyenne	14,800	20,000
F E Warren AFB	1,100	1,200
Kimball	1,000	1,050
Pine Bluffs	510	535

GROUNDWATER BASIN CONDITIONS

Recharge ($x10^3$ acre-ft/yr)
Pumpage ($x10^3$ acre-ft/yr)
Storage ($x10^3$ acre-ft)

*Assuming an average recharge rate of 1 inch/year

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	06679500	618,700	470
2	06686000	1,061,000	550
3	06685000	20,000	410
4	06762500	8,000	-
5	06677500	53,000	-
6	06756995	85,000	750(est)
7	06764000	385,000	990
8	06670500	119,000	460

LEGEND

SURFACE WATER BASIN
STREAM
STATE BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 10 20

L3-WR/12 (03-WR/12)

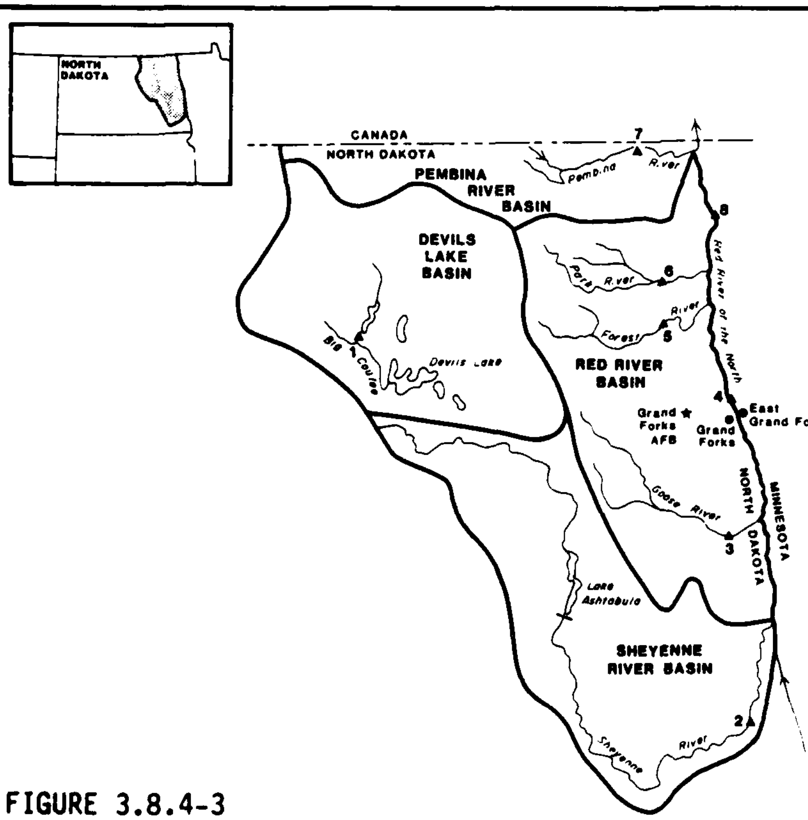


FIGURE 3.8.4-3
HYDROLOGIC FEATURES OF THE
GRAND FORKS AFB DEPLOYMENT AREA

MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
East Grand Forks, MN	1,400	1,450
Grand Forks, ND	7,500	9,300
Grand Forks AFB	1,230	1,260

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	05056400	29,780	850
2	05059000	145,600	518
3	05066500	49,900	823
4	05082500	1,866,000	356
5	05085000	36,200	489
6	05090000	41,900	629
7	05100000	138,400	484
8	05092000	2,776,000	521

LEGEND

SURFACE WATER BASIN
STREAM
INTERNATIONAL BOUNDARY
★ MAIN OPERATING BASE

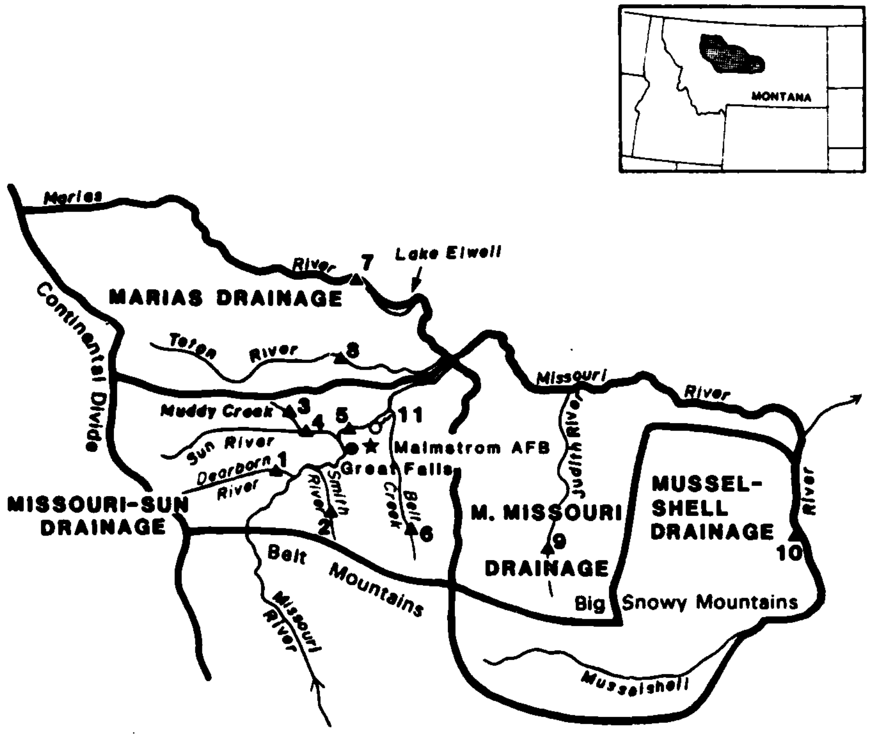
SCALE IN MILES
0 25 50

L3-WR/18 (03-WR/18)

considered satisfactory for domestic use during periods of medium to high flow. The City of Grand Forks supplies water to the MOB and has adequate water supplies to meet future needs. The Red River of the North is the principal hydrologic feature in the ROI and is used as the main water supply for Grand Forks. Grand Forks also obtains water from the Red Lake River, a tributary from Minnesota, to supplement its water supply. Because the Red River is in a broad valley of gentle grade, Grand Forks is subjected to severe flooding during spring snowmelt. The major tributary to the Red River is the Sheyenne River, which drains half of the ROI (Figure 3.8.4-3). Surface water quality problems include high TDS concentrations during periods of low flow, and excessive nutrient concentrations in the Red and Sheyenne rivers and in Devils Lake. Groundwater is abundant, though most of it is highly mineralized. Even so, groundwater supplies 60 percent of the total water use in the ROI. Although limited in areal extent, the glacial deposits are the most productive aquifers in the ROI. The Dakota Sandstone Aquifer underlies most of the ROI except for portions of the Red River Valley. Wells drilled into this confined aquifer often flow at the surface; however, its high salinity limits use to livestock and domestic consumption at locations where no other water source is available. No major changes in the recent trend of groundwater development will occur in the ROI during the projected period. Total water use is relatively small, since suitable quality water is scarce, amounting to 79,000 acre-ft/yr. Municipal use accounts for 43 percent and agricultural irrigation for 33 percent, with the remaining water use split about evenly between miscellaneous and rural uses. Water use for irrigation is expected to increase sharply in the ROI if the Garrison Diversion Unit proceeds. This will convey water from Lake Sakakawea to irrigate 130,000 acres within and west of the ROI.

3.8.4.4 Malmstrom Air Force Base

Most of the ROI has a semiarid climate that generates little runoff (0.5 to 1.0 in/yr). The majority of the streamflow originates in the mountainous region around the Continental Divide (Figure 3.8.4-4). Surface water supplies are of good quality in the mountains but variable in both quantity and quality in the plains area. Great Falls, which supplies Malmstrom AFB, has an ample supply of relatively good-quality water from the Missouri River. The stream is classified as a wild and scenic river for a 150-mile segment extending from its confluence with the Teton River to its intersection with the Musselshell River. Sediments derived from poor irrigation practices are a major problem in the lower portion of the Sun River, which receives 200,000 tons per year of soil. The Sun River is an erratic stream that has frequently subjected West Great Falls to flood damage. Depletion of surface waters as a result of irrigation withdrawals occurs regularly in the ROI. Another environmental concern is drainage from mines to Belt Creek and its tributaries; these streams are very acidic and contain high levels of heavy metals. The groundwater resources of the region are also abundant, but most water is at considerable depth and highly mineralized. Groundwater development in the region is in early stages, accounting for only 1 percent of the total use, with most wells tapping the unconsolidated glacial deposits. These shallow aquifers are susceptible to contamination from saline seep, a condition where wet, salty areas develop in nonirrigated soils when a field lies fallow. Total water use in the ROI is 2.3 million acre-ft/yr and is dominated by agricultural irrigation, which accounts for 98 percent of the total use. The water supply for Great Falls is adequate to meet anticipated growth. No major



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)		
ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Malmstrom AFB	1,140	1,300
Great Falls	13,500	16,640

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	06073500	157,800	-
2	06077500	244,700	-
3	06088500	92,700	-
4	06089000	519,800	575
5	06090300	5,852,000	250
6	06090500	139,000	-
7	06099500	676,900	387
8	06108000	113,700	-
9	06110000	39,700	-
10	06120500	120,200	1,675
11	Giant Springs	449,000	520

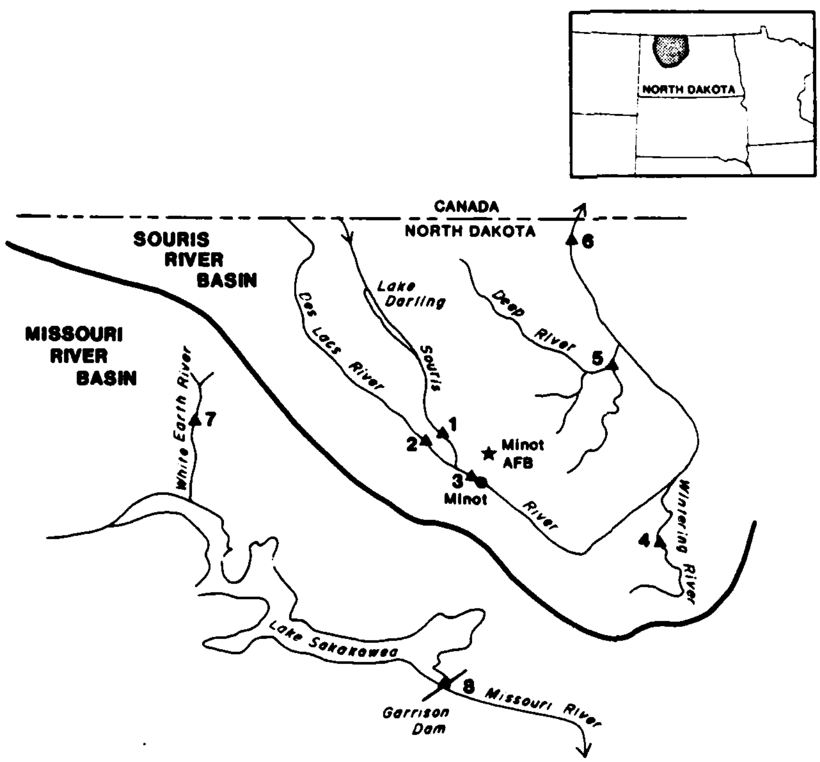
LEGEND

SURFACE WATER BASIN
STREAM
SPRING
★ MAIN OPERATING BASE

SCALE IN MILES
0 50

FIGURE 3.8.4-4
HYDROLOGIC FEATURES OF THE MALMSTROM AFB DEPLOYMENT AREA

L3-WR/14 (D3-WR/14)



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)		
ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Minot AFB	1,600	1,600
Minot City	6,730	7,420

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	05116000	107,150	425
2	05116500	22,370	-
3	05117500	122,350	390
4	05120500	9,630	425
5	05123510	14,720	-
6	05124000	192,380	460
7	06332000	20,400	-
8	06338490	18,121,720	470

LEGEND

SURFACE WATER BASIN
STREAM
INTERNATIONAL BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 25 50

FIGURE 3.8.4-5
HYDROLOGIC FEATURES OF THE MINOT AFB DEPLOYMENT AREA

L3-WR/16 (D3-WR/16)

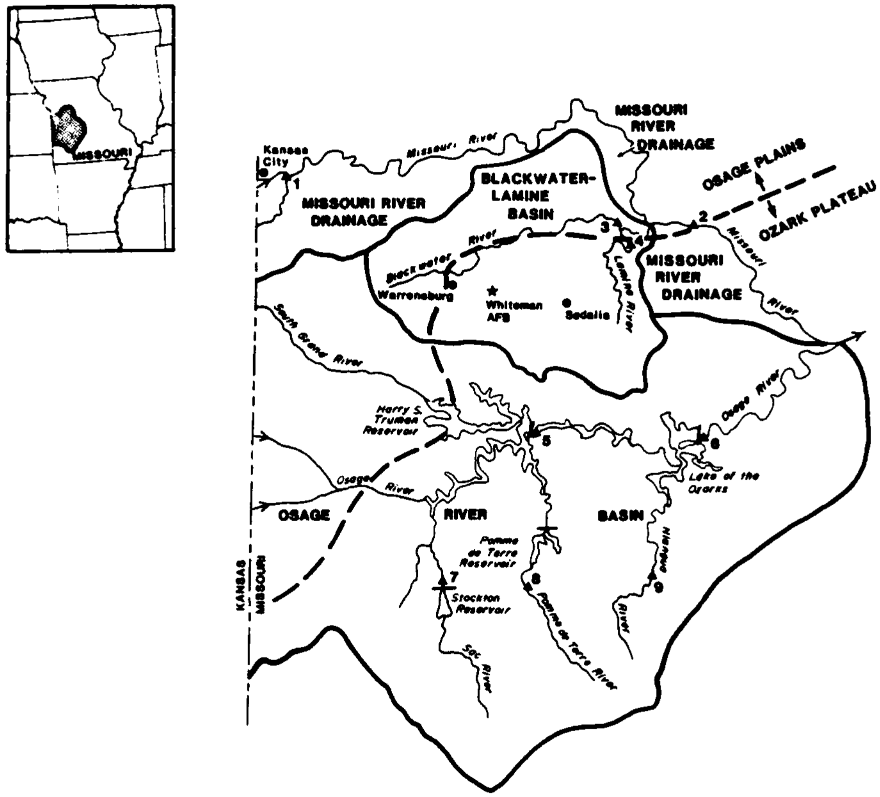
surface or groundwater development is likely to occur in the ROI during the projected period.

3.8.4.5 Minot Air Force Base

Runoff in this semiarid area is sparse and erratic, yet the region has substantial surface water resources from the Souris River and Lake Sakakawea on the Missouri River (Figure 3.8.4-5). Lake Sakakawea has a total capacity of 24.6 million acre-ft and is part of the multipurpose Garrison Diversion Unit. Water will be diverted from the lake to irrigate 130,000 dry-farmed acres and for municipal and industrial supply within and east of the ROI. Total phosphorus has been a problem in the Souris River Basin. The high phosphorus levels (0.1 to 0.6 mg/l) are a result of runoff from wildlife refuges, fertilized agricultural fields, and effluents from Minot's wastewater treatment plant. The erratic behavior of the Souris River has caused flooding in Minot. Groundwater resources are abundant, supplying half of the total water use in the ROI; however, much of it is highly mineralized and unsuitable for many uses. Unconsolidated glacial deposits, though limited in areal extent, are the most productive aquifers in the region. The Sundre and Minot aquifers are typical glacial formations and supply 70 percent of the water demand for Minot. The water table has historically declined 20 feet; however, groundwater levels have stabilized in recent years. Groundwater can also be obtained from the sedimentary bedrock aquifers, of which the Fort Union Formation is the most productive in the ROI. No major, additional groundwater development is expected to occur during the projected period. Total water use in the ROI is relatively small (amounting to 42,000 acre-ft/yr), with agricultural irrigation accounting for 55 percent of the total use. Most of the remaining water use is divided about evenly between municipal and rural use. The City of Minot, which supplies Minot AFB, has adequate water sources to meet anticipated growth; however, limited delivery capacity can result in occasional water shortages at the base.

3.8.4.6 Whiteman Air Force Base

The Whiteman AFB deployment area has numerous perennial streams as a result of its relatively moist climate (Figure 3.8.4-6). There are several major reservoirs on the Osage River supplying both water and hydroelectric power. Flood control is also provided by these projects. Surface water forms the principal water supply in the northwest portion of the ROI. Surface water quality in the region is generally good; however, some streams may contain poor-quality water depending on the source of the flow and the volume of discharge. Deep aquifers are used for municipal supplies in the southeastern two-thirds of the region where groundwater quality is excellent. Localized groundwater-level declines of 300 feet have occurred. To the northwest, the deep aquifers are highly saline and, as a result, shallow aquifers are used as water sources where availability and quality permit. In 1980, total water use in the region amounted to 810,000 acre-ft. Of that amount, only 2 percent went for agricultural purposes. Municipal and industrial water demands, including Kansas City, used 36 percent of the total, while thermoelectric power production used the remainder. Little growth in municipal water demand is expected. Industrial water use is expected to increase in the southwest portion of the region as a result of increases in oil and coal production. Some limited development of surface water resources is expected in the ROI in the future. However, the majority of future demands will be met by increased development of groundwater



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Kansas City, Mo	118,600	138,800
Sedalia	3,450	3,450
Warrensburg	2,020	2,020
Whiteman AFB	800	800

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	06893000	40,080,000	-
2	06909000	43,401,000	-
3	06908000	520,000	-
4	06908800	-	252
5	06922450	5,976,000	-
6	06926000	7,048,000	-
7	06919020	777,000	235
8	06921070	183,000	200
9	06923500	116,000	190

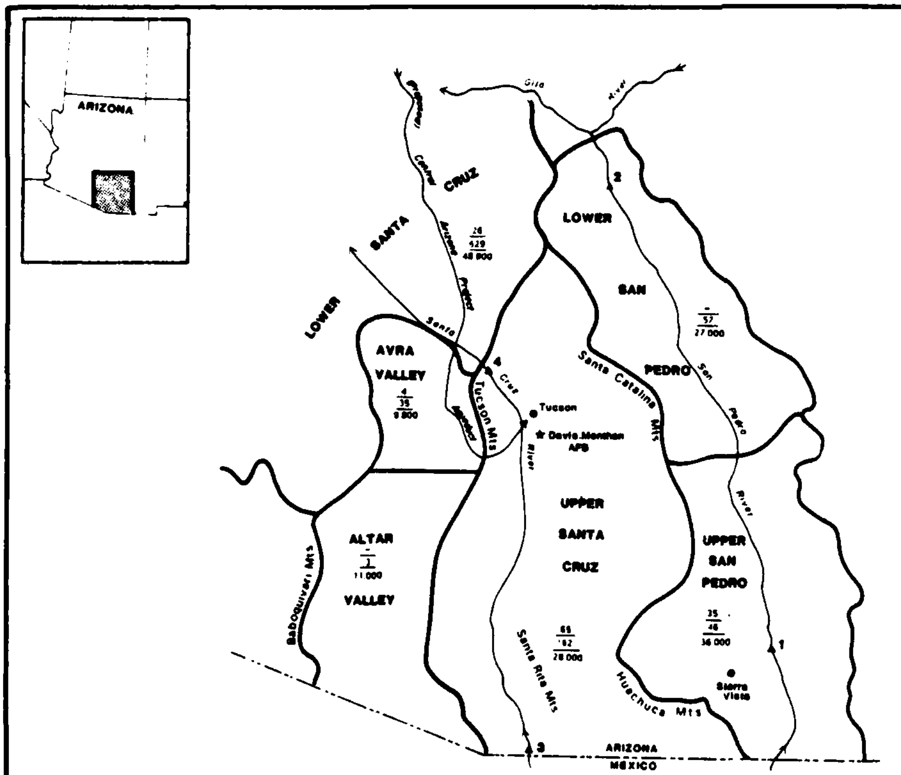
LEGEND

SURFACE WATER BASIN
STREAM
STATE BOUNDARY
PHYSIOGRAPHIC BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 25 50

FIGURE 3.8.4-6
HYDROLOGIC FEATURES OF THE WHITEMAN AFB DEPLOYMENT AREA

L3-WR/17 (D3-WR/17)



MUNICIPAL-INDUSTRIAL WATER USE (acre-ft/yr)

ENTITY	RECENT USE	PROJECTED USE (YR 2000)
Tucson	87,000	135,000
Sierra Vista	7,300	12,000
Davis-Monthan AFB	2,300	2,300

GROUNDWATER BASIN CONDITIONS

Recharge ($\times 10^3$ acre-ft/yr)
Pumpage ($\times 10^3$ acre-ft/yr)
Storage ($\times 10^3$ acre-ft)

SURFACE WATER CONDITIONS

Station (▲)	USGS Gage	Mean Discharge (acre-ft/yr)	Mean TDS (mg/l)
1	09471000	42,900	-
2	09473100	18,000	800
3	09480500	18,300	-
4	09466500	60,000	-

LEGEND

GROUNDWATER BASIN
STREAM
INTERNATIONAL BOUNDARY
★ MAIN OPERATING BASE

SCALE IN MILES
0 25

FIGURE 3.8.5-1
HYDROLOGIC FEATURES OF THE DAVIS-MONTHAN AFB DEPLOYMENT AREA

L3-WR/10 (D3-WR/10)

supplies. Abundant supplies exist to provide water in the southeastern two-thirds of the ROI. Elsewhere, surface water will form the supply. No increase in demand at Whiteman AFB and the two principal support communities of Warrensburg and Sedalia is expected during the projected period.

3.8.5 Existing and Projected Conditions for Hard Silo in Patterned Array

3.8.5.1 Davis-Monthan Air Force Base

Runoff is sparse in this arid region. The main hydrologic features in the ROI are the San Pedro and the Santa Cruz rivers, both of which are intermittent (Figure 3.8.5-1). There are no major flood control structures in the ROI, and the major support community of Tucson has been occasionally subjected to severe flood damage from the Santa Cruz River. Although surface water resources are currently limited, up to 150,000 acre-ft/yr of imported water from the Colorado River will be available to the ROI after 1991. Large quantities of good-quality groundwater are found in the alluvial aquifers in the region. The sole water source for Davis-Monthan AFB and Tucson are wells tapping the alluvial deposits of the river basins; however, extensive over-drafting has caused major declines in groundwater levels. A large area under-lying Tucson has had water table declines of about 100 feet since 1953, and declines of more than 300 feet are common in the Lower Santa Cruz Basin. Because of serious, long-term overdraft, parts of the ROI have been designated by the Arizona Legislature into the Tucson and Pinal Active Management Areas, which are subject to special groundwater regulations. Groundwater withdrawals are expected to decrease with the arrival of Central Arizona Project water, reducing the rate of groundwater level declines. Total water use in the ROI is 590,000 acre-ft/yr, with agricultural irrigation accounting for nearly 70 percent and municipal and industrial use accounting for most of the remainder. Municipal and industrial water use will increase 70 percent during the projected period. Much of the increase will be offset by declining irrigation water use in the Tucson Active Management Area. Sufficient water will be available for Tucson and Davis-Monthan AFB to adequately meet their future water demands during the projected period.

3.8.5.2 Edwards Air Force Base

Edwards AFB lies in the western portion of the Mojave Desert. For a discussion of the Mojave Desert region, see Section 3.8.3.5. The major surface water feature is the Mojave River, located in the southeast section of the proposed project area. The California Aqueduct of the State Water Project imports water into the region from northern California. Two large, dry lakes, Rosamond and Rogers, are found in the area. When water is present, the quality in these lakes is poor. The Antelope, Upper Mojave, and Middle Mojave River valleys are the three groundwater basins in the ROI. All of them are in various conditions of overdraft with a 200-foot decline in groundwater levels noted in Antelope Valley. Total recent water use in the ROI is about 480,000 acre-ft/yr. About 81 percent goes to agricultural uses and 12 percent to municipal and industrial demands. Edwards AFB currently supplies its own water from a series of wells located throughout the base. By the year 2000, agricultural demand is expected to decrease in the region by about one-third as a result of increased water costs, and municipal demand is projected to double. The combined effect will be to lower overall water use in the region. With the readily available supply of imported water, expected future demands can generally be met in the ROI.

3.8.5.3 F.E. Warren Air Force Base

This ROI has a semiarid climate that generates little runoff, and no major rivers flow through the region. Most of the streams in the area are ephemeral, flowing only after heavy rainfall or snowmelt. Crow Creek is one of four main streams in the ROI. It has several reservoirs with a total capacity of 10,600 acre-ft, which serve as a water supply for the city of Cheyenne. The remaining major streams are Lodgepole, Chugwater, and Horse creeks. All are heavily depleted by agricultural diversions. Although water quality is excellent in the upper reaches of all three creeks, deterioration occurs in the downstream reaches as a result of agricultural activities and effluent discharges. Crow Creek's flow downstream of Cheyenne consists almost entirely of effluent from two wastewater treatment plants. Large amounts of good-quality groundwater are present in the region; however, substantial depths or low well yields may discourage groundwater development in some areas. The principal aquifer in the ROI is the High Plains Aquifer, which is the major source of rural and irrigation water. Moderate declines in groundwater levels of 30 to 50 feet have occurred west of Cheyenne and around Pine Bluffs. Total water use in the ROI is about 100,000 acre-ft/yr; of this total, 80 percent is used for irrigation. Cheyenne, which supplies F.E. Warren AFB, has adequate water supplies to meet anticipated demands. Further information on the region is presented in Section 3.8.4.2.

3.8.5.4 Fort Bliss

The Rio Grande River is the principal stream in the ROI and provides most of the regional water supply. Its flow is fully allocated, primarily for agricultural irrigation. The ROI contains large quantities of groundwater, but low natural recharge, combined with high pumpage, has resulted in serious water declines in several areas, particularly in the Hueco Bolson around El Paso. The bolson is seriously overdrafted and water table declines of 1 to 3 feet per year are common in its central part. Water quality is deteriorating as a result of the inflow of poorer-quality groundwater from adjacent areas. Total water use in the ROI is approximately 840,000 acre-ft/yr, with irrigation consuming about three-quarters of the total. El Paso draws two-thirds of its water from the Hueco Bolson and has initiated steps to reduce the severe overdrafting, including reinjection of highly treated wastewater and the application for large groundwater rights in other basins in New Mexico. Although there are serious concerns over the long-term trend of declining groundwater quality and availability, the MOB and El Paso are expected to adequately meet their anticipated water demands during the projected period. Further information on the region is presented in Section 3.8.3.4.

3.8.5.5 Gila Bend Air Force Auxiliary Field

For a discussion of the Arizona region, see Section 3.8.3.1. The major surface water feature near Gila Bend Air Force Auxiliary Field (AFAF) is the Gila River. Downstream of Phoenix, the Gila River is perennial because of sewage discharge. It then becomes intermittent past Gillespie Dam where two canals, the Gila Bend and the Enterprise, divert the majority of surface flows for irrigation. Painted Rock Dam is primarily a flood-control structure designed to protect the lower Gila River and Yuma areas from flooding. Water quality in the river is poor as a result of effluent discharges and the influx

of high TDS return flows. Nine major groundwater basins are found in the ROI. Total groundwater production in the proposed project area amounted to 2,476,000 acre-ft in 1983. A groundwater level decline of 160 feet has occurred in the Gila Bend Basin because of overpumpage. Groundwater quality ranges from poor at and near segments of the Gila River to good farther up the alluvial valleys. High fluoride levels are found in isolated areas throughout the ROI. Total water use in the ROI was about 3.5 million acre-ft in 1983. The predominant water use in the ROI is agricultural, which accounts for 75 percent of the total. About 61,000 acre-ft were diverted from the Gila River in 1982 for crop irrigation in the Gila Bend Basin. About 5,000 acre-ft of groundwater were used for municipal supplies. High TDS and fluoride levels in the local groundwater have prompted Gila Bend AFAF to install a reverse osmosis water treatment system. Limited water supplies have slowed development of the region. No major changes in water use are expected. The general lack of good-quality surface and groundwater will continue to limit growth in the area.

3.8.5.6 Yuma Proving Ground

For a discussion of the Arizona region, see Section 3.8.3.1. The major surface water features in the Yuma Proving Ground (PG) ROI are the Colorado and Gila rivers. Total diversions from the Colorado River in 1983 amounted to 4,669,000 acre-ft. Of this, 3,021,000 acre-ft were exported outside of the proposed project area to California. The remainder was used in the ROI near the Colorado River. The lower Gila River is intermittent in its lower reaches and is not used as a water source. The Colorado River's water quality is consistently good, with years of high discharge characterized by lower TDS concentrations. The Gila River, when flow is present, contains poor quality water. Seven major groundwater basins are found in the ROI with a 1983 withdrawal rate of about 500,000 acre-ft. Groundwater recharge from the Colorado River to the Yuma Basin and from imported Colorado River water in the lower Gila River Basin maintains high groundwater levels in these two basins. The groundwater quality in the region ranges from good in the Colorado River area to poor at and near the lower Gila River. Total water use in the ROI in 1983 was about 2,200,000 acre-ft, with the great majority applied to agricultural irrigation. About 24,000 acre-ft were used by municipal and industrial concerns, primarily in the Yuma area. Yuma PG obtains its water supply from local groundwater and is constructing a water treatment plant that will use reverse electrodialysis to remove fluoride and excessive salts. Surface water is expected to be available from the Colorado River to meet new demands in the region through the increased use of existing entitlements. Limited increases in water demand are expected through the year 2000.

3.9 Geology and Soils

The proposed project will consume or use geologic materials, thereby affecting the resource supply of a region and its production rate. Typical geologic materials that may be affected include aggregate, energy, and mineral resources. Regulations for federally funded projects require the consideration of potential adverse and beneficial effects on the supply of Strategic and Critical Materials, prime and unique farmlands, and national natural landmarks, many of which were designated as landmarks because of their geological or soil characteristics. Furthermore, proposed project interaction with geologic conditions (such as ground subsidence and mass movements) may affect public health and safety. The analysis of geology and soils has been divided into considerations of engineering geology, geologic resources, and soil resources, which cover the range of issues relevant to the Small Intercontinental Ballistic Missile (ICBM) program.

3.9.1 Resource Description

Engineering Geology. The engineering geology element includes geologic conditions that could affect or be affected by the construction and operation of the proposed project. Seismicity and faulting, conditions that may represent potential geologic hazards (such as ground subsidence and debris flows), and the general engineering characteristics of geologic materials (e.g., suitability for shallow excavations, small buildings, roads and streets) that can be evaluated on a regional basis are included in this element.

Geologic Resources. Geologic resources, including energy and mineral resources, were assessed to evaluate possible project impacts to mining claims and other mineral rights issues. This evaluation includes mineral resources, energy resources, aggregate resources, and unique geologic features. Mineral commodity occurrences, past and active mining activities, oil and gas fields, known resource areas (e.g., known geothermal and coal resource areas) and areas of unique scientific importance (e.g., national natural landmarks) have been identified for each study area. Minerals and other raw materials on the Strategic and Critical Materials Stockpile list (31 March 1982) have also been identified.

Soil Resources. Soil resources were investigated to identify potential project impacts to the agricultural properties of soils, including those soils designated as important farmland, and on the creation of fugitive dust (Section 3.7). Important considerations include the distribution of prime farmland and farmland of statewide importance, and the susceptibility of soils to wind and sheet erosion.

3.9.2 General Analysis Methodology

The baseline conditions within the proposed project areas were determined from regional geology and soils data collected from publications of government agencies such as the U.S. Geological Survey (USGS), Bureau of Land Management (BLM), and Soil Conservation Service (SCS), and individual state geological or mineral surveys. In addition to these sources, data collected by the Air Force during the area narrowing process were used in evaluating baseline conditions. Computerized data bases were used to provide additional data on historic seismicity and soils.

The geology and soils data were compiled and entered into a computerized data base system for retrieval during impact analysis. Certain geology and soil conditions, including landforms and irrigated acreage, were interpreted from enhanced Multi-Spectral Scanner and Thematic Mapping imagery. The imagery was also used to verify and correlate soils and geology across mapping boundaries in the proposed project areas.

Geologic conditions generally change at a very slow rate; therefore, the past and present geologic conditions effectively identify future conditions over the operations life of the proposed project.

Region of Influence. The Region of Influence (ROI) for the Hard Mobile Launcher in Random Movement basing mode is the Main Operating Base (MOB), deployment installations, and the area encompassed by a 30-mile-wide zone (the maximum economic haul distance for aggregate) around each MOB and deployment installation. The Hard Mobile Launcher at Minuteman Facilities basing mode ROI includes a 30-mile buffer around the MOB, deployment area, and any other potential construction sites or areas of land acquisition in the Minuteman missile deployment areas. The ROI for the Hard Silo in Patterned Array basing mode includes the area within 30 miles of the MOB and all Suitable Deployment Areas (SDAs).

Engineering Geology. Seismicity and seismic effects were determined by an analysis of the existing geologic environment, particularly the structural and tectonic framework. Seismicity includes the surface location of seismic events (epicenter), depth of the event, magnitude (e.g., Richter), and intensity (e.g., Modified Mercalli). Seismic zoning takes these factors into account in a regional analysis. Historic seismicity was available from the National Oceanic and Atmospheric Administration's (NOAA) earthquake computerized data files. These files, compiled by many authors, contain records of historic events from throughout the world. A subset of this file for the United States, edited by NOAA, was used in the analysis and emphasizes high confidence events. These edited files were used to provide current information, verified by NOAA, to evaluate the historic seismicity (1769-March 1985) of the regions involved.

Other geologic hazards considered important within the regions investigated include mass movements and flooding, ground subsidence, surface fracturing, and volcanic eruptions. These potential hazards were identified qualitatively by analyzing the geologic conditions (e.g., stratigraphy, structure, and slope) throughout the proposed project areas and comparing these with conditions in other areas where geologic hazards are known to exist. In certain cases, site-specific hazard evaluations were conducted by other authorities (e.g., USGS). The determination of baseline conditions relied heavily on these analyses when available.

Analysis of the engineering characteristics of geologic materials relied on soil interpretations that are provided by the SCS in their regional soil survey reports and are available in the Army Corps of Engineers (COE) Construction Engineering Research Laboratory (CERL) soil data base. The data base was accessed to gather information on the suitability of soil series for routine construction practices (e.g., shallow excavations, dwellings with basements, small commercial buildings, and roads and streets). Construction limitations identified in the CERL data base (e.g., slight, moderate, and

severe) were used to identify areas where construction activities would be more difficult and therefore more costly or labor-intensive.

Geologic Resources. Baseline conditions for geologic resources were determined by identifying the distribution of various commodities in the proposed project area. Primary data sources included regional mineral resource assessments and statewide commodity occurrence maps. Each mineral, energy, and aggregate resource identified from the literature was characterized as to the commodity or commodities present, the current extraction status (e.g., active or inactive), and type (e.g., district, mine, or occurrence). Past production data were compiled at the district or field level where available. Commodities on the Strategic and Critical Materials Stockpile list were separated because of their importance and evaluated in a similar fashion. Mineral, energy, and aggregate resources were classified into a three-tier system for the proposed project area: resources with past production, known or measured resources, and potential resources. This system is a simplification of the methodology employed by the U.S. Bureau of Mines (USBM) and USGS in conducting regional and site-specific assessments.

Unique geologic features were identified from evaluations of areas of critical environmental concern, national natural landmarks, and research natural areas prepared by the BLM and National Park Service.

Soil Resources. Baseline soil resources data were compiled at the association level from modern soil surveys and general soil maps published by the SCS. Typically, soil associations are combinations of five to seven soil series. The relative percentage of each soil series in an association has been tabulated by the SCS. Baseline conditions for agricultural characteristics were measured by determining the amount of important farmland in each proposed project area. Important farmland for the regional analysis is considered either prime farmland or farmland of statewide importance as defined by the SCS. Maps depicting the areal extent of important farmland have been prepared for some counties, though none of the proposed project areas have complete coverage.

Soil series have been combined by the SCS into Wind Erodibility Groups based upon their similar properties with respect to wind erosion. Soil series have also been assigned a soil erodibility factor (K-factor) that predicts the long-term average soil loss resulting from sheet erosion. Wind and sheet erosion susceptibility were estimated from the available soils data in the proposed project area. The CERL data base and soil survey reports were used to access the Wind Erodibility Groups and K-factors for the soils within the proposed project areas. These values were placed into the SCS classification system (low, moderate, or high) for evaluating erosion potential.

3.9.3 Existing and Projected Conditions for Hard Mobile Launcher in Random Movement

Existing conditions for the Hard Mobile Launcher in Random Movement alternative locations are summarized in Table 3.9.3-1.

Table 3.9.3-1

SUMMARY OF GEOLOGY AND SOIL CONDITIONS FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES

Complex (sq mi)	Arizona (5,483)	Florida (724)	Nevada (6,062)	New Mexico (4,758)	South-Central California (4,176)	Washington (970)
ENGINEERING GEOLOGY						
Engineering Characteristics[1]	33%	99%	>50%	77%	94%	61%
Earthquakes With Magnitude >5.0[2]	0	0	60	0	43	0
Holocene or Active Faults Present	Yes	No	Yes	Yes	Yes	No
MCE Magnitude[3]	8.0	6.1	7.75	7.5	8.5	6.0
Other Geologic Hazards[4]	Yes	Yes	Yes	Yes	Yes	Yes
GEOLOGIC RESOURCES						
Mineral Resources[5]	98	0	29	68	173	13
Energy Resources	40	0	9	37	49	7
Aggregate Resources[6]	22	99	N/A	30	51	32
Unique Geologic Features	No	No	Yes	No	No	No
SOIL RESOURCES						
Important Farmland[7]	0%	<1%	0%	0%	0%	0%
Soil Erosion[8]						
Wind	44%	89%	N/A	57%	57%	53%
Sheet	13%	0%	N/A	32%	5%	57%

Notes: [1]Percent of area with moderate or severe limitations for routine construction.
[2]Current as of March 1985, for complex plus 15-mile buffer.
[3]Maximum credible earthquake magnitude.
[4]Presence of other geologic hazards including, for example, subsidence, mass movements, and flooding.
[5]Includes the number of mineral occurrences, mineral districts, oil/gas fields, and all active mining operations on installations.
[6]Percent of the area designated as a probable sand or gravel source.
[7]Percent of the area classified as prime farmland or farmland of statewide importance.
[8]Percent of the area with moderate or high susceptibilities to erosion.
N/A-Data not available.

3.9.3.1 Arizona Complex

The Arizona Complex ROI extends north from the United States-Mexico border to approximately Parker, Arizona (Figure 3.9.3-1), and west from about Casa Grande, Arizona to Glamis, California in the Imperial Valley. The majority of the ROI lies in the seismically quiescent Sonoran Seismic Region, with the southwestern portion in the seismically active Salton Trough Seismic Region. Several faults with known historic displacement occur near the Salton Sea, with the most active being the San Jacinto and Imperial faults. Minor Holocene faulting has occurred near the Pinacate volcanic field on the United States-Mexico border. Subsidence due to groundwater withdrawal has been reported near Eloy in south-central Pinal County (12 ft), in northeast Phoenix (3 ft), and near Luke Air Force Base (AFB), and is expected to occur in areas where groundwater is in overdraft. Debris flows are common along mountain fronts near the apex of alluvial fans, on young alluvial fans, and along channels on dissected alluvial fans near the mountain fronts. Channelized flooding is likely to occur on older alluvial fans and other dissected landforms in the ROI. Other flood-prone areas include floodplains and low terraces flanking major drainages such as the Gila River. Small playas are subject to standing water during periods of heavy or long rainfall. The Pinacate volcanic field should be considered a potential volcanic hazard. The majority of the soils on the installations have severe limitations for routine construction because of the presence of shallow, indurated calcium carbonate horizons. Active metallic (e.g., gold and copper) and nonmetallic (e.g., salt and gypsum) mining operations exist in the ROI and similar deposits, though inactive, may exist on the installations. Known Geothermal Resource Areas (KGRAs) occur in the ROI in the Imperial Valley of southeast California, but other energy resources are generally absent or not fully explored. Uranium occurrences have been identified in the central and eastern portions of the ROI, but their economic potential is considered speculative. Annual aggregate production (1984) in the ROI is estimated at 34,458,000 short tons, but concrete-quality aggregate is rare. Potentially acceptable concrete aggregate may be available from basalts, granitic rocks, gneiss and associated metamorphic rocks, and sedimentary rocks in areas of Luke Air Force Range (AFR). Much of the basin-fill deposits may be suitable as road base. Willcox Playa, in Cochise County, Arizona, and the Imperial Sand Dunes in Imperial County, California, are identified unique geologic features in or near the ROI. No important farmland exists within installation boundaries but does occur along the Colorado and Gila rivers within the ROI. Soils highly susceptible to wind and/or sheet erosion are found on approximately 5 percent of the installations and 3 percent of the Random Movement Areas (RMAs), and are typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils account for about 42 percent of the installations, 30 percent of the RMAs, and occur primarily on intermediate-age alluvial fans.

3.9.3.2 Florida Complex

The Florida Complex ROI extends north from the Gulf of Mexico to approximately Andalusia, Alabama, and west from about Panama City, Florida to the Florida-Alabama border (Figure 3.9.3-2). Sinkhole development is considered a potential hazard in the eastern counties of the ROI. The development of silica solution collapse features has been noted in the western portion of the ROI near Mobile, Alabama, but the distribution of this condition is unknown. Coastal areas in the ROI are susceptible to coastal hazards, such as storm

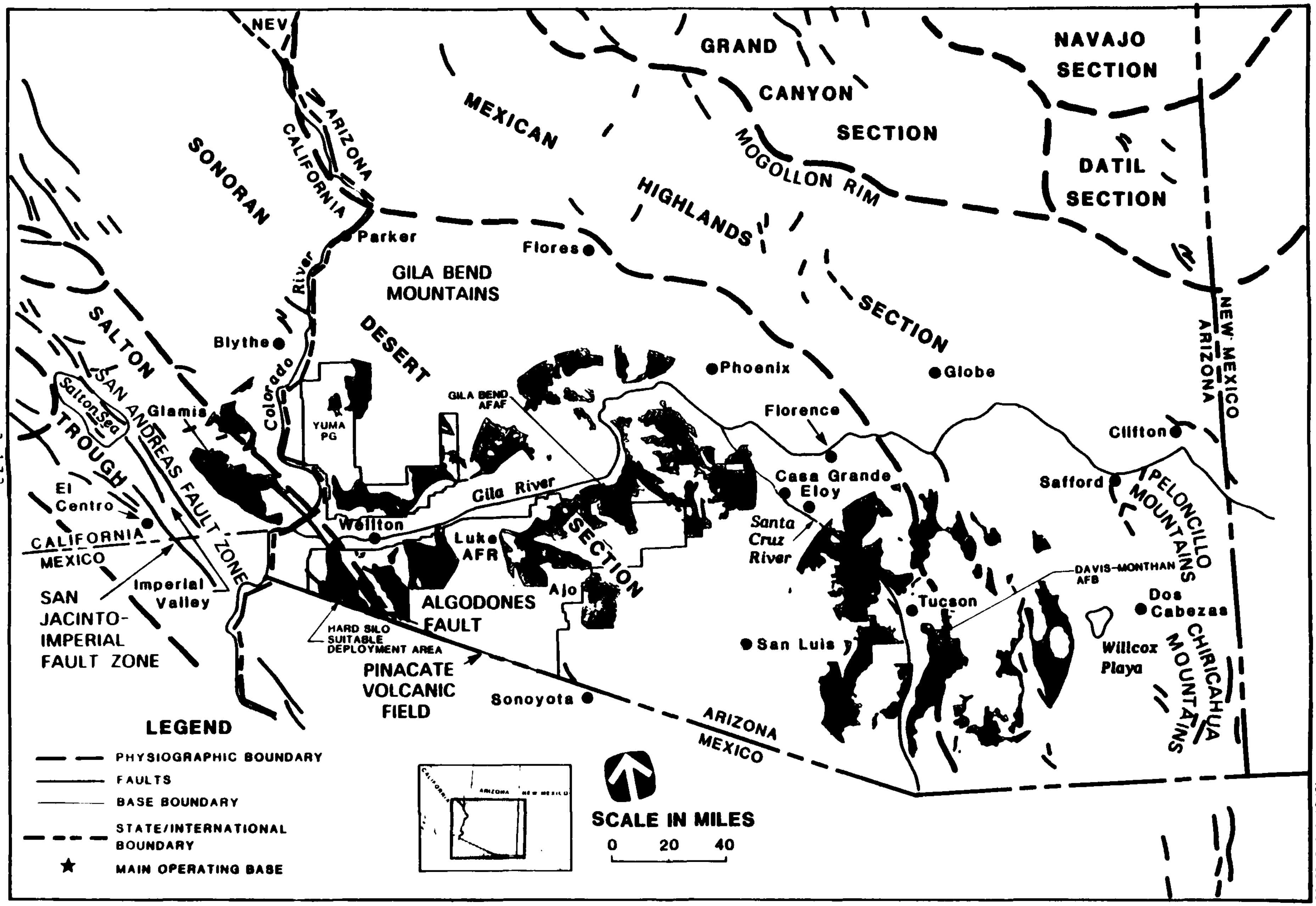


FIGURE 3.9.3-1 LOCATION OF THE ARIZONA COMPLEX HARD MOBILE LAUNCHER IN RANDOM MOVEMENT DEPLOYMENT AREA AND DAVIS-MONTHAN AFB, GILA BEND AFAF, AND YUMA PG HARD SILO IN PATTERNED ARRAY ALTERNATIVE DEPLOYMENT AREAS SHOWING FAULTS, PHYSIOGRAPHIC SECTIONS, AND IMPORTANT FEATURES

AD-A173 827 LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT SMALL INTERCONTINENTAL BALLISTIC MISSILE PROGRAM(U) AIR FORCE REGIONAL CIVIL ENGINEER NORTON AFB CA BALLISTIC MISSILE SUPPORT NOV 86 4/9

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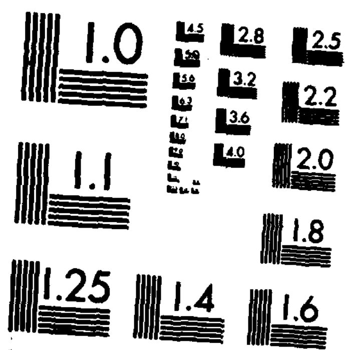

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

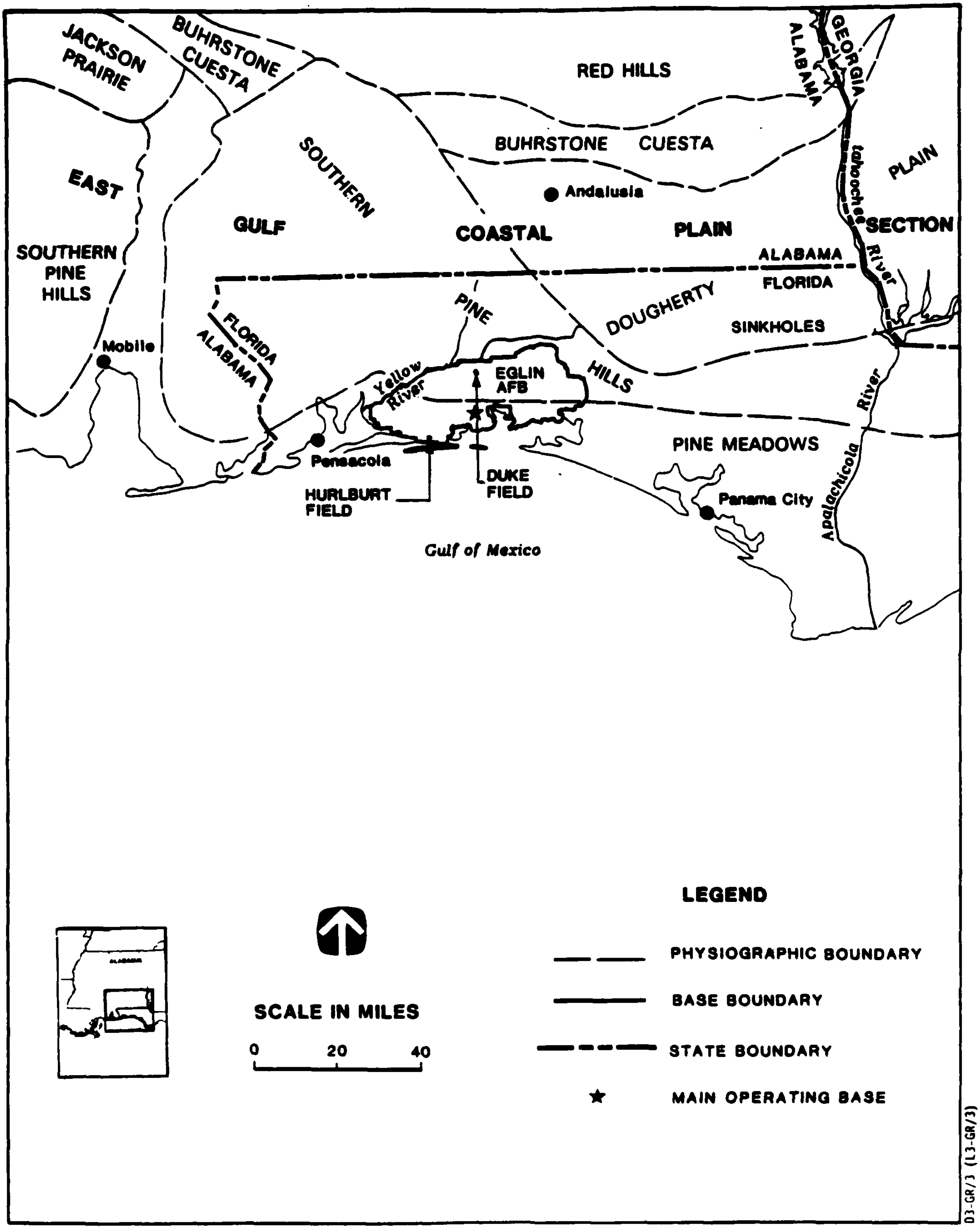

FIGURE 3.9.3-2 LOCATION OF THE FLORIDA COMPLEX HARD MOBILE LAUNCHER IN RANDOM MOVEMENT DEPLOYMENT AREA SHOWING PHYSIOGRAPHIC SECTIONS AND IMPORTANT FEATURES

surges and intertidal processes, that can modify the existing topography. The majority of the soils in the ROI and on the installation have only slight limitations for routine construction, but areas underlain by Dorovan, Pamlico, Pelam, and Rutledge soils are considered nonbuildable areas because of the shallow groundwater table. No metallic minerals occur in the ROI, though the Citronelle Formation contains kaolinite and clays suitable for brick, tile, and ceramic products. Heavy minerals, such as ilmenite and garnet, have been identified in beaches and dune deposits, but the economic viability of the deposits is unknown. Oil and gas fields in northern Santa Rosa County, Florida have accounted for 83 percent of the oil production and 99 percent of the natural gas production in the state from 1977 to 1983. The similarity of structural and stratigraphic environments between Eglin AFB and adjacent regions with known oil and gas resources have led to commercial interest in hydrocarbon production on the installation and prompted a recent seismic survey for the entire military installation. Concrete-quality aggregate has been identified in the eastern counties of the ROI, and sand and gravel pits in the Citronelle Formation in the western portion of the ROI have yielded aggregate for road-building material. Annual aggregate production (1984) in the ROI is estimated at 929,000 short tons. Crushed aggregate and oyster shells, an aggregate substitute, have been transported from sources in Alabama for use as road base and in cement manufacturing, and limestone mined near Marianna, Florida is used as road base and building material. Some important farmland occurs in the northern portion of the ROI, but agricultural use is restricted on the installation, and less than 1 percent of the soils have been designated as important farmland. Soils highly or moderately susceptible to wind erosion cover approximately 89 percent of Eglin AFB and the RMA and are typically found on upland surfaces underlain by fine-grained facies of the Citronelle Formation.

3.9.3.3 Nevada Complex

The Nevada Complex ROI extends north from Boulder City, Nevada to just north of Warm Springs, Nevada, and west from Moapa, Nevada to just west of Lida, Nevada (Figure 3.9.3-3). The ROI is characterized by low to moderate seismicity with increased activity occurring immediately following underground nuclear weapon testing. Blast aftershocks may continue for several months at shallow depths, but are believed to be restricted to an area 12 to 20 kilometers from the blast site. The underground tests have not produced a detectable increase in the regional seismicity pattern. Several Quaternary faults have been mapped in Frenchman and Yucca flats on the Nevada Test Site and along the eastern boundary of the Pahrump Valley south of Spring Mountain. Ground subsidence due to groundwater withdrawal has been reported in the Las Vegas and Pahrump valleys, near the Campbell Reservoir and Pumping Station east of Las Vegas, and on Nellis AFB, and can be expected to occur elsewhere in the ROI where groundwater overdraft is occurring. Debris flows are common along channels on dissected alluvial fans near the mountain fronts, particularly those close to the apex of alluvial fans. Playas and similar areas in valleys are susceptible to inundation for periods ranging from a few days to several months, and severe channelized flooding with a recurrence interval of 5 years is expected in major drainageways. Soils in the ROI have severe limitations (e.g., slumping and cemented horizons) for routine construction practices. Metallic and nonmetallic mineral occurrences, including several Strategic and Critical Materials, have been identified in the ROI and on the installations. All lands within the installation boundaries have been

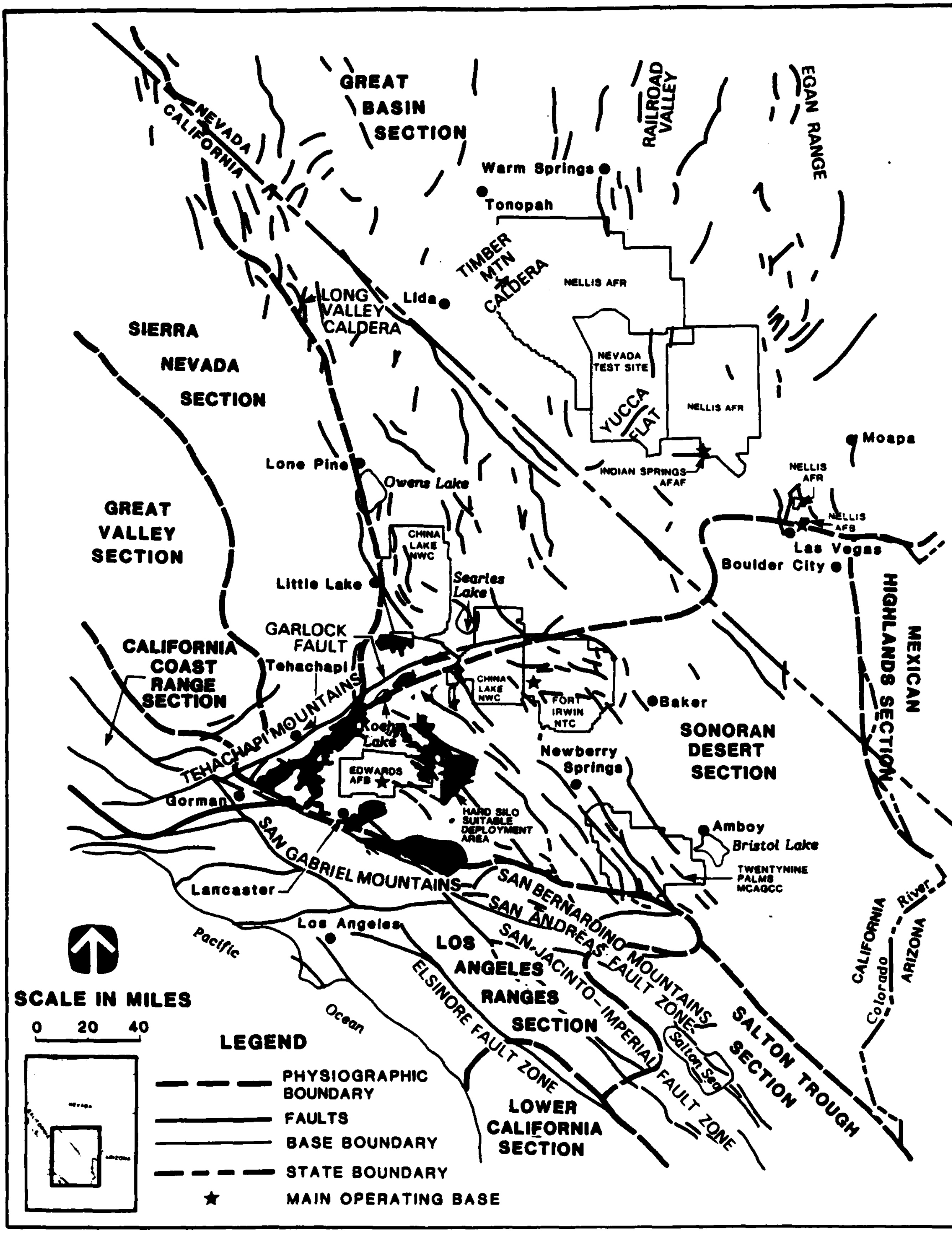

FIGURE 3.9.3-3 LOCATION OF THE NEVADA AND SOUTH-CENTRAL CALIFORNIA COMPLEXES HARD MOBILE LAUNCHER IN RANDOM MOVEMENT DEPLOYMENT AREAS AND EDWARDS AFB HARD SILO IN PATTERNED ARRAY ALTERNATIVE DEPLOYMENT AREA SHOWING FAULTS, PHYSIOGRAPHIC SECTIONS, AND IMPORTANT FEATURES

withdrawn from mining activity, though as of 1984, there were 100 active mining operations in the ROI counties. No producing oil or gas fields occur in the ROI, though much of the Nellis North Range and a small portion of the South Range are classified as prospectively valuable. Annual aggregate production (1984) in the ROI is estimated at 4,181,000 short tons, though concrete-quality aggregate is extremely rare. Three unique geologic features, Timber Mountain Caldera and the Ichthyosaur Site in Nye County, Nevada, and the Valley of Fire in Clark County, Nevada, are located in the ROI. All irrigated farmland is considered important farmland. Most irrigated farmland in the ROI occurs on private land and no important farmland has been identified on the installations. About 35 percent of Nellis AFR is considered moderately susceptible to soil erosion, with another 5 percent being highly erodible. Soils highly susceptible to wind and sheet erosion are typically found on young alluvial fans, terraces, floodplains, and playas, with moderately erodible soils occurring primarily on intermediate-aged alluvial fans.

3.9.3.4 New Mexico Complex

The New Mexico Complex ROI extends north from the United States-Mexico border to the Socorro-Torrance county line, and east from Truth or Consequences, New Mexico to about 10 miles west of Roswell, New Mexico (Figure 3.9.3-4). The ROI is characterized by locally moderate levels of seismicity indicating the possibility for minor to moderate earthquake damage. These levels may be underestimated because of the generally low level of historic seismicity in relation to active faulting, which indicates the potential for destructive surface rupture in the ROI. Late Quaternary north-south trending faults showing Holocene movement occur within the Tularosa, Hueco, Jornada del Muerto, and Mesilla basins, with documentable evidence of movement on the Organ Mountain Fault zone about 1,000 years before present (B.P.). Debris flows, occurring as sheets and lobate flows in canyons and near the heads and downslope channels of alluvial fans, are common in the ROI and on the installations. Rockfalls and landslides are confined to mountainous and cliff areas. Recent volcanism associated with the Rio Grande Rift has occurred within the ROI, and the high heat flow, potential geothermal resources, and potential near-surface magmatic source indicate a moderate volcanic hazard. Soils in the ROI have severe limitations for routine construction activities because of high shrink-swell potential, cemented horizons, and flooding conditions. Metallic and nonmetallic mineral districts and occurrences, including several commodities considered as Strategic and Critical Materials, are located in the ROI and on the installations. However, there are no active metal mines in the ROI, and all lands within installation boundaries have been restricted from mining because of mission conflicts. Oil and gas indications have been found in exploratory wells, but are not considered economic. Parts of the McGregor Range on Fort Bliss may be considered for oil and gas leasing later in the decade. Known Geothermal Resource Fields (KGRFs), KGRAs, and other areas favorable for geothermal resources, such as the Hueco Tanks area on Fort Bliss, occur in the ROI. Speculative uranium resources occur in the ROI, but there has been no production. Annual aggregate production (1984) in the ROI is estimated at 3,121,000 short tons, and it is likely that sufficient quantities of concrete-quality aggregate are available within or adjacent to the installation through direct source development and purchase. Kilbourne Hole, Fort Stanton Cave, and White Sands National Monument are unique geologic features located in the ROI. Most important farmland is found on floodplains

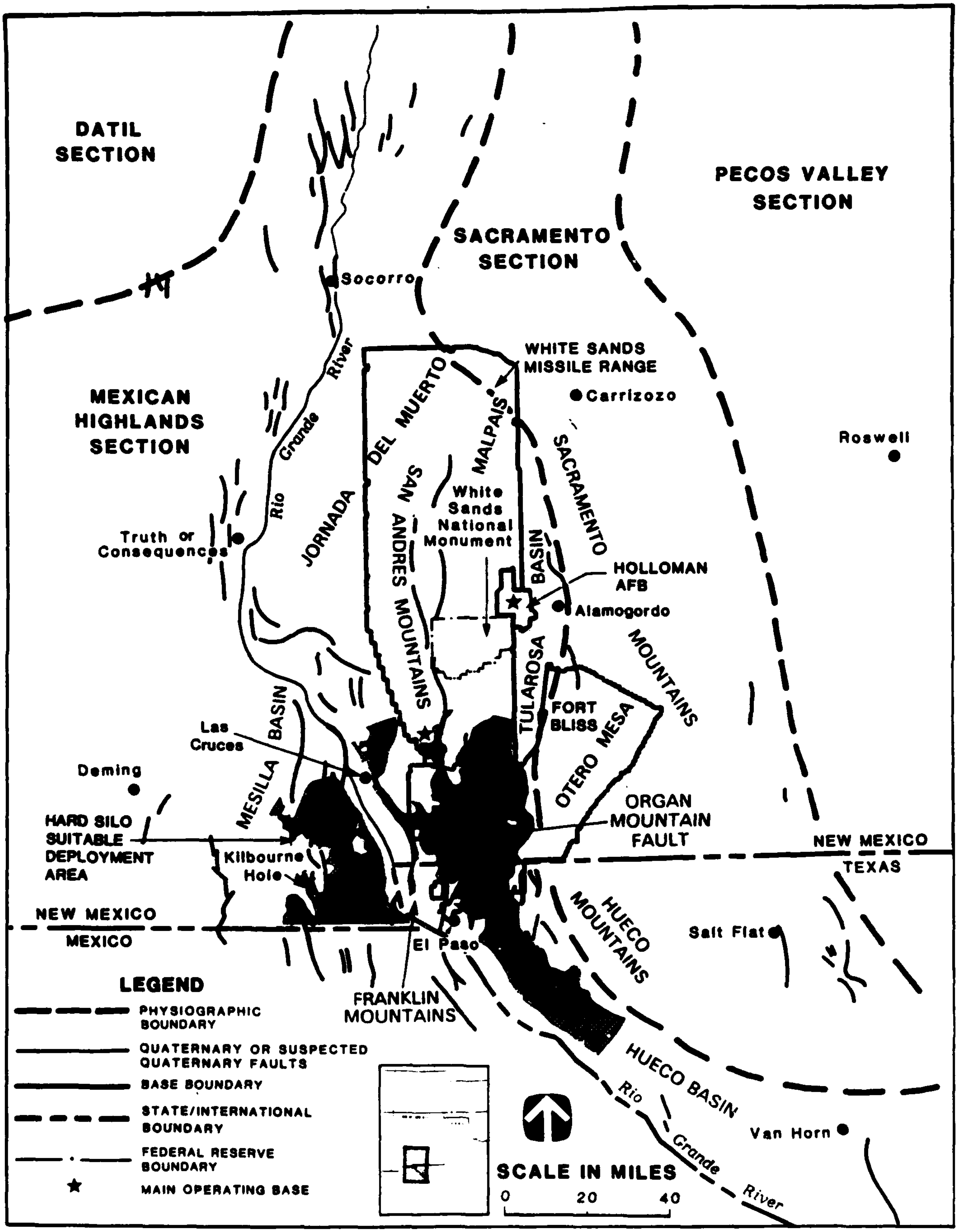

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FIGURE 3.9.3-4 LOCATION OF THE NEW MEXICO COMPLEX HARD MOBILE LAUNCHER IN RANDOM MOVEMENT DEPLOYMENT AREA AND FORT BLISS HARD SILO IN PATTERNED ARRAY ALTERNATIVE DEPLOYMENT AREA SHOWING FAULTS, PHYSIOGRAPHIC SECTIONS, AND IMPORTANT FEATURES

and terraces along the Rio Grande River and in lacustrine deposits west of the installations. No important farmland has been identified on the installations. Soils highly susceptible to wind and sheet erosion occur on about 42 percent of the installations and RMAs and are typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils occur primarily on intermediate-age alluvial fans and account for about 15 percent of the installations and RMAs.

3.9.3.5 South-Central California Complex

The South-Central California Complex ROI extends north from the San Bernardino Mountains to approximately Lone Pine, California, and west from Baker, California to Tehachapi, California (Figure 3.9.3-3). Seismicity in the Mojave Desert is characterized as infrequent in the west and moderate to high in the eastern portions of the desert. The Garlock Fault, in the northern portion of the ROI, is characterized by infrequent to moderate seismicity, while the California Basin and Range region to the north has high seismicity levels. The San Andreas Fault, in the southwest portion of the ROI, is characterized by high seismicity. Quaternary faulting has occurred in the Mojave Desert and along the Garlock Fault, and is abundant in the California Basin and Range and San Andreas Fault zone areas. Subsidence and associated surface fracturing due to groundwater withdrawal have been identified in the Lancaster area on the south side of Edwards AFB (0.9 m) and in the Koehn Lake area (0.5 m), and should be expected in areas with similar geologic conditions. Fracturing of playa sediments is common in many basins of the Mojave Desert. Potentially active volcanic zones occur in the Coso, Amboy, and Pisgah crater areas within China Lake Naval Weapons Center (NWC) and Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC). Soils of the ROI have moderate to severe limitations (e.g., low strength and high shrink-swell potential) for routine construction practices. A large number of metallic and nonmetallic mineral occurrences have been identified in the ROI, and several are on the Strategic and Critical Materials list. Active mining areas occur within the ROI, including areas of boron and evaporite mining. In addition, two important gold mining districts (Mohave and Rand) in the Mojave Desert occur in the ROI. The Randsburg and Coso Hot Springs KGRAs occur within the ROI, the latter of which is presently under development with a power plant producing electricity for China Lake NWC and another planned for construction. Geothermal resources have also been identified northeast of the Twentynine Palms area. Minor coal and speculative uranium resources have been identified in the ROI. Suitable crushed rock and sand and gravel resources are common within the ROI and the installations, with annual aggregate production in the ROI estimated at 26,174,000 short tons. Unique geologic features in the ROI include Afton Canyon, Amargosa River, Amboy Crater, Cinder Cone Natural Area, Harper Dry Lake, Marble Mountains Fossil Bed, Pisgah Lava Flow, Rainbow Basin/Owl Canyon, and Trona Pinnacles. Irrigated agricultural land in the ROI is considered important farmland and occurs primarily west and southwest of Edwards AFB. Most soils on the installations and RMAs (49% and 48%, respectively) are highly erodible, with these soils typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils on intermediate-aged alluvial fans account for only about 5 to 10 percent of the installations and RMAs.

3.9.3.6 Washington Complex

The Washington Complex ROI extends north from Plymouth, Washington on the Oregon-Washington border to approximately Quincy, Washington, and east from Cliffdell, Washington to approximately Eureka, Washington (Figure 3.9.3-5). The ROI is located in the Columbia Plateau, which is characterized by low-frequency, low-magnitude, scattered seismicity. Holocene fault ruptures have been located within the Yakima Fold Belt including a north-south trending, nearly vertical fault north of Yakima Firing Center (FC). Four faults in the Gable Mountain area of the Department of Energy (DOE) Hanford Site offset glaciofluvial gravels estimated at 13,000 years old, and are considered capable faults by the Nuclear Regulatory Commission and USGS, but of relatively low seismic potential. Additionally, the Wallula Fault system is postulated to have moved during the Quaternary and may contain a capable fault. Mass movements are present in the region around the DOE Hanford Site, particularly on the slopes of anticlinal ridges. Man-induced mass movements occur in the White Bluffs area as a result of irrigation water discharge on the tops of ridges that are underlain by clay deposits. The potential for rock falls exists on mountain slopes and steep escarpments on Yakima FC. Sheet flooding has been identified as a potential geologic hazard on generally smooth surfaces of alluvial fans, fluvial terraces, and older lakebed surfaces during snowmelts. The installations are within the ash-fall zone of many Cascade Range volcanoes, and sporadic eruptions are expected to continue (e.g., Mount St. Helens). The soils in the ROI have moderate limitations for routine construction practices because of conditions such as shallow depth to rock and slumping. No metallic minerals operations occur in the ROI; however, shale quarries have been opened on Yakima FC, and diatomite and silica have been produced on Yakima FC. Gas-producing wells exist in Benton County, Washington, south of the DOE Hanford Site, but the geologic conditions on the site are generally considered unfavorable for commercial production. Major bituminous coal-bearing rocks have been identified in Kittitas County and eastern Lewis County. Abundant sand and gravel resources exist in the ROI, with 16 sand and gravel producers and 4 commercial stone or rock producers in Yakima County alone. Annual aggregate production (1984) in the ROI is estimated at 2,464,000 short tons. Three national natural landmarks, Wallula Gap, Ginkgo Petrified Forest, and Umtanum Ridge Water Gap, are located within the ROI. Important farmland occurs primarily along floodplains of the Columbia River and on level, upland areas. Highly erodible soils account for 31 percent of the installations and 27 percent of the RMAs. Moderately erodible soils occur on about 30 percent of the installations and 36 percent of the RMAs.

3.9.4 Existing and Projected Conditions for Hard Mobile Launcher at Minuteman Facilities

Existing conditions for the Hard Mobile Launcher at Minuteman Facilities alternative locations are summarized in Table 3.9.4-1.

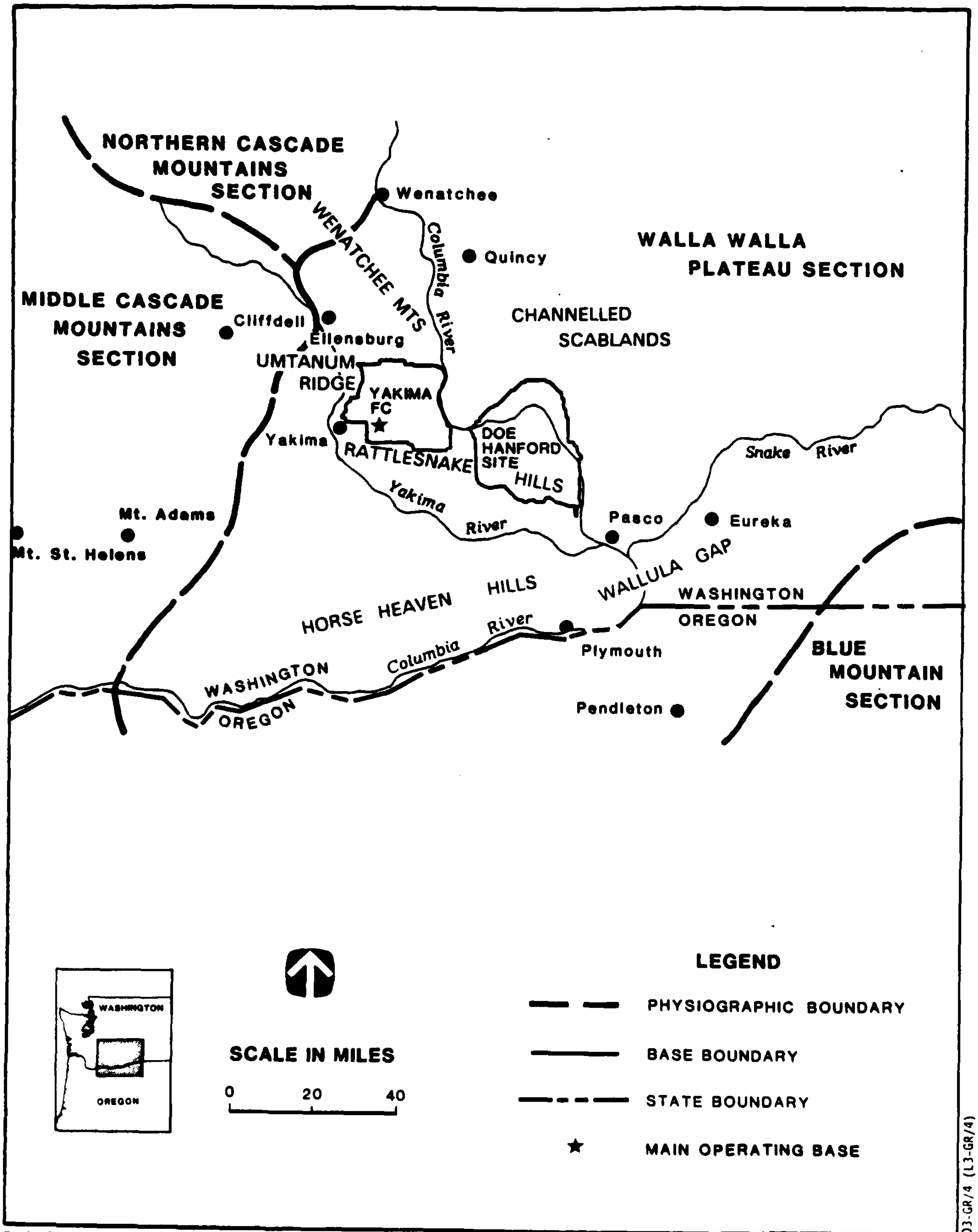

FIGURE 3.9.3-5 LOCATION OF THE WASHINGTON COMPLEX HARD MOBILE LAUNCHER IN RANDOM MOVEMENT DEPLOYMENT AREA SHOWING PHYSIOGRAPHIC SECTIONS AND IMPORTANT FEATURES

Table 3.9.4-1

SUMMARY OF GEOLOGY AND SOIL CONDITIONS FOR THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES

Main Operating Base	Ellsworth AFB	F.E. Warren AFB	Grand Forks AFB	Malmstrom AFB	Minot AFB	Whiteman AFB
(Sample Size)[1]	(165)	(220)	(165)	(220)	(165)	(165)
ENGINEERING GEOLOGY						
Engineering Characteristics[2]	19%[a]	28%[a]	96%	N/A	94%	96%
Earthquakes With Magnitude >5.0[3]	0	0	0	0	0	0
Holocene or Active Faults Present	No	No	No	Yes	No	No
MCE Magnitude[4]	5.5	6.5	6.1	6.5	6.1	6.1
Other Geologic Hazards[5]	Yes	No	Yes	Yes	Yes	Yes
GEOLOGIC RESOURCES						
Mineral Resources[6]	4%	6%[a]	0%	5%[a]	85%	0%
Energy Resources[7]	100%	79%	58%	86%	93%	59%
Aggregate Resources[8]	15%	13%	39%	28%	16%	14%
Unique Geologic Features	0	0	0	0	0	0
SOIL RESOURCES						
Important Farmland[9]	24%	28%	100%	N/A	98%	98%
Soil Erosion[10]						
Wind	6%	19%	7%	25%[a]	30%	30%
Sheet	27%	16%	48%	75%	99%	99%

Notes: [1]Number of sample points within deployment area.
[2]Percent of sample with moderate or severe limitations for routine construction.
[3]Current as of March 1985.
[4]Maximum credible earthquake magnitude.
[5]Presence of other geologic hazards including, for example, subsidence, mass movements, and flooding.
[6]Percent of sample occurring within 1 mile of a metallic or nonmetallic mine or occurrence, a Strategic and Critical mineral commodity, or a potential mineral resource.
[7]Percent of sample occurring within 1 mile of a producing oil or gas field or potential hydrocarbon resources, a known or potential geothermal resource (including low-temperature resources), an active coal mining region, or known or potential coal resources.
[8]Percent of sample occurring within 1 mile of an active or inactive pit or quarry, or geologic units potentially suitable as an aggregate source.
[9]Percent of sample within 1 mile of soil designated prime and/or farmland of statewide importance.
[10]Percent of sample with moderate or high susceptibilities to soil erosion.
[a]Evaluation based on less than 75% of sample.
N/A No data available to make quantitative appraisal.

3.9.4.1 Ellsworth Air Force Base

The ROI extends north from Fairburn to about Union Center, South Dakota, and east from Sturgis to about Wasta, South Dakota (Figure 3.9.4-1). The ROI is located in an area of low seismicity. Localized faulting, potentially of tectonic origin, commonly creates small displacements (20 ft) in the Pierre Shale. Slumps and block slides are common in the Pierre Shale, especially along roadcuts and in stream valleys. Runoff at Ellsworth AFB is moderate, and flooding is confined to the valleys and floodplains of local rivers and streams. The engineering characteristics of most soils have moderate to severe limitations for routine construction primarily because of high shrink-swell potential and low strength. The Black Hills area southwest of the deployment area is a major active gold mining area that has produced a variety of the metallic minerals in economic deposits. Bentonite mining is a local industry within the ROI. Exploratory tests have indicated the presence of oil and gas within the ROI, but there is no current production. Strippable coal reserves have been identified in the extreme northern section of the ROI. Uranium occurs in the northwestern section of the ROI. No known geothermal resource areas exist within the ROI, though scattered areas have shown potential for low-temperature geothermal resources. Annual aggregate production (1984) in the ROI is estimated at 356,530 short tons. Aggregate for concrete and construction are available from stream terraces and alluvium from the Black Hills. Prime farmland is scarce within the ROI, but most farmland is considered of statewide importance. Soils in the ROI have a low susceptibility to wind erosion, but most are moderately to highly susceptible to sheet erosion.

3.9.4.2 F.E. Warren Air Force Base

The ROI extends from Fort Collins, Colorado to about the southern border of Platte County, Wyoming, and east from the Laramie Mountains to about Lodgepole, Nebraska (Figure 3.9.4-2). Most of the ROI lies within the Denver-Julesburg Basin, an area of low seismicity. Two tectonic elements, the Wheatland-Whalen Fault system and the Bordeaux-Hyannis-North Platte Fault zone, occur within or near the ROI. No faults with confirmed Holocene movement have been identified within or near the Colorado, Nebraska, or Wyoming portions of the ROI, though a few small earthquakes are thought to be associated with the Bordeaux-Hyannis-North Platte Fault zone. Only one small area of landsliding, occurring in southern Platte County, is recognized, and mass movement is not likely to occur except near stream embankments. No active mines for metallic or nonmetallic commodities have been identified in the ROI, but there has been historic production of base and precious metals in the Laramie Range. Annual aggregate production (1984) in the ROI is estimated at 5,909,079 short tons. Concrete-quality sand and gravel have been identified in alluvial deposits along Horse, Lodgepole, and Crow creeks in Wyoming, along the South Platte River in Colorado, and along the North Platte River in Wyoming and Nebraska. Oil and gas occur in the Denver-Julesburg Basin, with extensive production from Kimball, Banner, and Cheyenne counties of southwestern Nebraska (45% of state production). Only a few small producing wells or fields exist in the Wyoming and Colorado portions of the ROI. No KGRAs occur in the ROI, though low-temperature geothermal waters may be present in some Denver-Julesburg Basin aquifers. Two unique geologic features are in or near the ROI: the Big Hollow and Bone Cabin Fossil areas in Albany County, Wyoming. Farmland throughout the ROI is highly susceptible

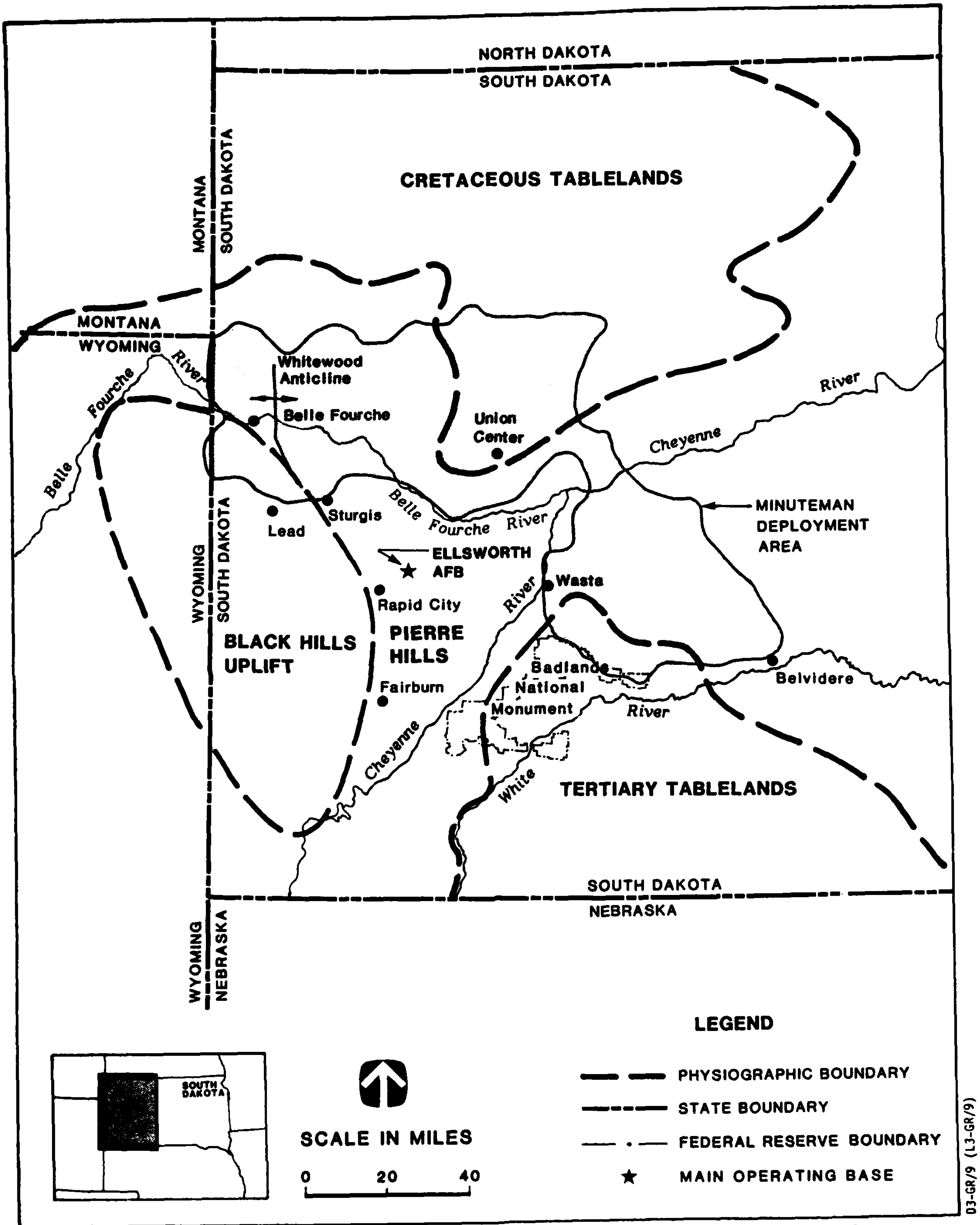

FIGURE 3.9.4-1 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT ELLSWORTH AFB SHOWING PHYSIOGRAPHIC SECTIONS, STRUCTURES, AND IMPORTANT FEATURES

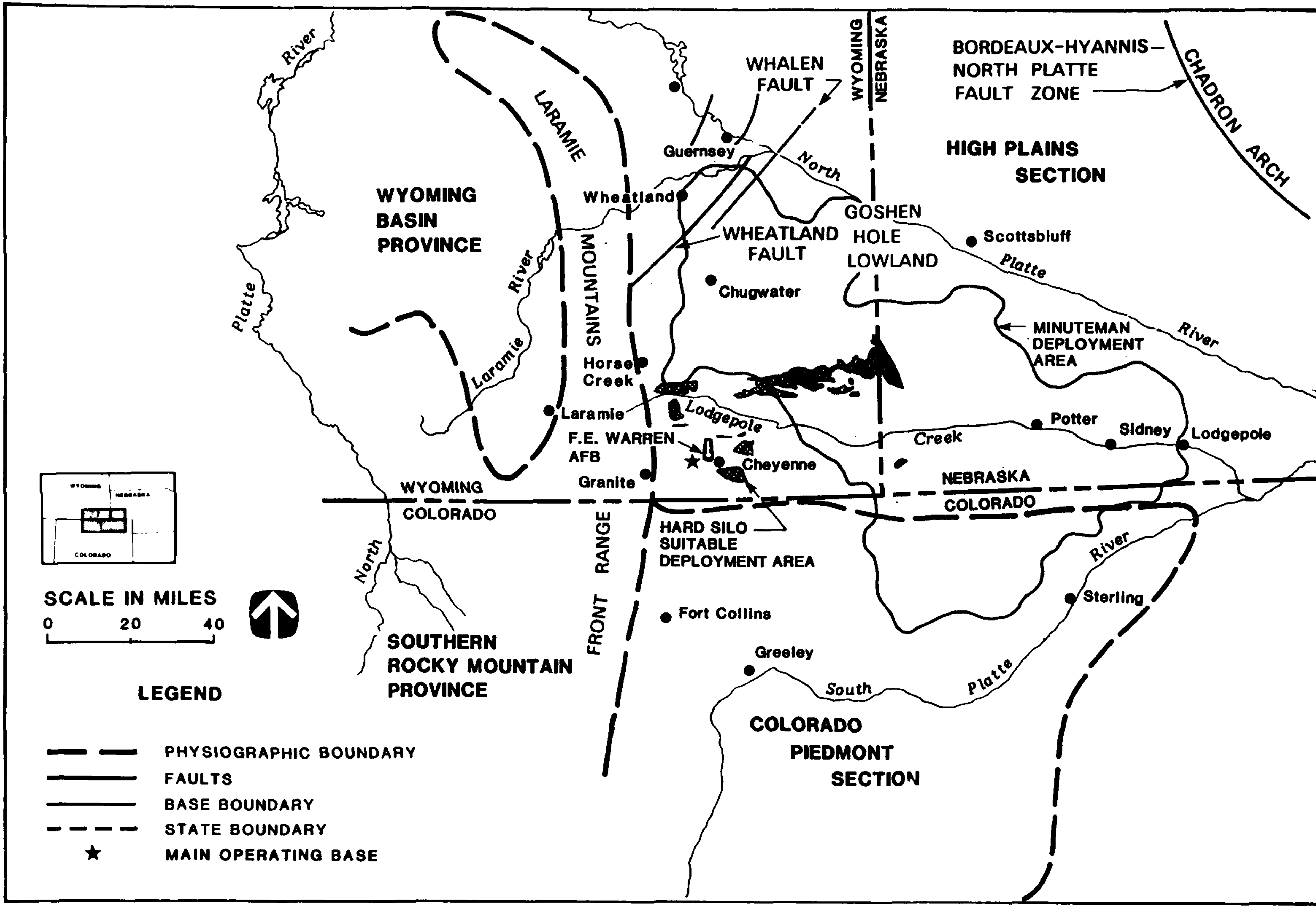

FIGURE 3.9.4-2 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT F.E. WARREN AFB SHOWING FAULTS, PHYSIOGRAPHIC SECTIONS, AND IMPORTANT FEATURES

to wind erosion. Soils with high sheet erosion potential are limited to those occurring on floodplains and terraces.

3.9.4.3 Grand Forks Air Force Base

The ROI extends north from Valley City, North Dakota to the Canada-North Dakota border, and west from Grand Forks to Devils Lake, North Dakota (Figure 3.9.4-3). Seismic activity is low and no known active faults occur in the ROI. Frequent flooding occurs along the Red River Valley and in the vicinity of Devils Lake. Localized landslides have occurred in river sediment deposited along the Red River of the North in Walsh County. Engineering characteristics of the majority of the soils in the ROI indicate moderate to severe limitations for routine construction. Sand and gravel are abundant in the ROI, but other mineral resources are scarce. Much of the sand and gravel has a high shale content and is of questionable quality. Good-quality sand and gravel occur in beach and deltaic deposits along the eastern edge of the Red River Valley. Annual aggregate production (1984) in the ROI is estimated at 762,403 short tons. No energy resources have been extracted from the area, though low-temperature geothermal waters have been identified in the western portions of the ROI. Important farmland is abundant and occurs throughout the region. Many soils associated with floodplains, as well as till and lake plains, are moderately to highly susceptible to wind and sheet erosion.

3.9.4.4 Malmstrom Air Force Base

The ROI extends north from Shawmut to Shelby, Montana, and west from Roy to Augusta, Montana (Figure 3.9.4-4). The ROI lies within an area characterized by scattered, low intensity (Modified Mercalli Intensities [MMIs] of V to VII) seismic events. Earthquake epicenters are typically located along the western boundary of the ROI. Quaternary faults have been idertified in the Big Belt Mountains and near Helena, Montana; the Pendroy Fault, located in the north-western portion of the deployment area, is considered active. Other minor faults are present in the ROI and may have remained active in the Quaternary. Areas of moderate landslide occurrence are found along the Missouri River and in the Judith Basin, and isolated areas have a high susceptibility to mass movements. Landslides occur most commonly in Cascade County, but have also been identified in Judith Basin, Toole, Chouteau, and Fergus counties. Engineering characteristics of the majority of the soils in the ROI have moderate to severe limitations for routine construction. Both metallic (e.g., iron, titanium, copper, lead, silver, and zinc) and nonmetallic mineral deposits (e.g., gypsum, kaolin, and limestone) are present in the ROI, several of which are on the Strategic and Critical Materials list. Sand and gravel pits are present throughout the ROI. In the Great Falls vicinity, sand and gravel pits are typically located in Pleistocene gravel deposits. Annual aggregate production (1984) in the ROI is estimated at 1,044,121 short tons. Building stone sources have been identified near Lewistown and Great Falls, Montana. Producing oil and gas wells are found along the Sweetgrass Arch in the northern portion of the ROI, and all of the nonmountainous areas of the ROI are considered prospectively valuable land for oil and gas production. Coal mines having past production and areas favorable for coal exploration occur within the ROI. Important farmland is found along major drainages and their terraces, with most of the basin areas of the ROI in cultivation. Most soils in the ROI are moderately to highly susceptible to wind and sheet erosion.

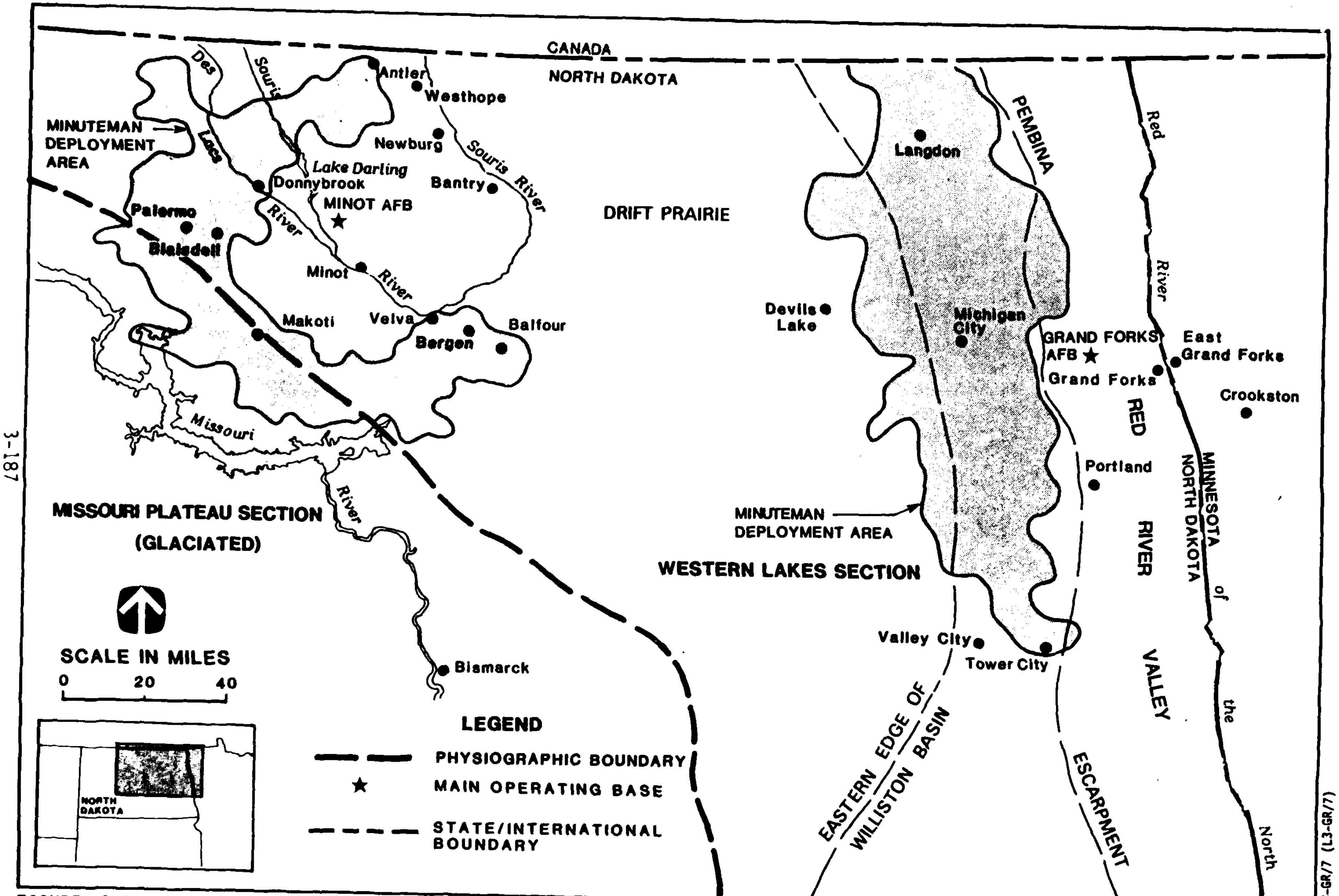

FIGURE 3.9.4-3 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT GRAND FORKS AFB AND MINOT AFB SHOWING PHYSIOGRAPHIC PROVINCES AND GEOLOGIC FEATURES

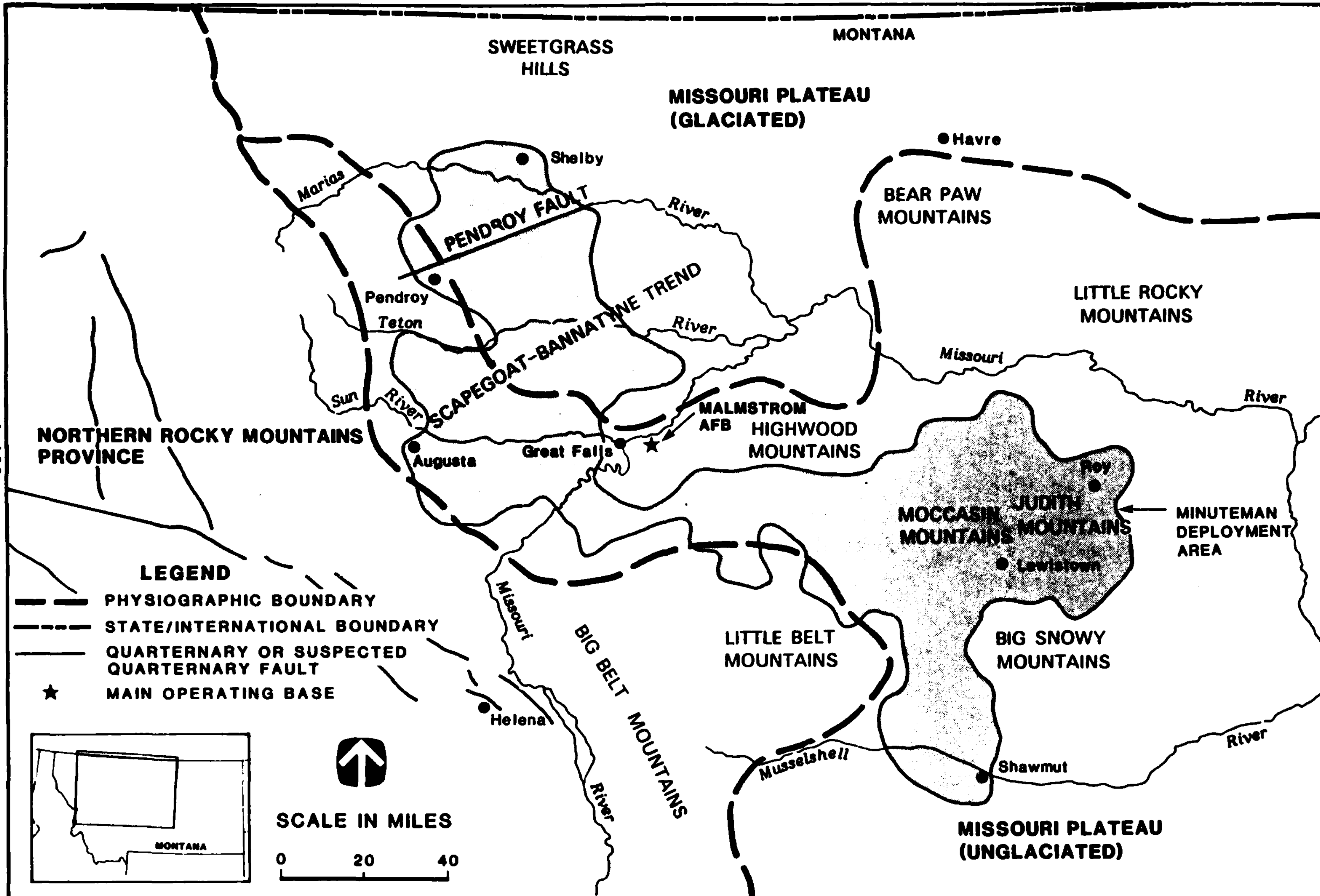

FIGURE 3.9.4-4 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT MALMSTROM AFB SHOWING PHYSIOGRAPHIC SECTIONS, MOUNTAIN RANGES, FAULTS, AND IMPORTANT FEATURES

3.9.4.5 Minot Air Force Base

The ROI extends north from Bergen to about Westhope, North Dakota, and east from Blaisdell to about Bantry, North Dakota (Figure 3.9.4-3). No known Quaternary faults occur in the ROI and seismic hazards are minimal. Periodic flooding by major rivers (e.g., the Souris and Des Lacs) has occurred in the ROI. Large, conspicuous landslides have occurred in glacial sediment along the valley walls of the Souris and Des Lacs rivers in the ROI. The slide deposits are historic, and unstable slopes are present in the Des Lacs River Valley area. The engineering characteristics of many soils in the ROI have moderate limitations (e.g., moderate shrink-swell potential) for routine construction. Molybdenum, an important Strategic and Critical mineral, is associated with uraniferous lignites, but no production has been reported. Nonmetallic minerals in the ROI include salt, potash, peat, sulfur, and sodium sulfate. Presently, peat is the only nonmetallic mineral commodity produced in the ROI. Annual aggregate production (1984) in the ROI is estimated at 612,876 short tons. Four commercial sand and gravel operations are active in the Minot area. Surficial, glacial, and fluvial deposits may be suitable sources of sand and gravel, but many deposits are of questionable quality. Important oil and gas discoveries have been made in McKinney Field in Renville County, and in the Mountrose and Eidsvold fields of Bottineau County. No KGRAs occur in the ROI, though low-temperature geothermal waters may occur throughout Renville County, most of McHenry and Bottineau counties, and the northern part of Ward County. Production and development of coal resources (lignite) is an important industry in northwest North Dakota, with one active mine in Ward County. Lignite deposits occur in Paleocene-age rocks in the southern portions of the ROI. Uranium and potential uranium-bearing rocks (thin, impure lignite beds) occur in the ROI, but there is no commercial production. Most soils in the ROI are used for farming and are designated important farmland. Most soils in the ROI are moderately susceptible to wind and sheet erosion.

3.9.4.6 Whiteman Air Force Base

The ROI extends north from Tightwad, Missouri to the Missouri River, and east from Kingsville to about Otterville, Missouri (Figure 3.9.4-5). Seismicity in the ROI is low and there is no evidence of Holocene faulting. Historically, the nearest sources of earthquakes have been the Nemaha Uplift in Kansas and the New Madrid area in southeastern Missouri. Ground subsidence is associated with limestone solution features in the western portion of the ROI. Subsidence over abandoned coal mines is believed to be minimal or nonexistent on a regional scale but is probably important locally. Extensive flooding by the Blackwater, Flat Creek, and South Grand rivers, particularly in the early spring or after rainstorms, occurs in the ROI. Flooding may also be aggravated by low soil permeability. Most of the soils have moderate to severe limitations (e.g., low load strength, wetness, or high shrink-swell potential) for routine construction. Annual aggregate production (1984) in the ROI is estimated at 261,831 short tons. Alluvial deposits associated with streams and their floodplains are the main sources of sand and gravel in the ROI. The lack of gravel in many surficial deposits makes crushed limestone an important source of aggregate. Past and present oil production has been concentrated in the Cherokee and Forest City structural basins of western Missouri. Cass, Jackson, and Vernon counties accounted for 90 percent of Missouri's 1983 production. Potential oil and gas fields and heavy oil deposits occur in the

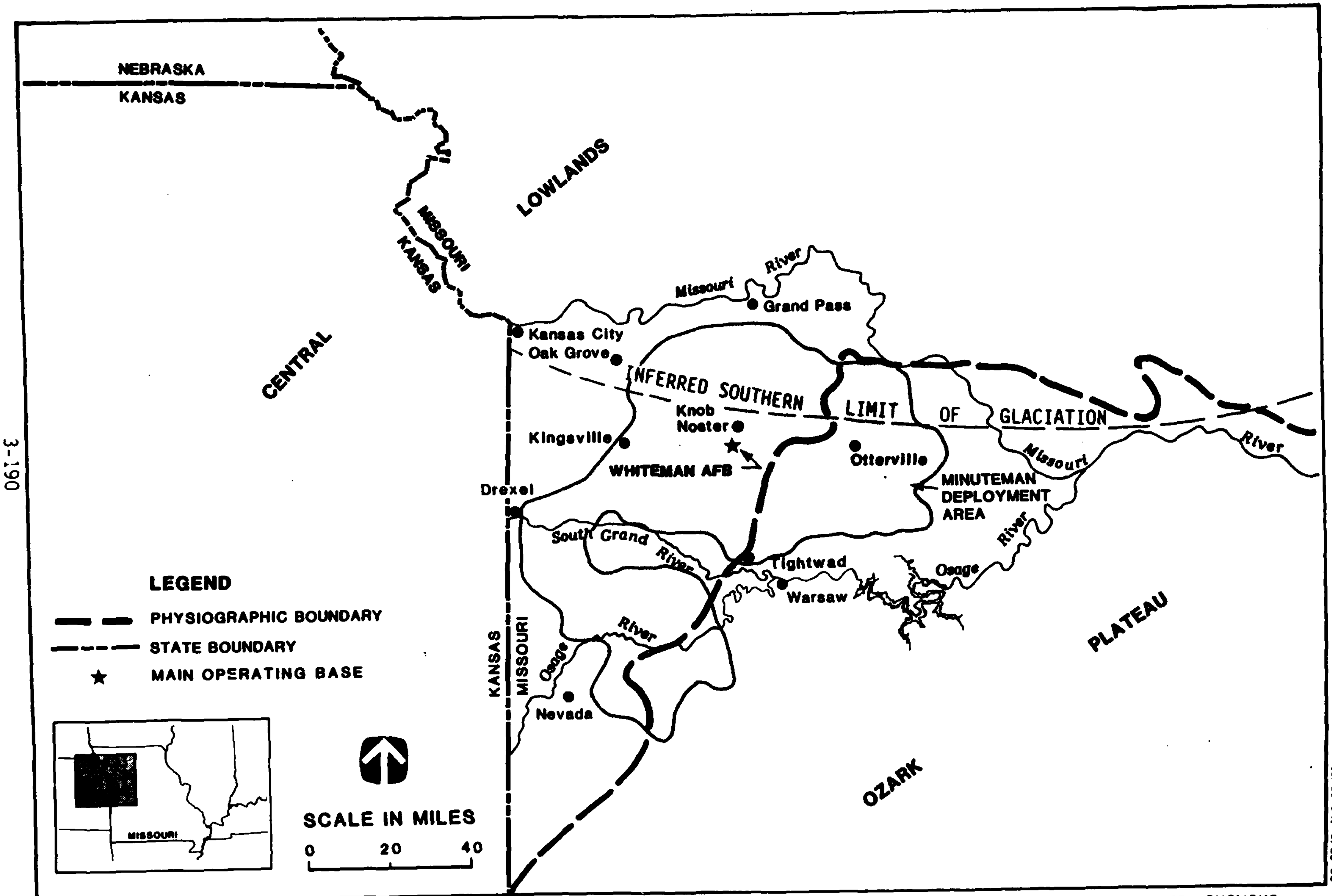

FIGURE 3.9.4-5 LOCATION OF THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVE AT WHITEMAN AFB SHOWING PHYSIOGRAPHIC PROVINCES AND GEOLOGIC FEATURES

western and north-central portions of the ROI. Missouri's leading coal-producing district, the Kaysinger Basin, lies in the ROI, with most coal coming from Henry and Bates counties. Considerable reserves are also present in the northern portions of the ROI. Localized, nonproducing deposits of lead and zinc occur in mineralized zones of Pennsylvanian rocks. Sporadic mining of barite, which accumulates in sink holes and other solution features, has occurred in parts of Cole, Morgan, and Moniteau counties. Much of the soil in the ROI is designated important farmland. Many of the soils occurring on ridgetops, floodplains, and other gently sloping soils are moderately to highly susceptible to wind erosion. Soils with high sheet erosion potential occur on slopes, broad ridgetops, low terraces, and bottomlands.

3.9.5 Existing and Projected Conditions for Hard Silo in Patterned Array

Existing conditions for Hard Silo in Patterned Array alternative locations are summarized in Table 3.9.5-1.

3.9.5.1 Davis-Monthan Air Force Base

The ROI extends north from the United States-Mexico border to about Globe, Arizona, and east from San Luis, Arizona to about Dos Cabezas, Arizona (Figure 3.9.3-1). Quaternary faulting in extreme southeast Arizona is dominated by north-south trending faults that are subparallel to the Rio Grande Rift 100 kilometers to the east. Holocene or late Pleistocene age faults have been identified in southeast Arizona and near Davis-Monthan AFB. Other late Quaternary or suspected Quaternary faults occur near the San Pedro River and Huachuca Mountains. The overall potential for large earthquakes in the northern portion of the ROI is low based on the lack of long Quaternary faults, but large events may occur south of the ROI because such events have occurred in historic times. Ground subsidence due to groundwater withdrawal has been reported near Eloy in south-central Pinal County (12 ft), in north-east Phoenix (3 ft), and in eastern Pima County near Tucson, and can be expected to occur in other areas of groundwater overdraft. Debris flows are common along mountain fronts near the apex of alluvial fans and along uncontrolled flow channels on alluvial fans. Channelized flooding is likely on older alluvial fans and floodplains and low terraces flanking the Santa Cruz River. Small playas are subject to standing water during periods of heavy or prolonged rainfall. Soils in the SDA have severe limitations for routine construction practices because of conditions including shallow depth to rock and high shrink-swell potential. Several economic deposits of metallic and nonmetallic Strategic and Critical minerals such as silver, copper, lead, and mercury, and precious metals such as gold, have been mined in the ROI. All current mining claims within installation boundaries are either condemned or leased. No oil or natural gas-producing wells occur in the ROI, though five inactive oil seeps have been reported in west-central Cochise County. No KGRAs occur in the ROI, but most of the alluvial basin areas, such as the Tucson and Avra valleys, are classified as having potential for low-temperature geothermal waters. A state-designated geothermal area occurs in the Avra Valley. Annual aggregate production (1984) in the ROI is estimated at 7,515,000 short tons. Concrete-quality aggregate in the ROI is expected to be extremely rare. Willcox Playa, in Cochise County, Arizona, is the only unique geologic feature in or near the ROI. Important farmland occurs largely along the Santa Cruz River with approximately 110 square miles of important farmland located in the SDA. Most soils in the SDA (65% or

Table 3.9.5-1

SUMMARY OF GEOLOGY AND SOIL CONDITIONS FOR THE HARD SILO IN PATTERNED ARRAY ALTERNATIVES

Main Operating Base Suitable Deployment Area (sq mi)	Davis-Monthan AFB (2,243)	Edwards AFB (1,267)	F.E. Warren AFB (215)	Fort Bliss (2,020)	Gila Bend AFAF (2,255)	Yuma PG (1,512)
ENGINEERING GEOLOGY						
Engineering Characteristics[1]	59%	100%	66%	72%	2%	37%
Earthquakes With Magnitude >5.0[2]	2	87	0	0	0	37
Holocene or Active Faults Present	Yes	Yes	No	Yes	Yes	Yes
MCE Magnitude[3]	7.5	8.5	6.5	7.5	5.5	8.0
Other Geologic Hazards[4]	Yes	Yes	No	Yes	Yes	Yes
GEOLOGIC RESOURCES						
Mineral Resources[5]	44	16	0	6	21	8
Energy Resources	4	2	0	0	1	0
Aggregate Resources[6]	36%	95%	70%	18%	42%	27%
Unique Geologic Features	No	No	No	Yes	No	Yes
SOIL RESOURCES						
Important Farmland[7]	5%	11%	50%	0%	14%	0%
Soil Erosion[8]						
Wind	65%	99%	70%	93%	57%	63%
Sheet	31%	4%	3%	12%	46%	75%

Note: [1]Percent of SDA with moderate or severe limitations for routine construction.
[2]Current as of March 1985 for the SDA plus a 30-mile buffer.
[3]Maximum credible earthquake magnitude.
[4]Presence of other geologic hazards including, for example, subsidence, mass movements, and flooding.
[5]Includes the number of mineral occurrences, mineral districts, and active mining operations or oil/gas fields and wells.
[6]Percent of the area with good characteristics for use as a sand or gravel source.
[7]Percent of SDA classified as prime farmland or farmland of statewide importance.
[8]Percent of the SDA with moderate or high susceptibilities to wind or sheet erosion.

935,714 acres) are highly or moderately erodible, with the highly erodible soils typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils occur primarily on intermediate-age alluvial fans.

3.9.5.2 Edwards Air Force Base

The Edwards AFB ROI extends north from the San Bernardino Mountains to just north of Little Lake, California, and west from Newberry Springs, California to about 10 miles west of Gorman, California (Figure 3.9.3-3). Seismicity in the ROI ranges from infrequent in the central portions of the Mojave Desert, to moderate in the eastern Mojave Desert, to high in the southern portions near the San Andreas Fault. The San Andreas Fault has generated two historical earthquakes with magnitudes exceeding 8.0. Areas near the Garlock Fault zone, north of the installation, are subject to infrequent to moderate seismicity, though seismicity has been low in the last 50 years compared with other active faults in the state. There is abundant geologic evidence of numerous, large displacements along the Garlock Fault during the Holocene. Subsidence and associated surface fracturing due to groundwater withdrawal have been identified in the Lancaster area on the south side of Edwards AFB (0.9 m) and in the Koehn Lake area (0.5 m), and should be expected to occur in other areas where groundwater overdraft occurs with similar geologic conditions. Many soils in the SDA have severe limitations (e.g., high shrink-swell potential) for routine construction practices. A large number of metallic and nonmetallic mineral occurrences have been identified in the ROI, several of which are on the Strategic and Critical Materials list. Active mining areas occur within the ROI, including areas of boron and evaporite mining. In addition, two of the most productive gold mining districts occur in the Mojave Desert. Exploratory oil or gas wells have been drilled in the ROI, but no production has occurred. The Randsburg and Coso Hot Springs KGRAs occur within the ROI; the latter is being developed to generate electricity for China Lake NWC with a new electric generating facility being planned. Suitable concrete-quality crushed rock and sand and gravel resources are common within the ROI. Annual aggregate production (1984) in the ROI is estimated at 26,174,000 short tons. Unique geologic features in or near the ROI include Afton Canyon, Amargosa River, Harper Dry Lake, and Pisgah Lava Flow. Important farmland in the ROI is found primarily west and southwest of Edwards AFB, with approximately 138 square miles of important farmland located in the SDA. Most of the soils in the SDA (92% or 799,506 acres) are highly susceptible to wind erosion and are typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils (7% or 58,209 acres) occur primarily on intermediate-aged alluvial fans.

3.9.5.3 F.E. Warren Air Force Base

The F.E. Warren AFB ROI extends north from about Fort Collins, Colorado to about Chugwater, Wyoming, and east from the Laramie Mountains to about Potter, Nebraska (Figure 3.9.4-2). The ROI is characterized by low seismicity. No faults with confirmed Holocene movement have been identified in the ROI, though a few small earthquakes are believed to be associated with the Bordeaux-Hyannis-North Platte Fault zone northeast of the ROI. One small mass movement has been identified in southwest Platte County, Wyoming, but others are not likely to occur except near steep stream embankments. Soils in the ROI have slight to moderate limitations for routine construction practices

because of conditions that include shallow depth to rock and high shrink-swell potential. Historic production of base and precious metals has occurred in the Laramie Range, but as of October 1982, there was no production or development. No active mines occur within the ROI. As of 1983, the entire northern Denver Basin was leased for oil and gas exploration. Numerous oil and gas-producing fields and wells exist in the Nebraska and Colorado portions of the ROI, with fewer fields occurring in the Wyoming portion. No producing wells have been identified in the SDAs. Portions of western Nebraska are classified as having potential geothermal resources, though no KGRAs have been identified. No active coal mines exist in the ROI, but areas north and east of Greeley, Colorado have been identified as potential coal and lignite mining areas, and speculative coal resources have been identified in the Goshen Hole coal field and southeast Laramie County, Wyoming. The only active coal mine in the northern Denver Basin is located a few miles north of Keenesburg, Colorado. Multiple uranium occurrences have been discovered in central Weld County, Colorado, and a single uranium lease was present on state land in Laramie County, Wyoming as of December 1982. A uranium prospect area, based on groundwater geochemistry, exists in Scotts Bluff and Banner counties, Nebraska. Concrete-quality sand and gravel have been identified in alluvial deposits along major drainageways in the ROI, but most near-surface geologic units in the ROI are unsuitable concrete-quality aggregate sources. Annual aggregate production (1984) in the ROI is estimated at 5,909,079 short tons. Limestones, dolomites, and granitic rocks in the Laramie Range are categorized as concrete-quality crushed rock sources. Prime and statewide important farmland occurs largely along Lodgepole and Horse creeks, though all irrigated farmland in the ROI is considered of statewide importance. About 108 square miles of important farmland occur in the SDA. Soils with high or moderate susceptibility to wind and/or sheet erosion (70% or 95,552 acres) are typically found in areas underlain by eolian sediments or located on terraces and floodplains.

3.9.5.4 Fort Bliss

The Fort Bliss ROI extends north from the United States-Mexico border to about Alamogordo, New Mexico, and east from Deming, New Mexico to approximately Salt Flat, Texas (Figure 3.9.3-4). The ROI is characterized by locally moderate levels of seismicity with the potential for minor to moderate earthquake damage. Recurrence intervals for large destructive surface ruptures are long, though historical data suggest that moderate earthquakes (magnitude 6.0) should occur about every 100 years. Late Quaternary north-south trending faults having Holocene-aged segments occur within the Tularosa, Hueco, Jornada del Muerto, and Mesilla basins, with documented evidence of movement on the Organ Mountain Fault zone about 1000 B.P. Debris flows commonly occur in the ROI as sheet and lobate flows in canyons, near the heads of alluvial fans, and as channel deposits farther down the fan surface. Rockfalls and landslides are confined to the mountainous and cliff areas of the San Andres, Oscura, Franklin, and Sacramento mountains. Recent volcanism associated with the Rio Grande Rift occurred southwest of the Rio Grande River, in an area west of the Trinity Site, and in the Malpais area. High heat flow, potential geothermal resources, and a potential near-surface magmatic source indicate the volcanic hazards may be moderate. Soils in the ROI have severe limitations for routine construction practices because of conditions that include shallow depth to rock and slumping. Metallic and nonmetallic mineral districts and occurrences have been located on the installation and within the ROI, including Strategic

and Critical minerals on Fort Bliss and in the Organ and Franklin mountains. Gold, silver, and associated commodities have been mined in the past, but all lands within installation boundaries have been withdrawn and no active metal mines are located within the ROI. Oil and gas occurrences are common in exploratory wells, but have not been considered economic. Parts of the McGregor Range on Fort Bliss may be considered for oil and gas leasing later in the decade. Two KGRAs, the Kilbourne Hole and Radium Springs areas, and a KGRF, are located within the ROI and border the SDA along the Rio Grande River. Speculative oil shale resources have been identified within the ROI. Sufficient quantities of concrete-quality aggregate are likely to be available within or adjacent to the ROI through direct source development and purchase. Annual aggregate production (1984) in the ROI is estimated at 3,121,000 short tons. Kilbourne Hole, Fort Stanton Cave, White Sands National Monument, and Aden Lava Flow are unique geologic features located in or near the ROI. Most important farmland is found on floodplains and terraces along the Rio Grande River, and no important farmland has been identified in the SDA. Nearly all of the soils in the SDA (93% or 1,140,873 acres) are highly or moderately erodible with the highly erodible soils typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils occur primarily on intermediate-aged alluvial fans.

3.9.5.5 Gila Bend Air Force Auxiliary Field

The Gila Bend Air Force Auxiliary Field (AFAF) ROI extends north from the United States-Mexico border to about Flores, Arizona, and west from Florence, Arizona to about Wellton, Arizona (Figure 3.9.3-1). The region is characterized by very low seismic activity. Minor Holocene faulting has occurred near the Pinacate volcanic field on the United States-Mexico border. Quaternary faults have been identified near the Gila Mountains, southeast of Gila Bend, Arizona near the northwest end of the Sand Tank Mountains and near Sonoyota, Sonora, Mexico. Ground subsidence due to groundwater withdrawal has been reported near Eloy in south-central Pinal County (12± ft) and in northeast Phoenix (3± ft), and is expected to occur in other areas in the ROI experiencing groundwater overdraft. Debris flows are common as sheets on younger fans, along channels on alluvial fans near the mountain fronts, and on dissected alluvial fans. Small playas are subject to standing water during periods of heavy or prolonged rainfall. The Pinacate volcanic field should be considered a potential volcanic hazard. In general, soils in the ROI have severe limitations for routine construction practices because of conditions that include cemented horizons and high shrink-swell potential. Large numbers of metallic and nonmetallic mineral occurrences have been identified in the ROI, several of which are on the Strategic and Critical Materials list. Minerals currently being produced include gold, copper, salt, and gypsum. State-identified KGRAs occur in the ROI, but other energy minerals are generally absent or not fully explored. Low-temperature geothermal resources (suitable for space heating) occur in many portions of the ROI. No oil or gas fields have been developed in the ROI, nor have any oil shale or coal deposits been identified. Uranium occurrences have been identified in the central and eastern portions of the ROI, but their economic potential is considered speculative. Concrete-quality aggregate is extremely rare in the ROI, though it is likely that sufficient quantities of aggregate are available to satisfy proposed project demands through direct source development or purchase. Annual aggregate production (1984) in the ROI is estimated at 25,987,000 short tons. Much of the basin-fill deposits may be suitable as road base. Willcox

Playa, in Cochise County, Arizona, is the only identified unique geologic feature in or near the ROI. Most important farmland is located along the Gila River with approximately 307 square miles of important farmland located in the SDA. Most soils in the SDA (57% or 834,661 acres) are highly or moderately susceptible to wind or sheet erosion. Soils highly susceptible to wind and sheet erosion are typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils occur primarily on intermediate-aged alluvial fans.

3.9.5.6 Yuma Proving Ground

The Yuma Proving Ground (PG) ROI extends north from the United States-Mexico border to about Parker, Arizona, and east from the Salton Sea to about Sentinel, Arizona (Figure 3.9.3-1). Most of the ROI is considered relatively aseismic, though the extreme southern portion of the ROI near the Mexican border is characterized by high seismicity. Three major fault zones, the San Jacinto-Imperial, San Andreas, and Elsinore faults, occur in the Salton Trough in the extreme western part of the ROI. Minor Quaternary faults have been identified near the Gila and Cargo Muchacho mountains; near Blythe, California; southeast of Gila Bend, Arizona; and near the Pinacate volcanic field. Another late Quaternary fault is located near Sonoyota, Sonora, Mexico. The minor Algodones Fault is within 20 miles of Yuma PG. Several fault zones with known historic displacement occur near the Salton Sea, with the most active being the San Jacinto-Imperial and San Andreas. Debris flows are common as sheets on younger fans and along channels on alluvial fans near the mountain fronts. The Pinacate volcanic field should be considered a potential volcanic hazard. In general, soils in the ROI have severe limitations for routine construction practices that result from conditions such as cemented horizons and high shrink-swell potential. A large number of metallic and nonmetallic mineral occurrences have been identified in the ROI, several of which are on the Strategic and Critical Materials list. Economic deposits of gold, silver, copper, lead, and mercury have been mined through patented and unpatented mining claims on Yuma PG. KGRAs are located within the California portion of the ROI, and KGRAs identified by Arizona are in the eastern part of the ROI. Over 100 geothermal wells have been drilled in the Imperial Valley area, which is a high-temperature source with promise for electrical generation. Several areas in and near the SDA have been designated as favorable for the discovery of low-temperature geothermal waters. No oil or natural gas, coal, uranium, or oil shale has been identified in the ROI. Concrete-quality aggregate is extremely rare in the ROI. Potentially acceptable concrete aggregate may be available from basalts, granitic rocks, gneiss and associated metamorphic rocks, and sedimentary rocks in bedrock areas of Luke AFR. Much of the basin-fill deposits may be suitable as road base. Annual aggregate production (1984) in the ROI is estimated at 16,910,000 short tons. The Imperial Sand Dunes in Imperial County, California is the only unique geologic feature located in the ROI. Prime or statewide important farmland is concentrated along the Colorado and Gila rivers and in the Imperial Valley, but no important farmland has been identified in the SDA. Many soils in the SDA (75% or 727,862 acres) are highly to moderately susceptible to wind or sheet erosion with highly erodible soils typically found on young alluvial fans, terraces, floodplains, and playas. Moderately erodible soils occur primarily on intermediate-aged alluvial fans.

4.0 ENVIRONMENTAL CONSEQUENCES

The environmental consequences of proposed deployment (or development) of the proposed Small Intercontinental Ballistic Missile (ICBM) program are considered in this chapter. This Legislative Environmental Impact Statement (LEIS) is not a site-specific document; therefore, potential impacts are identified primarily on a regional scale, with regions defined as county or multiple-county areas, watersheds, airsheds, or physical basins. Where local, state, or national consequences of the proposed project were identified in the analysis, they have also been discussed. Potential impacts are considered for each of the resource categories described in Chapter 3.0, Affected Environment.

The Council on Environmental Quality (CEQ) regulations state that environmental impact statements "shall provide full and fair discussion of significant environmental impacts." In addition, the following definition of significance is provided: "'Significantly' as used in NEPA requires considerations of both context and intensity."

Under the definition of context, the regulations indicate that "significance varies with the setting of the proposed action," and that "both short and long-term effects are relevant." Therefore, before assessing environmental impacts, the effects have been identified as either short term or long term. Since the LEIS addresses regional-scale issues, the primary contextual settings are regional.

Short-term impacts are transient effects of the proposed project that are of short duration and generally caused by construction activities or operations start-up. Long-term impacts will occur over an extended period of time, whether they start during the construction phase or operations phase. Most impacts from the operations phase are expected to be long term since project operations essentially represent a "steady-state" condition (i.e., impacts resulting from actions that occur repeatedly over a long period of time). However, long-term impacts can also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of the resource is low.

According to the CEQ regulations (Code of Federal Regulations 1981, 40 CFR 1508.27), intensity "refers to the severity of the impact." Ten items are listed that "should be considered in evaluating intensity:"

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

2. The degree to which the proposed action affects public health or safety.

3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Potentially significant impacts of the proposed project have been identified through a three-phase process. First, the environmental impacts within resource element categories were evaluated, then the level of the impact (LOI) was identified, and finally significance was assessed.

The LOI is a rating (negligible, low, moderate, or high) of the magnitude of an impact. The magnitude has been evaluated in terms of "numbers and kinds" of effects as compared to baseline conditions. The evaluation of LOI is based on both the absolute quantity of an affected resource and the comparisons of this quantity with the regional resource base. Once the LOI is determined, an evaluation must be made as to whether the impact is significant. Significance is determined by evaluating the effect within the ten settings of intensity previously identified, or by other criteria deemed appropriate for a given resource. In many cases, high LOIs will be judged to be significant, but not in all instances. For example, the excess capacity of a system may be large enough so that even a moderate or large impact will not be rated as significant.

A discussion of the methodology for evaluating potential impacts is provided for each resource category. The methodology includes procedures for evaluating proposed project impacts, determining LOIs, and determining significance. Each resource discussion also includes consideration of impacts that are common to all locations, and detailed discussion of potential project impacts at each alternative deployment area location.

4.1 Socioeconomics

Deployment of the Small Intercontinental Ballistic Missile (ICBM) system could lead to substantial regional changes in jobs, income, and population inmigration. To evaluate the likelihood and implications of these socioeconomic changes, four elements have been analyzed: regional growth (population, employment, and income), housing, public services, and public finance.

4.1.1 Impact Analysis Methodology

Three phases of county-level impact analysis for socioeconomics are discussed in this section: evaluation of potential project impacts, determination of levels of impact (LOIs), and the significance of impacts.

Components of the analysis included estimating the total number of direct and indirect workers required for project construction and support, determination of socioeconomic characteristics of inmigrating civilian and military workers and their dependents, projecting project-induced housing and public services needs, and evaluating and projecting imbalances between local government expenditures and revenues.

For three potential Main Operating Bases (MOBs), Gila Bend Air Force Auxiliary Field (AFAF), Edwards Air Force Base (AFB), and Fort Irwin National Training Center (NTC), the MOB county-level LOI and significance evaluation for the housing element was supplemented with analysis of communities surrounding the MOB because of the remoteness of these locations from large population centers.

4.1.1.1 Evaluation of Project Impacts

Regional Growth. For this element, the Region of Influence (ROI) changes in employment, labor force, population inmigration, and income associated with proposed project deployment were determined. The analysis has four components: (1) estimation of direct project employment, payrolls, and regional purchases; (2) determination of indirect-induced employment and income generated by the proposed project; (3) estimation of local labor availability, labor force, and total population inmigration to the ROI; and (4) allocation of project inmigrants and income to the counties within the ROI.

The direct number of jobs and wage estimates was based on data obtained from similar construction projects completed in the past, from building trade surveys, the Bureau of Labor Statistics, and from Air Force accounting reports. Regional purchases were projected based on preliminary cost estimates for Small ICBM deployment and on local spending data obtained from representative Air Force bases.

Input-output models developed for each ROI were used to estimate the secondary (indirect and induced) effects of proposed project spending. The number of dependents and accompaniment rates for various employment categories were estimated from Peacekeeper monitoring surveys and Army Corps of Engineers (COE) construction-worker profiles. Income effects in the ROI were determined from estimates of direct-worker payrolls. The distribution of project-induced employment, income, and population gains within the ROI was based on the size of the population centers within the counties and their distance from potential project worksites.

Housing. For this element, project-induced requirements for housing in the MOB county were examined. All inmigrating workers with families were assumed to require one housing unit each. Unaccompanied construction workers were assumed to need one unit each for temporary accommodations or one unit per 1.5 workers for year-round units, depending on estimates of their housing preferences. The impact analysis included three steps: (1) determination of inmigrants' housing preferences by occupational category, (2) estimation of permanent and temporary housing requirements, and (3) comparison of the project's housing requirements to baseline housing stock and available vacancies.

Public Services. For this element, annual project-induced changes in MOB county local government employment, including total police and education jobs, were examined. Changes in public school enrollments were also estimated. To arrive at public services impact assessments, three steps were followed: (1) determination of local government employment ratios (local government workers per 10,000 population) based on the most recent (1982) Census of Governments, (2) calculation of project-induced public service needs based on current local government employment ratios and project inmigration, and (3) comparison of these ratios to MOB historical ratios and to the most recent state average employment ratios.

Public Finance. For this element, the local governments' (within the MOB county) ability to pay for project-induced public expenditures from project-induced revenues was examined. Since the data represent an aggregation of all local government expenditures and revenues, they should not be interpreted as jurisdictional surpluses or deficits. Instead, any imbalances in revenues/expenditures should be viewed as indicators of local governments' relative ability to respond to future fiscal needs under project impact conditions.

In conducting these regional analyses, secondary data sources were used. No specific analyses were undertaken for either the general purpose or special purpose governments within the countywide areas.

Once site-specific deployment areas are identified and the preparation of related environmental impact analyses have begun, the Department of Defense (DOD) (Office of Economic Adjustment [OEA]) will determine whether or not to initiate more specific local growth management analyses, which may include fiscal impact analyses.

The impact analysis provided here includes three steps: (1) projection of expenditures based on project-related population changes, (2) projection of revenues derived from project-related personal income and population changes, and (3) comparison of the with-project difference in revenues and expenditures to baseline revenue levels.

4.1.1.2 Determination of Levels of Impact

Socioeconomic impacts occurring in the construction phase will generally be temporary and relate to build-up of the project workforce, transition from construction to missile assembly and checkout activities, and phase-in to operations staffing levels. All of the impacts relating to these stages of the construction phase are considered short term.

Socioecomonic changes associated with the operations phase of the proposed project will be ongoing and continuous, and are expected to vary little from year to year. Since these impacts will last for the operational life of the system, they are considered long term. The 1998 relationships between the impacts of the proposed project and baseline conditions are used to represent these long-term impacts.

Regional Growth. Generation of income and employment, sales gains, and decreased unemployment from the proposed project were considered beneficial effects; consequently, they were not assigned LOI ratings. Any sizable increase in ROI unemployment resulting from a phasing down of construction activities was considered an adverse impact. However, measured on an annual basis and compared to baseline projections, none of the estimated unemployment rate increases were large enough to warrant further rating consideration.

Housing. The LOIs for housing were estimated from project-related population effects. Comparisons of project-induced housing demand to both the housing stock level and to the baseline growth rate formed the basis for the LOI. Short-term effects were determined from project-induced changes in baseline housing stock growth rates. For the MOB counties studied, baseline population growth rates were projected by the states to range from less than 1 percent to about 3 percent per year. Housing growth is assumed to occur at the same rate. Project-induced increases in growth rates above 3 percentage points were consequently considered to be short-term, high impacts. Long-term changes were assessed using the percentage increases in project-induced demand, which indicate change in the size of the local housing market. Because of the perceived permanency of this change, impacts greater than 5 percent of the housing stock were assumed to be long-term, high impacts. Reduced vacancy rates are considered to be a beneficial effect, since they suggest that available resources are more fully used. For both the short and long terms, other impact levels were scaled down from these high values. Specific LOI criteria are as follows:

- Negligible Impact -- Both short and long-term effects will be negligible if, in any year, project-induced housing requirements do not result in a measurable response in the baseline housing stock or its growth rate in the MOB county (typically less than 0.5 percentage point, in the housing growth rate or less than 1% of baseline housing stock in 1998).
- Low Impact -- Short-term effects will be low if, in any year, project-related housing requirements measurably change the total MOB county baseline housing stock growth rate during the construction phase (typically between 0.5 and 1.5 percentage point increase in the rate). Long-term effects will be low if offbase housing requirements for operations personnel result in a possible 1 to 3-percent change of the total MOB county baseline housing stock in 1998, a representative year for operations-phase impacts.
- Moderate Impact -- Short-term effects will be moderate if, in any year, project-related housing requirements increase total MOB county housing demand enough to cause observable expansion in the local housing stock growth rate during the construction phase (typically between 1.5 and 3 percentage point increase in the rate). Long-term effects will be moderate if offbase housing requirements for operations personnel represent 3 to 5 percent of the 1998 MOB county baseline housing stock.

- High Impacts -- Short-term effects will be high if, in any year, the project-related housing requirements increase total MOB county housing demand enough to cause substantial expansion in the local housing stock growth rate during the construction phase (typically 3 or more percentage point increase in the rate). Long-term effects will be high if offbase housing requirements for operations personnel could lead to more than a 5-percent change of the 1998 MOB county baseline housing stock.

Public Services. The LOIs for public services were determined by the magnitude of change in the level and rate of growth of local government employment associated with project-induced increases in MOB county population. Fluctuations in public services requirements during the construction phase (1990-1997) will create impacts that will generally be brief in duration. These will be short-term effects. For the MOB counties studied, baseline population growth rates were projected by the states to range from less than 1 percent to about 3 percent per year. Service demands are assumed to grow at the same rate. Project-induced increases in growth rates above 3 percentage points were consequently considered to be short-term, high impacts.

During the operations phase (beginning in 1998), the proposed project population (predominantly military) will require a relatively constant level of public services in each year for the life of the proposed project. These will be ongoing, long-term impacts. Since effects in 1998 are representative of the continuous public service demands created by the proposed project during operations, the relationship of project requirements to baseline levels in this year was used as an indicator of the long-term impacts. Prior federal educational programs in areas affected by military installations established a long-term demand increase of 5 percent as a threshold beyond which local service problems could develop. This threshold has been used in this analysis. Other LOI thresholds were scaled down from this value. Specific criteria used to determine LOIs are as follows:

- Negligible Impact -- Short-term effects will be negligible if, in any year, the proposed project will have virtually no discernible effect on the rate of growth of local government employment requirements in the MOB county. Long-term effects will be negligible if no measurable change in public service requirements is estimated for 1998. (A change of less than 0.5 percentage point in the growth rate of employment requirements.)

- Low Impacts -- Short-term effects will be low if, in any year, the proposed project measurably increases the growth rate of local government employment requirements in the MOB county (typically between 0.5 and 1.5 percentage point annual increase in the growth rate of employment requirements). Long-term effects will be low if added employment requirements represent between 1 and 3 percent of 1998 baseline levels.

- Moderate Impacts -- Short-term effects will be moderate if, in any year, the proposed project increases MOB county local government employment requirements enough to cause observable decreases in service delivery (typically between 1.5 and 3 percentage point

annual increase in the growth rate of employment requirements). Long-term effects will be moderate if added employment requirements represent between 3 and 5 percent of the 1998 baseline levels.

- High Impacts -- Short-term effects will be high if, in any year, the proposed project increases MOB county local government employment requirements enough to cause substantial changes in existing service levels (typically an annual increase of more than 3 percentage points in the growth rate of employment requirements). Long-term effects will be high if added employment requirements represent over 5 percent of 1998 baseline levels.

Public Finance. For this element, the LOIs were determined by comparing the shortfalls in project-induced local government revenues (revenues minus expenditures) with baseline revenues. Project-induced revenue shortfalls have the effect of reducing reserve funding accounts usually maintained by local governments for the purpose of providing emergency public services. Generally, reserve funding levels of 3 to 5 percent are considered normal, and if depleted, the financial health of the jurisdictions are at risk. Therefore, in the short term, shortfalls of 3 or more percent in any 1 year were assumed to be the threshold at which high impacts will occur. Long-term impacts were rated as high if shortfalls of 3 or more percent will occur during the operations phase of the project. For both the short and long term, other impact levels were scaled down from these values. Impacts were considered beneficial when annual project-induced revenues will exceed annual project-induced expenditures. Specific criteria used to determine LOIs are as follows:

- Negligible Impact -- Effects will be negligible if, in any year, project-induced shortfalls do not measurably reduce reserve funding levels of local governments in the MOB county (typically shortfalls of less than 0.5% of baseline revenues in the construction phase or 1% of baseline revenues in the operations phase).

- Low Impact -- Effects will be low if, in any year, project-induced shortfalls measurably reduce reserve funding levels of local governments in the MOB county (typically between 0.5% and 2% of baseline revenues in the construction phase or between 1% and 2% of baseline revenues in the operations phase).

- Moderate Impact -- Effects will be moderate if, in any year, project-induced shortfalls are between 2 and 3 percent of baseline revenues in either the construction or operations phase.

- High Impact -- Effects will be high if, in any year, project-induced shortfalls are more than 3 percent of baseline revenues in either the construction or operations phase.

4.1.1.3 Determination of Significance

Regional Growth. For this element, LOIs were either beneficial or negligible. Consequently, no short or long-term significance statements are provided.

Housing. For this element, significance was determined by changes in the number of available housing units within the MOB county. Short-term impacts were considered significant if, in any 1 year, project-associated housing demand will absorb more than one-half of the existing MOB county vacant housing. Long-term impacts were determined to be significant if more than one-half of the vacant housing will be required during the operations phase. (In all but 3 of the 23 locations studied, a change of this magnitude will result in vacancy rates of less than 3%, the level at which substantial increases in rents and home prices can usually be expected). Since most of the expected inmigrants will be seeking moderately priced homes, reductions in the availability of housing will result in sharp cost increases and a reduced availability of low and moderately priced housing.

Public Services. For this element, significance was determined by changes in the number of local government employees per 10,000 population in each MOB county. A decrease in this number, caused by project-related population inmigration, indicates a reduction in existing county public services levels. In the short term, this impact was considered significant if the number of local government employees per 10,000 population will fall 5 percent or more below the historical low MOB county number. Long-term impacts were considered significant if the project-induced reduction in the local government employment ratio will fall 5 or more percent below the MOB county's historical low service levels during the operations phase. The 5-percent threshold assumption is based on information reported in various economic growth studies.

Public Finance. For this element, significance was determined by MOB county shortfalls in revenues that may create the potential for excessive fiscal burdens on local governments. Short-term impacts were considered significant if, in any year, project-induced expenditures will exceed project-induced revenues by more than 1 percent of baseline revenues, or by between 0.5 and 1 percent if such imbalances persist for at least 2 years. Long-term impacts were considered significant if project-induced revenues minus expenditures will exceed baseline revenues by more than 1 percent during the operations phase. Impacts below these thresholds were assumed to be manageable by local jurisdictions.

4.1.2 Impacts Common to All Locations

Small ICBM deployment will create beneficial economic activity, regardless of the basing mode or region selected, since many of the workers hired for the proposed project are expected to be local residents. Although a substantial number of workers will also inmigrate to the selected deployment areas either temporarily or permanently, most of the indirect and induced jobs created by the proposed project will be filled by local area workers. A summary of direct employment requirements by basing mode and calendar year is presented in Table 4.1.2-1.

In all potential deployment locations, housing and local public services demands associated with this population inmigration will increase. While local government expenditures should increase if these service demands are met, tax revenues should also rise as local economic activity expands. However, possible mitigation measures required by any fiscal imbalances, public services shortfalls, or housing issues are not included in this analysis.

Table 4.1.2-1

ESTIMATED ANNUAL DIRECT EMPLOYMENT BY CALENDAR YEAR
(Full-Time Equivalent Jobs)

Employment Category	1990	1991	1992	1993	1994	1995	1996	1997	1998 and on
Hard Mobile Launcher in Random Movement									
50 Missiles									
Main Operating Base									
Site Activation	20	35	97	124	100	-	-	-	-
Construction	1,602	988	222	59	101	39	1	-	-
Assembly & Checkout	-	-	305	188	127	-	-	-	-
Operations	6	267	1,050	1,315	1,570	1,570	1,570	1,570	1,570
Deployment Area									
Construction	511	310	154	95	11	-	-	-	-
50 Missiles, Total:	2,139	1,600	1,828	1,781	1,909	1,609	1,571	1,570	1,570
200 Missiles									
Main Operating Base									
Site Activation	20	35	97	124	134	144	125	-	-
Construction	2,290	1,432	419	74	101	27	-	-	-
Assembly & Checkout	-	-	305	188	281	378	214	-	-
Operations	6	305	1,231	1,643	2,308	3,179	3,955	3,955	3,955
Deployment Area									
Construction	1,166	868	680	547	74	-	-	-	-
200 Missiles, Total:	3,482	2,640	2,732	2,576	2,898	3,728	4,294	3,955	3,955
Hard Mobile Launcher at Minuteman Facilities									
170 Missiles									
Main Operating Base									
Site Activation	20	35	97	124	134	144	125	-	-
Construction	2,407	1,362	532	68	67	49	1	-	-
Assembly & Checkout	-	-	320	203	142	393	193	-	-
Operations	6	129	509	836	1,385	2,180	2,900	2,900	2,900
Deployment Area									
Construction	49	82	230	354	228	117	4	-	-
170 Missiles, Total:	2,482	1,608	1,688	1,585	1,956	2,883	3,223	2,900	2,900
200 Missiles									
Main Operating Base									
Site Activation	20	35	97	124	134	144	125	-	-
Construction	2,414	1,366	533	63	63	46	1	-	-
Assembly & Checkout	-	-	320	203	142	393	229	-	-
Operations	6	129	507	831	1,429	2,419	3,285	3,285	3,285
Deployment Area									
Construction	86	99	255	406	261	131	5	-	-
200 Missiles, Total:	2,526	1,629	1,712	1,627	2,029	3,133	3,645	3,285	3,285
Hard Silo in Patterned Array									
250 Missiles									
Main Operating Base									
Site Activation	20	35	60	64	64	64	64	64	10
Construction	980	787	273	268	189	99	-	-	-
Assembly & Checkout	-	26	521	548	749	923	914	78	-
Operations	7	206	821	1,117	1,329	1,520	1,648	1,763	1,763
Deployment Area									
Construction	903	1,359	2,305	2,636	2,789	2,132	1,174	186	-
Assembly & Checkout	-	9	174	183	249	307	304	26	-
250 Missiles, Total:	1,910	2,422	4,154	4,816	5,369	5,045	4,104	2,117	1,773

Housing required by military personnel and their dependents is estimated to be provided onbase by the Air Force for 85 percent of the military population at 7 of the potential bases (Gila Bend AFAF, Yuma Proving Ground [PG], Fort Bliss, White Sands Missile Range, Fort Irwin NTC, Grand Forks AFB, and Malmstrom AFB), and for 60 percent at the remaining 11 bases (Eglin AFB, Indian Springs AFAF, Nellis AFB, Holloman AFB, Edwards AFB, Yakima Firing Center [FC], Ellsworth AFB, F.E. Warren AFB, Minot AFB, Whiteman AFB, and Davis-Monthan AFB). Reduced vacancy rates in the MOB counties are considered to be beneficial in both the short and long term since existing resources will be more fully used.

4.1.2.1 Hard Mobile Launcher in Random Movement

The short-term (peak-year) and long-term (1998 representative year) effects of the Hard Mobile Launcher in Random Movement basing mode on the socioeconomic elements of regional growth, housing, public services, and public finance are summarized in Table 4.1.2-2 for each of the 11 MOBs.

For the 200-missile alternatives (Arizona, Nevada, New Mexico and South-Central California), total direct (onsite) employment will begin with nearly 3,500 jobs in 1990, decline to approximately 2,600 jobs in 1991, and then rise to a high of nearly 4,300 jobs in 1996. Operations personnel will increase to a level of about 4,000 positions by 1996 and remain constant at this number throughout system deployment (Table 4.1.2-1).

For the Florida and Washington complexes (50-missile deployment), total direct employment will start at a peak level of approximately 2,100 jobs in 1990, and later range from a 1991 low of 1,600 jobs to a 1994 level of about 1,900. By 1994, operations staffing levels will reach a total of nearly 1,600, most of which will be military personnel.

Peak-population levels resulting from the proposed project will be largely a result of military personnel and their dependents. In the 200-missile complexes, peak-population gains will occur in 1996 and number about 10,400 persons. In the operations phase, population in these complexes will be slightly less at 10,000 persons. In the 50-missile complexes, the peak population will average close to 4,400 persons in 1994. The operations-phase population will be about 4,000 persons.

Offbase housing demands in the 200-missile alternative locations will range between 1,200 and 1,600 units in 1990. In those areas providing 85 percent onbase housing, the community housing demands will decrease to about 600 during the operations phase. Where 60-percent onbase housing is supplied, offbase demands will increase to about 1,500 for the operations phase.

School enrollments will show a common pattern among all locations. In the 200-missile complexes, annual school enrollments will increase to a peak of nearly 2,000 students in the construction phase and by about 1,900 in the operations phase. Annual enrollments in areas supporting 50 missiles will peak at 1,000 students in the construction phase and fall to 900 in the operations phase.

Table 4.1.2-2

SELECTED SOCIOECONOMIC PROJECT IMPACTS, HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES
BY MAIN OPERATING BASE AND MAIN OPERATING BASE COUNTY

Complex	Arizona		Florida	Nevada	New Mexico			South-Central California		Washington
Main Operating Base	Gila Bend AFAF	Yuma PG	Eglin AFB	Indian Springs AFAF	Fort Bliss	Holloman AFB	White Sands Missile Range	Edwards AFB	Fort Irwin NTC	Yakima FC
Main Operating Base County	Maricopa, AZ (200 Missiles)	Yuma, AZ	Okaloosa, FL (50 Missiles)	Nellis AFB Clark, NV (200 Missiles)	El Paso, TX	Otero, NM (200 Missiles)	Dona Ana, NM	Los Angeles, CA (200 Missiles)	San Bernardino, CA	Yakima, WA (50 Missiles)
Peak-Year Short-Term Effects, 1990-1996										
Total Employment:	7,504	7,504	3,653	6,873	6,943	6,943	6,943	8,015	8,015	3,885
Direct	3,482	3,482	2,139	3,482	3,482	3,482	3,482	3,482	3,482	2,139
Indirect and Induced	4,022	4,022	1,514	3,391	3,461	3,461	3,461	4,533	4,533	1,746
Population Inmigration, Peak Year (1996) ROI	10,400	10,400	4,400	10,400	10,400	10,400	10,400	10,400	10,400	4,400
Population Inmigration, Peak Year (1996) MOB County	10,300	10,400	4,400	10,400	10,400	10,300	10,300	10,400	10,400	4,400
Project Housing Requirements, Peak Year (1990)	1,600	1,700	1,100	1,400	1,400	1,300	1,300	1,200	1,200	1,000
Potential Increase in Year-Round Housing Stock[1]	75.7%	4.7%	2.0%	0.5%	0.8%	6.6%	3.1%	2.1%	2.4%	1.3%
Available Baseline Vacancies Required[2]	689.9%	88.6%	30.4%	8.0%	22.6%	112.1%	55.4%	50.3%	57.2%	36.3%
Project Local Government Employment, Peak Year (1996)	360	366	140	326	384	300	464	160	324	120
Potential Increase in Local Government Employment[1]	0.1%	1.5%	0.7%	0.2%	0.2%	2.5%	1.1%	0.0%	0.1%	0.5%
Local Government Employment/Population Ratio, Peak Year (1996)[3]	345	320	313	309	365	252	420	355	308	267
Decrease From Baseline Level[4]	0.0%	9.1%	2.5%	1.3%	1.4%	13.4%	6.5%	0.0%	1.0%	2.2%
Project Public School Enrollment, Peak Year (1996)	1,980	2,000	840	2,000	1,990	1,990	1,990	900	2,000	850
Increase in County School Enrollments[1]	15.9%	1.4%	0.5%	0.2%	0.2%	2.1%	1.0%	2.0%	1.0%	0.4%
Project-Generated Revenues Less Expenditures, Peak Years (millions 84$)	-$1.8	-$1.0	-$0.5	$2.3	-$1.2	-$0.5	-$0.3	$4.6	-$1.2	-$0.4
Net Imbalance as a Percent of Baseline Revenues	<-0.1%	-0.5%	-0.2%	0.2%	-0.1%	-0.8%	-0.1%	<0.1%	-0.1%	-0.1%

Table 4.1.2-2 Continued, Page 2 of 2

Complex	Arizona		Florida	Nevada	New Mexico			South-Central California		Washington
Main Operating Base	Gila Bend AFAF	Yuma PG	Eglin AFB	Indian Springs AFAF / Nellis AFB	Fort Bliss	Holloman AFB	White Sands Missile Range	Edwards AFB	Fort Irwin NTC	Yakima FC
Main Operating Base County	Maricopa, AZ	Yuma, AZ	Okaloosa, FL	Clark, NV	El Paso, TX	Otero, NM	Dona Ana, NM	Los Angeles, CA	San Bernardino, CA	Yakima, WA
	(200 Missiles)		(50 Missiles)	(200 Missiles)		(200 Missiles)		(200 Missiles)		(50 Missiles)
Long-Term Effects, 1998										
Total Employment:	5,623	5,623	2,160	5,379	5,435	5,435	5,435	5,907	5,907	2,108
Direct	3,955	3,955	1,570	3,955	3,955	3,955	3,955	3,955	3,955	1,570
Indirect and Induced	1,668	1,668	590	1,424	1,480	1,480	1,480	1,952	1,952	538
Population Inmigration ROI	9,800	9,800	3,900	9,800	9,800	9,800	9,800	9,800	9,800	3,900
Population Inmigration MOB	9,700	9,800	3,900	9,800	9,800	9,800	9,800	9,800	9,800	3,900
Project Housing Requirement	580	590	600	1,520	590	1,520	590	1,520	590	600
Percent of Baseline Housing Stock	21.6%	1.4%	0.9%	0.5%	0.3%	6.3%	1.1%	2.0%	0.9%	0.7%
Available Baseline Vacancies Required	201.1%	26.4%	14.2%	7.0%	7.7%	110.5%	21.3%	50.2%	22.2%	20.1%
Percent of Military Onbase	85%	85%	60%	60%	85%	60%	85%	60%	85%	60%
Project Local Government Employment Requirement	340	340	125	310	360	285	440	140	305	110
Percent of Local Government Employment	0.4%	8.1%	2.2%	1.2%	1.3%	14.2%	6.4%	0.0%	0.7%	1.8%
Local Government Employment/Population Ratio	345	323	314	309	365	255	421	355	309	268
Decrease From Baseline Level	0.0%	8.2%	2.2%	1.3%	1.4%	12.4%	6.2%	0.0%	0.6%	1.8%
Project Public School Enrollment	1,870	1,880	750	1,880	1,880	1,880	1,880	1,120	1,880	750
Percent of County School Enrollments	45.6%	8.5%	1.9%	1.2%	1.0%	12.2%	5.2%	14.0%	0.6%	1.7%
Project-Generated Revenues Less Expenditures (millions 84$)	-$1.6	-$0.7	-$0.5	-$0.8	-$0.7	-$0.4	-$0.2	-$0.1	-$0.9	-$0.4
Net Imbalance as a Percent of Baseline Revenues	<-0.1%	-0.4%	-0.2%	-0.1%	-0.1%	-0.6%	-0.1%	<-0.1%	<-0.1%	-0.1%

Notes: [1]Percentage point change in growth rate between 1990 and 1996.

[2]Housing requirements divided by available vacancies expressed as a percent.

[3]Number of local government employees per 10,000 population.

[4]Percent decrease in local government employee/population ratio with no additional personnel.

Peak-year population in Florida and Washington/Complexes are 1994.

Peak-year employment data are for 1990.

All numbers for MOB county unless otherwise noted.

4.1.2.2 Hard Mobile Launcher at Minuteman Facilities

The short-term (peak-year) and long-term (1998 representative year) effects of the Hard Mobile Launcher at Minuteman Facilities basing mode on the socioeconomic elements of regional growth, housing, public services, and public finance are summarized in Table 4.1.2-3 for each of the six MOBs.

At the 200-missile bases (F.E. Warren and Malmstrom AFBs), direct employment will begin in 1990 with a total of almost 2,500 jobs, decline to about 1,900 in 1992, increase to nearly 3,600 in 1996, and stabilize at 3,300 jobs in the operations phase. At the 170-missile bases (Ellsworth, Grand Forks, Minot, and Whiteman AFBs), total direct employment will be slightly less than for the 200-missile alternatives, starting at about 2,500 jobs in 1990, decreasing to 1,600 in 1991, rising to 3,200 in 1996, and stabilizing at about 2,900 in the operations phase (Table 4.1.2-1).

In both the peak year and operations phase, population increases (most military personnel), will be similar for all the 200-missile alternatives. In 1996, population increases are expected to total 8,800, while operations-phase population changes as a result of the proposed project should amount to about 8,100 persons. At the 170-missile alternatives, peak-year population changes should total 7,800 persons. Operations-phase population increases are expected to reach about 7,200 individuals.

At the 200-missile alternatives, offbase housing demands will average about 1,100 units in 1990. With 85 percent onbase housing, community housing requirements at Malmstrom AFB will decrease to about 500 during the operations phase. F.E. Warren AFB's offbase housing needs for operations personnel will increase to 1,300 since only 60 percent will be housed onbase. For the 170-missile alternatives, housing demands offbase should number between 900 and 1,300 in 1990, declining to about 1,100 in 1996 and thereafter. Only at Grand Forks AFB will the operations housing requirement decline to 400 since 85 percent of military personnel will be housed onbase.

School enrollments will total about 1,700 students at the 200-missile bases in 1996, the peak-construction year, and 1,600 in 1998, the representative operations year. For the 170-missile bases, 1996 school enrollments will number about 1,400 to 1,500 students, with operations-phase (1998) enrollments numbering about 1,400 students.

4.1.2.3 Hard Silo in Patterned Array

The short-term (peak-year) and long-term (1998 representative year) effects of the Hard Silo in Patterned Array basing mode on the socioeconomic elements of regional growth, housing, public services, and public finance are summarized in Table 4.1.2-4 for each of the six MOBs.

Direct employment should increase from about 1,900 jobs in 1990 to a peak of nearly 5,400 jobs in 1994, and decline to a level of almost 1,800 jobs after 1998 (Table 4.1.2-1).

Operations-phase population gains, attributable to inmigrating military personnel, are expected to total about 4,400 persons at all base locations. Offbase housing demands in the operations phase will total about 300 units for

Table 4.1.2-3

SELECTED SOCIOECONOMIC PROJECT IMPACTS, HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES BY MAIN OPERATING BASE AND MAIN OPERATING BASE COUNTY

Main Operating Base / Main Operating Base County	Ellsworth AFB / Pennington, SD (170 Missiles)	F.E. Warren AFB / Laramie, WY (200 Missiles)	Grand Forks AFB / Grand Forks, ND (170 Missiles)	Malmstrom AFB / Cascade, MT (200 Missiles)	Minot AFB / Ward, ND (170 Missiles)	Whiteman AFB / Johnson, MO (170 Missiles)
Peak-Year Short-Term Effects, 1990-1996						
Total Employment	4,468	4,981	4,384	5,014	4,282	4,690
Direct	3,223	3,645	3,223	3,645	3,223	2,482
Indirect and Induced	1,245	1,336	1,161	1,369	1,059	2,208
Population Inmigration, Peak Year (1996) ROI	7,800	8,800	7,800	8,800	7,800	7,800
Population Inmigration, Peak Year (1996) MOB County	7,700	8,700	7,600	8,800	7,700	7,500
Project Housing Requirement, Peak Year 1990	1,300	1,100	900	1,100	1,300	900
Potential *Increase in Year*-Round Housing Stock[1]	4.1%	3.5%	3.3%	3.4%	5.6%	6.5%
Available Baseline Vacancies Required[2]	72.2%	85.6%	44.8%	59.1%	141.7%	120.2%
Project Local Government Employment, Peak Year (1996)	230	390	181	260	205	220
Potential Increase in Local Government Employment[1]	1.4%	1.6%	1.4%	1.6%	1.7%	2.7%
Local Government Employment/Population Ratio, Peak Year (1996)[3]	275	406	218	265	239	243
Decrease From Baseline Level[4]	7.7%	8.9%	8.4%	8.9%	9.8%	15.3%
Project Public School Enrollment, Peak Year (1996)	1,490	1,670	1,460	1,680	1,490	1,440
Increase in County School Enrollments[1]	1.2%	1.6%	1.8%	1.7%	1.8%	3.3%
Project-Generated Revenues Less Expenditures, Peak Years (millions 84$)	-$2.3	-$1.9	-$2.0	-$1.4	-$0.6	-$0.4
Net Imbalance as a Percent of Baseline Revenues	-1.9%	-1.1%	-1.9%	-1.2%	-0.9%	-0.9%

Table 4.1.2-3 Continued, Page 2 of 2

Main Operating Base / Main Operating Base County	Ellsworth AFB / Pennington, SD (170 Missiles)	F.E. Warren AFB / Laramie, WY (200 Missiles)	Grand Forks AFB / Grand Forks, ND (170 Missiles)	Malmstrom AFB / Cascade, MT (200 Missiles)	Minot AFB / Ward, ND (170 Missiles)	Whiteman AFB / Johnson, MO (170 Missiles)
Long-Term Effects, 1998						
Total Employment	4,037	4,506	3,961	4,543	3,872	4,174
Direct	2,900	3,285	2,900	3,285	2,900	2,900
Indirect and Induced	1,137	1,221	1,061	1,258	972	1,274
Population Inmigration ROI	7,200	8,100	7,200	8,100	7,200	7,200
Population Inmigration MOB	7,200	8,100	7,200	8,100	7,200	7,100
Project Housing Requirements	1,100	1,300	400	500	1,100	1,100
Percentage of Baseline Housing Stock	3.1%	3.4%	1.4%	1.4%	4.3%	7.6%
Available Baseline Vacancies Required	56.5%	84.5%	19.2%	23.9%	109.4%	141.6%
Percent of Military Onbase	60%	60%	85%	85%	60%	60%
Project Local Government Employment Requirement	215	360	170	240	190	200
Percent of Local Government Employment	7.6%	8.7%	8.7%	9.0%	9.7%	16.7%
Local Government Employment/Population Ratio	277	410	218	267	242	246
Decrease From Baseline Level	7.0%	8.1%	8.4%	8.2%	8.7%	14.3%
Project Public School Enrollment	1,380	1,560	1,370	1,560	1,380	1,360
Percent of County School Enrollments	6.8%	8.3%	10.0%	10.3%	10.3%	20.6%
Project-Generated Revenues Less Expenditures (millions 84$)	-$1.5	-$1.7	-$2.0	-$0.8	-$0.3	-$0.3
Net Imbalance as a Percent of Baseline Revenues	-1.0%	-0.9%	-1.9%	-0.7%	-0.4%	-0.6%

Notes: [1]Percentage point change in growth rate between 1990 and 1996.
[2]Housing requirements divided by available vacancies expressed as a percent.
[3]Number of local government employees per 10,000 population.
[4]Percent decrease in local government employee/population ratio with no additional personnel.

Peak-year employment data are for 1996 except at Whiteman AFB where they are for 1990.

All numbers for MOB county unless otherwise noted.

Table 4.1.2-4

SELECTED SOCIOECONOMIC PROJECT IMPACTS, HARD SILO IN PATTERNED ARRAY ALTERNATIVES
BY MAIN OPERATING BASE AND MAIN OPERATING BASE COUNTY

Main Operating Base / Main Operating Base County	Davis-Monthan AFB / Pima, AZ (250 Missiles)	Edwards AFB / Los Angeles, CA (250 Missiles)	F.E. Warren AFB / Laramie, WY (250 Missiles)	Fort Bliss / El Paso, TX (50 Missiles)	Gila Bend AFAF / Maricopa, AZ (250 Missiles)	Yuma PG / Yuma, AZ (250 Missiles)
Peak-Year Short-Term Effects, 1990-1994						
Total Employment (1994)	8,314	10,340	8,125	8,429	8,934	8,038
Direct	5,369	5,369	5,369	5,369	5,369	5,369
Indirect and Induced	2,945	4,971	2,756	3,060	3,565	2,669
Population Inmigration, Peak Year (1994) ROI	10,100	8,200	10,600	11,500	9,900	11,300
Population Inmigration, Peak Year (1994) MOB County	9,900	8,200	9,700	11,200	9,600	10,800
Project Housing Requirement, Peak Year (1990)	2,670	2,160	2,640	2,790	2,230	2,630
Potential Increase in Year-Round Housing Stock[1]	0.1%	0.6%	1.5%	0.2%	14.3%	1.3%
Available Baseline Vacancies Required[2]	14.2%	79.8%	190.2%	40.1%	847.8%	128.1%
Project Local Government Employment, Peak Year (1994)	312	222	440	415	333	380
Potential Increase in Local Government Employment[1]	0.3%	0.0%	2.8%	0.4%	0.1%	2.4%
Local Government Employment/Population Ratio, Peak Year (1994)[3]	312	355	401	364	345	321
Decrease From Baseline Level[4]	1.3%	0.0%	10.1%	1.6%	0.3%	8.8%
Project Public School Enrollment, Peak Year (1994)	1,900	1,200	1,870	2,150	1,850	2,080
Increase in County School Enrollments[1]	0.3%	0.0%	2.7%	0.3%	24.6%	2.2%
Project-Generated Revenues Less Expenditures, Peak Years (millions 84$)	-$0.4	$4.7	-$1.2	-$0.5	-$0.4	-$0.1
Net Imbalance as a Percent of Baseline Revenues	<-0.1%	<0.1%	-0.7%	-0.1%	<-0.1%	-0.1%

Table 4.1.2-4 Continued, Page 2 of 2

Main Operating Base Main Operating Base County	Davis-Monthan AFB Pima, AZ (250 Missiles)	Edwards AFB Los Angeles, CA (250 Missiles)	F.E. Warren AFB Laramie, WY (250 Missiles)	Fort Bliss El Paso, TX (50 Missiles)	Gila Bend AFAF Maricopa, AZ (250 Missiles)	Yuma PG Yuma, AZ (250 Missiles)
Long-Term Effects, 1998						
Total Employment	2,360	2,618	2,397	2,418	2,504	2,352
Direct	1,773	1,773	1,773	1,773	1,773	1,773
Indirect and Induced	587	845	624	645	731	579
Population Inmigration, ROI	4,400	4,400	4,400	4,400	4,400	4,400
Population Inmigration, MOB	4,400	4,400	4,400	4,400	4,400	4,400
Project Housing Requirements	680	680	680	270	270	270
Percentage of Baseline Housing Stock	0.2%	0.9%	1.8%	0.1%	9.8%	0.6%
Available Baseline Vacancies Required	3.3%	22.6%	45.8%	3.5%	91.9%	12.1%
Percent of Military Onbase	60%	60%	60%	85%	85%	85%
Project Local Government Employment Requirement	140	60	200	160	150	150
Percent of Local Government Employment	0.5%	0.0%	4.8%	0.6%	0.2%	3.6%
Local Government Employment/Population Ratio	314	356	426	367	345	339
Decrease From Baseline Level	0.6%	0.0%	4.5%	0.8%	0.3%	3.7%
Project Public School Enrollment	840	800	840	840	840	840
Percent of County School Enrollments	0.5%	10.0%	4.5%	0.5%	56.7%	3.4%
Project-Generated Revenues Less Expenditures (millions 84$)	$1.3	$1.6	-$0.3	$1.1	$1.0	$0.9
Net Surplus (Deficit) as a Percent of Baseline Revenues	0.1%	<0.1%	-0.2%	0.1%	<0.1%	0.5%

Notes: [1]Percentage point change in growth rate between 1990 and 1994.
[2]Housing requirements divided by available vacancies expressed as a percent.
[3]Number of local government employees per 10,000 population.
[4]Percent decrease in local government employee/population ratio with no additional personnel.

All numbers for MOB county unless otherwise noted.

those areas with 85 percent onbase housing and 700 for areas with 60 percent onbase housing. The proposed project is expected to add approximately 900 students to county school enrollments in the operations phase.

4.1.3 Impacts of Hard Mobile Launcher in Random Movement

4.1.3.1 Arizona Complex

The socioeconomic consequences of the proposed project depend on the location of the MOB. Two impact analyses were performed: with the MOB at Gila Bend AFAF in Maricopa County and with the MOB at Yuma PG in Yuma County.

Regardless of the MOB selected, regional growth impacts will be beneficial consequences of the proposed project. If the MOB is located at Gila Bend AFAF, both short and long-term housing and public services impacts will be high and significant. Short and long-term public finance impacts will be negligible.

If Yuma PG is chosen as the MOB, short-term housing impacts are expected to be high and significant and long-term impacts will be low and not significant. Short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. Short-term public finance impacts will be low and not significant and long-term impacts will be negligible.

Regional Growth. If the Arizona Complex is selected, project-related employment (including direct, indirect, and induced jobs) is expected to total 7,500 in 1990, about 0.5 percent of forecast baseline employment. This 1990 impact, consisting of 3,500 direct (onsite) jobs and 4,000 indirect-induced (offsite) jobs, reflects both the first year when employment impacts will reach measurable levels, and the highest annual employment level that will be created by the proposed project. About 5,000 of these jobs (67% of the total) are expected to be filled by local hires. In 1998 and thereafter, the proposed project will create about 5,600 jobs, 0.3 percent of 1998 baseline employment. Approximately 70 percent of all long-term jobs will go to military personnel inmigrating from outside the ROI, with most of the remaining 1,700 jobs held by locally hired civilians.

The proposed project is expected to slightly decrease the ROI unemployment rates in both the construction and operations phases because of local hiring. However, these changes will be minor, since project employment is small compared to the ROI labor force.

The proposed project's ROI population, including both inmigrating workers and their dependents, is forecast to rise from 5,900 persons in 1990 to a peak of 10,400 in 1996 before falling to 9,800 in 1998. These effects represent about 0.3 percent of ROI baseline population in the 1996 to 1998 period.

The distribution of this population growth within the ROI will depend on the location of the MOB. The county containing the MOB is projected to experience project-related population growth ranging from 5,600 to 5,800 persons in 1990, with some variation depending on the county chosen. Peak MOB county population impacts will exceed 10,300 in 1996, with operations-phase (1998 and thereafter) population effects of more than 9,700 persons.

With the MOB at Gila Bend AFAF, Maricopa County's population growth rate will remain nearly unchanged at about 3.3 percent per year during the 1990 through 1996 period. The county's 1998 population will be only about 0.4 percent higher with the proposed project than without the project. Because of the distance between Gila Bend AFAF and the populated sections of Maricopa County, much of the project-related growth could occur in the thinly settled southern part of the county. Such growth could substantially change the less-developed character of this rural portion of the county. In the area near Gila Bend, the population is projected to increase 2.8 percent per year from 1989 to 1996 without the project and an average of 16 percent per year with the project. As a consequence, the population of the Gila Bend area will be 120 percent higher in 1998 with the project than without the project.

If the MOB is sited at Yuma PG, average annual population growth in Yuma County will increase from 1.7 percent without the project to 3.2 percent with the project. Population change attributable to the proposed project in 1998 will be equivalent to 9.2 percent of baseline population. Since most of the project's activity will occur less than 30 minutes driving time from the most populated portion of the county, only minor changes in the urban-rural character of the Yuma PG vicinity are anticipated.

The proposed project is expected to create about $204 million in personal income in 1990, declining to $117 million by 1998 and thereafter. Consumer spending by project personnel and ROI purchases by the Air Force and the COE's civilian contractors are estimated to reach $160 million in 1990 and decline to $67 million in 1998.

If the MOB is located at Gila Bend AFAF, peak-year (1990) personal income effects will total $179 million in Maricopa County. If the MOB is situated at Yuma PG, $140 million in personal income gains will accrue to Yuma County.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Gila Bend AFAF, nearly all project-related housing demand will occur in the southern area of Maricopa County. In 1990, the initial year of project construction and the peak year for housing requirements, inmigrants will need about 1,600 year-round housing units, 73.8 percent of the total baseline housing stock forecast at about 2,200 permanent units. Projected 1990 available year-round housing vacancies in the Gila Bend area number about 250 units. Occupancy by inmigrating households will use all of these vacancies, creating a considerable shortage. Projections of available temporary accommodations indicate that all of the MOB county's hotel and motel rooms will be occupied during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase and civilian workers will need about 600 permanent housing units. This represents about 21.6 percent of the forecast 1998 housing stock of about 2,700 units and nearly twice the projected available vacancies. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population in the Gila Bend area will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.6 percent to a with-project rate of 78.3 percent. Since the project will increase the baseline growth rate by over 75 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over six times the projected available vacant housing will be needed in this peak year. Long-term housing impacts will be high since over 22 percent of the permanent housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since twice the projected available vacancies will be required.

With the MOB located at Yuma PG, nearly all project-related housing demand will occur in Yuma County. In 1990, inmigrants will need about 1,700 year-round housing units, 4.7 percent of the total baseline housing stock. Projected 1990 available year-round housing vacancies in Yuma County number about 1,900 units. Occupancy by inmigrating households will use 88.6 percent of these vacancies. Projections of available temporary accommodations indicate that about 60 percent of available county hotel and motel rooms will be used by project-related workers during this major construction year. During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 600 permanent housing units. This represents 1.4 percent of the forecast 1998 housing stock and 26.6 percent of projected available vacancies. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 0.8 percent to a with-project rate of 5.5 percent. Since the project will increase the baseline growth rate by 4.7 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since nearly 90 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 1.4 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will not be significant since only 26.6 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Maricopa County will require about 195 additional personnel in 1990, increasing to a peak of 360 employees in 1996. This total includes 26 police and 125 education personnel. In the operations years, the requirements for maintaining existing service levels will drop to 340 positions. Without additional staff, the local government employment ratio for both the peak year and the operations phase is forecast to remain virtually unchanged (346 compared to 345 employees per 10,000 population).

Project-induced local government employment requirements in Maricopa County are expected to increase the growth rate from 3.1 to 3.2 percent between 1990 and 1996. Since the resulting growth rate is only 0.1 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 340 workers will constitute a 0.4-percent increase over the 1998 baseline local government workforce of nearly 94,700. Therefore, the long-term employment impacts will be negligible.

Public education will experience an increase in pupil enrollment of about 1,100 in 1990, rising to a peak of about 2,000 in 1996. Project-related students will increase the annual baseline growth rate of enrollments in the Gila Bend area from 2.8 to 18.7 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,900 students will create a 125.7-percent increase above 1998 baseline enrollment of about 1,500 pupils in the Gila Bend area.

For public services, both short and long-term impacts will be high and significant in Maricopa County. These conclusions reflect potential local government employment impacts that may result in the rural area adjacent to Gila Bend AFAF.

Maintaining existing local government service levels in Yuma County will require 210 additional personnel in 1990, increasing to a peak of 370 employees in 1996. This total includes 22 police and 155 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 9.1 percent (from 352 to 320 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will drop to 340 positions. Without these additional persons, the employment ratio will fall to 323 workers per 10,000 population, a 9-percent drop.

Project-induced local government employment requirements in Yuma County will increase the baseline growth rate of local government employment from 1.7 to 3.2 percent between 1990 and 1996. Since the resulting growth rate is 1.5 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 9.1 percent in the local government employment ratio caused by the proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 350.

During the operations years, project-induced local government employment of 340 workers constitutes an 8.1-percent increase over the 1998 baseline local government workforce of about 4,250. The long-term local government employment impacts will consequently be high. These impacts will be significant since a decline of 8.2 percent in the local government employment ratio caused by the proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 1,100 in 1990, rising to a peak of 2,000 in 1996. Project-related students will increase the baseline growth rate of Yuma County enrollment from 1.7 to 3.1 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,900 students will create an 8-percent increase over 1998 baseline enrollment of 25,000 pupils.

Based on local government employment requirements, short-term public services impacts in Yuma County will be moderate and significant and long-term impacts will be high and significant.

Public Finance. With the MOB at Gila Bend AFAF, Maricopa County's local government expenditures related to the proposed project will increase from $7 million in fiscal year (FY) 1990 to $30.2 million in FY 1998.

Project-related revenues will increase from $6.3 million in FY 1990 to $28.6 million in FY 1998. Project-induced expenditures are expected to exceed project-induced revenues in FY 1990 and FY 1995 to FY 1998. These shortfalls ($700,000 in FY 1990 and ranging up to $1.8 million in FY 1996) represent less than 0.1 percent of baseline revenues of all local governments in those years. The FY 1998 shortfall is estimated to be $1.6 million.

Both short and long-term impacts will be negligible for this alternative since the estimated shortfalls represent less than 0.5 percent of baseline revenues and expenditures in the years when they will occur. However, while the aggregate financial measures indicate negligible effects countywide, substantial project-induced public facility development in the Gila Bend AFAF area is expected. Because of the relatively low assessed valuations in the area and low taxable sales per capita, it is unlikely that this development could be funded through local source revenues. Therefore, fiscal effects on local jurisdictions in the Gila Bend area probably will be more severe than those implied by the countywide indicators.

With the MOB at Yuma PG, Yuma County's local government expenditures should increase under impact conditions from $4.6 million in FY 1990 to $16.7 million in FY 1997. Operations-phase expenditure effects, estimated to be $16.3 million, will occur in the following year (FY 1998).

Project-induced revenues will increase from $3.9 million in FY 1990 to $16 million in FY 1997, and reach operations-phase levels of $15.6 million in FY 1998. Project-induced expenditures are expected to exceed project-induced revenues in FY 1990 and FY 1995 to FY 1998. These shortfalls are estimated to be $700,000 in FY 1990 and range up to $1 million and $700,000 in FY 1996 and FY 1997, respectively. The FY 1998 shortfall is estimated at $700,000.

If Yuma PG is selected as the MOB, short-term public finance impacts in Yuma County will be low and not significant, because project-induced shortfalls represent 0.5 percent of baseline revenues in FY 1996 only. Long-term effects will be negligible because project-induced shortfalls represent less than 1 percent of baseline revenues in FY 1998. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.3.2 Florida Complex

If the Florida Complex is selected, growth impacts in the ROI will be beneficial consequences of the proposed project. In Okaloosa, the MOB county, short-term housing impacts will be moderate and not significant and long-term effects will be beneficial. Both short and long-term public services impacts will be low and not significant. Short and long-term public finance impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 3,650, an increase of 1 percent above baseline ROI employment. This initial-year effect, which is also the peak-employment impact of the proposed project, consists of 2,150 direct (onsite) jobs and 1,500 indirect and induced (offsite) jobs. Of total peak employment, locally hired workers are estimated to number 1,900 or about 52 percent. In the operations phase (1998 and beyond), the proposed project will create about 2,200 jobs, representing 0.5 percent of baseline employment in 1998. About 1,550 (72%) of these jobs will be filled by military personnel, while most of the remaining direct, indirect, and induced jobs will be held by locally hired civilians.

Unemployment rates in the ROI in the first years of the proposed project (1990-1992) are estimated to decrease slightly from a baseline level of 6.5 to 6.3 percent with the project as local workers are hired. In the operations phase, unemployment in the ROI will not change as a result of the project.

In the short term, the number of persons inmigrating to the region because of the proposed project, including both workers and their dependents, is expected to fluctuate between 2,900 and 4,500. The 1990 population change is estimated to be 4,200 persons, falling to 2,900 in 1991, rising to 4,500 in 1994, and finally settling at 3,900 in the operations phase. The 1998 population gain of 3,900 persons represents 0.4 percent of baseline population in that year.

Nearly all of these population gains will be concentrated in Okaloosa County, the site of the MOB. The county's population will increase 5.1 percent between 1989 and 1990 with the project, compared to 2.6 percent without the project. For the entire 1989 to 1994 period, average population growth in the county with the proposed project will increase to 2.8 percent annually from 2.3 percent without the project. By 1998, project-related population gains will represent 2.2 percent of baseline population.

About $85 million of personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to fall to $44 million by 1998. Okaloosa County will experience income gains of $62 million in 1990, falling to $40 million in 1998. Spending by proposed project personnel, along with Air Force, COE, and contractor purchases in the ROI, will total $73 million in 1990. Spending will decline to $27 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Eglin AFB, nearly all of project-related housing demand will occur in Okaloosa County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,000 year-round housing units, 2 percent of the total baseline housing stock forecast at about 55,300 permanent units. Projected 1990 available year-round housing vacancies in Okaloosa County number about 3,600 units. Occupancy by inmigrating households will use 30.4 percent of these vacancies. Projections of available temporary accommodations indicate that the required 300 units will use 9 percent of the county's hotel and motel rooms during this major construction year. During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian

workers, will need about 600 permanent housing units. This represents 0.9 percent of the forecast 1998 housing stock of nearly 65,600 units and 14.2 percent of projected available vacancies. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.6 percent to a with-project rate of 4.6 percent. Since the project will increase the baseline growth rate by 2 percentage points, the potential short-term housing impacts will be moderate. Short-term impacts will not be significant since only 30 percent of available vacant housing will be needed in this peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Okaloosa County will require 120 additional personnel in 1990, increasing to a peak of 140 employees in 1994. This total includes 10 police and 40 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 2.5 percent (321 to 313 employees per 10,000 population). In the operations years, the requirement for maintaining existing service levels will decline to 130 positions. Without these additional persons, the operations-phase employment ratio will fall to 314 workers per 10,000 population, a 2.2-percent drop.

Project-induced local government employment requirements in Okaloosa County will increase the baseline growth rate from 3.3 to 3.9 percent between 1990 and 1994. Since the resulting growth rate is 0.6 percentage point above the baseline rate, short-term local government employment impacts will be low. These impacts will not be significant since a 2.5-percent decrease in the employment ratio caused by proposed project population will not result in an appreciable reduction in the level of service.

During the operations years, project-induced local government employment of 130 workers will constitute a 2.2-percent increase over the 1998 baseline workforce of nearly 5,800. Consequently, the long-term local government employment impacts will be low. These impacts will not be significant since a 2.2-percent decline in the local government employment ratio caused by the proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 700 in 1990, rising to a peak of 850 in 1994. Project-related students will increase the baseline growth rate of Okaloosa County enrollment from 3.3 to 3.8 percent between 1990 and 1994. During the operations years, project-induced enrollment of 750 students will create a 1.9-percent increase over 1998 baseline enrollment of 39,500 pupils.

Based on local government employment requirements, short and long-term public services impacts in Okaloosa County will be low and not significant.

Public Finance. Total project-induced expenditures of all local governments in Okaloosa County will increase from $2.6 million in FY 1990 to $6.4 million in FY 1995. Expenditures will decline slightly over the next 2 years and reach operations-phase levels of $6.3 million in FY 1998.

Project-induced revenues follow a similar pattern, increasing from $2.2 million in FY 1990 to $6.1 million in FY 1995, then decreasing slightly over the next 2 years and reaching operations-phase levels of $5.8 million in FY 1998. Project-induced expenditures will exceed revenues in all years during the project, except FY 1992.

Both short and long-term public finance impacts in Okaloosa County will be negligible because the estimated shortfalls ($400,000 in FY 1990, $300,000 in FY 1991, and ranging from $200,000 to $500,000 in the remaining years) represent less than 0.5 percent of baseline revenues in the years when they will occur. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.3.3 Nevada Complex

If the Nevada Complex is selected, the MOB county will be Clark County, where both Indian Springs AFAF and Nellis AFB are located. Regional growth impacts will be beneficial consequences of the proposed project. Short-term housing impacts will be low and not significant and long-term impacts will be beneficial. Short-term public services impacts will be negligible and long-term impacts will be low and not significant. Short-term public finance impacts will be beneficial and long-term impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 6,900, 1.9 percent above baseline ROI employment. The 1990 job impact will consist of 3,500 direct (onsite) jobs and 3,400 indirect-induced (offsite) jobs. Locally hired workers are estimated to number about 4,800 or 72 percent of the jobs created by the proposed project. In the operations phase, the proposed project will create about 5,400 jobs, representing about 1.1 percent of baseline employment in 1998. Approximately 3,900 (73%) of these jobs will be military, while locally hired civilians will fill most of the remaining direct, indirect, and induced jobs.

The ROI unemployment rates in 1990 and 1993 are expected to be measurably lower with the proposed project than without the project. In particular, unemployment is assumed to be 7.2 percent in 1990 without the project, but initial-year civilian job creation will lower this figure to 6.3 percent with the project. In the operations phase, unemployment in the ROI will not change as a result of the project.

Population gains in the ROI are projected to increase from 4,800 persons in 1990 to 10,400 in 1996, and decline to 9,800 in 1998. Impacts in the 1996 to 1998 period represent 1.1 to 1.2 percent of projected baseline ROI population in those years. This population increase is projected to occur in Clark County (metropolitan Las Vegas). Between 1989 and 1990, the proposed project will raise the rate of population increase in the county from 2.6 percent without the project to 3.3 percent with the project. Between 1989 and 1996, Clark County's growth rate will rise only slightly as a result of the proposed project, from an average of 2.9 percent per year without Small ICBM deployment to 3.1 percent with deployment. Operations-phase (1998) population impacts will represent 1.2 percent of baseline population.

Approximately $200 million in personal income gains will be generated by the proposed project in 1990, with operations-phase gains of $108 million in 1998 and thereafter. Nearly all of these increases will accrue to Clark County. Air Force, COE, and contractor purchases, plus consumer spending by onsite project workers, are projected to total $165 million in 1990, declining to $68 million by 1998.

The Department of Energy (DOE) is studying plans to develop a radioactive waste repository at Yucca Mountain on the Nevada Test Site in the ROI. The DOE projects a maximum population increase of 25,500 persons as a result of repository construction, and up to 20,400 persons resulting from its operations. The timing of this activity, if it occurs, is unknown.

Peak construction-related population changes could occur in the 1994 to 1997 time period. Since this is the period of largest population change from the Small ICBM project, population growth from the two projects combined could cumulatively amount to about 36,000 persons within the ROI.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. Regardless of the location of the MOB, nearly all of the project-related housing demand will occur in Clark County. In 1990, the initial year of project construction and the peak year for housing requirements, inmigrants will need about 1,400 year-round housing units, 0.5 percent of the total baseline housing stock forecast at about 265,100 permanent units. Projected 1990 available year-round housing vacancies in Clark County number about 17,000 units. Occupancy by inmigrating households will use 8 percent of these vacancies. Projections of available temporary accommodations indicate that the required 400 units in 1990 will use 1.4 percent of the county's hotel and motel rooms during this major construction year. During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 1,500 permanent housing units. This represents 0.5 percent of the forecast 1998 housing stock of nearly 335,900 units and 7 percent of projected available vacancies. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.6 percent to a with-project rate of 3.1 percent. Since the project will increase the baseline growth rate by only 0.5 percentage point, the potential short-term housing impacts will be low. Short-term impacts will not be significant since only 8 percent of available vacant housing will be needed in this peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Clark County will require 150 additional personnel in 1990, increasing to a peak of 325 employees in 1996. This total includes 30 police and 160 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 1.3 percent (313 to 309 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 310 positions. Without these

additional persons, the operations-phase employment ratio will fall to 309 workers per 10,000 population, a 1.3-percent drop.

Project-induced local government employment requirements in Clark County will increase the baseline growth rate of local government employment from 3 to 3.2 percent between 1990 and 1996. Since the resulting growth rate is 0.2 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 310 workers will constitute a 1.2-percent increase over the 1998 baseline workforce of nearly 26,200. The long-term local government employment impacts will therefore be low. These long-term impacts will not be significant since a 1.3-percent decline in the employment ratio caused by proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollments of about 900 in 1990, rising to a peak of 2,000 in 1996. Project-related students will increase the baseline growth rate of Clark County enrollments from 3 to 3.2 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,900 students will create a 1.2-percent increase over 1998 baseline enrollment of over 150,000 pupils.

Based on local government employment requirements, short-term public services impacts in Clark County will be negligible and long-term impacts will be low and not significant.

Public Finance. Total project-induced expenditures of all local governments in Clark County will increase from $3.6 million in FY 1990 to $15.5 million in FY 1997. Expenditures will reach operations-phase levels of $15 million in FY 1998.

Project-related revenues will increase from $3.8 million in FY 1990 to $14.6 million in the peak year (FY 1997), then will fall slightly to operations-phase levels of $14.2 million in FY 1998. Project-induced expenditures will exceed revenues in FY 1995 and thereafter. These shortfalls are estimated at $500,000 in FY 1995, $900,000 in FY 1996 and FY 1997, and $800,000 in FY 1998 and thereafter.

Short-term public finance impacts will be beneficial because project-related revenues exceed project-related expenditures during the construction phase. Long-term impacts will be negligible because project-induced shortfalls represent less than 1 percent of baseline revenues in FY 1998 and thereafter. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.3.4 New Mexico Complex

The socioeconomic impacts of the proposed project depend on the location of the MOB. Three impact analyses were performed: (1) with the MOB at Fort Bliss (El Paso County, Texas), (2) with the MOB at Holloman AFB (Otero County, New Mexico), and (3) with the MOB at White Sands Missile Range Headquarters (Dona Ana County, New Mexico). Socioeconomic impacts in the ROI will vary little,

regardless of the installation selected as the MOB. However, the intraregional distribution of these effects will vary with the MOB. For each element of the socioeconomic analysis, impacts are discussed first for an MOB at Fort Bliss, followed by analyses of impacts for Holloman AFB and White Sands Missile Range Headquarters.

If the New Mexico Complex is selected, growth impacts in the ROI will be beneficial consequences of the proposed project. Short-term housing impacts will be low and not significant in El Paso County and high and significant in Otero and Dona Ana counties. Long-term housing impacts will be beneficial in El Paso County, high and significant in Otero County, and low and not significant in Dona Ana County. For public services in El Paso County, short-term impacts will be negligible and long-term impacts will be low and not significant. In Otero County, short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. In Dona Ana County, short-term public service impacts will be low and not significant and long-term impacts will be high and not significant. Short-term public finance impacts will be negligible in El Paso County, low and significant in Otero County, and negligible in Dona Ana County. El Paso, Otero, and Dona Ana counties will all experience long-term, negligible public finance impacts.

Regional Growth. Project-related employment will begin in 1990, with total workforce requirements (direct, indirect, and induced) estimated at 6,900, about 2 percent above forecast baseline ROI employment. This initial-year impact, consisting of 3,500 direct (onsite) jobs and 3,400 indirect-induced (offsite) jobs, represents the peak-employment impact of the proposed project. Approximately 4,800 of these jobs (69% of the total) will be filled by local hires. In the operations phase (1998 and thereafter), the proposed project will create 5,450 jobs, or 1.3 percent of baseline employment. About 3,950 of these jobs will be direct, while the remaining 1,500 will be indirect and induced jobs. Approximately 72 percent of all operations-phase jobs will be filled by military personnel inmigrating from outside the ROI.

The proposed project will lower construction-phase ROI unemployment rates (from 7.9% in 1990 without the proposed project to 7.1% with the project) as local workers are hired. In the operations phase, unemployment in the ROI will remain at its baseline level.

Population growth in the ROI associated with the proposed project, including both workers and their dependents, will rise from 5,200 persons in 1990 to a peak of 10,400 in 1996. This will be 1.1 percent of projected 1996 ROI baseline population. Population effects are estimated at 9,800 persons in 1998 and thereafter (1% of 1998 ROI baseline population).

The distribution of project-related population growth within the ROI will depend on the location of the MOB. The MOB county population will be between 4,500 and 5,000 persons in 1990, 10,350 in 1996, and 9,800 in 1998 and thereafter. With the MOB located at Fort Bliss, El Paso County's average population growth rate for the 1989 to 1996 period will increase only marginally, from 2.3 percent per year without the proposed project to 2.5 percent with the project. County population impacts in 1998 will represent 1.3 percent of baseline county population in that year.

If the MOB is located at Holloman AFB in Otero County, the influx of proposed project workers and their dependents will raise Otero County's 1989 to 1996 annual average population growth rate from 2.3 percent without the project to 4.4 percent with the project. The 1998 population change resulting from the proposed project will amount to 14.2 percent of county baseline population.

Locating the MOB at White Sands Missile Range Headquarters will raise Dona Ana County's 1989 to 1996 population growth rate from 2.1 percent per year without the project to 3 percent with the project. Population change in 1998 from the project will represent 6.4 percent of county baseline population.

In 1990, the first year of construction, the proposed project is expected to generate about $160 million in ROI personal income. This will decline to $107 million in 1998 and thereafter. Consumer spending by project personnel, in addition to ROI procurement by the Air Force and its project contractors, is estimated to peak at $151 million in 1990 and then decline to $66 million by 1997.

With the MOB at Fort Bliss, $143 million (89% of ROI income gains) will go to El Paso County. This high county total will be a result of the greater ability of the El Paso area to provide materials and services needed for project construction. With the MOB located at Holloman AFB, the peak-year (1990) personal income effects will total $98 million (61% of ROI income gains from the project) in Otero County. If the MOB is sited at White Sands Missile Range Headquarters, $104 million (65% of total ROI gains) will accrue to Dona Ana County residents.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Fort Bliss, nearly all project-related housing demand will occur in El Paso County. In 1990, the initial year of project construction and the peak year for housing requirements, inmigrants will need about 1,400 year-round housing units, 0.7 percent of the total baseline housing stock forecast at about 191,900 permanent units. Projected 1990 available year-round housing vacancies in El Paso County number about 6,400 units. Occupancy by inmigrating households will use 22.6 percent of these vacancies. Projections of available temporary accommodations indicate that 9.6 percent of the county's available hotel and motel rooms will be used during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 600 permanent housing units. This represents 0.3 percent of the forecast 1998 housing stock of 229,600 units and 7.7 percent of projected available vacancies. Needs for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.8 percent to a with-project rate of 3.6 percent. Since the project will increase the baseline growth rate by only 0.8 percentage point, the potential short-term housing impacts will be low. Short-term impacts will not be significant since only 22.6 percent of available vacant

housing will be needed in the peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

With the MOB located at Holloman AFB, nearly all project-related housing demand will occur in Otero County. In 1990, inmigrants will need about 1,300 year-round housing units, 6.4 percent of the total baseline housing stock forecast at about 20,300 permanent units. Projected 1990 available year-round housing vacancies in Otero County number about 1,200 units. Occupancy by inmigrating households will require over 100 percent of these vacancies. Projections of available temporary accommodations indicate that the required 400 units will use all of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase, including some civilian workers, will need about 1,500 permanent housing units. This represents 6.3 percent of the forecast 1998 housing stock of nearly 24,000 units and over 100 percent of projected available vacancies. Needs for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.8 percent to a with-project rate of 9.4 percent. Since the project will increase the baseline growth rate by 6.6 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the initial year. Long-term housing impacts will be high since 6.3 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since over 100 percent of projected available vacancies will be required.

With the MOB located at White Sands Missile Range Headquarters, nearly all project-related housing demand will occur in Dona Ana County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,300 year-round housing units, 3 percent of the total baseline housing stock forecast at about 43,800 permanent units. Projected 1990 available year-round housing vacancies in Dona Ana County number about 2,400 units. Occupancy by inmigrating households will use 55.4 percent of these vacancies. Projections of available temporary accommodations indicate that 80.4 percent of the county's hotel and motel rooms will be used during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase, including some civilian workers, will need about 600 permanent housing units. This represents 1.1 percent of the forecast 1998 housing stock of nearly 51,000 units and 21.3 percent of projected available vacancies. Needs for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.5 percent to a with-project rate of 5.6 percent. Since the project will increase the baseline growth rate by 3.1 percentage points, the potential short-term housing impacts will be high. Short-term impacts

will be significant since over 50 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 1.1 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact is not significant since only 21.3 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in El Paso County will require 185 additional personnel in 1990, increasing to a peak of 380 employees in 1996. This total includes 25 police and 140 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 1.4 percent (370 to 365 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 360 positions. Without these additional persons, the long-term employment ratio will fall to 365 workers per 10,000 population, a 1.4-percent drop.

Project-induced local government employment requirements in El Paso County will increase the baseline growth rate of local government employment from 2.3 to 2.5 percent between 1990 and 1996. Since the resulting growth rate is 0.2 percentage point above the baseline rate, short-term employment impacts will be negligible.

During the operations years, project-induced local government employment of 360 workers will constitute a 1.3-percent increase over the 1998 baseline workforce of nearly 28,000. The long-term local government employment impacts will consequently be low. These impacts will not be significant since a 1.4-percent decline in the employment ratio as a result of proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollments of about 1,000 in 1990, rising to a peak of 2,000 in 1996. Project-related students will increase the baseline growth rate of El Paso County enrollments from 2.3 to 2.5 percent between 1990 and 1996.

During the operations years, project-induced enrollments of 1,900 students will create a 1-percent increase over 1998 baseline enrollments of about 185,000 pupils.

Based on local government employment requirements, short-term public services impacts in El Paso County will be negligible and long-term impacts will be low and not significant.

Maintaining existing local government service levels in Otero County will require 130 additional personnel in 1990, increasing to a peak of 300 employees in 1996. This total includes 25 police and 140 education personnel. Without additional staff, the employment ratio in the peak year will decline 13.4 percent (291 to 252 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will drop to 290 positions. Without these additional persons, the operations-phase employment ratio will fall to 255 workers per 10,000 population, a 12.4-percent drop.

Project-induced local government employment requirements in Otero County will increase the baseline growth rate from 2.2 to 4.7 percent between 1990 and 1996. Since the resulting growth rate is 2.5 percentage points above the baseline rate, short-term employment impacts will be moderate. These impacts will be significant since a decline of 13.4 percent in the employment ratio from the proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 331.

During the operations years, project-induced local government employment of 290 workers will constitute a 14.2-percent increase over the 1998 baseline local government workforce of nearly 2,000. The long-term employment impacts will consequently be high. These impacts will be significant since a 12.4-decline in the employment ratio as a result of proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollments of about 900 in 1990, rising to a peak of 2,000 in 1996. Project-related students will increase the baseline growth rate of Otero County enrollments from 2.2 to 4.3 percent between 1990 and 1996.

During the operations years, project-induced enrollments of 1,900 students will create a 12.2-percent increase over the 1998 baseline enrollment of approximately 15,400 pupils.

Based on local government employment requirements, short-term public services impacts in Otero County will be moderate and significant and long-term impacts will be high and significant.

Maintaining existing local government service levels in Dona Ana County will require 200 additional personnel in 1990, increasing to a peak of 460 employees in 1996. This total includes 15 police and 180 education personnel. Without additional staff, the employment ratio in the peak year will decline 6.5 percent (449 to 420 employees per 10,000 population). In the operations years, the requirement for maintaining existing service levels will drop to 440 positions. Without these additional persons, the operations-phase employment ratio will fall to 421 workers per 10,000 population, a 6.2-percent drop.

Project-induced local government employment requirements in Dona Ana County will increase the baseline growth rate from 2 to 3.1 percent between 1990 and 1996. Since the resulting growth rate is 1.1 percentage points above the baseline rate, short-term employment impacts will be low. These impacts will not be significant since a decline of 6.7 percent in the employment ratio caused by the proposed project population will not result in an appreciable reduction in the level of service. The with-project rate will remain above the state average of 331.

During the operations years, project-induced local government employment of 440 workers will constitute a 6.4-percent increase over the 1998 baseline workforce of about 6,800. The long-term employment impacts will therefore be high. These impacts will not be significant since a 6.2-percent decline in the employment ratio caused by proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollments of about 900 in 1990, rising to a peak of 2,000 in 1996. Project-related students will increase the baseline growth rate of Dona Ana County enrollments from 2 to 3 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,900 students will create a 5.2-percent increase over 1998 baseline enrollment of about 36,000 pupils.

Based on local government employment requirements, short-term public services impacts in Dona Ana County will be low and not significant and long-term impacts will be high and not significant.

Public Finance. If the MOB is located at Fort Bliss, total project-related expenditures of all local governments in El Paso County will increase from $3.6 million in FY 1990 to $16.2 million in FY 1997. Expenditures will reach operations-phase levels of $15.9 million in FY 1998.

Project-related revenues are estimated to increase from $2.9 million in FY 1990 to $15.3 million in FY 1997, and reach operations-phase levels of $15.2 million in FY 1998. Project-induced expenditures exceed revenues in FY 1990 and FY 1995 to FY 1998.

Both short and long-term public finance impacts will be negligible because the estimated shortfalls ($700,000 in FY 1990 and ranging up to $1.2 million in FY 1996) represent less than 0.5 percent of countywide revenues in the years when the shortfalls will occur. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

If the MOB is located at Holloman AFB, total expenditures of all local governments in Otero County will increase from $2 million in FY 1990 to $9.2 million in FY 1997. Operations-phase (FY 1998), project-induced expenditures will be $9 million.

Project-related revenues are estimated to increase from $1.8 million in FY 1990 to $8.8 million in FY 1997, and reach operations-phase levels of $8.6 million in FY 1998. Project-related expenditures will exceed project-related revenues in all years except FY 1991 to FY 1993. These shortfalls are estimated to be $200,000 in FY 1990 and range between $100,000 and $500,000 in the remaining years. The short-term impact will be low and significant because project-induced shortfalls represent between 0.5 and 1.5 percent of baseline revenues and expenditures in FY 1995 to 1997 during the build-up phase. The long-term (FY 1998 and after) impact will be negligible because project-induced shortfalls represent less than 1 percent of baseline revenues and expenditures in that year. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

If the MOB is located at White Sands Missile Range Headquarters, total expenditures of all local governments in Dona Ana County will increase from $3.4 million in FY 1990 to $15.9 million in FY 1997. Expenditures will decline from this peak and reach operations-phase levels of $15.6 million in FY 1998.

Project-related revenues are estimated to increase from $3.3 million in FY 1990 to $15.7 million in FY 1997, and reach operations-phase levels of $15.4 million in FY 1998. Project-induced expenditures will exceed revenues in FY 1990 and FY 1995 to FY 1998. These shortfalls are estimated to be $100,000 in FY 1990 and range from $200,000 to $300,000 in the remaining years.

Both short and long-term public finance impacts will be negligible because project-related shortfalls represent less than 0.5 percent of baseline revenues in the years when they will occur. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.3.5 South-Central California Complex

The ROI for this analysis is one of the largest population and economic activity regions in the United States. However, the two deployment areas under consideration are situated in the region's remote and sparsely settled Mojave Desert area. One of the MOB locations, Edwards AFB, encompasses parts of Kern, Los Angeles, and San Bernardino counties, with its onbase population residing in southeastern Kern County and the largest nearby communities (Lancaster and Palmdale) located in northeastern Los Angeles County. Fort Irwin NTC, the other potential MOB location, is in north-central San Bernardino County, northeast of Barstow. Although socioeconomic effects in the ROI will be similar regardless of the MOB location chosen, the distribution of these impacts will depend on the MOB site, with communities nearest the chosen base experiencing most of the effects. Proposed project consequences are discussed for both the Edwards AFB and Fort Irwin NTC MOB locations.

If the South-Central California Complex is selected, the regional growth impacts will be beneficial consequences of the proposed project. With Edwards AFB as the MOB, short-term housing impacts will be moderate and significant and long-term impacts will be low and significant. Short-term public services impacts will be negligible and long-term impacts will be moderate and significant. Short-term impacts for public finance will be beneficial and long-term impacts will be negligible. With Fort Irwin NTC as the MOB, short-term housing impacts will be moderate and significant and long-term impacts will be beneficial. Short and long-term public services impacts will be negligible. Short and long-term public finance impacts will be negligible.

Regional Growth. In the first year of project-related employment (1990), total (direct, indirect, and induced) employment gains are estimated at 8,000, an increase of 0.1 percent above baseline ROI employment. This initial-year impact, which also is the peak-employment impact year of the proposed project, consists of 3,500 direct (onsite) jobs and 4,500 indirect-induced (offsite) jobs. Of the total peak employment, locally hired workers are estimated to be 6,300 or about 79 percent. In the operations phase, the proposed project will create about 5,900 jobs, representing 0.1 percent of baseline employment in 1998. About 3,900 (66%) of these jobs will be filled by military personnel, while nearly all of the remaining 2,000 direct, indirect, and induced jobs will be held by locally hired civilians.

Slight decreases in ROI unemployment rates will occur in the first years of the proposed project (1990-1991), though the ROI's civilian labor force is so large these changes will be hardly measurable. In the operations phase, unemployment in the ROI will not change as a result of the proposed project.

Population inmigration to the region resulting from the proposed project, including both workers and their dependents, is expected to increase from 4,100 in 1990 to 10,400 in 1996, settling at 9,800 in the operations phase. The 1998 population gain of 9,800 persons represents 0.1 percent of baseline population in that year.

Most workers and their dependents inmigrating to the area and not residing onbase are likely to reside in the largest nearby communities of northeastern Los Angeles County. Population gains in this general area will total 4,000 persons in 1990, declining to 3,000 persons in 1991, and stabilizing at 4,000 persons by 1998. This portion of Los Angeles County is forecast by the Southern California Association of Governments (SCAG) to have a population of 157,700 persons in 1990, increasing to 205,200 in 1998. The proposed project will add negligibly to the area's growth rate during this period. Project-related population gains will represent 2.6 percent of the area's baseline population in 1990 and 1.9 percent of the population in 1998.

Onbase population gains will occur in Kern County, where Edwards AFB is located. The project-related population at this base will rise rapidly from less than 50 persons in 1990 to 5,800 persons by 1998, and remain at that level thereafter.

With the MOB at Fort Irwin NTC, both onbase and offbase population increases, ranging from 4,100 persons in 1990 to 3,500 in 1991 before rising to a permanent level of 9,800 persons in 1998, are expected to occur largely in San Bernardino County. The Barstow-Victorville area, south of Fort Irwin NTC, is forecast by SCAG to have a 1990 population of 139,600, rising to 181,200 in 1998. The proposed project will raise the area's average growth rate from 3.3 percent per year under baseline conditions to 3.7 percent annually with the project. In 1998, population gains resulting from the proposed project will represent 5.4 percent of the forecast baseline population.

The proposed project will create approximately $236 million in personal income in the region in 1990 and about $125 million in the operations phase. With the MOB at Edwards AFB, Los Angeles County will gain about $217 million in personal income in 1990 and $58 million in 1998. Kern County income benefits will rise from $3 million in 1990 to $63 million in 1998. If the MOB is located at Fort Irwin NTC, income gains in San Bernardino County will total $168 million in 1990 and about $108 million in 1998. Procurement in the ROI by the DOD and its contractors, in addition to consumer purchases by proposed project personnel, is expected to total $176 million in 1990 and fall to $67 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

<u>Housing</u>. With the MOB located at Edwards AFB, almost all project-related housing demand, excluding military personnel housed onbase in Kern County, will occur in the northeast area of Los Angeles County. In 1990, the initial

year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,200 year-round housing units, 2 percent of the total baseline housing stock forecast at about 57,200 permanent units. Projected 1990 available year-round housing vacancies in the area number about 2,300 units. Occupancy by inmigrating households will use 50.3 percent of these vacancies. Projections of available temporary accommodations indicate that the required 300 units in 1990 will use 75.8 percent of the area's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 1,500 permanent housing units. This represents 2 percent of the forecast 1998 housing stock of about 74,400 units and 50.2 percent of the projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 3.8 percent to a with-project rate of 5.9 percent. Since the project will increase the baseline growth rate by 2.1 percentage points, the potential short-term housing impacts will be moderate. Short-term impacts will be significant since over 50 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 2 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since over 50 percent of projected available vacancies will be required.

With the MOB at Fort Irwin NTC, nearly all project-related housing demand will occur in the Barstow-Victorville area of San Bernardino County. In 1990, inmigrants will need about 1,200 year-round housing units, 2.3 percent of the total baseline housing stock forecast at about 50,400 permanent units. Projected 1990 available year-round housing vacancies in this area of San Bernardino County number about 2,000 units. Occupancy by inmigrating households will use 57.2 percent of these vacancies. Projections of available temporary accommodations indicate that the required 300 units in 1990 will use 22.7 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 600 permanent housing units. This represents 0.9 percent of the forecast 1998 housing stock of 65,500 units and 22.2 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 2.8 percent to a with-project rate of 5.2 percent. Since the project increases the baseline growth rate by 2.4 percentage points, the potential short-term housing impacts will be moderate. Short-term impacts will be significant since over 50 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Los Angeles County will require 150 additional personnel in 1990, increasing to a peak of 160 employees in 1996. This total includes 10 police and 50 education personnel. Without additional staff, the local government employment ratio in the peak year will remain virtually unchanged (355 compared to 356 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 140 positions. Without hiring these additional persons, the operations-phase local government employment ratio will not change measurably.

Project-induced local government employment requirements in Los Angeles County will not affect the baseline growth rate of 0.5 percent between 1990 and 1996. Since the growth rate will remain unchanged, short-term employment impacts will be negligible.

During the operations years, project-induced local government employment of 140 workers will constitute a minimal increase over the 1998 baseline workforce of over 300,000. Consequently, the long-term local government employment impacts will be negligible.

Public education will experience an increase in pupil enrollment of about 800 in 1990, increasing to a peak of 900 in 1996. Project-related students will increase the baseline growth rate of Los Angeles County enrollment in the Edwards AFB area from 3.6 to 4 percent between 1990 and 1996. During the operations years, project-induced enrollment of 800 students will create a 2-percent increase over 1998 baseline enrollment of about 40,000 pupils.

The children of military personnel housed at Edwards AFB will attend schools in Kern County. During the operations years of the proposed project, about 1,100 additional students will be added to the baseline enrollment of about 8,000 pupils.

Based on local government employment requirements, short-term public service impacts for Edwards AFB will be negligible and long-term impacts will be moderate and significant because of school impacts in Kern County.

Maintaining existing local government service levels in San Bernardino County will require 130 additional personnel in 1990, increasing to a peak of 325 employees in 1996. This total includes 20 police and 120 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 1 percent (311 to 308 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will drop to 305 positions. Without these additional persons, the operations-phase employment ratio will fall to 309 workers per 10,000 population, a 0.6-percent drop.

Project-induced local government employment requirements in San Bernardino County will increase the baseline growth rate of local government employment from 2.3 to 2.4 percent between 1990 and 1996. Since the resulting growth rate is 0.1 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 305 workers will constitute a 0.7-percent increase over the 1998 baseline

workforce of nearly 47,000. The long-term employment impacts will therefore be negligible.

Public education will experience an increase in pupil enrollment of about 800 in 1990, rising to a peak of 2,000 students in 1996. Project-related students will increase the baseline growth rate of enrollments in the Fort Irwin NTC area of San Bernardino County from 3 to 4 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,900 students will create a 4.9-percent increase above 1998 baseline enrollment of over 38,800 pupils.

For overall public services based on local government employment requirements, short and long-term impacts will be negligible in San Bernardino County.

Public Finance. With Edwards AFB as the MOB, Los Angeles County's local government expenditures related to the proposed project are estimated to be $4.4 million in FY 1990 and $9.4 million in the peak year (FY 1996). In FY 1998, expenditures will decline and reach operations-phase levels of $8.8 million.

Project-related revenues, estimated to be $4.5 million in FY 1990, will peak at $9.3 million in FY 1996 and reach operations-phase levels of $8.7 million in FY 1998. Project-induced revenues exceed expenditures during the build-up phase (FY 1990-1995), while shortfalls of $100,000 are estimated in FY 1996 and 1998.

Short-term public finance impacts will be beneficial because project-induced revenues exceed expenditures over the FY 1990 to FY 1995 period. Long-term impacts will be negligible since project-induced shortfalls represent less than 0.1 percent of countywide revenues and expenditures in the years when they will occur. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators. Sixty percent of the military personnel are expected to live onbase in Kern County and local governments will probably experience the greatest increase in expenditures, particularly during the operations phase. However, the greatest increase in revenues is expected to occur in the Lancaster-Palmdale area of Los Angeles County, where most new offbase housing and commercial activity is expected to occur.

With Fort Irwin NTC as the MOB, San Bernardino County's local government expenditures related to the proposed project are estimated at $3.2 million in FY 1990, rising to $15.5 million in FY 1997. Operations-phase (FY 1998), project-induced expenditures are estimated at $15 million.

Project-related revenues are estimated to increase from $2.9 million in FY 1990 to $14.5 million in FY 1997, leveling off at $14.1 million in FY 1998 for the duration of the proposed project. Project-induced expenditures will exceed revenues in FY 1990 and FY 1995 to FY 1998. These shortfalls are estimated to be $300,000 in FY 1990 and range from $700,000 to $1.2 million in FY 1995 to FY 1998.

The short and long-term impacts in San Bernardino County will be negligible because project-induced shortfalls represent less than 0.5 percent of baseline revenues in the years when they will occur. However, fiscal effects on

individual local governments may be more severe than those implied by the countywide indicators.

4.1.3.6 Washington Complex

If the Washington Complex is selected, growth impacts in the ROI will be beneficial consequences of the proposed project. In Yakima, the MOB county, short-term housing impacts will be low and not significant and long-term impacts will be beneficial. Short and long-term public service impacts will be low and not significant. Both short and long-term public finance impacts will be negligible.

Regional Growth. Project-related employment will reach measurable levels in 1990, with a total workforce (direct, indirect, and induced) estimated at 3,900, an increase of 1.8 percent above baseline ROI employment. This 1990 increase, which is also the peak-employment impact of the proposed project, consists of 2,100 direct (onsite) jobs and 1,800 indirect-induced (offsite) jobs. Of total 1990 employment, locally hired workers are estimated to number 2,500 (about 64%). In the operations phase (1998 and thereafter), the proposed project will create about 2,100 jobs, representing 0.9 percent of baseline employment in 1998. Approximately 1,550 (74%) of these jobs will be military, while most of the remaining 550 (direct, indirect, and induced jobs) will be held by locally hired civilians.

Local project hiring is expected to reduce ROI unemployment rates below baseline levels in 1990, from 10 percent without the project to 9.3 percent with the project. In the operations phase, unemployment in the ROI will change slightly as a result of the proposed project.

The project-related population inmigration to the ROI, including both workers and their dependents, is expected to fluctuate between 2,300 and 4,400. The initial-year (1990) population change is estimated at 3,400 persons, falling to 2,300 in 1991, rising to 4,400 in 1994, and stabilizing at 3,900 in the operations phase. The 1998 population gain of 3,900 persons represents 0.8 percent of the ROI baseline population in that year.

Yakima County's population will increase 3 percent between 1989 and 1990 with the proposed project, compared to 1.3 percent without the project. For the entire 1989 to 1994 period, average population growth in the county with the project will increase to 1.8 percent annually from 1.5 percent without the project. By 1998, project-related population gains will represent 1.8 percent of baseline population.

About $114 million of personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to fall to $43 million by 1998. Yakima County will experience income gains of $100 million in 1990, falling to $40 million in 1998. Spending in the ROI by project personnel, along with Air Force, COE, and contractor purchases in the area, will total $83 million in 1990. Spending is expected to decline to $27 million by 1998.

The DOE is considering plans to locate a radioactive waste repository at the DOE Hanford Site within the ROI. The peak-population change resulting from siting the repository in the area is projected by DOE at 2,900 persons in 1994 and less than 1,000 persons after the year 2000. With a peak-population

change from Small ICBM deployment of about 4,400 persons in 1994, the two projects combined could add over 7,000 people to the ROI's population during this period.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Yakima FC, nearly all of project-related housing demand will occur in Yakima County. In 1990, the initial year of project construction and the peak year for housing requirements, inmigrants will need about 1,000 year-round housing units, 1.3 percent of the total baseline housing stock forecast at about 71,900 permanent units. Projected 1990 available year-round housing vacancies in Yakima County number about 2,700 units. Occupancy by inmigrating households will use 36.3 percent of these vacancies. Projections of available temporary accommodations indicate that the required 300 units in 1990 will use 16.7 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian workers, will need about 600 permanent housing units. This represents 0.7 percent of the forecast 1998 housing stock of nearly 80,900 units and 20.1 percent of projected available vacancies. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 1.3 percent to a with-project rate of 2.6 percent. Since the project will increase the baseline growth rate by only 1.3 percentage points, the potential short-term housing impacts will be low. Short-term impacts will not be significant since only 36 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Yakima County will require 90 additional personnel in 1990, increasing to a peak of 120 employees in 1994. Without additional staff, the local government employment ratio in the peak year will decline 2.2 percent (273 to 267 employees per 10,000 population). In the operations years, maintaining existing service levels will require an additional 110 positions. Without these additional persons, the operations-phase employment ratio will fall to 268 workers per 10,000 population, a 1.8-percent decline.

Project-induced public employment requirements in Yakima County will increase the baseline growth rate of local government employment from 2.3 to 2.8 percent between 1990 and 1994. Since the resulting growth rate is 0.5 percentage point above the baseline rate, short-term local government employment impacts will be low. These impacts will not be significant since a 2.2-percent decline in the employment ratio from proposed project population will not result in an appreciable reduction in the level of service.

During the operations years, project-induced local government employment of 110 workers will constitute a 1.8-percent increase over the 1998 baseline workforce of nearly 6,000. The long-term local government employment impacts

will consequently be low. These long-term impacts will not be significant since a 1.8-percent decline in the employment ratio from proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 800 students in 1994. Project-related students will increase the baseline growth rate of Yakima County enrollment from 2.3 to 2.7 percent between 1990 and 1994. During the operations years, project-induced enrollment of 750 students will create a 1.7-percent increase over 1998 baseline enrollment of nearly 44,000 pupils.

Based on local government employment requirements, short and long-term public services impacts in Yakima County will be low and not significant.

Public Finance. Total project-induced expenditures of all local governments in Yakima County are estimated to be $2.2 million in FY 1990, rising to a peak of $6 million in FY 1995. Expenditures will decline from this peak and reach operations-phase levels of $5.8 million in FY 1998.

Project-related revenues are estimated to increase from $2.1 million in FY 1990 to $5.8 million in FY 1995, then decrease slightly to $5.4 million in FY 1998. Project-induced expenditures exceed revenues in FY 1990 and FY 1994 to FY 1998. The shortfalls are estimated to be $100,000 in FY 1990 and will be in the $100,000 to $400,000 range in the remaining years. Short and long-term public finance impacts will be negligible because project-induced shortfalls represent less than 0.5 percent of baseline revenues in the years when they will occur. However, fiscal effects on local jurisdictions may be more severe than those implied by the countywide indicators.

4.1.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.1.4.1 Ellsworth Air Force Base

The ROI growth impacts will be beneficial consequences of the proposed project. In Pennington, the MOB county, short-term housing impacts will be high and significant and long-term effects will be moderate and significant. Short-term public services impacts will be low and significant and long-term impacts will be high and significant. Short and long-term public finance impacts will be low and significant.

Regional Growth. Initial project-related employment ..ill occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,400. Employment will fluctuate between a low of 2,400 jobs in 1993 to a high of 4,450 jobs in 1996, before stabilizing at 4,050 in 1998. The 4,400 jobs in 1990 will consist of 2,500 direct (onsite) and 1,900 indirect-induced (off-site) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated to be 2,450 or 55 percent of total employment. The operations-phase employment impact of 4,050 jobs will represent 4.5 percent of 1998 baseline employment. Approximately 2,900 (72%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 peak-construction years (1990-1992) will substantially decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 4.4 percent to a 3-year with-project average of 3.5 percent. Unemployment in the ROI during the operations phase is expected to remain at its baseline level.

The number of persons inmigrating to the ROI as a result of the proposed project, including both workers and dependents, is expected to fluctuate between 2,900 and 7,800. Initial-year (1990) population gains are estimated to be 4,700 persons, falling to 3,000 in 1991, then rising to 7,800 in 1996, and stabilizing at about 7,200 in the operations phase. The 1998 population gain of 7,200 persons represents 4.3 percent of ROI baseline population in that year.

Pennington County will be the probable location of most offbase population gains. Population effects in the county will be greatest in 1996 (7,700 persons) and will decline to 7,200 by 1998. The population change in the county between 1989 and 1990 will be 1.2 percent without the proposed project but 4.3 percent with the project. The county's population growth rate for the 1989 to 1996 period will increase from 1.3 percent annually without the proposed project to 2.5 percent with the project. By 1998, county population will be 7.6 percent higher than the baseline forecast as a result of the proposed project.

In 1990, approximately $105 million in personal income will be created in the ROI as a result of the proposed project. This total is expected to fall to $78 million by 1998. Income benefits to Pennington County will total $90 million in 1990 and decline to $74 million in 1998. Spending in the ROI by proposed project personnel, along with Air Force, COE, and contractor purchases in the ROI, will total $78 million in 1990. Spending is expected to decline to $50 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Ellsworth AFB, almost all project-related housing demand will occur in Pennington County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,300 year-round housing units, 4 percent of the total baseline housing stock forecast at about 32,200 permanent units. Projected 1990 available year-round housing vacancies in Pennington County number about 1,800 units. Occupancy by inmigrating households will require 72.2 percent of these vacancies. Projections of available temporary accommodations indicate that the required 500 units in 1990 will use 21.5 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian workers, will need about 1,114 permanent housing units. This represents 3.1 percent of the forecast 1998 housing stock of about 35,700 units and 56.5 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 1.4 percent to a with-project rate of 5.5 percent. Since the project will increase the baseline growth rate by 4.1 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over 70 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be moderate since 3.1 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since 56.5 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Pennington County will require 130 additional personnel in 1990, increasing to a peak of 230 employees in 1996. This total includes 20 police and 111 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 7.7 percent (298 to 275 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 215 positions. Without these additional persons, the operations-phase employment ratio will fall to 277 workers per 10,000 population, a 7-percent drop.

Project-induced local government employment requirements in Pennington County will increase the baseline growth rate from 1.3 to 2.7 percent between 1990 and 1996. Since the resulting growth rate is 1.4 percentage points above the baseline rate, short-term local government employment impacts will be low. These impacts will be significant since a decline of 7.7 percent in the employment ratio from the proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 317.

During the operations years, project-induced local government employment of 215 workers will constitute a 7.6-percent increase over the 1998 baseline workforce of over 2,800. The long-term local government employment impacts will therefore be high. These impacts will be significant since a 7-percent decline in the employment ratio from the proposed project population will result in an appreciable reduction in the level of service.

Public school enrollment will experience an increase of about 900 pupils in 1990, increasing to about 1,500 in 1996. Project-related students will increase the baseline growth rate of Pennington County enrollment from 1.3 to 2.5 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,400 students will create a 6.8-percent increase over 1998 baseline enrollment of 20,300 pupils.

Based on local government employment requirements, short-term public services impacts in Pennington County will be low and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Pennington County will increase from $6.2 million in FY 1990 to $11.8 million in FY 1996. Operations-phase expenditures will be $11.4 million in FY 1998.

Project-induced revenues will be $3.9 million in FY 1990 and peak at $10.4 million in FY 1996. Revenues will decline from this peak to reach operations-phase levels of $9.9 million in FY 1998. Project-induced expenditures will exceed revenues in FY 1990 and FY 1994 to FY 1998. These shortfalls are estimated to be $2.3 million in FY 1990 and range between $500,000 and $1.8 million in the FY 1994 to FY 1997 period. The FY 1998 shortfall is estimated to be $1.5 million.

Short-term impacts will be low and significant because the FY 1990 shortfall represents 1.9 percent of baseline revenues in that year. Long-term impacts will be low and significant because project-induced shortfalls represent 1 percent of baseline revenues and expenditures in FY 1998. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.4.2 F.E. Warren Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Laramie, the MOB county, short-term housing impacts will be high and significant and long-term impacts will be moderate and significant. Short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. Short-term public finance impacts will be low and significant and long-term impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,500. Employment will fluctuate between a low of 2,450 jobs in 1993 to a high of 5,000 in 1996, before stabilizing at 4,500 in 1998. The 4,500 jobs in 1990 will consist of 2,500 direct (onsite) and 2,000 indirect-induced (offsite) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated at 2,700 or 60 percent of total employment. The operations-phase employment impact of 4,500 jobs will represent 1.3 percent of 1998 baseline employment. Approximately 3,250 (72%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 peak-construction years (1990-1992) will decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 5 percent to a 3-year with-project average of 4.7 percent. Unemployment in the ROI during the operations phase is expected to remain at its baseline level.

The number of persons inmigrating to the ROI because of the proposed project, including both workers and their dependents, is expected to fluctuate between 2,900 and 8,800. Initial-year (1990) population gains are estimated at 4,300 persons, dropping to 2,900 in 1991, and increasing to 8,800 in 1996, before stabilizing at 8,150 in the operations phase. The 1998 population gain 8,150 persons represents 1.2 percent of baseline population in that year.

Most of these population gains will be concentrated in Laramie County, the MOB county. Population in Laramie County will increase 6.7 percent between 1989 and 1990 with the proposed project, compared to 1.8 percent without the project. For the entire 1989 to 1996 period, average population growth in the

county with the project will increase to 3.2 percent annually from 1.8 percent without the project. By 1998, project-related population gains will represent 8.7 percent of baseline population.

About $115 million in personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to decrease to $93 million by 1998. Laramie County will experience income gains of $80 million in 1990, rising to $84 million in 1998. Spending in the ROI by proposed project personnel, along with Air Force, COE, and contractor purchases in the ROI, will total $86 million in 1990. Spending is expected to decline to $55 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at F.E. Warren AFB, nearly all project-related housing demand will occur in Laramie County. In 1990, the initial year of proposed project construction, inmigrants will need about 1,100 year-round housing units, 3.4 percent of the total baseline housing stock forecast at approximately 32,000 permanent units. Projected 1990 available year-round housing vacancies in Laramie County are nearly 1,300 units. Occupancy by relocating households will absorb 85.6 percent of these vacancies. Projections of available temporary accommodations indicate that the required 400 units in 1990 will use 16.8 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 1,300 permanent housing units. This represents 3.4 percent of the forecast 1998 housing stock of over 37,000 units and 84.5 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 1.8 percent to a with-project rate of 5.3 percent. Since the proposed project will increase the baseline growth rate by 3.5 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since 85 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be moderate since 3.4 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since 84.5 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Laramie County will require 170 additional personnel in 1990, increasing to a peak of 390 employees in 1996. This total includes 20 police and 160 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 8.9 percent (446 to 406 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will drop to 360 positions. Without these additional persons, the operations-phase employment ratio will fall to 410 workers per 10,000 population, an 8.1-percent decline.

Project-induced local government employment requirements in Laramie County will increase the baseline growth rate of local government employment from 1.8 to 3.4 percent between 1990 and 1996. Since the resulting growth rate is 1.6 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 8.9 percent in the employment ratio from proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 468.

During the operations years, project-induced local government employment of 360 workers will constitute an 8.7-percent increase over the 1998 baseline workforce of nearly 4,200. The long-term local government employment impacts will therefore be high. These impacts will be significant since an 8.1-percent decline in the employment ratio caused by the proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 700 in 1990, rising to a peak of 1,700 in 1996. Project-related students will increase the baseline growth rate of Laramie County enrollment from 1.8 to 3.4 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,600 students will create an 8.3-percent increase over 1998 baseline enrollment of about 18,700 pupils.

Based on local government employment requirements, short-term public services impacts in Laramie County will be moderate and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Laramie County will increase from $3.6 million in FY 1990 to $16.7 million in FY 1997. Expenditures will reach operations-phase levels of $16.2 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $2.9 million in FY 1990 to $14.9 million in FY 1997, reaching operations-phase levels of $14.5 million in FY 1998. Project-induced expenditures will exceed revenues in all years except FY 1992. These shortfalls are estimated to be $700,000 in FY 1990, $200,000 in FY 1991, and reach $1.9 million and $1.8 million in FY 1996 and FY 1997, respectively. Shortfalls of $1.7 million are estimated in FY 1998 and thereafter.

Short-term public finance impacts in Laramie County will be low and significant because shortfalls in FY 1996 and FY 1997 represent 1.1 percent and 1 percent of baseline revenues and expenditures in those years. Long-term impacts will be negligible because project-induced shortfalls in FY 1998 represent less than 1 percent of baseline revenues in that year. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.4.3 Grand Forks Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Grand Forks, the MOB county, short-term housing impacts will be high and not significant and long-term impacts will be low and not

significant. Short-term public services impacts will be low and significant and long-term impacts will be high and significant. Short and long-term public finance impacts will be low and significant.

Regional Growth. Initial project-related employment will occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,200. Employment will fluctuate between a high of 4,400 jobs in 1996 to a low of 2,400 jobs in 1993, before stabilizing at 4,000 in 1998. The jobs created in 1990 will consist of 1,700 direct (onsite) and 2,500 indirect-induced (offsite) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated at 1,700 or 41 percent of total employment. The operations-phase employment impact of 4,000 jobs will represent 2.1 percent of 1998 baseline employment. Approximately 2,900 (73%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 construction years (1990-1992) will decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 5 percent to a 3-year with-project average of 4.6 percent. Unemployment in the ROI during the operations phase is expected to remain at its baseline level.

The number of persons inmigrating to the ROI as a result of the proposed project, including both workers and their dependents, is expected to fluctuate between 3,300 and 7,800. Initial-year (1990) population gains are estimated at 4,650 persons, falling to 2,900 in 1991, rising to 7,800 in 1996, and settling at 7,200 in the operations phase. The 1998 population gain of 7,200 persons represents 2.2 percent of baseline population in that year.

Grand Forks County, North Dakota and Polk County, Minnesota will experience most of these population impacts. Grand Forks County contains both the base and the city of Grand Forks, located near the base. The county will experience population gains starting at 3,200 in 1990, rising to 7,600 in 1996, and settling at 7,150 in the operations phase. The county's population growth rate from 1989 to 1990 will increase to 6 percent with the proposed project compared to 1.8 percent without the project. From 1989 to 1996, average population growth in the county with the proposed project is forecast at 2.4 percent per year compared to 1.2 percent without the project. By 1998, project-related population gains will represent 8.5 percent of baseline population.

In Polk County, population gains due to the proposed project are forecast to be 1,300 persons in 1990, declining to less than 50 by 1998. Polk County's population gain from 1989 to 1990 is estimated at 0.1 percent without the proposed project but 3.8 percent with the project. The operations-phase population change in the county as a result of the proposed project will represent only 0.1 percent of baseline population.

Personal income gains will total about $102 million in the region in 1990 because of the proposed project. By 1998, income benefits will decline to approximately $79 million. Grand Forks County will experience increases in income ranging between $40 and $79 million from 1990 to 1998. Operations-phase MOB coun*y personal income will be $70 million higher with the proposed

project than without the project. Spending in the ROI by proposed project personnel, along with Air Force, COE, and civilian contractor purchases, will total $73 million in 1990. Spending is expected to decline to $49 million by 1998.

Increased employment, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Grand Forks AFB, almost all project-related housing demand will occur in Grand Forks County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 900 year-round housing units, 3.3 percent of the total baseline housing stock forecast at about 28,000 permanent units. Projected 1990 available year-round housing vacancies in Grand Forks County number about 2,100 units. Occupancy by inmigrating households will use about 44.8 percent of these vacancies. Projections of available temporary accommodations indicate that the required 400 units in 1990 will use 51.7 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian workers, will need about 400 permanent housing units. This represents 1.4 percent of the forecast 1998 housing stock of nearly 31,000 units and 19.2 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 1.8 percent to a with-project rate of 5.1 percent. Since the proposed project will increase the baseline growth rate by 3.3 percentage points, the potential short-term housing impacts will be high. Short-term impacts will not be significant since less than 50 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 1.4 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact is not significant since only 19.2 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Grand Forks County will require 80 additional personnel in 1990, increasing to a peak of 180 employees in 1996. This total includes 10 police and 110 education workers. Without additional staff, the local government employment ratio in the peak year will decline 8.4 percent (238 to 218 employees per 10,000 population). In the operations years, the requirement for maintaining existing service levels will decline to 170 positions. Without these additional persons, the operations-phase employment ratio will fall to 218 workers per 10,000 population, an 8.4-percent drop.

Project-induced local government employment requirements in Grand Forks County will increase the baseline growth rate of local government employment from 1.1 to 2.5 percent between 1990 and 1996. Since the resulting growth rate is 1.4 percentage points above the baseline rate, short-term local government employment impacts will be low. These impacts will be significant since a decline of 8.4 percent in the employment ratio as a result of the proposed project population will cause an appreciable reduction in the level

of service. The with-project rate will be considerably below the state average of 297.

During the operations years, project-induced local government employment of 170 workers will constitute an 8.7-percent increase over the 1998 baseline workforce of nearly 2,000. The long-term local government employment impacts will therefore be high. These impacts will be significant since an 8.4-percent decline in the local government employment ratio from the proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 1,500 in 1996. Project-related students will increase the baseline growth rate of Grand Forks County enrollment from 1 to 2.8 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,400 students will create a 10-percent increase over 1998 baseline enrollment of nearly 14,000 pupils.

Based on local government employment requirements, short-term public services impacts in Grand Forks County will be low and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Grand Forks County will increase from $1.9 million in FY 1990 to $9.2 million in FY 1997. Expenditures will reach operations-phase levels of $9 million in FY 1998.

Project-related revenues will increase from $1.3 million in FY 1990 to $7.2 million in the peak year (FY 1997), then fall slightly to operations-phase levels of $7 million in FY 1998. Project-induced expenditures will exceed revenues in all years over the FY 1990 to FY 1998 period, with shortfalls during the construction phase ranging from a $300,000 to $2 million. Project-induced shortfalls will be greatest over the FY 1996 to FY 1998 period, when shortfalls of $2 million are estimated.

Short-term public finance impacts will be low and significant since the shortfalls during FY 1996 and FY 1997 represent 1.9 percent of baseline revenues and expenditures in those years.

Long-term public finance impacts will be low and significant since the shortfalls in FY 1998 represent 1.9 percent of baseline revenues in that year. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.4.4 Malmstrom Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Cascade, the MOB county, short-term housing impacts will be high and significant and long-term impacts will be low and not significant. Short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. Short-term public finance impacts will be low and significant and long-term impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,400. Employment will fluctuate between a low of 2,400 jobs in 1993 to a high of 5,000 jobs in 1996 before stabilizing at 4,500 in 1998. The 4,400 jobs in 1990 will consist of 2,550 direct (onsite) and 1,850 indirect-induced (off-site) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated at 2,650 or 61 percent of total employment. Operations-phase employment impacts of 4,500 jobs will represent 4.3 percent of 1998 baseline employment. Approximately 3,250 (72%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 peak-construction years (1990-1992) will substantially decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 6 percent to a 3-year with-project average of 5 percent. Unemployment in the ROI during the operations phase is expected to remain at its baseline level.

The number of persons inmigrating to the region as a result of the proposed project, including both workers and their dependents, is expected to fluctuate between 2,750 and 8,800. Initial-year (1990) population gains are estimated at 4,100 persons, falling to 2,750 in 1991, rising to 8,800 in 1996, and settling at 8,150 in the operations phase. The 1998 population gain of 8,150 persons represents 4.3 percent of baseline population in that year.

Cascade County's population will increase 5.5 percent between 1989 and 1990 with the proposed project, compared to 0.9 percent without the project. For the entire 1989 through 1996 period, average population growth in the county will increase to 2.1 percent with the project from 0.7 percent without the project. By 1998, project-related population gains will represent an increase of 9 percent over baseline levels.

In 1990, about $112 million in personal income will be created in the ROI from the proposed project. This total is expected to fall to $88 million by 1998. Cascade County will experience income gains of $99 million in 1990, falling to $84 million in 1998. Spending by proposed project personnel, along with DOD and contractor purchases in the ROI, will total $81 million in 1990. Spending is expected to decline to $56 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Malmstrom AFB, almost all project-related housing demand will occur in Cascade County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,100 year-round housing units, 3.4 percent of the total baseline housing stock forecast at about 33,300 permanent units. Projected 1990 available year-round housing vacancies in Cascade County number about 1,900 units. Occupancy by inmigrating households will require nearly 59.1 percent of these vacancies. Projections of available temporary accommodations indicate that the required 500 units in 1990 will use 50 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 85 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 500 permanent housing units. This represents 1.4 percent of the forecast 1998 housing stock of over 35,000 units and 24 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 0.9 percent to a with-project rate of 4.3 percent. Since the project will increase the baseline growth rate by 3.4 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since nearly 60 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 1.4 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will not be significant since only 23.9 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Cascade County will require 120 additional personnel in 1990, increasing to a peak of 260 employees in 1996. This total includes 15 police and 110 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 8.9 percent (291 to 265 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 240 positions. Without these additional persons, the operations-phase employment ratio will fall to 267 workers per 10,000 population, an 8.2-percent drop.

Project-induced local government employment requirements in Cascade County will increase the baseline growth rate from 0.7 to 2.3 percent between 1990 and 1996. Since the resulting growth rate is 1.6 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 8.9 percent in the local government employment ratio as a result of the proposed project population will cause an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 353.

During the operations years, project-induced local government employment of 240 workers will constitute a 9-percent increase over the 1998 baseline workforce of over 2,600. Therefore, the long-term local government employment impacts will be high. These impacts will be significant since an 8.2-percent decline in the local government employment ratio caused by proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 800 in 1990, rising to a peak of 1,700 in 1996. Project-related students will increase the baseline growth rate of Cascade County enrollment from 0.7 to 2.4 percent between 1989 and 1996. During the operations years, project-induced enrollment of 1,600 students will create a 10-percent increase over 1998 baseline enrollment of 15,700 pupils.

Based on local government employment requirements, short-term public services impacts in Cascade County will be moderate and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Cascade County will increase from $2.5 million in FY 1990 to $11 million in FY 1997. Expenditures will reach operations-phase levels of $10.6 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $1.5 million in FY 1990 to $10.1 million in FY 1997, and reaching operations-phase levels of $9.8 million in FY 1998. Project-induced expenditures will exceed revenues in FY 1990 and FY 1995 to FY 1998. These shortfalls are estimated at $1 million in FY 1990 and range between $1 million and $1.4 million over the FY 1995 to FY 1997 period. The FY 1998 shortfall is estimated at $800,000.

Short-term public finance impacts in Cascade County will be low and significant because shortfalls over the FY 1995 to FY 1997 period represent 0.9 to 1.2 percent of baseline revenues and expenditures. Long-term impacts will be negligible because project-induced shortfalls represent less than 1 percent of baseline revenues in FY 1998. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.4.5 Minot Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Ward, the MOB county, short-term housing impacts will be high and significant and long-term impacts will be moderate and significant. Short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. Short-term public finance impacts will be low and significant, and long-term impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,000. Employment will fluctuate between a low of 2,300 jobs in 1993 to a high of 4,300 jobs in 1996, before stabilizing at 3,900 in 1998. The 4,000 jobs in 1990 will consist of 2,500 direct (onsite) and 1,500 indirect-induced (offsite) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated at 2,000 or 50 percent of total employment. Operations-phase employment impacts of 3,900 jobs will represent 6.3 percent of 1998 baseline employment. Approximately 2,900 (74%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 peak-construction years (1990-1992) will substantially decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 5.7 percent to a 3-year with-project average of 4.7 percent. Unemployment in the ROI during the operations phase is expected to stabilize at its baseline level.

The number of persons inmigrating to the ROI as a result of the proposed project, including workers and their dependents, is expected to fluctuate between 2,800 and 7,800. Initial-year (1990) population gains are estimated at 4,800 persons, declining to 2,800 in 1991, rising to 7,800 in 1996, and settling at 7,200 in the operations phase. The 1998 population gain 7,200 persons represents 5.7 percent of baseline population in that year.

Almost all of these population gains will be concentrated in Ward County, the MOB county. Ward County's population will increase 8.1 percent between 1989 and 1990 with the proposed project, compared to 1.4 percent without the project. From 1989 to 1996, average population growth in the county with the proposed project will increase to 2.6 percent annually, from 1.2 percent without the project. By 1998, project-related population gains will represent 9.7 percent of baseline population.

In 1990, the proposed project will create personal income totaling \$103 million in the ROI. This total is expected to fall to \$80 million by 1998. Ward County will experience income gains of \$89 million in 1990, falling to \$76 million in 1998. Consumer spending by project personnel, in addition to DOD and contractor purchases in the ROI, will total \$74 million in 1990. Spending is expected to decline to \$49 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Minot AFB, almost all project-related housing demand will occur in Ward County. In 1990, the initial year of proposed project construction and the peak year for housing requirements, inmigrants will need about 1,300 year-round housing units, 5.4 percent of the total baseline housing stock forecast at about 24,100 permanent units. Projected 1990 available year-round housing vacancies in Ward County number about 900 units. Occupancy by inmigrating households will use all of these vacancies, with a shortage of about 400 units. Projections of available temporary accommodations indicate that the required 500 units in 1990 will use 46.2 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 1,114 permanent housing units. This represents 4.3 percent of the forecast 1998 housing stock of over 26,000 units and over 100 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 1.4 percent to a with-project rate of 7 percent. Since the project will increase the baseline growth rate by 5.6 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be moderate since 4.3 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since over 100 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Ward County will require 120 additional personnel in 1990, increasing to a peak of 200 employees in 1996. This total includes 10 police and 100 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 9.8 percent (265 to 239 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 190 positions. Without these additional

persons, the operations-phase employment ratio will fall to 242 workers per 10,000 population, an 8.7-percent drop.

Project-induced local government employment requirements in Ward County will increase the baseline growth rate from 1.1 to 2.8 percent between 1990 and 1996. Since the resulting growth rate is 1.7 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 9.8 percent in the employment ratio as a result of the proposed project population will cause an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 297.

During the operations years, project-induced local government employment of 190 workers will constitute a 9.7-percent increase over the 1998 baseline local government workforce of nearly 2,000. The long-term local government employment impacts will consequently be high. These long-term impacts will be significant since an 8.7-percent decline in the local government employment ratio resulting from the proposed project population will cause an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 900 in 1990, rising to a peak of 1,500 in 1996. Project-related students will increase the baseline growth rate of Ward County enrollment from 1.1 to 2.9 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,400 students will create a 10.3-percent increase over 1998 baseline enrollment of about 13,500 pupils.

Based on local government employment requirements, short-term public service impacts in Ward County will be moderate and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Ward County are estimated to be $2.3 million in FY 1990, increasing to a peak of $7.5 million in FY 1997. Expenditures will reach operations-phase levels of $7.2 million in FY 1998.

Project-related revenues are estimated to be $1.7 million in FY 1990, rising to $7.2 million in the peak year (FY 1997), and falling slightly to operations-phase levels of $6.9 million in FY 1998. Project-induced expenditures will exceed revenues in all years except FY 1991 to FY 1994. The shortfalls are estimated at $600,000 in FY 1990 and range between $300,000 to $500,000 over the FY 1995 to FY 1998 period. The FY 1998 shortfall is estimated at $300,000.

Short-term public finance impacts will be low and significant because project-related shortfalls in FY 1990 and FY 1996 represent 0.9 and 0.7 percent of baseline revenues and expenditures, respectively. Long-term impacts will be negligible because project-induced shortfalls represent less than 1 percent of baseline revenues in FY 1998. However, fiscal effects on individual local governments may be more severe than those implied by the countywide indicators.

4.1.4.6 Whiteman Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Johnson, the MOB county, both short and long-term housing impacts will be high and significant. Short-term public services impacts will be moderate and significant and long-term impacts will be high and significant. Short-term public finance impacts will be low and significant and long-term impacts will be negligible.

Regional Growth. Initial project-related employment will occur in 1990 with a total workforce (direct, indirect, and induced) estimated at 4,700. Employment will fluctuate between a low of 2,500 jobs in 1993 to a high of 4,700 in 1990, before stabilizing at 4,200 in 1998. The 4,700 jobs in 1990 will consist of 2,500 direct (onsite) and 2,200 indirect-induced (offsite) jobs. The number of locally hired workers will also fluctuate from year to year, with local hires in 1990 estimated to be 2,945 or 63 percent of total employment. Operations-phase employment impacts of 4,200 jobs will represent 0.7 percent of 1998 baseline employment. Approximately 2,900 (69%) of these operations-phase jobs will be filled by military personnel, with most of the balance held by locally hired civilians.

Unemployment rates in the ROI during the 3 peak-construction years (1990-1992) will decline as a result of the proposed project. During this period, the unemployment rate is expected to fall from a 3-year baseline average of 6 percent to a 3-year with-project average of 5.8 percent. Unemployment in the ROI during the operations phase is expected to remain at its baseline level.

The number of persons inmigrating to the ROI as a result of the proposed project, including both workers and their dependents, is expected to fluctuate between 2,800 and 7,800. Population gains in 1990 are estimated to be 4,200 persons, falling to 2,800 in 1991, increasing to 7,800 in 1996, and stabilizing at 7,200 in the operations phase. The 1998 population gain of 7,200 persons represents 0.7 percent of baseline ROI population in that year.

Almost all of these population gains will be concentrated in Johnson County, the MOB county. Population in the county will increase 10.9 percent between 1989 and 1990 with the project, compared to 0.6 percent without the project. For the entire 1989 to 1996 period, average population growth in the county with the project will increase to 2.9 percent annually from 0.6 percent without the project. By 1998, project-related population gains will represent 16.6 percent of baseline population.

About $122 million in personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to fall to $82 million by 1998. Johnson County will experience income gains of $68 million in 1990, falling to $67 million in 1998. Consumer spending by project personnel in the region, plus purchases by the DOD and its contractors, will total $82 million in 1990. Spending is expected to decline to $49 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Whiteman AFB, a major portion of project-related housing demand will occur in Johnson County. In 1990, the initial year of proposed project construction, inmigrants will need about 900 year-round housing units, 6.4 percent of the total baseline housing stock forecast at about 13,800 permanent units. Projected 1990 available year-round housing vacancies in Johnson County number about 700 units. Occupancy by inmigrating households will require all of these vacancies and create a shortage of about 200 units. Projections of available temporary accommodations indicate that the required 300 units in 1990 will use all of the county's hotel and motel rooms during this major construction year.

During the operations phase, it is estimated that 60 percent of military personnel will be housed onbase. Military personnel living offbase, including some civilian workers, will need about 1,100 permanent housing units. This represents 7.6 percent of the forecast 1998 housing stock of over 14,400 units and 142 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first year of the construction phase from a baseline level of 0.6 percent to a with-project rate of 7.1 percent. Since the proposed project will increase the baseline growth rate by 6.5 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be high since 7.6 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since over 100 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Johnson County will require 90 additional personnel in 1990, increasing to a peak of 220 employees in 1996. This total includes 10 police and 90 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 15.3 percent (287 to 243 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 200 positions. Without these additional persons, the operations-phase employment ratio will fall to 246 workers per 10,000 population, a 14.3-percent drop.

Project-induced local government employment requirements in Johnson County will increase the baseline growth rate from 0.6 to 3.3 percent between 1990 and 1996. Since the resulting growth rate is 2.7 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 15.3 percent in the employment ratio as a result of proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 312.

During the operations years, project-induced local government employment of 200 workers will constitute a 16.7-percent increase over the 1998 baseline workforce of about 1,200. The long-term local government employment impacts will consequently be high. These long-term impacts will be significant since a 14.3-percent decline in the employment ratio caused by the proposed project population will result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 1,400 in 1996. Project-related students will increase the baseline growth rate of Johnson County enrollment from 0.6 to 3.9 percent between 1990 and 1996. During the operations years, project-induced enrollment of 1,400 students will create a 20-percent increase over 1998 baseline enrollment of about 6,800 pupils.

Based on local government employment requirements, short-term public services impacts in Johnson County will be moderate and significant and long-term impacts will be high and significant.

Public Finance. Total project-induced expenditures of all local governments in Johnson County are estimated at $3.3 million in FY 1990, rising to $8.4 million in FY 1996. Expenditures will decline slightly over the next 2 years and reach operations-phase levels of $7.9 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $2.9 million in FY 1990 to $8 million in FY 1996, decreasing slightly over the next 2 years, and reaching operations-phase levels of $7.6 million in FY 1998. Project-induced expenditures will exceed revenues in all years except FY 1991 to FY 1993. The shortfalls are estimated at $400,000 in FY 1990 and range from $200,000 to $400,000 over the FY 1994 to FY 1997 period. The FY 1998 shortfall is estimated at $300,000.

Short-term public finance impacts in Johnson County will be low and significant because the FY 1995 and FY 1996 shortfalls represent 0.6 and 0.9 percent of baseline revenues in those years. Long-term impacts will be negligible because project-induced shortfalls in FY 1998 represent less than 1 percent of baseline revenues in that year.

4.1.5 Impacts of Hard Silo in Patterned Array

4.1.5.1 Davis-Monthan Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Pima, the MOB county, short and long-term housing impacts will be primarily beneficial. Both short and long-term public services impacts will be negligible. Short-term public finance impacts will be negligible and long-term impacts will be beneficial.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 3,200, an increase of 0.8 percent above baseline ROI employment. Impacts in the peak year (1994) consist of 5,400 direct (onsite) jobs and 2,900 indirect and induced (offsite) jobs, for a total of 8,300. Locally hired workers in the peak year are estimated to number 4,100 or about 49 percent of the total. In the operations phase, the proposed project will create about 2,350 jobs, representing 0.5 percent of baseline employment in 1998. About 1,750 (74%) of these jobs will be military, while most of the remaining 600 direct, indirect, and induced jobs will be held by locally hired civilians.

Hiring of local workers will reduce ROI unemployment rates during the construction phase (1990-1995) by 0.2 point below their baseline value of 6.2 percent. In the operations phase, unemployment in the ROI will change slightly as a result of the proposed project.

The number of persons inmigrating to the ROI as a result of the proposed project, including workers and dependents, is expected to rise from 3,200 in 1990 to a peak of 10,100 in 1994, before stabilizing at an operations level of 4,400. The 1998 population gain of 4,400 persons represents 0.4 percent of baseline ROI population in that year.

Assuming silo construction occurs close to Davis-Monthan AFB, nearly all of these population gains will be concentrated in Pima County. The county's population will increase 3.2 percent between 1989 and 1990 with the proposed project, compared to 2.8 percent without the project. For the entire 1989 to 1994 period, average population growth in the county will rise from 2.8 to 3 percent annually from the proposed project. By 1998, project-related population gains will represent 0.5 percent of Pima County's baseline population.

Personal income amounting to about $90 million will be created in the ROI in 1990 because of the proposed project. This total is expected to fall to $50 million by 1998. Pima County will experience most of these income gains with $83 million in 1990 and $48 million in 1998. Consumer spending by project personnel, along with DOD and contractor purchases in the ROI, will total $63 million in 1990. Spending is expected to rise to $136 million in 1994 before declining to $29 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Davis-Monthan AFB, nearly all project-related housing demand will occur in Pima County. In 1990, the initial year of proposed project construction, inmigrants will need about 900 year-round housing units and nearly 300 temporary accommodations. Proposed project housing demand will peak in 1994, requiring over 2,600 year-round units, 0.8 percent of the total baseline housing stock forecast at 315,300 permanent units. Projected 1994 available year-round housing vacancies in Pima County number about 18,800 units. Occupancy by inmigrating households will absorb 14.2 percent of these vacancies. Projections of available temporary accommodations indicate that the required 500 units in 1994 will use only 5.4 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, military personnel living offbase, plus some civilian workers, will need about 700 permanent housing units. This represents 0.2 percent of the forecast 1998 housing stock of nearly 350,000 units and 3.3 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from a baseline level of 2.8 percent to a with-project rate of 2.9 percent. Since the proposed project will increase the baseline growth rate by only 0.1 percentage point, the potential short-term housing impacts will be negligible. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Pima County will require 100 additional personnel in 1990, increasing to a peak of 300 employees in 1994. This total includes 20 police and 100 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 1.3 percent (316 to 312 employees per 10,000 population). In the operations years, the requirement for maintaining existing service levels will decrease to 140 positions. Without these additional persons, the operations-phase employment ratio will fall to 314 workers per 10,000 population, a 0.6-percent drop.

Project-induced local government employment requirements in Pima County will increase the baseline growth rate from 2.8 to 3.1 percent between 1990 and 1994. Since the resulting growth rate is 0.3 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 140 workers will constitute a 0.5-percent increase over the 1998 baseline local government workforce of over 28,000. Therefore, long-term local government employment impacts will be negligible.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 1,900 in 1994. Project-related students will increase the baseline growth rate of Pima County enrollment from 2.8 to 3.1 percent between 1990 and 1994.

During the operations years, project-induced enrollment of 900 students will create a 0.5-percent increase over 1998 baseline enrollment of about 161,000 pupils.

Based on local government employment requirements, both short and long-term public services impacts in Pima County will be negligible.

Public Finance. Total project-induced expenditures of all local governments in Pima County are estimated to be $2.4 million in FY 1990, rising to a peak of $15.2 million in FY 1995. Expenditures will decline over the next 2 years and reach operations-phase levels of $7.3 million in FY 1998.

Project-induced revenues follow a similar pattern, increasing from $2 million in FY 1990 to $18.4 million in FY 1995, decreasing slightly over the next 2 years, and reaching operations-phase levels of $8.6 million in FY 1998. Project-induced revenues will exceed expenditures in all years except FY 1990, where a shortfall of $400,000 is estimated.

Short-term public finance impacts in Pima County will be negligible because the FY 1990 shortfall represents less than 0.5 percent of baseline revenues in that year. Long-term impacts will be beneficial because project-induced revenues exceed expenditures over the remaining years of the project. However, fiscal effects on individual local governments in the county may be more severe than those indicated by the aggregate countywide indicators.

4.1.5.2 Edwards Air Force Base

Regional growth impacts will be beneficial consequences of the proposed project. In Los Angeles, the MOB county, short-term housing impacts will be low and significant and long-term impacts will be beneficial. Short-term public services impacts will be negligible and long-term impacts will be moderate and significant. Both short and long-term public finance impacts will be beneficial.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 4,200, an increase of 0.1 percent above baseline ROI employment. Impacts in the peak year (1994) consist of 5,350 direct and 5,000 indirect (onsite) and induced (offsite) jobs, for a total of 10,350. Of total peak employment, locally hired workers are estimated to number 6,900 or about 72 percent. In the operations phase, the proposed project will create about 2,600 jobs, amounting to only a small fraction of ROI baseline employment in 1998. About 1,750 of these jobs will be held by military personnel, while most of the remaining 850 direct, indirect, and induced jobs will be held by locally hired civilians.

Unemployment rates in the ROI during the construction phase (1990-1995) will be below (0.1 point) their baseline range of 6.5 to 7 percent because of local hiring for the proposed project. No measurable operations-phase, project-related change in ROI unemployment will occur.

The number of persons inmigrating to the ROI as a result of the proposed project, including both workers and their dependents, is expected to increase from 2,200 in 1990 to 8,200 in 1994. The 1998 population gain of 4,400 persons represents a negligible fraction of baseline population in that year. Almost all of the population gains will occur in the vicinity of Edwards AFB. Offbase population growth, probably concentrated in northeastern Los Angeles County near the communities of Lancaster and Palmdale, is expected to increase from 2,200 in 1990 to 6,200 in 1994, before falling to an operations-phase level of about 1,800 persons. The area's population growth rate for the 1989 to 1996 period will increase from 3.8 percent annually without the project to 4.5 percent with the project. This peak (1994) population gain will amount to about 3.4 percent of the Lancaster-Palmdale area's baseline projected population.

About $122 million in personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to fall to $55 million by 1998. Los Angeles County will experience income gains of $116 million in 1990, falling to $26 million in 1998. Kern County personal income benefits will increase from $2 million in 1990 to $28 million in 1998. Spending by proposed project personnel, along with the DOD and contractor purchases in the ROI, will total $85 million in 1990. Spending is expected to rise to $182 million in 1994 before declining to $29 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Edwards AFB, nearly all project-related housing demand, excluding military personnel housed onbase (Kern County), will occur in the northeast area of Los Angeles County. In 1990, the initial year of

proposed project construction, inmigrants will need about 600 year-round housing units and nearly 200 temporary accommodations. Proposed project housing demand will peak in 1994, requiring about 2,150 year-round units, 3.3 percent of the total baseline housing stock forecast at 66,400 permanent units. Projected 1994 available year-round housing vacancies in the Edwards AFB area number about 2,700 units. Occupancy by inmigrating households will absorb 79.9 percent of these vacancies. Projections of available temporary accommodations indicate that the required 400 units in 1994 will use 65.1 percent of the area's hotel and motel rooms during this major construction year.

During the operations phase, 60 percent of military personnel will be housed onbase in Kern County. Military personnel living offbase, plus some civilian workers, will need about 684 permanent housing units in northeastern Los Angeles County. This represents 0.9 percent of the projected housing stock of about 74,400 units and 22.6 percent of projected available vacancies in 1998. Operations-phase needs for temporary housing will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from a baseline level of 3.8 percent to a with-project rate of 4.4 percent. Since the proposed project will increase the baseline growth rate by only 0.6 percentage point, the potential short-term housing impacts will be low. Short-term impacts will be significant since nearly 80 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Los Angeles County will require 80 additional personnel in 1990, increasing to a peak of 220 employees in 1994. This total includes 20 police and 60 education personnel. Without additional staff, the local government employment ratio in the peak year will remain virtually unchanged (356 compared to 355 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 60 positions. Without these additional persons, the operations-phase employment ratio will not change measurably.

Project-induced local government employment requirements in Los Angeles County will not affect the baseline growth rate of 0.5 percent between 1990 and 1994. Since the growth rate will remain unchanged, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 60 workers will constitute a minimal increase over the 1998 baseline workforce of over 300,000. Consequently, the long-term local government employment impacts will be negligible.

Public education will experience an increase in pupil enrollment of about 400 in 1990, rising to a peak of 1,200 students in 1994. Project-related students will create a minimal increase in the baseline growth rate of Los Angeles County enrollment between 1990 and 1994.

During the operations years, project-induced enrollment of 350 students will create a minimal increase above the 1998 baseline enrollment of over 1.7 million pupils.

The children of military personnel housed at Edwards AFB will attend schools in Kern County. During the operations years of the proposed project, about 500 additional students will be added to the baseline enrollment of about 8,000 pupils, a 10-percent increase.

Based on local government employment requirements, short-term public services impacts for Edwards AFB will be negligible and long-term impacts will be moderate and significant because of school impacts in Kern County.

Public Finance. Total project-induced expenditures of all local governments in Los Angeles County are estimated to be $2.4 million in FY 1990, rising to a peak of $13.4 million in FY 1995. Expenditures will decline from this peak and reach operations-phase levels of $4.4 million in FY 1998.

Project-related revenues are estimated to increase from $2.4 million in FY 1990, peak at $18.1 million in FY 1995, and reach operations-phase levels of $6 million in FY 1998. Project-induced revenues will equal expenditures in FY 1990 and exceed expenditures in all years over the FY 1991 to FY 1998 period.

Both short and long-term public finance impacts will be beneficial since project-induced revenues exceed expenditures in all years over the FY 1991 to FY 1998 period. Fiscal effects on individual local governments, particularly those surrounding Edwards AFB, will probably be more severe than those implied by the countywide indicators. Sixty percent of the military personnel are expected to live onbase in Kern County, and local governments in this county are expected to experience the greatest increases in expenditures, particularly in the long term. However, since most new offbase housing and commercial activity will be focused in the Lancaster-Palmdale area of Los Angeles County, the greatest increase in revenues are expected there, creating the potential for jurisdictional conflicts.

4.1.5.3 F.E. Warren Air Force Base

Regional growth impacts will be beneficia` consequences of the proposed project. In Laramie, the MOB county, short-term housing impacts will be moderate and significant and long-term impacts will be low and not significant. Both short and long-term public services impacts will be moderate and significant. Short-term public finance impacts will be low and significant and long-term impacts will be negligible.

Regional Growth. Project-related employment (direct, indirect, and induced) is estimated at 3,300 jobs in 1990, an increase of 1.4 percent above baseline ROI employment. In the peak year (1994), the impact will total 8,400 jobs; 5,350 will be direct (onsite) jobs and 3,050 indirect and induced (offsite) jobs. Of total peak employment, locally hired workers are estimated to number 4,050 or about 48 percent. In the operations phase, the proposed project will create about 2,400 jobs, representing 0.8 percent of baseline employment in 1998. About 1,750 (74%) of these jobs will be filled by military personnel, and most of the remaining 650 direct, indirect, and induced jobs will be held by locally hired civilians.

Unemployment rates in the ROI during the 1990 to 1995 construction phase will decrease from a baseline level of 5 percent to a range of 4.6 to 4.8 percent

with the proposed project as a result of local hiring. In the operations phase, unemployment in the ROI will change slightly as a results of the proposed project.

The number of persons inmigrating to the ROI for the proposed project, including workers and dependents, is expected to increase from 3,300 in 1990 to 10,600 in 1994, and then decline to 4,400 in the operations phase. The 1998 population gain of 4,400 persons represents 0.7 percent of baseline population in that year.

Since F.E. Warren AFB and most of the land suitable for deployment are situated in this county, almost all of these population gains will be concentrated in this county. The county's population will increase 5.5 percent between 1989 and 1990 with the proposed project, compared to 1.8 percent without the project. For the entire 1989 through 1994 period, average population growth in the county with the project will increase to 4 percent annually, from 1.8 percent without the project. Project-related population gains will represent 11.2 percent of baseline population in 1994, but only 4.7 percent of baseline in 1998.

About $86 million of personal income will be created in the ROI in 1990 by the proposed project. This total is expected to fall to $50 million by 1998. Laramie County will experience income gains of $56 million in 1990, falling to $40 million in 1998. Consumer spending by project personnel, and DOD and contractor purchases in the ROI, will total $66 million in 1990. Spending is expected to rise to $137 million in 1994 before declining to $29 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at F.E. Warren AFB, almost all project-related housing demand will occur in Laramie County. In 1990, the initial year of proposed project construction, inmigrants will need about 800 year-round housing units and nearly 300 temporary accommodations. Proposed project housing demand will peak in 1994 requiring over 2,600 year-round units, 7.6 percent of the total baseline housing stock forecast at about 35,000 permanent units. Projected 1994 available year-round housing vacancies in Laramie County number nearly 1,400 units. Occupancy by inmigrating households will absorb all of these vacancies with a shortage of 1,200 units. Projections of available temporary accommodations indicate that the required 500 units in 1994 will use 22.3 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, 60 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need 700 permanent housing units. This represents 1.8 percent of the forecast 1998 housing stock of over 37,000 units and 45.8 percent of the projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from a baseline level of 1.8 percent to a with-project rate of 3.3 percent. Since

the proposed project will increase the baseline growth rate by 1.5 percentage points, the potential short-term housing impacts will be moderate. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be low since 1.8 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will not be significant since only 46 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Laramie County will require 130 additional personnel in 1990, increasing to a peak of 440 employees in 1994. This total includes 20 police and 170 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 10.1 percent (446 to 401 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 200 positions. Without these additional persons, the operations-phase employment ratio will fall to 425 workers per 10,000 population, a 4.7-percent drop.

Project-induced local government employment requirements in Laramie County will increase the baseline growth rate from 1.8 to 4.6 percent between 1990 and 1994. Since the resulting growth rate is 2.8 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a 10.1-percent decline in the local government employment ratio from the proposed project population will result in an appreciable reduction in the level of service. This rate will be considerably below the state average of 468.

During the operations years, project-induced local government employment of 200 workers will constitute a 4.8-percent increase over the 1998 baseline workforce of nearly 4,200. Consequently, the long-term local government employment impacts will be moderate. These long-term impacts will be significant since a 4.7-percent decline in the local government employment ratio resulting from the proposed project population will cause an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 1,900 in 1994. Project-related students will increase the baseline growth rate of Laramie County enrollment from 1.8 to 4.5 percent between 1990 and 1994. During the operations years, project-induced enrollment of 800 students will create a 4.5-percent increase over 1998 baseline enrollment of over 19,000 pupils.

Based on local government employment requirements, overall short and long-term public services impacts in Laramie County will be moderate and significant.

Public Finance. Total project-induced expenditures of all local governments in Laramie County will increase from $2.7 million in FY 1990 and reach $18.7 million in the peak year (FY 1995). Expenditures will reach operations-phase levels of $9.3 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $2.2 million in FY 1990 to $17.9 million in FY 1995, and reach operations-phase levels of $9 million in FY 1998. Project-induced expenditures will exceed revenues in all years of the proposed project. These shortfalls,

estimated at $500,000 in FY 1990, will grow to $1.2 million and $1 million in FY 1993 and FY 1994, respectively, and decline to $300,000 in FY 1998 and thereafter.

Short-term public finance impacts in Laramie County will be low and significant because the shortfalls will extend throughout the construction phase and range from 0.5 to 0.7 percent of baseline revenues over the FY 1991 to FY 1995 period. Long-term impacts will be negligible because project-induced shortfalls in FY 1998 represent only 0.3 percent of baseline revenues and expenditures in that year. However, fiscal effects on individual local governments in Laramie County may be more severe than those implied by the countywide indicators.

4.1.5.4 Fort Bliss

Regional growth impacts will be beneficial consequences of the proposed project. In El Paso, the MOB county, short and long-term housing impacts will be primarily beneficial. Both short and long-term public services impacts will be negligible. Short-term public finance impacts will be negligible and long-term impacts will be beneficial.

Regional Growth. Project-related employment (direct, indirect, and induced) is estimated at 3,100 in 1990, an increase of 0.9 percent above baseline regional employment. Employment gains are projected to rise to about 8,100 jobs in 1994, before declining to 2,400 jobs by 1998. Peak employment will consist of 5,350 direct (onsite) jobs and 2,750 indirect-induced (offsite) jobs. Of the total peak employment, locally hired workers are estimated to number about 3,100 (38%). In the operations phase, project-related employment of 2,400 jobs will represent 0.6 percent of 1998 baseline employment. About 1,750 (81%) of operations-phase jobs will be filled by military personnel. Most of the remaining jobs will be held by locally hired civilians, with very few civilians inmigrating to the area to fill operations-phase jobs.

As local workers are hired, unemployment in the ROI during the first years of the proposed project (1990-1992) is expected to decrease slightly, from a baseline range of 7.8 to 8 percent to about 7.7 percent with the proposed project. In the operations phase, the proposed project will have little effect on unemployment in the ROI

The number of persons inmigrating to the ROI as a result of the proposed project, including both workers and their dependents, is expected to rise from 3,000 in 1990 to 11,500 in 1994, and then decline to an operations-phase level of 4,400. The 1998 population gain of 4,400 persons represents 0.4 percent of baseline population in that year.

El Paso County's population will increase at a slightly higher rate because of the proposed project, from an average of 2.7 percent per year between 1989 and 1994 with the project compared to 2.4 percent without the project. The peak-population impact will represent 1.6 percent of the county's forecast baseline population in 1994. An operations-phase population gain of 4,400 persons will be 0.6 percent of 1998 population in the MOB county.

Personal income in the ROI will increase by $174 million in 1994 as a result of the proposed project. Operations-phase income gains will be about

$48 million per year. Most of these income benefits will accrue to El Paso County. Purchases in the ROI by the DOD and its contractors, plus consumer spending of project employees, will reach $125 million in 1994 before falling to $30 million in 1998.

Increased employment and income, reduced unemployment, and greater ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB located at Fort Bliss, virtually all project-related housing demand will occur in El Paso County. In 1990, the initial year of proposed project construction, inmigrants will need about 800 year-round housing units and nearly 300 temporary accommodations. Proposed project housing demand will peak in 1994, requiring nearly 2,800 year-round units, 1.3 percent of the total baseline housing stock forecast at 210,000 permanent units. Projected 1994 available year-round housing vacancies in El Paso County number almost 6,400 units. Occupancy by inmigrating households will absorb 40 percent of these vacancies. Projections of available temporary accommodations indicate that the required 600 units in 1994 will use only 11.5 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, 85 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian workers, will need about 270 permanent housing units. This represents 0.1 percent of the forecast 1998 housing stock of nearly 230,000 units and 3.5 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from a baseline level of 2.4 percent to a with-project rate of 2.6 percent. Since the proposed project will increase the baseline growth rate by only 0.2 percentage point, the potential short-term housing impacts will be negligible. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in El Paso County will require 100 additional personnel in 1990, increasing to a peak of 415 employees in 1994. This total includes 30 police and 150 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 1.6 percent (370 to 364 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 160 positions. Without these additional persons, the operations-phase employment ratio will fall to 367 workers per 10,000 population, a 0.8-percent drop.

Project-induced local government employment requirements in El Paso County will increase the baseline growth rate from 2.3 to 2.7 percent between 1990 and 1994. Since the resulting growth rate is 0.4 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 160 workers will constitute a 0.6-percent increase over the 1998 baseline

workforce of nearly 28,000. Therefore, the long-term local government employment impacts will be negligible.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 2,200 in 1994. Project-related students will increase the baseline growth rate of El Paso County enrollment from 2.3 to 2.6 percent between 1990 and 1994.

During the operations years, project-induced enrollment of 800 students will create a 0.4-percent increase over 1998 baseline enrollment of about 185,000 pupils.

Based on local government employment requirements, both short and long-term public services impacts in El Paso County will be negligible.

Public Finance. Total project-induced expenditures of all local governments in El Paso County are estimated at $2.1 million in FY 1990, rising to a peak of $17 million in FY 1995. Expenditures will decline slightly over the next 2 years and reach operations-phase levels of $7.6 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $1.6 million in FY 1990 to $17.8 million in FY 1995, decreasing slightly over the next 2 years, and reach operations-phase levels of $8.7 million in FY 1998. Project-induced revenues will exceed expenditures in all years except FY 1990 through FY 1994, where shortfalls will range between $300,000 to $500,000 and represent less than 0.1 percent of countywide baseline revenues and expenditures in those years.

Short-term public finance impacts in El Paso County will be negligible because project-induced shortfalls represent less than 0.5 percent of baseline revenues in the years when they will occur. Long-term impacts will be beneficial because project-induced revenues will exceed baseline expenditures in the remaining years of the proposed project. However, fiscal effects on individual local governments in El Paso County may be more severe than those implied by the countywide indicators.

4.1.5.5 Gila Bend Air Force Auxiliary Field

Regional growth impacts will be beneficial consequences of the proposed project. In Maricopa, the MOB county, both short and long-term housing impacts will be high and significant. Both short and long-term public services impacts will be high and significant. Short-term public finance impacts will be negligible and long-term impacts will be beneficial.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 3,500, an increase of 0.2 percent above baseline ROI employment. Employment gains will peak in 1994 at 8,900 jobs; 5,350 will be direct (onsite) and 3,550 will be indirect and induced (offsite) jobs. Of total peak employment, locally hired workers are estimated to number 4,800 or about 54 percent. In the operations phase, the proposed project will create about 2,500 jobs, representing 0.1 percent of baseline employment in 1998. About 1,750 of these jobs will be held by military personnel, while most of the remaining 750 direct, indirect, and induced jobs will be held by locally hired civilians.

The ROI 1990 to 1995 unemployment rates will be slightly (0.1 percentage point) reduced because of local hiring for the proposed project. Long-term unemployment in the ROI will not be affected by the proposed project.

The number of persons inmigrating to the region because of the proposed project, including both workers and their dependents, is expected to increase from 3,300 in 1990 to 9,900 in 1994, before stabilizing at 4,400 in 1998. The 1998 population gain represents 0.1 percent of ROI baseline population in that year.

Most of these population increases will occur in Maricopa County, where Gila Bend AFAF and large expanses of land suitable for missile deployment are located. The areas nearest Gila Bend AFAF in southern Maricopa County will experience most of the population gains related to the proposed project. Population change in the Gila Bend area will amount to 3,100 persons in 1990, increase to 9,600 in 1994, and stabilize at about 4,400 in 1998 and thereafter. Population growth in the Gila Bend area from 1989 to 1994 is forecast to average 2.9 percent per year without the proposed project and 21.6 percent per year with the project. In 1998, the area's population will be 54 percent higher with the project than without the project.

About $95 million in personal income will be created in the region in 1990 as a result the proposed project. This total is expected to fall to $52 million by 1998. Maricopa County will experience income gains of $85 million in 1990, falling to $50 million in 1998. Consumer spending by project personnel, along with the DOD and contractor purchases in the ROI, will total $66 million in 1990. Spending is expected to rise to $142 million in 1994 before declining to $29 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Gila Bend AFAF, virtually all project-related housing demand will occur in southwestern Maricopa County. In 1990, the initial year of proposed project construction, inmigrants will need about 900 year-round housing units and nearly 300 temporary accommodations. Proposed project housing demand will peak in 1994, requiring over 2,200 year-round units, 90 percent of the total baseline housing stock forecast at about 2,500 permanent units. Projected 1994 available year-round housing vacancies in the Gila Bend area number about 300 units. Occupancy by inmigrating households will absorb all of these vacancies and create considerable shortages. Projections of available temporary accommodations indicate that the required 500 units in 1994 will use all of the area's total hotel and motel rooms during this major construction year.

During the operations phase, 85 percent of military personnel will be housed onbase. Military personnel living offbase and some civilian workers will need about 300 permanent housing units. This represents 9.8 percent of the forecast 1998 housing stock of about 2,700 units and 92 percent of the projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from

a baseline level of 4.3 percent to a with-project rate of 18.6 percent. Since the proposed project will increase the baseline growth rate by 14.3 percentage points, the potential short-term housing impacts will be high. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be high since 9.8 percent of the housing stock will be required by operations workers in 1998 and thereafter. This long-term impact will be significant since 92 percent of projected available vacancies will be required.

Public Services. Maintaining existing local government service levels in Maricopa County will require 100 additional personnel in 1990, increasing to a peak of 330 employees in 1994. This total includes 20 police and 115 education personnel. Without additional staff, the local government employment ratio in the peak year will remain almost unchanged (346 compared to 345 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 150 positions. Without these additional persons, the operations-phase employment ratio will fall to 345 workers per 10,000 population, a minimal drop.

Project-induced local government employment requirements in Maricopa County will increase the baseline growth rate from 3.3 to 3.4 percent between 1990 and 1994. Since the resulting growth rate is 0.1 percentage point above the baseline rate, short-term local government employment impacts will be negligible.

During the operations years, project-induced local government employment of 150 workers will constitute a minimal increase over the 1998 baseline workforce of nearly 95,000. The long-term local government employment impacts will consequently be negligible.

Public education will experience an increase in pupil enrollment of about 600 in 1990, rising to a peak of 1,800 in 1994. Project-related students will increase the baseline growth rate of the Gila Bend area enrollment from 2.8 to 27.4 percent between 1990 and 1994.

During the operations years, project-induced enrollment of 800 students will create a 56.7-percent increase over 1998 baseline enrollment of about 1,500 pupils.

Both the short and long-term public services impacts in Maricopa County will be high and significant. These conclusions reflect potential public employment and education impacts that might result in the rural area adjacent to Gila Bend AFAF.

Public Finance. Total project-induced expenditures of all local governments in Maricopa County are estimated at $3.8 million in FY 1990, rising to a peak of $27 million in FY 1995. Expenditures will decline over the next 2 years and reach operations-phase levels of $14.4 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $3.4 million in FY 1990 to $29.6 million in FY 1995, decreasing slightly over the next 2 years, and reach operations-phase levels of $15.4 million in FY 1998. Project-induced revenues will exceed expenditures in all years except FY 1990, where a shortfall of $400,000 is estimated. Short-term public

finance impacts in Maricopa County will be negligible because the FY 1990 shortfall represents less than 0.5 percent of countywide baseline revenues in that year. The long-term impact will be beneficial since project-induced revenues will exceed expenditures in the remaining years of the project.

While countywide local government fiscal measures indicate an overall beneficial effect, it is unlikely that the substantial public facility development required by the proposed project around Gila Bend could be funded through local revenue sources. Fiscal effects on local governments around Gila Bend will probably be more severe than those implied by the countywide indicators.

4.1.5.6 Yuma Proving Ground

Regional growth impacts will be beneficial consequences of the proposed project. In Yuma, the MOB county, short-term housing impacts will be low and significant and long-term impacts will be beneficial. Short-term public service impacts will be moderate and significant and long-term impacts will be moderate and not significant. Short-term public finance impacts will be negligible and long-term impacts will be beneficial.

Regional Growth. Initial project-related employment will occur in 1990, with a total workforce (direct, indirect, and induced) estimated at 3,100, an increase of 3.2 percent above baseline ROI employment. Peak-year (1994) employment gains will total 8,000 jobs; 5,350 will be direct (onsite) and 2,650 will be indirect and induced (offsite). Locally hired workers will fill 3,350 (about 42%) peak-year jobs. In the operations phase, the proposed project will create about 2,350 jobs, representing 2.1 percent of baseline employment in 1998. Approximately 1,750 (74%) of these jobs will go to military personnel, while most of the remaining 600 direct, indirect, and induced jobs will be held by locally hired civilians.

Unemployment rates in the ROI for the years 1990 to 1995 are assumed to continue at high levels (13-17%) without the proposed project. Unemployment will be measurably reduced by the proposed project, as much as 1.4 percentage points in 1990.

The number of persons inmigrating to the ROI for the proposed project, including both workers and their dependents, is expected to increase from 1,900 in 1990 to 11,300 in 1994, and then decline to 4,400 in the operations phase. The 1998 population gain of 4,400 persons represents 1.7 percent of ROI baseline population in that year.

Most of these population increases will occur in Yuma County, where Yuma PG and large expanses of land suitable for missile deployment are located. County population will increase 2.6 percent between 1989 and 1990 with the proposed project, compared to 0.8 percent without the project. For the 1989 to 1994 construction build-up phase, the average annual rate of population growth in Yuma County will increase from 1.6 to 3.8 percent because of the proposed project. The peak-population increase represents 10.9 percent of baseline county population, while in 1998, project-induced population gains amount to 4.1 percent of baseline population.

About $84 million of personal income will be created in the ROI in 1990 as a result of the proposed project. This total is expected to fall to $48 million

by 1998. Yuma County will experience income gains of $69 million in 1990, falling to $45 million in 1998, assuming both the MOB and deployment area are located in the county. Consumer spending by project personnel, along with DOD and contractor purchases in the ROI, will total $62 million in 1990. Spending is expected to rise to $132 million in 1994 before declining to $30 million by 1998.

Increased employment and income, reduced unemployment, and increased ROI spending will be beneficial effects of the proposed project.

Housing. With the MOB at Yuma PG, a major portion of project-related housing demand will occur in Yuma County. In 1990, the initial year of proposed project construction, inmigrants will need about 500 year-round housing units and nearly 200 temporary accommodations. Proposed project housing demand will peak in 1994, requiring over 2,600 year-round units, 6.7 percent of the total baseline housing stock forecast at about 39,000 permanent units. Projected 1994 available year-round housing vacancies in Yuma County number nearly 2,100 units. Occupancy by inmigrating households will absorb all of these vacancies, creating a shortage of about 500 units. Projections of available temporary accommodations indicate that the required 600 units in 1994 will use 58 percent of the county's hotel and motel rooms during this major construction year.

During the operations phase, 85 percent of military personnel will be housed onbase. Military personnel living offbase, plus some civilian workers, will need about 270 permanent housing units. This represents 0.6 percent of the forecast 1998 housing stock of about 42,000 units and 12.1 percent of projected available vacancies. The need for temporary housing during the operations phase will be minimal.

The inmigration of project-related population will increase the annual growth rate of housing demand during the first 5 years of the construction phase from a baseline level of 1.5 percent to a with-project rate of 2.8 percent. Since the proposed project increases the baseline growth rate by only 1.3 percentage points, the potential short-term housing impacts will be low. Short-term impacts will be significant since over 100 percent of available vacant housing will be needed in the peak year. Long-term housing impacts will be primarily beneficial because of reduced vacancy rates in the county.

Public Services. Maintaining existing local government service levels in Yuma County will require 60 additional personnel in 1990, increasing to a peak of 380 employees in 1994. This total includes 20 police and 160 education personnel. Without additional staff, the local government employment ratio in the peak year will decline 8.8 percent (352 to 321 employees per 10,000 population). In the operations years, the requirements for maintaining existing service levels will decline to 150 positions. Without these additional persons, the operations-phase employment ratio will fall to 339 workers per 10,000 population, a 3.7-percent drop.

Project-induced local government employment requirements in Yuma County will increase the baseline growth rate from 1.7 to 4.1 percent between 1990 and 1994. Since the resulting growth rate is 2.4 percentage points above the baseline rate, short-term local government employment impacts will be moderate. These impacts will be significant since a decline of 8.8 percent in the

local government employment ratio caused by proposed project population will result in an appreciable reduction in the level of service. The with-project rate will be considerably below the state average of 350.

During the operations years, project-induced local government employment of 150 workers will constitute a 3.6-percent increase over the 1998 baseline workforce of nearly 4,300. Consequently, the long-term local government employment impacts will be moderate. These long-term impacts will not be significant since a 3.8-percent decline in the local government employment ratio caused by the proposed project population will not result in an appreciable reduction in the level of service.

Public education will experience an increase in pupil enrollment of about 350 in 1990, rising to a peak of 2,100 in 1994. Project-related students will increase the baseline growth rate of Yuma County enrollment from 1.6 to 3.8 percent between 1990 and 1994. During the operations years, project-induced enrollment of 800 students will create a 3.4-percent increase over 1998 baseline enrollment of about 25,000 pupils.

Based on local government employment requirements, overall short-term public services impacts in Yuma County will be moderate and significant and long-term impacts will be moderate and not significant.

Public Finance. Total project-induced expenditures of all local governments in Yuma County are estimated at $1.4 million in FY 1990, rising to a peak of $17.6 million in FY 1995. Expenditures will decline over the next 2 years and reach operations-phase levels of $7.6 million in FY 1998.

Project-induced revenues will follow a similar pattern, increasing from $1.3 million in FY 1990 to $19.1 million in FY 1995, decreasing slightly over the next 2 years, and reaching operations-phase levels of $8.5 million in FY 1998. Project-induced revenues will exceed expenditures in all years except FY 1990, where a shortfall of $100,000 is estimated.

Short-term public finance impacts in Yuma County will be negligible because the estimated FY 1990 shortfall represents less than 0.5 percent of baseline revenues in that year. Long-term impacts will be beneficial because project-induced revenues will exceed expenditures in the remaining years of the project.

4.1.6 Impacts of the No Action Alternative

Under the No Action Alternative, socioeconomic activity associated with maintenance of the current Minuteman force will continue indefinitely at the Minuteman bases included in this analysis. No ICBM-related actions can be predicted for the other areas. Therefore, the baseline forecast described in Section 3.1 represent the implications of the No Action Alternative.

4.1.7 Irreversible and Irretrievable Resource Commitments

The proposed project requires the use of substantial quantities of labor, materials, and other economic elements during both the construction and operations phases. The expected population inmigration and the local procurement of building materials (such as cement, sand, and gravel) may alter some

resource characteristics in the deployment areas. Although these economic factors, once used by the proposed project, generally cannot be recovered for other purposes, the extent of their use will be small in comparison to total resource availability.

4.1.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Regional socioeconomic effects of the proposed project on the use of the environment will be small during both the short and long term. During the expected life of the proposed project, additional economic activity will enhance productivity in all regions considered.

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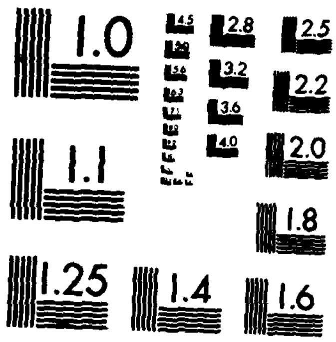

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4.2 Utilities

The deployment of the proposed Small Intercontinental Ballistic Missile (ICBM) will increase the demands on existing utility systems. As a result, the treatment and distribution systems for potable water and wastewater, solid waste disposal systems, and energy utility elements are considered in the impact analysis process for utilities.

4.2.1 Impact Analysis Methodology

The impact analysis methodology for utilities consisted of three phases: evaluation of potential project impacts, determination of level of impact (LOI), and determination of significance.

4.2.1.1 Evaluation of Project Impacts

For utilities, a single methodology, applicable to all elements in the resource, was developed to determine proposed project impacts. The evaluation of proposed project impacts to utility systems was based on the baseline capacity analysis. Demands associated with inmigrating populations and direct project requirements were added to a projected baseline without the project to yield the with-project demand. While most of the utility requirements for the proposed project will be obtained at, or near, the construction sites, a portion of the water demand will be drawn from the Main Operating Base (MOB) potable water system. This amount is identified in Table 1.6-5 (Section 1.6) for each basing mode and incorporated into the new demands on that particular system. Certain assumptions concerning the distribution of the inmigrating population were used in the analysis:

- A majority (either 60% or 85%) of the military personnel will be located onbase and use the utility systems provided by the base; and

- The remaining inmigrating population will be distributed throughout the Region of Influence (ROI), mainly in the MOB county, as identified by the socioeconomics regional growth analysis.

To arrive at the new demands for each utility, on and offbase populations were multiplied by a per capita use quantity, derived from rates that represent averages for the systems within the ROI and for the MOB. These rates were held constant throughout the study unless specific values had been provided by the systems' operators. These demands were then compared against the projected baseline demands to determine the percentage increase associated with the proposed project. If the MOB received utility service from offbase facilities, the demands associated with the increased onbase personnel were incorporated in the total demand. If the MOB had its own utility system, the onbase personnel demands were analyzed against the projected capacity of the onbase system.

For the Hard Silo in Patterned Array basing locations, an additional analysis was performed as part of the energy utilities element because the establishment of deployment areas has the potential to conflict with existing or proposed utility transmission lines and pipelines. These locations were evaluated by calculating the existing miles of utility lines within the proposed Suitable Deployment Areas (SDAs). This analysis was not incorporated into the evaluation of LOI for the energy utilities element.

4.2.1.2 Determination of Levels of Impact

Impacts to regional utility systems are directly related to increased service populations, project-induced land development, and to specific project-related construction activities. Each region's utility systems were evaluated separately and the assessment of LOI was made on a case-by-case basis. The LOI ratings were based on the assumption that utility systems, in general, are designed to meet peak demands. To meet peak demands, each utility uses a certain design factor in determining facility requirements; however, for the planning purposes of this study, peak demands were taken at 1.5 times the average daily requirements. A project-induced demand that increases the regional demand over 50 percent may consume a majority of the available capacity that a regional system has incorporated into its design and planning. This condition will indicate an LOI being rated as high. Lower LOI levels have been established using this condition as an upper guideline. The following LOIs were assigned for each utility:

- Negligible Impact -- Project-induced demands for the utility's service represent an increase in regional projected demand that will lead to no changes in operations procedures and will be met by existing system capacity. These demands are represented by zero to 1.5-percent increases.

- Low Impact -- Project-induced demands for the utility's service represent an increase in regional projected demand that will reduce system capacity or reserve margins. The ability to maintain service levels will not be affected. Increases greater than 1.5 to 11 percent characterize this condition.

- Moderate Impact -- Project-induced demands for the utility's service represent an increase in regional projected demand that may trigger temporary interruptions of service levels and require modifications and improvements to the systems infrastructure. These demands are represented by increases greater than 11 to 50 percent.

- High Impact -- Project-induced demands for the utility's service represent an increase in regional projected demand that will severely affect the utility's ability to provide adequate service and are indicated by increases over 50 percent.

4.2.1.3 Determination of Significance

Significance criteria, applicable to all utilities resource elements, were developed. Impacts were considered significant if they produced any of the following general conditions:

- Continued violation or exceedance of federal or state regulations resulting from the complete utilization of excess utility system capacity was indicated;

- The need to construct major new processing or transmission facilities was indicated; or

- o Substantial degradation in service levels from use of existing or planned system capacity could occur.

4.2.2 Impacts Common to All Locations

Potential impacts common to all alternative locations for each basing mode are summarized in Table 4.2.2-1. For each of the utilities analyzed, the range of impacts is given for peak-year on and offbase construction demands and annual demands during the operations phase. These demands are a direct consequence of the inmigration of personnel into the MOB county or onto the base. Direct project water requirements are also identified for each basing option. These water requirements represent construction, dust control, and revegetation water needs at the MOB and in the deployment area. It was assumed that the water required at the MOB will be taken from the onbase potable water system.

In addition to the solid waste generated by the proposed project and the inmigrating population, small quantities of hazardous wastes may be generated. Potential types of such wastes include expended or unusable oils and lubricants, solvents, paints and thinners, hydraulic and machine fluids, cleaning agents, and adhesives. To the extent the types and quantities of waste generated meet the Environmental Protection Agency (EPA) criteria, all hazardous wastes generated will be handled and disposed in accordance with the Resource Conservation and Recovery Act of 1976. Strict control of hazardous wastes is required from the time they are generated through any intermediate storage or transportation, to ultimate disposal. The special nuclear materials incorporated into the Small ICBM warheads are never separated or become sources of hazardous wastes (within the meaning of the Resource Conservation and Recovery Act) while in the custody of the Department of Defense (DOD).

Table 4.2.2-1 also identifies the diesel requirements necessary to support construction activities at the MOB and the deployment area.

4.2.3 Impacts of Hard Mobile Launcher in Random Movement

4.2.3.1 Arizona Complex

For the Arizona Complex, impact analyses were performed for the two alternative MOB locations: Gila Bend Air Force Auxiliary Field (AFAF) in Maricopa County and Yuma Proving Ground (PG) in Yuma County. If the MOB is located at Gila Bend AFAF, short-term impacts to Maricopa County potable water and wastewater treatment systems will be negligible. Long-term impacts to Gila Bend's potable water system will be moderate and not significant. Long-term impacts to Gila Bend's wastewater system will be moderate and significant. Short and long-term impacts to solid waste will be negligible. Short and long-term energy impacts will be negligible.

If the MOB is located at Yuma PG, short-term impacts to potable water treatment systems are expected to be negligible and long-term impacts will be low and not significant. Short-term wastewater treatment impacts are expected to be negligible; long-term impacts will be low and not significant. Short-term solid waste impacts will be low and not significant and long-term impacts will be negligible. Short and long-term energy impacts will be negligible.

Table 4.2.2-1

SUMMARY OF SELECTED PROJECT IMPACTS TO UTILITY SYSTEMS

	Hard Mobile Launcher in Random Movement		Hard Mobile Launcher at Minuteman Facilities		Hard Silo in Patterned Array
	50 Missiles	200 Missiles	170 Missiles	200 Missiles	250 Missiles
Potable Water					
Direct Project Reqs.[1] (MG) (1990-1996)	365	1,257	196	326	352
MOB	67	82	53	54	37
Deployment Area	298	1,175	143	272	315
Onbase Population-Induced Demand (MGD)					
Construction Phase (Peak Year)	*	0-0.1	0.49-1.13	a	0.34-0.59
Operations Phase (Annual Demand)	0.35-0.46	1.17-1.65	0.48-1.11	a	0.44-0.76
Offbase Population-Induced Demand (MGD)					
Construction Phase (Peak Year)	0.45-0.57	0.72-1.5	0.38-1.36	1.31-1.57	1.02-1.8
Operations Phase (Annual Demand)	0.19-0.27	0.28-1.03	0.31-1.27	1.27-1.47	0.13-0.32
Wastewater					
Onbase Population-Induced Flow (MGD)					
Construction Phase (Peak Year)	*	0-0.1	*	a	0.28-0.55
Operations Phase (Annual Demand)	0.34-0.46	0.57-1.66	0.39-0.78	a	0.37-0.72
Offbase Population-Induced Flow (MGD)					
Construction Phase (Peak Year)	0.38-0.67	0.37-1.06	0.37-0.66	1.26-1.35	0.51-1.41
Operations Phase (Annual Demand)	0.16-0.32	0.9-1	0.12-0.43	1.18-1.25	0.07-0.64
Solid Waste					
Onbase Population-Induced Demand (cy/yr)					
Construction Phase (Peak Year)	616	982-1,004	a	a	3,652-5,172
Operations Phase (Annual Demand)	4,225	10,115-15,876	a	a	4,756-6,738
Offbase Population-Induced Demand (cy/yr)					
Construction Phase (Peak Year)	6,114-10,143	7,369-23,761	9,056-17,681	12,743-19,867	14,244-23,424
Operations Phase (Annual Demand)	2,882-8,874	2,820-22,379	5,320-16,409	12,529-18,569	1,283-10,026
Energy Utilities					
Electricity					
Offbase Population-Induced Demand (MW/yr)					
Construction Phase (Peak Year)	2.6-2.7	1.2-6.2	2.3-5.3	4.6-4.7	3.7-5.9
Operations Phase (Annual Demand)	2.3	0.9-5.9	2-4.9	4.3	0.4-2.6
Natural Gas					
Offbase Population-Induced Demand (MMcf/yr)					
Construction Phase (Peak Year)	65-137	31-314	403-425	160-397	121-475
Operations Phase (Annual Demand)	58-120	23-298	375-397	138-368	10-214
Direct Diesel Construction Reqs. (gal/yr)					
MOB	3,640-364,000	2,860-1,167,920	2,860-28,886	2,600-301,600	18,200-248,040
Deployment Area	45,240-250,120	317,200-7,498,920	9,100-48,412	1,040-693,420	24,180-406,900
Direct Diesel Operational Reqs. (gal/yr)	9,125	36,500	--	--	--

Notes: [1] Water for construction, dust control, and revegetation.
[a] No onbase facilities; demands are included in offbase figures.
* = Negligible.

Potable Water Treatment and Distribution. With Gila Bend AFAF as the MOB, most of the project-induced inmigration during the construction phase will be dispersed throughout Maricopa County. The offbase inmigrating population of 5,608 in 1990 will require an additional 1.5 million gallons per day (MGD) (excluding onbase demands) of potable water treatment capacity. This represents a 0.3-percent increase over the projected demand of 576 MGD. The capacity of systems servicing the county will be 700 MGD in 1990.

During the operations phase, it is anticipated that all of the 1,946 offbase inmigrants will locate within Gila Bend's service area and require an additional 0.5 MGD of potable water treatment capacity. This represents a 45-percent increase over the projected demand of 1.1 MGD in the year 2000. Capacity of the town's system will be 2 MGD in 1990 and will provide 0.4 MGD of excess average daily capacity. Short-term impacts to the potable water treatment systems will be negligible and long-term impacts will be moderate and not significant. Project-induced demands at Gila Bend AFAF will increase by 1.7 MGD or 644 percent over the projected demand of 0.26 MGD by 1996 and continue through the operations phase. To meet this demand new wells and treatment facilities will be required.

With Yuma PG as the MOB, project-induced demand in Yuma County from an offbase inmigrating population of 5,787 will be 1.2 MGD in 1990, excluding onbase demands. With the beginning of the operations phase and the inmigration of 1,526 offbase persons, demand will continue at 0.32 MGD each year. This represents 7.5 and 1.6-percent increases, respectively, over the projected demands of 16.3 MGD in 1990 and 19.8 MGD in the year 2000. The capacity of systems servicing the county is 28.5 MGD. The systems will provide 8.4 MGD of excess average daily capacity through the year 2000. Project-induced demands for municipal potable water treatment in Yuma County will result in short-term, negligible impacts. Long-term impacts will be low and not significant. Project-induced demand at Yuma PG will increase by 1.7 MGD or 226 percent over the projected demand of 0.73 MGD during the operations phase. Treatment and distribution facilities at Yuma PG will require considerable expansion in order to meet the increased demands resulting from an additional 8,265 onbase personnel.

Wastewater. The peak project-induced demand on municipal wastewater treatment systems in Maricopa County will be 0.59 MGD (excluding onbase flows) in 1990. During the operations phase, Gila Bend's demands will be 0.09 MGD. These demands represent 0.3 and 47-percent increases, respectively, over the county's projected demand of 226 MGD in 1990 and the town's projected demand of 0.19 MGD in the year 2000. The capacity of systems servicing the county will be 225 MGD in 1990 and the capacity of the town's system will be 0.13 MGD in the year 2000. Short-term impacts to the wastewater treatment systems in Maricopa County will be negligible and long-term impacts will be moderate and significant. Long-term impacts are significant since additional capacity will have to be added to the town's system to meet project-induced demands. Project-induced demands on Gila Bend AFAF facilities will increase by 0.84 MGD in 1996 or by 1,675 percent over the projected demand of 0.05 MGD. New onbase treatment facilities will be required to process the additional flows.

The peak project-induced demand on municipal wastewater treatment in Yuma County will be 0.61 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.16 MGD. This represents 8.6 and 1.9-percent

increases, respectively, over the projected demands of 7.1 MGD in 1990 and 8.7 MGD in the year 2000. The capacity of systems servicing the county is 12.3 MGD and will provide 4.5 MGD of excess capacity in 1990 and 3.4 MGD in the year 2000. Short-term impacts are expected to be negligible; long-term impacts to municipal wastewater treatment facilities in Yuma County will be low and not significant. Project-induced demand on Yuma PG facilities will increase by 1.6 MGD or 413 percent over the projected demand of 0.39 MGD during the operations phase.

Solid Waste. The peak project-induced demand for solid waste disposal in Maricopa County will amount to 23,540 cubic yards (cy) (including wastes generated onbase) in 1996. During the operations phase, demand will be 22,224 cubic yards per year (cy/yr). Project-induced demands represent 0.4 and 0.3-percent increases, respectively, over the projected demands of 5.9 million cy in 1996 and 6.5 million cy in the year 2000. The capacity of landfill sites is 960 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short and long-term, negligible impacts.

The peak project-induced demand for solid waste disposal in Yuma County will amount to 10,561 cy (excluding wastes generated onbase) in 1990. During the operations phase, demand will be 2,785 cy/yr. Project-induced demands represent 6.5 and 1.4-percent increases, respectively, over the projected demands of 163,155 cy in 1990 and 198,560 cy in the year 2000. The capacity of landfill sites servicing the county is 160 acres. The project-induced demand for solid waste disposal will result in short-term, low, and not significant impacts. Long-term impacts will be negligible. Project-induced demands at Yuma PG will increase by a total of 1,001 cy in 1990 and by 15,084 cy in the year 2000. This represents 27 and 413-percent increases, respectively, over the projected demand of 3,650 cy/yr.

Energy Utilities. With Gila Bend AFAF as the MOB, the peak project-induced demand for electricity in Maricopa County will amount to 6.2 megawatts (MW) in 1996 and 5.9 MW per year during the operations phase (including onbase demands). This represents 0.07 and 0.06-percent increases, respectively, over the combined projected peak loads for the Arizona Public Service Company and the Salt River Project. Electrical capacities are projected to be 9,126 MW in 1996 and 10,426 MW in the year 2000, providing a 9-percent reserve margin in 1996 and a 7-percent reserve margin in the year 2000. The combined capacities of the two companies will be adequate for the projected growth demands.

The peak project-induced demand for natural gas in Maricopa County will amount to 118,000 thousand cubic feet (Mcf) in 1990 and 31,000 Mcf per year in the operations phase (excluding onbase demands). This represents 0.3 and 0.06-percent increases, respectively, over the projected consumption levels in the county, based on population projections. The Southwest Gas Corporation has recently acquired the natural gas service areas in Maricopa County, and anticipates an increased service capability through conversions from electricity and expansion of the distribution system. Number 2 diesel fuel is used for heating needs on Gila Bend AFAF. The peak project-induced demand for No. 2 diesel fuel onbase will amount to 1,407,000 gallons in 1996 and 1,389,000 gallons per year in the operations phase. This represents over a 1,000-percent increase in the baseline annual use and will necessitate increases in storage capacity and contract rates of supply.

The peak project-induced demand for gasoline in Maricopa County, including onbase demands, will increase projected consumption levels by 0.4 percent in 1996 and by 0.3 percent in the operations phase. The peak project-induced demand for diesel fuel, including onbase demands, will increase projected consumption levels by 0.8 percent in 1990, and by 0.3 percent per year in the operations phase. The regional supply systems in the county will be adequate to meet the project-induced demands.

With the MOB located at Yuma PG, the peak project-induced demand for electricity in Yuma County will amount to 3.5 MW in 1990 and 0.9 MW per year in the operations phase (excluding onbase demands). This represents 0.1 and 0.02-percent increases, respectively, in the projected peak load for the Arizona Public Service Company. Electrical capacity is projected to be 4,680 MW in 1990 and 5,630 MW in the year 2000, providing a 21-percent reserve margin in 1996 and an 8-percent reserve margin in the year 2000. The project-induced demands are within the projected peak demands for the company, and will be met by present and planned generating capacities.

The Western Area Power Administration provides electricity to Yuma PG. In 1984, the onbase consumption was 24,807,000 kilowatt-hours (kWh). The peak project-induced consumption of electricity on Yuma PG will amount to 103,855,000 kWh in 1996 and 102,515,000 per year in the operations phase. This represents an over 400-percent increase in consumption, necessitating an increase in the supply contract with the Western Area Power Administration.

The peak project-induced demand for natural gas in Yuma County will amount to 88,890 Mcf in 1990 and 23,400 Mcf per year in the operations phase (excluding onbase demands). This represents 0.2 and 0.05-percent increases, respectively, over the projected consumption levels based on population projections. The Southwest Gas Corporation has recently acquired the natural gas service areas in Yuma County, and anticipates an increase in service capability through conversions from electricity and expansion of the distribution system. Fuel oil is used on Yuma PG for heating needs. The peak project-induced demands onbase will amount to 628,000 gallons in 1996 and 620,000 gallons per year in the operations phase. This represents over 400-percent increases in annual consumption levels and will necessitate increases in the storage capacity and contracted rates of supply.

The peak project-induced demand for gasoline in Yuma County will increase consumption by 10.1 percent in 1996 and by 8.8 percent per year in the operations phase (including onbase demands). The peak project-induced demand for diesel fuel, including onbase demands, will increase consumption by 19 percent in 1990 and by 9.2 percent per year in the operations phase. The regional supply systems should be adequate to meet the increases in demand.

The project-induced demand on electricity consumption in both Maricopa and Yuma counties will have no noticeable effect. The project-induced demand on natural gas, gasoline, and diesel fuel consumption for both MOB alternatives will not represent noticeable increases in the regional projected demands. Short and long-term impacts in both counties will be negligible. Project-induced demand for No. 2 diesel at Gila Bend AFAF will necessitate increases in the supply and storage capacities. Project-induced demand for fuel oil at Yuma PG will necessitate increases in the supply and storage systems.

4.2.3.2 Florida Complex

The proposed project will result in short-term, low, and not significant impacts to the potable water and wastewater treatment systems of Okaloosa County. Long-term impacts will be negligible. Short-term impacts to solid waste and energy systems are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at Eglin Air Force Base (AFB), project-induced demand in Okaloosa County will be 0.5 MGD (excluding onbase demands) in 1990 as a result of an offbase inmigrating population of 3,762. This demand will continue at 0.21 MGD through the operations phase with the additional offbase inmigration of 1,575 persons. This represents 2.8 and 0.9-percent increases, respectively, over the projected demands of 17.7 MGD in 1990 and 22.3 MGD in the year 2000. The capacity of systems servicing the county is 33.9 MGD. The systems will provide 11.6 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for potable water treatment will generate short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand at Eglin AFB will increase by 0.5 MGD or 9 percent over the projected demand of 5.4 MGD. Onbase facilities have an 8.8 MGD capacity, which will be adequate to meet average daily requirements.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Okaloosa County will be 0.38 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.16 MGD. This represents 2.8 and 0.9-percent increases, respectively, over the projected demands of 15 MGD in 1994 and 17.1 MGD in the year 2000. The capacity of systems servicing the county is 17.7 MGD and will increase to 20.63 in 1988. Short-term impacts to municipal wastewater treatment facilities in Okaloosa County are expected to be low and not significant. Long-term impacts will be negligible. Project-induced demands at Eglin AFB will increase by 0.35 MGD or 13-percent over the projected demand of 2.7 MGD. The capacity of onbase treatment facilities will be 3.7 MGD, which will be adequate for average daily flows.

Solid Waste. The peak project-induced demand for solid waste disposal in Okaloosa County will amount to 10,143 cy (including wastes generated onbase) in 1994. During the operations phase, the demand will be 8,874 cy/yr. Project-induced demands represent 2.7 and 2.1-percent increases, respectively, over the projected demands of 377,323 cy in 1994 and 425,681 cy in the year 2000. The capacity of landfill sites is 180 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Energy Utilities. The peak project-induced demand for electricity in Okaloosa County will amount to 2.7 MW in 1994 and 2.3 MW per year during the operations phase (including onbase demands). This represents 0.15 and 0.13-percent increases, respectively, over the projected peak load for the Gulf Power Company. Electrical capacities are projected to be 2,258 MW in 1994 and 2,261 MW in the year 2000, providing 20 and 16-percent reserve margins, respectively. The project-induced demand is well within historical peak-demand increases of the Gulf Power Company.

The peak project-induced demand for natural gas in Okaloosa County will amount to 66,000 Mcf in 1994 and 58,000 Mcf per year in the operations phase (including onbase demands). This represents 2.8 and 2.4-percent increases, respectively, over the projected consumption levels in the county.

The peak project-induced demands for gasoline in Okaloosa County will increase projected consumption levels by 2.7 percent in 1994 and by 2.1 percent per year in the operations phase (including onbase demands). The peak project-induced demand for diesel fuel will increase projected consumption levels by 5.5 percent in 1990 and by 2.1 percent per year in the operations phase (including onbase demands). The regional supply systems in the county will be adequate to meet the project-induced demands.

The project-induced demands for electricity and liquid fuels do not represent a noticeable increase in projected consumption levels. Project-induced demand for natural gas represents a small increase in projected consumption levels for the county. Short-term impacts are expected to be negligible; long-term impacts will be low and not significant.

4.2.3.3 Nevada Complex

Both short and long-term impacts to Clark County utility systems will be negligible.

Potable Water Treatment and Distribution. Regardless of whether the MOB is located at Indian Springs AFAF or Nellis AFB, project-induced demand in Clark County (where both installations are located) from an offbase inmigrating population of 4,822 will be 1.25 MGD in 1990, excluding onbase demands. With the beginning of the operations phase and the inmigration of 3,976 offbase persons, demand will continue at 1.03 MGD each year. This represents 0.61 and 0.37-percent increases, respectively, over the projected demands of 207 MGD in 1990 and 281 MGD in the year 2000. The capacity of systems servicing the county is 602 MGD. The systems will provide 320 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for potable water treatment, regardless of the MOB location, will result in short and long-term, negligible impacts. Project-induced demands at Nellis AFB will increase by 1.2 MGD in 1996 or 24 percent over the projected demand of 5 MGD. Project-induced demands at Indian Springs AFAF will increase by 1.2 MGD in 1996 or 480 percent over the projected demand of 0.25 MGD.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Clark County, regardless of MOB location, will be 1.5 MGD in 1996. During the operations phase, demand will be 0.58 MGD. This represents 1.3 and 1.1-percent increases, respectively, over the projected demands of 115 MGD in 1996 and 129 MGD in the year 2000 and includes flows from Nellis AFB. The capacity of systems servicing the county will be 191 MGD in 1996 and 215 MGD in the year 2000, providing 75 MGD of excess capacity in 1996 and 85 MGD in the year 2000. Short and long-term impacts to municipal wastewater treatment facilities in Clark County will be negligible, regardless of the MOB location. Project-induced demands at Indian Springs AFAF will increase by 1.18 MGD in 1996 or 39.3 percent over the projected demand of 0.3 MGD. New treatment facilities will be required to process this increased flow.

Solid Waste. The peak project-induced demand for solid waste disposal in Clark County will amount to 23,761 cy (including waste from either MOB) in 1996. During the operations phase, demand will be 22,379 cy/yr. Project-induced demands represent 1.3 and 1.1-percent increases, respectively, over the projected demands of 1.8 million cy in 1996 and 2.02 million cy in the year 2000. Capacity of the landfill sites will be adequate through 1989. A new site is being sought to replace the major site in Clark County. The project-induced demand for solid waste disposal will result in short and long-term, negligible impacts.

Energy Utilities. The peak project-induced demand for electricity in Clark County will amount to 6.3 MW in 1996 and 5.9 MW per year during the operations phase (including onbase demands). This represents 0.3 and 0.25-percent increases, respectively, over the projected peak load for the Nevada Power Company. Electrical capacities are projected to be 2,225 MW in 1996 and 2,428 MW in the year 2000, providing 5 and 3-percent reserve margins, respectively. With an increased generating capacity in the year 2000, Nevada Power Company anticipates meeting all customer demands.

The peak project-induced demand for natural gas in Clark County will amount to 116,000 Mcf in 1996 and will decline to 102,000 Mcf per year in the operations phase (excluding onbase demands). This represents 0.4 and 0.3-percent increases, respectively, over the projected consumption levels in the county. The Southwest Gas Corporation anticipates no problems in serving projected increases in demands. No. 2 diesel fuel is used for heating needs on Indian Springs AFAF and natural gas is used on Nellis AFB. The peak project-induced demand for natural gas on Nellis AFB will amount to 152,000 Mcf in 1996 and 150,000 Mcf per year in the operations phase.

The peak project-induced demand for gasoline in Clark County will increase consumption by 1.3 percent in 1996 and by 1.1 percent per year in the operations phase (including onbase demands). The peak project-induced demand for diesel fuel will increase consumption by 2.1 percent in 1990 and by 1.1 percent per year in the operations phase (including onbase demands). The regional supply systems in the county will be adequate to meet the project-induced demands.

The project-induced demands on all of the energy utilities will not affect service reliability and no major system upgrades are anticipated. Short and long-term impacts will be negligible.

4.2.3.4 New Mexico Complex

For the New Mexico Complex, impact analyses were performed for the three alternative MOB locations: Fort Bliss in El Paso County, Texas; Holloman AFB in Otero County, New Mexico; and White Sands Missile Range Headquarters in Dona Ana County, New Mexico. If the New Mexico Complex is selected, impacts to regional utility systems will range from negligible to moderate depending on the alternative.

If the MOB is located at Fort Bliss, short and long-term impacts to potable water treatment, wastewater, and solid waste disposal systems will be negligible. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

If the MOB is located at Holloman AFB, short-term impacts to potable water treatment systems will be negligible and long-term impacts will be low and not significant. Short-term wastewater treatment impacts are expected to be negligible; long-term impacts will be low and significant. Short-term solid waste disposal impacts are expected to be negligible; long-term impacts will be low and not significant. Short-term energy impacts are expected to be negligible; long-term impacts will be moderate and not significant.

If the MOB is located at White Sands Missile Range Headquarters, short-term potable water treatment impacts will be low and not significant; long-term impacts will be negligible. Short-term wastewater treatment impacts are expected to be negligible; long-term impacts will be low and not significant. Short-term solid waste disposal impacts will be low and not significant; long-term impacts will be negligible. Short-term energy impacts are anticipated to be negligible; long-term impacts will be moderate and not significant.

Potable Water Treatment and Distribution. With the MOB located at Fort Bliss, project-induced demand in El Paso County will be 0.89 MGD (excluding onbase demands) in 1990 as a result of an offbase inmigrating population of 4,969. This demand will decrease to 0.28 MGD in the operations phase as the offbase inmigrating population drops to 1,542. This represents 0.7 and 0.2-percent increases, respectively, over the projected demands of 122 MGD in 1990 and 171 MGD in the year 2000 for El Paso County. The capacity of systems servicing the county will continue to expand as additional wells are developed to meet the increased demand. Long-range planning efforts anticipate growth rates greater than those associated with the proposed project. Proposed project effects on municipal potable water systems will result in short and long-term, negligible impacts. Project-induced demand at Fort Bliss will increase by 1.6 MGD in 1996 or 26 percent over the projected demand of 6.1 MGD. The capacity of onbase facilities is projected to be 12.4 MGD, providing for 4.7 MGD of excess average daily capacity.

With the MOB located at Holloman AFB, project-induced demand in Otero County will be 0.72 MGD (excluding onbase demands) in 1990 as a result of an offbase inmigrating population of 4,501. This demand will decrease to 0.63 MGD during the operations phase as the offbase inmigrating population drops to 3,965. This represents 6.8 and 4.8-percent increases, respectively, over the projected demands of 10.6 MGD in 1990 and 13.3 MGD in the year 2000. The capacity of the 37 municipal systems servicing the county is 16 MGD, providing 2 MGD of excess average daily capacity in the year 2000. Short-term impacts to municipal potable water treatment systems are expected to be negligible. Long-term impacts will be low and not significant. Project-induced demand at Holloman AFB will increase by 1.2 MGD or 44 percent over the projected demand of 2.7 MGD by 1996 and continue through the operations phase. The capacity of onbase facilities is projected to increase to 6.9 MGD, providing for 3 MGD of excess average daily capacity.

With the MOB located at White Sands Missile Range Headquarters, project-induced demand in Dona Ana County will be 0.91 MGD (excluding onbase demand) in 1990 as a result of an offbase inmigrating population of 4,530. This demand will decrease to 0.31 MGD in the operations phase as the offbase inmigrating population drops to 1,535. This represents 4.8 and 1.4-percent increases, respectively, over the projected demands of 18.8 MGD in 1990 and 22.8 MGD in the year 2000 for Dona Ana County. The capacity of systems

servicing the county is 36.4 MGD and will continue to expand with the drilling of additional wells. Short-term impacts to municipal systems are considered to be low and not significant; long-term impacts will be negligible. Project-induced demand at White Sands Missile Range Headquarters will increase by 1.7 MGD or 98 percent over the projected demand of 1.7 MGD. The capacity of onbase facilities is 5.9 MGD. The facilities will provide 2.5 MGD of excess average daily capacity.

Wastewater. The peak project-induced demand for municipal wastewater treatment in El Paso County will be 1.1 MGD (including flows from the base) in 1996. During the operations phase, demand will be 1 MGD. This represents 1.4 and 1.2-percent increases, respectively, over the projected demands of 73.8 MGD in 1996 and 80.7 MGD in the year 2000 for El Paso County. The capacity of systems servicing the county will increase from 57 MGD in 1985 to 78.8 MGD in 1990. An additional 10 MGD of capacity is planned by the year 2000, providing adequate capacity for projected flows. The proposed project will result in short and long-term, negligible impacts.

The peak project-induced demand on municipal wastewater treatment in Otero County will be 0.49 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.43 MGD. This represents 8.9 and 6.2-percent increases, respectively, over the projected demands of 5.5 MGD in 1990 and 6.9 MGD in the year 2000. The capacity of systems servicing the county is 5 MGD. Projected growth requirements will necessitate additional municipal treatment capacity prior to 1990, and project-induced demands may be incorporated into planning efforts supporting the expansion. Short-term impacts to municipal wastewater treatment facilities are expected to be negligible; however, long-term impacts will be low and significant. Impacts will be significant since additional facilities will be required to process projected and project-induced flows. Project-induced demand at Holloman AFB will increase by 1.7 MGD or 77 percent over the projected demand of 2.2 MGD. The capacity of onbase facilities is 2.2 MGD. Project-induced demand for wastewater treatment at Holloman AFB will require an approximate doubling of the size of existing facilities.

The peak project-induced demand on municipal wastewater treatment in Dona Ana County will be 0.48 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.16 MGD. This represents 7.3 and 2-percent increases, respectively, over the projected demands of 6.6 MGD in 1990 and 8 MGD in the year 2000 for Dona Ana County. The capacity of systems servicing the county will be 9.6 MGD in 1987 and will provide 1.4 MGD of excess capacity in the year 2000. Short-term impacts are expected to be negligible for municipal wastewater treatment facilities and long-term impacts in Dona Ana County will be low and not significant. Project-induced demand at White Sands Missile Range Headquarters will increase by 0.94 MGD or 174 percent over the projected demand of 0.54 MGD. The capacity of onbase facilities is 1 MGD. Project-induced demand for wastewater treatment at White Sands Missile Range Headquarters will require the size of existing facilities to be increased.

Solid Waste. The peak project-induced demand for solid waste disposal in El Paso County will amount to 9,545 cy (excluding wastes from the base) in 1990. During the operations phase, demand will be 2,962 cy/yr. Project-induced demands represent 0.83 and 0.20-percent increases, respectively, over the projected demands of 1.1 million cy in 1990 and 1.4 million cy in the

year 2000. The capacity of landfill sites is 752 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short and long-term, negligible impacts. Project-induced demand at Fort Bliss will increase by a total of 16,098 cy in 1996 and by 15,876 cy in the 2000. This represents 26.2 and 25.8-percent increases, respectively, over the projected demand of 61,466 cy/yr, which will be disposed at the onbase landfill that has a remaining capacity of 70 acres.

The peak, project-induced demand for solid waste disposal in Otero County will amount to 7,804 cy (excluding wastes generated onbase) in 1990. During the operations phase, demand will be 6,874 cy/yr. Project-induced demands represent 8.9 and 6.2-percent increases, respectively, over the projected demands of 88,075 cy in 1990 and 110,960 cy in the year 2000. The capacity of landfill sites is 110 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term, negligible impacts and long-term impacts will be low and not significant. Project-induced demand at Holloman AFB will increase by a total of 10,261 cy in 1996, and by 10,115 cy in the year 2000. This represents 76.9 and 75.8-percent increases, respectively, over the projected demand of 13,350 cy/yr, which will be disposed at the 160-acre onbase landfill.

The peak project-induced demand for solid waste disposal in Dona Ana County will amount to 7,854 cy (excluding wastes generated onbase) in 1990. During the operations phase, demand will be 2,661 cy/yr. Project-induced demands represent 3.6 and 1-percent increases, respectively, over the projected demands of 219,423 cy in 1990 and 266,235 cy in the year 2000. The capacity of landfill sites is 336 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand at White Sands Missile Range Headquarters will increase by a total of 998 cy in 1990 and by 14,329 cy in the year 2000. This represents 12 and 174-percent increases, respectively, over the projected demand of 8,218 cy/yr. The current 60-acre landfill will require expansion in order to handle the wastes from the project-induced population.

Energy Utilities. The El Paso Electric Company services all three MOB counties. The peak project-induced demand for electricity will amount to 6.2 MW in 1996 and 6 MW per year during the operations phase (including onbase demands). This represents 0.5 and 0.4-percent increases, respectively, over the projected peak load for El Paso Electric Company. Electrical capacity is projected to be 1,589 MW in 1996 and the same in the year 2000, providing 20 and 14-percent reserve margins, respectively. The project-induced demands are well within the projected peak demands for the El Paso Electric Company.

With Fort Bliss as the MOB, the peak project-induced natural gas demand in El Paso County will be 291,000 Mcf in 1996 and 275,000 Mcf per year in the operations phase (including onbase demands). This represents 2.4 and 2-percent increases, respectively, in the projected demands for the Southern Union Gas Company, El Paso District. With Holloman AFB as the MOB, the peak project-induced demands for natural gas in Otero County will be 314,000 Mcf in 1996 and 298,000 Mcf per year in the operations phase (including onbase demands). This represents 22 and 17-percent increases, respectively, over the projected consumption levels for the Gas Company of New Mexico. With White Sands Missile Range Headquarters as the MOB, the peak project-induced demand

for natural gas in Dona Ana County will be 314,000 Mcf in 1996 and 298,000 Mcf per year in the operations phase (including onbase demands). This represents 22 and 17-percent increases, respectively, over the projected consumption levels in Dona Ana County. These are appreciable increases in consumption level projections for the Gas Company of New Mexico, and will require an improvement in service system infrastructure.

In El Paso County, the peak project-induced demands on gasoline will increase consumption by 1.4 percent in 1996 and by 1.2 percent in the operation phase (including onbase demands). The peak project-induced demand for diesel fuel will increase consumption by 2.2 percent in 1990 and by 1.2 percent per year in the operations phase. The project-induced demands for gasoline in Otero County will amount to a 16-percent increase over projected consumption levels in 1996 and a 14-percent increase per year in the operations phase (including onbase demands). The project-induced demand for diesel fuel will increase consumption by 20 percent in 1990 and by 14-percent per year in the operations phase. The project-induced demand for gasoline will increase consumption by 7 percent in 1996 and by 6.2 percent in the operations phase in Dona Ana County, including onbase demands. The peak project-induced demand for diesel fuel in Dona Ana County will increase consumption by 9 percent in 1990 and by 6 percent per year in the operations phase. The regional supply systems in these counties should be adequate to meet the project-induced demands.

The project-induced demand on electricity consumption at all three MOB locations will not represent noticeable increases in projected demands. In El Paso County, the project-induced demand for natural gas represents a small increase in regional projected demands. In Otero and Dona Ana counties, project-induced demands for natural gas represent substantial increases in regional projected demands. Project-induced demand for liquid fuels represents minor increases at all three MOB alternatives. In El Paso County, short-term energy impacts are anticipated to be negligible; long-term impacts will be low and not significant. In Otero and Dona Ana counties, short-term energy impacts are anticipated to be negligible; long-term impacts will be moderate and not significant.

4.2.3.5 South-Central California Complex

For the South-Central California Complex, impact analyses were performed for the two alternative MOB locations: Edwards AFB, situated in the desert portion of Los Angeles County, and Fort Irwin National Training Center (NTC) in San Bernardino County. If the South-Central California Complex is selected, impacts to regional utility systems will range from negligible to low, depending on the alternative.

If the MOB is located at Edwards AFB, short-term impacts to potable water treatment will be negligible; long-term impacts will be low and not significant. Short-term wastewater treatment impacts will be negligible; long-term impacts will be low and significant. Short-term solid waste disposal impacts are expected to be negligible; long-term impacts will be low and not significant. Short and long-term energy impacts will be negligible.

If the MOB is located at Fort Irwin NTC, short-term impacts to potable water treatment, wastewater, and solid waste impacts will be low and not significant; long-term impacts will be negligible. Short and long-term energy impacts will be negligible.

Potable Water Treatment and Distribution. With the MOB located at Edwards AFB, project-induced demand in the desert region of Los Angeles County from an off-base inmigrating population of 4,498 will be 0.81 MGD (excluding onbase demands) in the peak-construction year (1996). With the beginning of the operations phase and the offbase inmigration of 3,976 persons, demand will continue at 0.72 MGD each year. This represents 2.4 and 1.9-percent increases, respectively, over the projected demands of 33.1 MGD in 1996 and 37.7 MGD in the year 2000. The capacity of systems servicing the desert region of the county is 60.3 MGD and will provide 21.9 MGD of excess average daily capacity through the year 2000. Short-term impacts to municipal potable water treatment systems will be negligible. Long-term impacts will be low and not significant. Project-induced demand on Edwards AFB facilities will increase by 1.2 MGD in 1996 or 22 percent over the projected demand of 5.4 MGD. The capacity of onbase wells is estimated to be 12.5 MGD and will provide 5.9 MGD of excess average daily capacity. However, distribution facilities at Edwards AFB will require upgrading prior to absorbing the increased demand.

With the MOB located at Fort Irwin NTC, project-induced demand in the desert portion of San Bernardino County will be 0.93 MGD (excluding onbase demands) in 1990, as a result of an offbase inmigrating population of 4,038. With the beginning of the operations phase and the offbase inmigration of 1,545 persons, demand will continue at 0.36 MGD each year. This represents 5.2 and 1.4-percent increases, respectively, over the projected demands of 17.9 MGD in 1990 and 25.8 MGD in the year 2000. The capacity of systems servicing the desert region of the county is 34 MGD and will provide 7.6 MGD of excess average daily capacity through the year 2000. Short-term impacts to municipal potable water treatment systems will be low and not significant; long-term impacts will be negligible. Project-induced demand on Fort Irwin NTC facilities will increase by 1.6 MGD in 1996 or 80 percent over the projected demand of 2 MGD. The capacity of onbase facilities equals 5.1 MGD which will be adequate to meet average daily demands.

Wastewater. The peak project-induced demand on municipal wastewater treatment in the desert region of Los Angeles County will be 0.37 MGD (excluding onbase flows) in 1996. During the operations phase, demand will be 0.33 MGD. This represents 3 and 2.3-percent increases, respectively, over the projected demands of 12.3 MGD in 1996 and 14 MGD in the year 2000. The capacity of systems servicing the desert region of the county is programmed to be 10 MGD by 1990. Projected demands will exceed projected wastewater treatment capacity throughout the construction phase because of the high growth rate associated with the Lancaster/Palmdale area. Short-term impacts to municipal wastewater treatment facilities in the desert region of Los Angeles County will be negligible and long-term impacts will be low. Long-term impacts will be significant since additional facilities will be required to process projected and project-induced flows. Project-induced demand at Edwards AFB will increase by 0.57 MGD in 1996 or 38 percent over the projected demand of 1.5 MGD. Onbase facilities, which have a capacity of 1.3 MGD, will require expansion to process project-induced flows.

The peak project-induced demand on municipal wastewater treatment in the desert region of San Bernardino County will be 0.44 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.17 MGD. This represents 6 and 1.4-percent increases, respectively, over the projected demands of 7.3 MGD in 1990 and 12.1 MGD in the year 2000. The capacity of

systems servicing this region will be 11 MGD in 1988 and will provide 3.3 MGD of excess capacity in 1990. Projected growth will exceed the presently planned capacity for the region by 1.2 MGD in the year 2000. Project-induced demands to municipal wastewater treatment facilities in San Bernardino County will result in short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand at Fort Irwin NTC will increase by 0.8 MGD in 1996 or 80 percent over the projected demand of 1 MGD. Onbase facilities, which have a capacity of 1 MGD, will require expansion to process project-induced flows.

Solid Waste. The peak project-induced demand for solid waste disposal in the desert region of Los Angeles County will amount to 10,261 cy (excluding wastes generated onbase) in 1996. During the operations phase, demand will be 9,070 cy/yr. Project-induced demands represent 2.6 and 2-percent increases, respectively, over the projected demands of 401,333 cy in 1996 and 456,916 cy in the year 2000. The capacity of landfill sites is 320 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and not significant. Project-induced demand at Edwards AFB will increase by 10,801 cy in 1996 and by 10,647 cy in the year 2000. This represents 37.6 and 37.1-percent increases, respectively, over the projected demand of 28,691 cy/yr. The current onbase landfill may require expansion to accommodate project-induced wastes.

The peak project-induced demand for solid waste disposal in the desert portion of San Bernardino County will amount to 7,369 cy (excluding wastes generated onbase) in 1990. During the operations phase, demand will be 2,820 cy/yr. Project-induced demands represent 3.1 and 0.83-percent increases, respectively, over the projected demands of 235,618 cy in 1990 and 339,868 cy in the year 2000. The capacity of landfill sites is 4.6 million cy, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term impacts that are low and not significant; long-term impacts will be negligible. Project-induced demand at Fort Irwin NTC will increase by 15,296 cy in 1996 and by 15,084 cy in the year 2000. This represents 79.8 and 78.7-percent increases, respectively, over the projected demand of 19,163 cy/yr. The onbase landfill site will have adequate capacity to accommodate the increased waste flow.

Energy Utilities. For both the Edwards AFB and the Fort Irwin NTC areas, electricity is supplied by the Southern California Edison Company. The peak project-induced demand for electricity regardless of the MOB chosen, will amount to 6.2 MW in 1996 and 6 MW per year during the operations phase (including onbase demands). This represents 0.04 and 0.03-percent increases over the projected peak load for Southern California Edison Company. Electrical capacities are projected to be 21,709 MW in 1996 and 23,711 MW in the year 2000, providing 20 and 23.6-percent reserve margins, respectively. The project-induced demand is well within projected peak demands for the Southern California Edison Company. The electrical system at Edwards AFB will have to be upgraded to meet project-induced demands. The capacity of the Fort Irwin NTC substation will have to be increased so it can provide service to the existing population and meet project-induced demands.

With Edwards AFB as the MOB, the peak project-induced demand for natural gas will amount to 287,000 Mcf in 1996 and 271,000 Mcf per year in the operations

phase (including onbase demands). This represents 0.07 and 0.06-percent increases over projected consumption levels in the county. With Fort Irwin NTC as the MOB, the peak project-induced demand for natural gas will amount to 111,000 Mcf in 1990 and 43,000 Mcf per year in the operations phase (excluding onbase demands). This represents 0.03 and 0.01-percent increases, respectively, over the projected consumption levels for the county. Liquid petroleum gas is used for heating needs at Fort Irwin NTC. Peak project-induced demands will increase consumption by 80 percent in 1996 and by 79 percent in the operations phase. This will necessitate increases in supply and storage capacities.

With Edwards AFB as the MOB, project-induced demand for gasoline in Los Angeles County will increase consumption by 0.12-percent in both 1996 and in the operations phase (including onbase demands). The peak project-induced demand for diesel fuel will increase consumption by 0.2 percent in 1990 and by 0.12 percent per year in the operations phase. With Fort Irwin NTC as the MOB, project-induced demands for gasoline in San Bernardino County will increase consumption by 0.7 percent in 1996 and by 0.6 percent per year during the operations phase (including onbase demands). The peak project-induced demand for diesel fuel will increase consumption by 1.2 percent in 1990 and by 0.6 percent per year during the operations phase. The regional supply systems in either of these counties will be adequate to meet the project-induced demands.

The project-induced demands on electricity, natural gas, gasoline, and diesel fuel consumption are within projected consumption levels and will not affect service reliability. No major system upgrades are anticipated. Short and long-term energy impacts will be negligible. The Fort Irwin NTC substation will have to be upgraded to meet projected demand. The electrical system at Edwards AFB will have to be upgraded. Project-induced demand for liquid petroleum gas on Fort Irwin NTC will require increases in supply and storage systems.

4.2.3.6 Washington Complex

The proposed project will result in short-term, low, and not significant impacts to the potable water, wastewater treatment, and solid waste disposal systems of Yakima County. Long-term impacts will be negligible. Short-term energy impacts will be negligible and long-term impacts will be moderate and not significant.

Potable Water Treatment and Distribution. With the MOB at Yakima Firing Center (FC), project-induced demand in Yakima County from an offbase inmigrating population of 3,350 will be 0.57 MGD (excluding onbase demands) in 1990. With the beginning of the operations phase and the offbase inmigration of 1,579 persons, demand will continue at 0.27 MGD each year. This represents 2.3 and 0.95-percent increases, respectively, over the projected demands of 24.4 MGD in 1990 and 28.3 MGD in the year 2000. The capacity of systems servicing the county is 49.4 MGD and will provide 20.8 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for potable water treatment will result in short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand on Yakima FC facilities will

increase by a total of 0.38 MGD in 1994 or 1,474 percent over the projected demand of 0.03 MGD. The capacity of onbase facilities is 0.89 MGD and is adequate to meet average daily demands.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Yakima County will be 0.67 MGD (excluding onbase flows) in 1990. During the operations phase, demand will be 0.32 MGD. This represents 3.3 and 1.3-percent increases, respectively, over the projected demands of 20.6 MGD in 1990 and 23.9 MGD in the year 2000. The capacity of systems servicing the county is 28.3 MGD, which will provide 4.5-MGD excess capacity in 1990 and 1.57 MGD in the year 2000. Short-term impacts to wastewater treatment facilities in Yakima County will be low and not significant; long-term impacts will be negligible. Project-induced demand on Yakima FC facilities will increase by 0.48 MGD in 1994 or by 522 percent over the projected demand of 0.09 MGD. Current facilities may be able to process the increased flow demands.

Solid Waste. The peak project-induced demand for solid waste disposal in Yakima County will amount to 6,114 cy (excluding wastes generated onbase) in 1990. During the operations phase, demand will be 2,882 cy/yr. Project-induced demands represent 1.7 and 0.7-percent increases, respectively, over the projected demands of 354,473 cy in 1990 and 411,231 cy in the year 2000. The capacity of landfill sites is 70 acres, which will be adequate through the year 2000. The project-induced demand for solid waste disposal will result in short-term, low, and not significant impacts. Long-term impacts will be negligible. Project-induced demand at Yakima FC will increase by a total of 4,377 cy in 1994 and by 4,225 cy in the year 2000. This represents 1,426 and 1,376-percent increases, respectively, over the projected demand of 307 cy/yr. Onbase facilities (which will be expanded in 1987) will be used at an accelerated rate, requiring further expansion earlier than planned.

Energy Utilities. The peak project-induced demand for electricity in Yakima County will amount to 2.7 MW in 1994 and 2.3 MW per year during the operations phase (including onbase demands). This represents 0.05 and 0.04-percent increases, respectively, over the projected peak load for Pacific Power Company. Electrical capacities are projected to be 4,567 MW in 1994 and 4,452 MW in the year 2000, creating the need for additional generating and transmitting capacity to meet the projected peak demands of 4,958 MW in 1994 and 5,455 MW in the year 2000.

The peak project-induced demand for natural gas in Yakima County, including onbase demands, will amount to 137,000 Mcf in 1994 and 120,000 Mcf per year in the operations phase. This represents 34 and 30-percent increases, respectively, over the projected consumption levels in the county. The Cascade Natural Gas Company has recently increased the capacity of its system, and has the ability to meet the project-induced demands. A new system recently installed on Yakima FC has abundant capacity to meet demands.

The peak project-induced demand for gasoline in Yakima County will increase consumption by 2.1-percent in 1994 and by 1.7 percent per year in the operations phase (including onbase demands). The peak project-induced demand for diesel fuel will increase consumption by 3.7 percent in 1990 and by 1.7 percent per year in the operations phase (including onbase demands). The regional supply systems in these counties will be adequate to meet the project-induced demands.

Project-induced demands for electricity, gasoline, and diesel fuel will be within projected consumption levels and will not affect service reliability, and no major system upgrades are anticipated. Project-induced demands for natural gas represent a substantial increase in regional projected demands. Short-term energy impacts will be negligible; long-term impacts will be moderate and not significant.

4.2.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.2.4.1 Ellsworth Air Force Base

The proposed project will result in short-term, negligible impacts to the potable water treatment systems of Pennington County. Long-term potable water impacts will be low and not significant. Short-term wastewater impacts are expected to be negligible; long-term impacts will be low and not significant. Short-term solid waste impacts are expected to be negligible; long-term impacts will be low and not significant. Short and long-term energy impacts will be negligible.

Potable Water Treatment and Distribution. With the MOB located at Ellsworth AFB, project-induced demand in Pennington County from an inmigrating population of 7,744 will be 1.1 MGD (including onbase demands) in 1996. With the beginning of the operations phase and the inmigration of 7,193 persons, demand will continue at 0.97 MGD each year. This represents 8.2 and 7.2-percent increases, respectively, over the projected demands of 12.8 MGD in 1996 and 13.5 MGD in the year 2000. The capacity of systems servicing the county is 45 MGD. The systems will provide 29.3 MGD of excess average daily capacity through the year 2000. Demand at Ellsworth AFB will increase by 0.54 MGD in 1996 or 44 percent over the projected demand of 1.2 MGD. The projected demand includes the requirements associated with the B-1B bomber program. The capacity of the interconnection with Rapid City is 3.6 MGD, providing 1.8 MGD of excess capacity. Water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for municipal potable water treatment will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Pennington County will amount to 0.66 MGD (excluding flows from the base) in 1990. During the operations phase, demand will be 0.43 MGD. This represents 6.4 and 3.6-percent increases, respectively, over the projected demands of 10.3 MGD in 1990 and 11.9 MGD in the year 2000. Capacity of the systems servicing the county equals 14 MGD providing 2 MGD of excess capacity through the year 2000. Short-term impacts to municipal wastewater treatment facilities in Pennington County are expected to be negligible; long-term impacts will be low and not significant. Project-induced demand on Ellsworth AFB facilities will increase by 0.42 MGD in 1996 or 44 percent over the projected demand of 0.96 MGD. Onbase treatment facilities, with a 3-MGD capacity, will be adequate to process average daily flows.

Solid Waste. The peak project-induced demand for solid waste disposal in Pennington County will amount to a total of 17,681 cy (including wastes generated onbase) in 1996. During the operations phase, demand will be 16,409 cy/yr. Project-induced demands represent 9.4 and 8.3-percent increases, respectively, over the projected demands of 187,555 cy in 1996 and

198,391 cy in the year 2000. The capacity of landfill sites is 65 acres, which will be adequate to handle waste flows from the projected population and the increase caused by the proposed project through the year 2000. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Energy Utilities. The peak project-induced demand for electricity will be 4.7 MW in 1996 and 4.3 MW per year during the operations phase (including onbase demands). This represents 1.5 and 1.2-percent increases, respectively, over the projected peak load for Black Hills Power and Light Company. The electrical capacity is projected to be 345 MW in 1996, providing an 8-percent reserve margin. The company's firm power purchases will supplement generating capacity to meet the increased demand by the year 2000.

The peak project-induced demand for natural gas in Pennington County will be 209,000 Mcf in 1990 and 138,000 Mcf per year in the operations phase (excluding onbase demands). This represents 0.5 and 0.3-percent increases, respectively, over the projected consumption levels in the county. The Montana-Dakota Utility Company maintains natural gas supplies in excess of 934 billion cubic feet (Bcf), and will service the additional demand within the region. The peak project-induced demand on Ellsworth AFB will be 206,000 Mcf in 1996 and 202,000 Mcf per year in the operations phase. This represents 7.7 and 7.5-percent increases, respectively over the projected consumption levels for the base.

The project-induced demands for gasoline and diesel fuel in Pennington County will increase consumption levels by 8.4-percent in the construction phase and by 7.4 percent in the operations phase (including onbase demands). The regional supply systems in the county should be adequate to meet the project-induced demand.

The project-induced demands on all of the energy systems are within supply capabilities and will not affect service reliability and no major system upgrades are anticipated. Therefore, short and long-term energy impacts will be negligible.

4.2.4.2 F.E. Warren Air Force Base

The proposed project will result in short-term, negligible impacts on the potable water treatment systems of Laramie County. Long-term potable water impacts will be low and not significant. Short-term wastewater impacts will be moderate and significant; long-term impacts will be low and significant. Short-term solid waste impacts are expected to be negligible; long-term impacts will be low and significant. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at F.E. Warren AFB, project-induced demand in Laramie County will amount to 1.6 MGD (including demands onbase) in 1996 as a result of an inmigrating population of 8,709. With the beginning of the operations phase and the inmigration of 8,140 persons, demand will continue at 1.5 MGD each year. This represents 9.4 and 8.2-percent increases, respectively, over the projected demands of 16.7 MGD in 1996 and 18 MGD in the year 2000. The capacity of systems servicing the county is 35 MGD. The systems will provide 15.6 MGD of excess

average daily capacity through the year 2000. Water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for municipal potable water treatment will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Laramie County will be 1.3 MGD (including onbase flows) in 1996. During the operations phase, demand will be 1.2 MGD. This represents 11.1 and 9.7-percent increases, respectively, over the projected demands of 11.4 MGD in 1996 and 12.2 MGD in the year 2000. The capacity of systems servicing the county is 11 MGD. Projected demand for wastewater treatment capacity will exceed capacity by 1.6 MGD in 1996 and by about 2.4 MGD in the year 2000. Short-term impacts to municipal wastewater treatment facilities in Laramie County will be moderate; long-term impacts will be low. These impacts will be significant since additional facilities will be required to process projected and project-induced flows.

Solid Waste. The peak, project-induced demand for solid waste disposal in Laramie County will amount to a total of 19,984 cy (including wastes generated onbase) in 1996. During the operations phase, demand will be 18,569 cy/yr. Project-induced demands represent 9.7 and 8.4-percent increases, respectively, over the projected demands of 205,226 cy in 1996 and 220,734 cy in the year 2000. The capacity of the landfill site in Laramie County will provide disposal space through 1990. An additional facility will be required after 1990. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and significant. Long-term impacts will be significant since the lack of landfill capacity will require the development of new facilities.

Energy Utilities. The peak project-induced demand for electricity in Laramie County will be 2.3 MW in 1990 and 2 MW per year during the operations phase (excluding onbase demands). This represents 1.7 and 1.4-percent increases, respectively, over the projected peak load for Cheyenne Light, Fuel and Power Company. Electrical capacities are projected to be 131 MW in 1990 and 160 MW in the year 2000, providing a 9-percent reserve margin. Cheyenne Light, Fuel and Power purchases its supply under a long-term contract with other Western Systems Coordinating Council members, and will be able to meet the project-induced increases. The peak project-induced consumption of electricity on F.E. Warren AFB will amount to 41,016,000 kWh in 1996 and 40,383,000 kWh per year in the operations phase. This represents a 135-percent increase in consumption. The supplemental power contract with Rocky Mountain Generation Cooperative will have to be increased to meet the projected consumption level.

The peak project-induced demand for natural gas in Laramie County will amount to 425,000 Mcf in 1996 and 397,000 Mcf per year in the operations phase (including onbase demands). This represents 3.1 and 2.9-percent increases, respectively, over the projected consumption levels in the county. Cheyenne Light, Fuel and Power recently lost a major industrial consumer who represented 45 percent of their sales. Surplus capacity exists to meet baseline and project-induced demands.

A coal-fired heating plant will serve the project-induced demands on F.E. Warren AFB. Present capacity is adequate to meet the baseline and

project-induced demands. Annual natural gas use onbase is 344,715 Mcf, which is projected to remain the same.

The peak project-induced demands for gasoline and diesel fuel in Laramie County will increase projected consumption levels by 9.7 percent in 1996 and by 8.4 percent per year in the operations phase. The regional supply systems in the county will be adequate to meet the project-induced demands.

The project-induced demands on electricity and natural gas will represent small increases in the regional projected demand. Project-induced demand for liquid fuels will not represent a noticeable increase in demand. Reserve margins will not be completely used, and service reliability will not be affected by the increased load factors or consumption levels. Short-term impacts are expected to be negligible; long-term impacts will be low and not significant.

4.2.4.3 Grand Forks Air Force Base

The proposed project will result in short-term, negligible impacts to the potable water treatment systems of Grand Forks County and the City of East Grand Forks. Long-term potable water impacts will be moderate and not significant. Short-term wastewater impacts will be low and not significant; long-term impacts will be negligible. Short-term solid waste impacts are expected to be negligible; long-term impacts will be low and not significant. Short and long-term energy impacts will be negligible.

Potable Water Treatment and Distribution. With the MOB located at Grand Forks AFB, project-induced demand in Grand Forks County and the city of East Grand Forks will amount to 1.4 MGD (including onbase demands) in 1996 as a result of an inmigrating population of 7,754. With the beginning of the operations phase and the inmigration of 7,192 persons, demand will continue at 1.3 MGD each year. This represents 13.8 and 12.7-percent increases, respectively, over the projected demands of 9.8 MGD in 1996 and 10 MGD in the year 2000. The capacity of systems servicing the counties will be 20 MGD in 1988. The systems will provide 8.8 MGD of excess average daily capacity through the year 2000. Project-induced demand at Grand Forks AFB will increase by 1.1 MGD or 101 percent over the baseline demand of 1.1 MGD. The projected demand includes the requirements associated with the B-1B bomber program. The capacity of the interconnection with the city of Grand Forks is 2.6 MGD. To meet average daily demands this interconnection will be operating at 86-percent capacity. Water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for potable water treatment will result in short-term, negligible impacts; long-term impacts will be moderate and not significant.

Wastewater. The peak project-induced demand on municipal wastewater treatment in the region will amount to 0.48 MGD or 44.8 acres of additional lagoon area (excluding flows from the base) in 1990. During the operations phase, demand will be 0.12 MGD or 11.3 acres of additional lagoon area. This represents 5.5 and 1.3-percent increases, respectively, over the projected demand of 7.2 MGD or 668 acres in 1990 and 7.8 MGD or 720 acres in the year 2000. The capacity of systems servicing the area is 2,034 acres of lagoons and will provide 1,321 acres of excess capacity in 1990 and 1,303 acres in the year 2000. Short-term impacts to municipal wastewater treatment facilities in the

regions will be low and not significant; long-term impacts will be negligible. Project-induced demand at Grand Forks AFB will increase by 0.79 MGD in 1996 or 101 percent over the projected demand of 0.78 MGD. Capacity of onbase treatment facilities equals 1.1 MGD. Expansion of onbase facilities will be necessary after 1996 to process project-induced flows.

Solid Waste. The peak project-induced demand for solid waste disposal in Grand Forks County and East Grand Forks will amount to a total of 14,166 cy in 1996. During the operations phase, demand will be 13,125 cy/yr. Project-induced demands represent 8.4 and 7.7-percent increases, respectively, over the projected demands of 168,792 cy in 1996 and 171,608 cy in the year 2000. The capacity of landfill sites is 160 acres with an estimated life span of 25 years. Adequate disposal area will be available at the existing site. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Energy Utilities. The peak project-induced demand for electricity will be 4.7 MW in 1996 and 4.3 MW per year during the operations phase (including onbase demands). This represents 0.6 and 0.5-percent increases, respectively, over the projected combined peak loads for Northern States Power Company and Minnkota Power Cooperative. The combined electrical capacity is projected to be 750 MW in 1996 and will remain at that level through the year 2000, creating the need for additional generating and transmitting capacity.

The peak project-induced demand for natural gas will be 397,000 Mcf in 1996 and 368,000 Mcf per year in the operations phase (including onbase demands). This represents 0.55 and 0.51-percent increases, respectively, over projected consumption levels in the county. The Northern States Power Company projects consumption levels to remain stable between 1990 and the year 2000, and anticipates no problems in serving customer demands. Natural gas will be available for the first time in 1986 to Grand Forks AFB. Approximately 900 Mcf per hour will be supplied to the base, which will be adequate to serve both baseline and project-induced demands.

The peak project-induced demands for gasoline and diesel fuel in Grand Forks County will increase projected consumption levels by 6.5-percent in 1996 and by 6 percent per year in the operations phase (including onbase demands). The regional supply systems in the county should be adequate to meet the project-induced demands.

The project-induced demands on all of the energy utilities will not represent a noticeable increase in projected consumption levels. Therefore, short and long-term energy impacts will be negligible.

4.2.4.4 Malmstrom Air Force Base

The proposed project will result in short-term, negligible impacts to potable water treatment systems and solid waste disposal in Cascade County. Long-term potable water and solid waste impacts will be low and not significant. Short-term wastewater impacts will be moderate and not significant; long-term impacts will be low and not significant. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at Malmstrom AFB, project-induced demand in Cascade County will be 1.3 MGD (including onbase demands) in 1996 as a result an inmigrating population of 8,763. With the beginning of the operations phase, demand will continue at 1.2 MGD each year. This represents 8.6 and 7.8-percent increases, respectively, over the projected demands of 15.3 MGD in 1996 and 15.7 MGD in the year 2000. The capacity of systems servicing the county is 48 MGD. The systems will provide 31 MGD of excess average daily capacity through the year 2000. Water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demands for municipal potable water treatment will result in short-term, negligible impacts; long-term impacts will be low and not significant. Project-induced demand at Malmstrom AFB will increase by 1.2 MGD in 1996 or 82 percent over the projected demand of 1.5 MGD. The capacity of the interconnection with the city of Great Falls is 2.6 MGD and is presently being upgraded.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Cascade County will be 1.4 MGD (including flows from the base) in 1996. During the operations phase, demand will be 1.3 MGD. This represents 11.8 and 10.4-percent increases, respectively, over the projected demands of 11.5 MGD in 1996 and 12.1 MGD in the year 2000. The capacity of systems servicing the county will be 21.2 MGD, providing 8.4 MGD of excess capacity in 1996 and 7.9 MGD in the year 2000. Short-term impacts to municipal wastewater treatment facilities in Cascade County will be moderate and not significant; long-term impacts will be low and not significant. Project-induced demand at Malmstrom AFB will increase by 0.62 MGD or by 83 percent over the projected demand of 0.75 MGD.

Solid Waste. The peak project-induced demand for solid waste disposal in Cascade County will amount to a total of 12,743 cy (including wastes generated onbase) in 1996. During the operations phase, demand will be 12,529 cy/yr. Project-induced demands represent 7.8 percent and 7.5-percent increases, respectively, over the projected demands of 163,538 cy in 1996 and 168,083 cy in the year 2000. The capacity of four landfill sites is 186 acres, which will be adequate through the year 2026. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and not significant.

Energy Utilities. The peak project-induced demand for electricity in Cascade County will amount to 5.3 MW in 1996 and 4.9 MW per year during the operations phase (including onbase demands). This represents 0.4 and 0.3-percent increases, respectively, over the projected peak load for Montana Power Company. Electrical capacities are projected to be 1,631 MW in 1996 and 1,734 MW in the year 2000, providing a 7-percent reserve margin. The company will purchase additional capacity to service projected peak loads by 1990.

The peak project-induced demand for natural gas in Cascade County will be 403,000 Mcf in 1996 and 375,000 Mcf per year in the operations phase (including onbase demands). This represents 6.3 and 5.3-percent increases, respectively, over the projected consumption levels in the county. The Great Falls Gas Company has recently lost customers, creating an excess of natural gas service capability. Therefore, the company will be able to meet the projected increases in demand.

The peak project-induced demands for gasoline and diesel fuel in Cascade County will increase projected consumption levels by 9.8 percent in 1996 and by 8.8 percent per year in the operations phase (including onbase demands). The regional supply systems in the county will be adequate to meet the project-induced demands.

Project-induced demands for electricity and liquid fuels will not represent noticeable increases in regional demands. Project-induced demands for natural gas will represent a small increase in regional demands. The project-induced demands will not affect service reliability and no major system upgrades are anticipated. Short-term impacts are expected to be negligible; long-term impacts will be low and not significant.

4.2.4.5 Minot Air Force Base

The proposed project will result in short-term, moderate, and not significant impacts to the potable water treatment systems of Ward County facilities. Long-term potable water impacts will be low and not significant. Short-term impacts to wastewater systems are expected to be negligible; long-term impacts will be low and not significant. Short-term solid waste impacts are expected to be negligible; long-term impacts will be low and significant. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at Minot AFB, project-induced demand in Ward County will be 0.83 MGD in 1996 as a result of an inmigrating population of 7,746. With the beginning of the operations phase and the inmigration of 7,193 persons, demand will continue at 0.77 MGD each year. This represents 12.0 and 10.8-percent increases, respectively, over the projected demands of 6.9 MGD in 1996 and 7.1 MGD in the year 2000. The capacity of systems servicing the county is 18 MGD. Project-induced demands for municipal potable water treatment will result in short-term, moderate, and not significant impacts; long-term impacts will be low and not significant. Project-induced demand at Minot AFB will increase by 0.46 MGD in 1996 or 28 percent over the projected demand of 1.7 MGD. The capacity of the interconnection with the city of Minot is 2.5 MGD, which will be adequate for average daily demands.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Ward County will amount to 0.5 MGD or 45.9 acres of additional lagoon area (excluding onbase flows) in 1990. During the operations phase, demand will be 0.31 MGD or 29.1 acres of additional lagoon area. This represents 8.7 and 4.9-percent increases, respectively, over the projected demands of 5.7 MGD or 527 acres in 1990 and 6.4 MGD or 597 acres in the year 2000. The capacity of systems servicing Ward County is 759 acres of lagoons and will provide 186 acres of excess capacity in 1990 and 133 acres in the year 2000. Short-term impacts are expected to be negligible; long-term impacts to municipal wastewater treatment facilities in Ward County will be low and not significant. Project-induced demand at Minot AFB will increase by 0.4 MGD or 43.5 acres of lagoon area in 1996 or 28 percent over the projected demand of 1.4 MGD. The capacity of onbase treatment facilities equals 1.3 MGD. Expansion of the facilities will be required in order to meet project-induced demands.

Solid Waste. The peak project-induced demand for solid waste disposal in Ward County will amount to a total of 9,056 cy (including waste generated onbase) in 1990. During the operations phase, demand will be 5,320 cy/yr. Project-induced demands represent 7.3 and 3.9 percent increases, respectively, over the projected demands of 124,272 cy in 1990 and 136,948 cy in the year 2000. The capacity of landfill sites is 80 acres, which will be adequate through 1996. The project-induced demand for solid waste disposal will result in short-term, negligible impacts; long-term impacts will be low and significant. Long-term impacts will be significant since additional landfill sites will be required to meet the projected and project-induced disposal requirements.

Energy Utilities. The peak project-induced demand for electricity in Ward County will be 4.7 MW in 1996 and 4.3 MW per year during the operations phase (including onbase demands). This represents a 2-percent increase over the combined projected peak loads for Northern States Power Company, the Central Power Cooperative, and the Upper Missouri Generating and Transmission Cooperative. Electrical capacity is projected to be 1,644 MW in 1996 and will remain the same in the year 2000, providing an adequate reserve margin. Northern States Power Company will need to expand its generating capacity to meet projected requirements by the 1990s. The combined capacities of the three utility companies will be adequate to meet project-induced demands.

The peak project-induced demand for natural gas in Ward County will amount to 366,000 Mcf in 1996 and 340,000 Mcf per year in the operations phase (including onbase demands). This represents 0.9 and 0.8-percent increases, respectively, over the projected consumption levels in the county. The Montana-Dakota Utility Company maintains reserves in excess of 934 Bcf, and will supply the increase in demand with interties to regional natural gas supply systems.

The peak project-induced demands for gasoline and diesel fuel in Ward County will increase projected consumption levels by 10.6 percent in 1996 and by 9.6 percent in the operations phase (including onbase demands). The regional supply systems in the county will be adequate to meet the project-induced demands.

The project-induced demands on electricity consumption will represent a small increase in regional projected demand. Service reliability will not be affected, and no major system upgrades are anticipated. Project-induced demands for natural gas and liquid fuels will not represent a noticeable increase in regional consumption levels. Short-term impacts are expected to be negligible; long-term impacts will be low and not significant.

4.2.4.6 Whiteman Air Force Base

The proposed project will result in short-term, negligible impacts to the potable water and wastewater treatment systems of Johnson and Pettis counties. Long-term potable water and wastewater impacts will be low and not significant. Short-term solid waste impacts are expected to be negligible; long-term impacts will be low and significant. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at Whiteman AFB, project-induced demand in Johnson and Pettis counties will be 0.38 MGD

(excluding onbase demands) in 1990 as a result of an offbase inmigrating population of 3,653. With the beginning of the operations phase and the offbase inmigration of 2,915 persons, demand will continue at 0.31 MGD each year. This represents 7.2 and 5.6-percent increases, respectively, over the projected demands of 5.3 MGD in 1990 and 5.5 MGD in the year 2000. The capacity of systems servicing the area is 10 MGD. Project-induced demand for municipal potable water treatment will result in short-term, negligible impacts; long-term impacts will be low and not significant. Project-induced demand at Whiteman AFB will increase by 0.49 MGD in 1996 or 69 percent over the projected demand of 0.71 MGD. Onbase capacity is 1.5 MGD and should be adequate to meet average daily demands.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Johnson and Pettis counties will be 0.37 MGD (excluding flows onbase) in 1990. During the operations phase, demand will be 0.29 MGD. This represents 5.2 and 4-percent increases, respectively, over the projected demand of 7.1 MGD in 1990 and 7.3 MGD in the year 2000. The capacity of systems servicing the county is 12.2 MGD and will provide 4.7 MGD of excess capacity in 1990 and 4.6 MGD in the year 2000. Short-term impacts to municipal wastewater treatment facilities in Johnson and Pettis counties are expected to be negligible; long-term impacts will be low and not significant. Project-induced demand at Whiteman AFB will increase by 0.41 MGD in 1996 or 69 percent over the projected demand of 0.6 MGD. Onbase treatment facilities will be operating near capacity and certain equipment may require upgrades.

Solid Waste. The peak project-induced demand for solid waste disposal in Johnson and Pettis counties will amount to a total of 14,113 cy (including wastes generated onbase) in 1996. During the operations phase. demand will be 13,127 cy/yr. Project-induced demands represent 9.8 and 9.1-percent increases, respectively, over the projected demands of 143,188 cy in 1996 and 144,358 cy in the year 2000. The three landfill sites will be available for 5 to 10 years. Additional sites will need to be developed in 1990 as existing sites begin to close. The project-induced demand for solid waste disposal will result in short-term, negligible impacts. Long-term solid waste impacts will be low and significant since additional sites will be required to meet project-induced disposal requirements.

Energy Utilities. The peak project-induced demand for electricity in Johnson and Pettis counties will amount to 4.6 MW in 1996 and 4.3 MW in the operations phase (including onbase demands). This represents 0.5 and 0.4-percent increases, respectively, over the projected peak load for the Missouri Public Service Company. Generating capacity is projected to be 912 MW in 1996, and the same in the year 2000, creating the need for additional generating capacity to meet projected demands. The company is evaluating methods to extend the life of existing generating plants and to reactivate previously retired plants.

The peak project-induced demand for natural gas in Johnson and Pettis counties will amount to 278,000 Mcf in 1996 and 260,000 Mcf per year in the operations phase (including onbase demands). This represents 2.3 and 2.1-percent increases, respectively, over the projected consumption levels in the region. The Missouri Public Service Company maintains adequate supplies to meet increased demands.

The peak project-induced demands for gasoline and diesel fuel in Johnson and Pettis counties will increase projected consumption levels by 9.8 percent in 1996 and by 9 percent in the operations phase (including onbase demands). The regional supply systems in these counties should be adequate to meet the project-induced demands.

The project-induced demand on electricity and liquid fuels will not represent a noticeable increase in regional project demands. Project-induced demand on natural gas will represent a small increase in regional projected demand. The natural gas system on Whiteman AFB may have to be upgraded because of the proposed project. The project-induced demand will not affect service reliability, and no major system upgrades are anticipated. Short-term impacts are expected to be negligible; long-term impacts will be low and not significant.

4.2.5 Impacts of Hard Silo in Patterned Array

4.2.5.1 Davis-Monthan Air Force Base

The proposed project will result in short and long-term, negligible impacts to Pima County utility systems.

Potable Water Treatment and Distribution. With the MOB located at Davis-Monthan AFB, project-induced demand in Pima County will amount to 1 MGD (excluding onbase demands) in 1994 as a result of an offbase inmigrating population of 7,881. During the operations phase, demand will continue at 0.23 MGD. This represents 1 and 0.19-percent increases, respectively, over the projected demands of 100 MGD in 1994 and 120 MGD in the year 2000. The capacity of systems servicing the county is 165 MGD, providing 45 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demand for municipal potable water treatment will result in short and long-term, negligible impacts. Project-induced demands at Davis-Monthan AFB will increase by a total of 0.58 MGD in 1994 and 0.44 MGD in the year 2000. This equals a 28-percent increase in 1994 and 21 percent in the year 2000 over the projected demand of 2.1 MGD. The onbase wellfield has an average daily capacity of 5.9 MGD which will be able to meet projected increases.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Pima County will amount to 0.79 MGD (including flows from the base) in 1994. During the operations phase, demand will be 0.35 MGD. This represents 1.2 and 0.5-percent increases, respectively, over the projected demands of 64.3 MGD in 1994 and 75.1 MGD in the year 2000. The capacity of systems servicing the county will be 70.5 MGD in 1994, providing 5.4 MGD of excess capacity in 1994. By the year 2000, a deficit of 4.9 MGD will exist if no additional plans are implemented. Short and long-term impacts to wastewater treatment facilities in Pima County will be negligible.

Solid Waste. The peak project-induced demand for solid waste disposal in Pima County will amount to a total of 23,424 cy (including wastes from the base) in 1994. During the operations phase, demand will be 10,026 cy/yr. Project-induced demands represent 1.3 and 0.47-percent increases, respectively, over the projected demands of 1.8 million cy in 1994 and 2.1 million cy in the year 2000. The capacity of landfill sites is 492 acres, which will be adequate to

handle project-induced waste flows. The project-induced demand for solid waste disposal will result in short and long-term, negligible impacts.

Energy Utilities. The peak project-induced demand for electricity in Pima County will amount to 5.9 MW in 1994 and 2.6 MW per year during the operations phase (including onbase demands). This represents 0.4 and 0.1-percent increases, respectively, over the projected peak load for Tucson Electric Power Company. Electrical capacities are projected to be 2,053 MW in 1994 and 2,353 MW in the year 2000, providing a 10-percent reserve margin in the year 2000. The project-induced demand is well within the projected consumption levels for Tucson Electric.

The peak project-induced demand for natural gas in Pima County will amount to 204,000 Mcf in 1994 and 90,000 Mcf per year in the operations phase (including onbase demands). This represents 1 and 0.4-percent increases, respectively, over the projected consumption levels in the county. The Southwest Gas Corporation anticipates increased service capability in Pima County through expansion of its distribution system and conversions from electricity.

The peak project-induced demands for gasoline in Pima County will increase projected consumption levels by 1.2 percent in 1994 and by 0.5 percent in the operations phase (including onbase demands). The peak project-induced demand for diesel in Pima County will increase projected consumption levels by 1.5 percent in 1994 and by 0.5 percent in the operations phase (including onbase demands). The regional supply systems in the county should be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines traverse the northwest and southeast regions surrounding Davis-Monthan AFB: adjacent to U.S. 89, Interstates 8 and 10, Arizona State Highway 82, and the Southern Pacific Railroad. A total of 280 miles of transmission lines, 220 miles of gas pipelines, 15 miles of petroleum product pipelines, and two substations exist within the potential SDAs. There are no existing oil pipelines within the region; however, there are two proposed crude oil pipelines that could potentially traverse the SDAs.

The project-induced demands on all of the energy utilities do not represent noticeable increases in regional projected demands, and will not affect service reliability. No major system upgrades are anticipated. Short and long-term energy impacts will be negligible.

4.2.5.2 Edwards Air Force Base

The proposed project will result in short-term, low, and not significant impacts to the potable water treatment systems of the desert portion of Los Angeles County. Long-term potable water impacts will be negligible. Short-term wastewater impacts will be low and significant; long-term impacts will be negligible. Short-term solid waste impacts will be low and not significant; long-term impacts will be negligible. Short and long-term energy impacts will be negligible.

Potable Water Treatment and Distribution. With the MOB located at Edwards AFB, project-induced demand in the desert region of Los Angeles County will amount to 1.1 MGD (excluding onbase demands) in 1994 as a result of an

offbase inmigrating population of 6,244. With the beginning of the operations phase and the offbase inmigration of 1,789 persons, demand will decline to 0.32 MGD per year. This represents 3.6 and 0.85-percent increases, respectively, over the projected demands of 31.2 MGD in 1994 and 38 MGD in the year 2000. The capacity of systems servicing the desert region is 60.3 MGD. The systems will provide 22 MGD of excess average daily capacity through the year 2000. Long-term potable water impacts will be negligible. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demand for municipal potable water treatment will result in short-term, low, and not significant impacts. Project-induced demands on Edwards AFB facilities in 1994 will increase by a total of 0.64 MGD or 12 percent over the projected demand of 5.4 MGD. The capacity of wells onbase is estimated at 12.5 MGD, providing 6.6 MGD of excess average daily capacity. However, distribution facilities at Edwards AFB will require upgrading prior to absorbing the increased demand.

Wastewater. The peak project-induced demand on municipal wastewater treatment in the desert region of Los Angeles County will amount to 0.51 MGD (excluding onbase flows) in 1994. During the operations phase, demand will be 0.15 MGD. This represents 4.5 and 1.1-percent increases, respectively, over the projected demands of 11.5 MGD in 1994 and 14 MGD in the year 2000. The capacity of systems servicing the county is projected to be 10 MGD by 1990. Projected demand for wastewater treatment capacity will exceed the capacity presently planned for the region. Shortages of approximately 1.5 MGD in 1994 and 4 MGD in the year 2000 are forecast. Short-term impacts to wastewater treatment facilities in the region will be low; long-term impacts will be negligible. During the construction phase, the impacts will be significant since additional facilities will be required to process the projected and project-induced flows. Project-induced demands on Edwards AFB facilities will increase by 0.3 MGD or by 16.6 percent over the projected demand of 1.5 MGD. Onbase wastewater treatment facilities will require expansion to adequately process projected and project-induced flows.

Solid Waste. The peak project-induced demand for solid waste disposal in the desert portion of Los Angeles County will amount to 14,244 cy (excluding wastes generated onbase) in 1994. During the operations phase, demand will be 4,081 cy/yr. Project-induced demands represent 3.8 and 0.89-percent increases, respectively, over the projected demands of 373,847 cy in 1994 and 456,916 cy in the year 2000. The capacity of landfill sites is 320 acres, which will be adequate to handle project-induced waste flows. The project-induced demand for municipal solid waste disposal will result in short-term impacts that will be low and not significant; long-term impacts will be negligible. Project-induced demand at Edwards AFB will increase by a total of 4,533 cy in 1994 and by 4,756 cy in the year 2000. This represents 15.8 and 16.6-percent increases, respectively, over the projected demand of 28,691 cy/yr and will consume landfill space at an accelerated rate. New landfill space may be required because of this increase.

Energy Utilities. The peak project-induced demand for electricity in the desert portion of Los Angeles County offbase will amount to 3.7 MW in 1994 and 1.1 MW per year during the operations phase (excluding onbase demands). This represents 0.02 and 0.01-percent increases, respectively, over the projected peak load for Southern California Edison Company. Electrical capacity is

projected to be 21,709 MW in 1994 and 23,711 MW in the year 2000, providing an 18-percent reserve margin in the year 2000. The project-induced demand is well within projected peak demands for Southern California Edison. The peak project-induced consumption of electricity on Edwards AFB will amount to 17,538,183 kWh in 1994 and 22,840,833 kWh during the operations phase. This represents 13 and 17-percent increases, respectively, over the average annual consumption onbase. The electrical system onbase will have to be upgraded to serve the project-induced consumption.

The peak project-induced demand for natural gas in the desert portion of Los Angeles County will amount to 228,000 Mcf in 1994 and 121,000 Mcf per year in the operations phase (including onbase demands). This represents 0.05 and 0.03-percent increases, respectively, over the projected consumption levels of Pacific Gas and Electric. Pacific Gas and Electric maintains adequate supplies of natural gas to service the increase in demand.

The project-induced demands for gasoline and diesel fuel in Los Angeles County will increase projected consumption levels by 0.1 percent in 1994 and by 0.05 percent per year in the operations phase (including onbase demands). The regional supply systems in the county should be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines traverse most of the region surrounding Edwards AFB, and cross the base on the east and west sides. Corridors are adjacent to U.S. 66 and 395, Interstate 15, California State Highways 14 and 58, and the Southern Pacific Railroad. A total of 174 miles of transmission lines, 105 miles of natural gas pipelines, and one substation exist within the potential SDAs. There are no oil or product pipelines within the SDAs; however, there is one proposed crude oil pipeline and a proposed transmission line that could potentially traverse the SDAs.

The project-induced demands on all of the energy utilities do not represent noticeable increases in projected demand and will not affect service reliability; no major system upgrades are anticipated. Short and long-term energy impacts will be negligible.

4.2.5.3 F.E. Warren Air Force Base

The proposed project will result in short-term, moderate, and not significant impacts to potable water treatment systems of Laramie County. Long-term potable water impacts will be low and not significant. Short-term wastewater and solid waste disposal impacts will be moderate and significant; long-term impacts to wastewater and solid waste will be low and significant. Short-term energy impacts are expected to be negligible; long-term impacts will be low and not significant.

Potable Water Treatment and Distribution. With the MOB located at F.E. Warren AFB, project-induced demand in Laramie County will amount to 1.9 MGD (including onbase requirements) in 1994 as a result of an inmigrating population of 9,741. With the beginning of the operations phase and the inmigration of 4,390 persons, demand will continue at 0.83 MGD each year. This represents 11.5 and 4.7-percent increases, respectively, over the projected demands of 16.1 MGD in 1994 and 17.9 MGD in the year 2000. The capacity of systems servicing the county is 35 MGD. The systems will provide

16.3 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Proposed project effects resulting from increased demand for municipal potable water treatment will result in short-term, moderate, and not significant impacts. Long-term potable water impacts will be low and not significant.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Laramie County will amount to 1.4 MGD (including flows from the base) in 1994. During the operations phase, demands will be 0.64 MGD. This represents 12.9 and 5.2-percent increases, respectively, over the projected demand of 10.9 MGD in 1994 and 12.2 MGD in the year 2000. The capacity of systems servicing the county is 11 MGD. Project-induced demand for wastewater treatment in 1994 will exceed the projected capacity by about 1.4 MGD. Projected demand in the year 2000, along with project-induced demands, will cause the systems capacity to be exceeded by 1.8 MGD. Short-term impacts to municipal wastewater treatment facilities in Laramie County will be moderate and long-term impacts will be low. Short and long-term impacts will be significant since additional treatment facilities will be required to meet project-induced flows.

Solid Waste. The peak, project-induced demand for solid waste disposal in Laramie County will amount to a total of 23,103 cy (including wastes from the base) in 1994. During the operations phase, demand will be 10,015 cy/yr. Project-induced demands represent 12.2 and 4.7-percent increases, respectively, over the projected demands of 189,672 cy in 1994 and 212,521 cy in the year 2000. The capacity of the landfill site in Laramie County will provide adequate disposal space through 1990. An additional site will be required after 1990. The project-induced demand for solid waste disposal will result in short-term, moderate impacts and long-term, low impacts. Short and long-term impacts will be significant since additional sites will be required to meet the projected and project-induced disposal requirements.

Energy Utilities. The peak project-induced demand for electricity in Laramie County will amount to 4.6 MW in 1994 and 1.1 MW per year during the operations phase (excluding onbase demands). This represents 3.6 and 0.7-percent increases, respectively, over the projected peak load for Cheyenne Light, Fuel and Power Company. Electrical capacity is projected to be 141 MW in 1994 and 160 MW in the year 2000, providing a 9-percent reserve margin. The company purchases electrical supply from regional wholesalers, and should be able to meet the increases in demand with supply purchases.

The peak project-induced consumption of electricity on F.E. Warren AFB will amount to 16,674,333 kWh in 1994 and 21,715,798 kWh per year in the operations phase. This represents 55 and 72-percent increases, respectively, in consumption. The supplemental power contract with Rocky Mountain Generation Coopera[illegible] will have to be increased to meet the projected consumption level.

The peak project-induced demand for natural gas in Laramie County will amount to 475,000 Mcf in 1994 and 214,000 Mcf per year in the operations phase (including onbase demands). This represents 3.5 and 1.6-percent increases, respectively, over the projected consumption levels in the region. Cheyenne Light, Fuel and Power has recently had a significant reduction in sales, creating an excess capacity of natural gas. Therefore, the company will be

able to meet the projected increase in demand. A coal-fired heating plant serves the space-heating needs on F.E. Warren AFB, and its capacity is adequate to meet increased demands onbase. Current natural gas use onbase will not be affected by the proposed project, and will remain at 344,715 Mcf annually.

The peak project-induced demands for gasoline in Laramie County will increase projected consumption levels by 11.2 percent in 1994 and by 4.5 percent in the operations phase (including onbase demands). The project-induced demand for diesel fuel will increase consumption by 12 percent 1994 and by 4.5 percent in the operations phase. The regional supply systems in the county will be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines traverse the northeast region surrounding F.E. Warren AFB and the city of Cheyenne, adjacent to U.S. 85 and 87 and Interstate 25. A total of 35 miles of transmission lines, 20 miles of crude oil lines, and 6 miles of petroleum product lines exist within the potential SDAs. There are no natural gas pipelines within the SDAs.

The project-induced demands on electricity and natural gas consumption represent a small increase in regional projected levels. Project-induced demands for gasoline and diesel fuel will not affect service reliability, and no major system upgrades are anticipated. Therefore, short-term energy impacts are expected to be negligible and long-term impacts will be low and not significant.

4.2.5.4 Fort Bliss

The proposed project will result in short and long-term, negligible impacts to the potable water treatment, and solid waste systems in El Paso County. Short-term wastewater and energy impacts will be low and not significant and long-term impacts will be negligible.

Potable Water Treatment and Distribution. With the MOB located at Fort Bliss, project-induced demands in El Paso County caused by an offbase inmigrating population of 8,389 will be 1.5 MGD (excluding onbase demands) in 1994. These demands will decrease to 0.13 MGD during the operations phase. This represents 1.1 and 0.07-percent increases, respectively, over the projected demands of 139 MGD in 1994 and 171 MGD in the year 2000. The capacity of municipal system servicing the county will continue to expand as additional wells are developed to meet increased demand. Long-range planning efforts anticipate growth rates greater than those associated with this program. Proposed project effects on municipal potable water treatment systems will result in short and long-term, negligible impacts. Project-induced demands at Fort Bliss will increase by a total of 0.78 MGD in 1994 and 0.7 MGD in the year 2000. This represents 12.8 and 11.5-percent increases, respectively, over the projected demand of 6.1 MGD. The capacity of onbase facilities is projected to be 12.4 MGD, providing 5.6 MGD excess average daily capacity.

Wastewater. The peak project-induced demand on municipal wastewater treatment in El Paso County will amount to 1.1 MGD (including flows from the base) in 1994. During the operations phase, demand will be 0.45 MGD. This represents 1.6 and 0.56-percent increases, respectively, over the projected demands of 73.8 MGD in 1994 and 80.7 MGD in the year 2000. The capacity of systems

servicing the county will reach 78.8 MGD in 1990 and expansion to 88.8 MGD is forecast by the year 2000. Short-term impacts will be low and not significant and long-term impacts are considered negligible.

Solid Waste. The peak project-induced demand for solid waste disposal in El Paso County will amount to 19,137 cy (excluding wastes generated onbase) in 1994. During the operations phase, demand will be 1,601 cy/yr. Project-induced demands represent 1.3 and 0.09-percent increases, respectively, over the projected demands of 1.5 million cy in 1994 and 1.7 million cy in the year 2000. The capacity of municipal landfill sites is 752 acres, providing capacity through the year 2000. The project-induced demand for municipal solid waste disposal will result in short and long-term, negligible impacts. Project-induced demand at Fort Bliss will increase by a total of 6,053 cy in 1994 and by 6,738 cy in the year 2000. This represents 10.4 and 11.5-percent increases, respectively, over the projected demand of 58,400 cy/yr. Waste will be disposed at the remaining 70 acres onbase.

Energy Utilities. The peak project-induced demand for electricity in El Paso County will amount to 6.7 MW in 1994 and 2.6 MW per year during the operations phase (including onbase demands). This represents 0.6 and 0.2-percent increases, respectively, over the projected peak load for El Paso Electric Company. Electrical capacity is projected to be 1,589 MW in 1994 and to remain the same in the year 2000, providing 23 and 14-percent reserve margins, respectively. The project-induced demand is well within projected peak demands for the El Paso Electric Company.

The peak project-induced demand for natural gas in El Paso County will amount to 314,000 Mcf in 1994 and 123,000 Mcf per year in the operations phase (including onbase demands). This represents 2.8 and 0.9-percent increases, respectively, over the projected consumption levels in the El Paso District of the Southern Union Gas Company. These increases are within the projected consumption levels as estimated by the Southern Union Gas Company.

The peak project-induced demands for gasoline in El Paso County will increase consumption by 1.5 percent in 1994 and by 0.6 percent in the operations phase (including onbase demands). The peak project-induced demands for diesel fuel will increase consumption by 1.8 percent in 1994 and by 0.6 percent in the operations phase. The regional supply systems in the county will be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines exist in the northwest region surrounding Fort Bliss, adjacent to U.S. 80 and 85, Interstate 10, and the Southern Pacific Railroad. A total of 210 miles of transmission lines, 295 miles of gas pipelines, 87 miles of petroleum product pipelines, 40 miles of crude oil pipelines, and two substations exist within the potential SDAs. In addition, there are two proposed crude oil pipelines that could potentially traverse the SDAs.

The project-induced demand for electricity will not represent a noticeable increase in projected regional consumption. The project-induced demand for natural gas represents a small increase in projected demands. Project-induced demands for gasoline and diesel fuel will not affect service reliability and no major system upgrades are anticipated. Short-term energy impacts will be low and not significant; long-term impacts will be negligible. Impacts to Fort Bliss may necessitate changes in the service system infrastructure.

4.2.5.5 Gila Bend Air Force Auxiliary Field

The proposed project will result in short-term, negligible impacts to the potable water and wastewater treatment systems in Maricopa County. Long-term impacts to Gila Bend's potable water system will be moderate and not significant. Long-term impacts to Gila Bend's wastewater system will be moderate and significant. Short and long-term impacts to solid waste and energy systems will be negligible.

Potable Water Treatment and Distribution. With Gila Bend AFAF as the MOB, nearly all of the project-induced inmigration during the construction phase will be dispersed throughout Maricopa County. An offbase inmigrating population of 6,779 in 1994 will require an additional 1.8 MGD (excluding onbase demands) of potable water treatment capacity. This represents a 0.28-percent increase over the projected demand of 655 MGD. The capacity of systems servicing the county will be 700 MGD in 1990. During the operations phase, it is anticipated that all of the 673 offbase inmigrants will locate within the town of Gila Bend's service area and require an additional 0.17 MGD of potable water treatment capacity. This represents a 15-percent increase over the projected demand of 1.1 MGD in the year 2000. The capacity of the town's system will be 2 MGD in 1990, providing 0.73 MGD of excess average daily capacity. Short-term impacts to the potable water treatment systems will be negligible; long-term impacts will be moderate and not significant. Project-induced demands at Gila Bend AFAF will increase by a total of 0.81 MGD or by 310 percent over the projected demand of 0.26 MGD in 1994. Onbase wells, with a 1.3-MGD capacity, will be able to meet average daily demands.

Wastewater. The peak project-induced demand on municipal wastewater treatment systems in Maricopa County will be 0.71 MGD (excluding onbase flows) in 1994. During the operations phase, demands of the town of Gila Bend will be 0.04 MGD. These demands represent 0.26 and 21-percent increases, respectively, over the county's projected demand of 273 MGD in 1994 and the town's projected demand of 0.19 MGD in the year 2000. The capacity of systems servicing the county will be 225 MGD in 1990 and capacity of the town's system will be 0.13 MGD in the year 2000. Short-term impacts to the wastewater treatment systems in Maricopa County will be negligible. Long-term impacts to the town's system will be moderate and significant. Long-term impacts are significant since additional capacity will have to be added to the town's system to meet projected demands. Project-induced demands at Gila Bend AFAF will be 0.28 MGD in 1994 and, during the operations phase, will increase by 0.38 MGD or by 738 percent over the projected demand of 0.05 MGD. Onbase treatment capacity equals 2 MGD and will be capable of processing project-induced flows.

Solid Waste. The peak project-induced demand for solid waste disposal in Maricopa County will amount to a total of 22,811 cy (including wastes from the base) in 1994. During the operations phase, demand will be 9,958 cy/yr. Project-induced demands represent 0.41 and 0.15-percent increases, respectively, over the projected demands of 5.6 million cy in 1994 and 6.5 million cy in the year 2000. The capacity of landfill sites is 960 acres, providing capacity through the year 2000. The project-induced demand for municipal solid waste disposal will result in short and long-term, negligible impacts.

Energy Utilities. The peak project-induced demand for electricity in Maricopa County will amount to 5.8 MW in 1994 and 2.6 MW per year during the operations phase (including onbase demands). This represents 0.07 and 0.03-percent increases, respectively, over the combined projected peak loads for the Arizona Public Service Company and the Salt River Project. The combined electrical capacities are projected to be 9,126 MW in 1994 and 10,426 MW in the year 2000, providing a 15-percent reserve margin in 1994 and a 7-percent reserve margin in the year 2000. The combined capacities will be adequate to meet projected growth.

The peak project-induced demand for natural gas in Maricopa County will be 142,000 Mcf in 1994 and 14,000 Mcf per year in the operations phase (excluding onbase demands). This represents 0.4 and 0.04-percent increases, respectively, over the projected consumption levels as determined by projected baseline population increases. The Southwest Gas Corporation anticipates increased service capability in Maricopa County through conversions from electricity and expansion of the distribution system. Number 2 diesel is used for space-heating needs on Gila Bend AFAF. The peak project-induced demand onbase will amount to 476,000 gallons in 1994 and 620,000 gallons per year in the operations phase. These increases are approximately five to seven times the annual consumption onbase, and will necessitate increases in the storage capacity and additions to the distribution system.

The peak project-induced demand for gasoline in Maricopa County will increase projected consumption levels by 0.4 percent in 1994 and by 0.2 percent in the operations phase (including onbase demands). The project-induced demand for diesel fuel will increase consumption by 0.5 percent in 1994 and by 0.2 percent in the operations phase. The regional supply systems in this county will be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines traverse the central and northern regions surrounding Gila Bend AFAF, adjacent to Interstate 8; Interstate 10; Arizona State Highway 85; the Tucson, Cornelia and Gila Bend Railroad; and the Southern Pacific Railroad. A total of 159 miles of transmission lines, 115 miles of natural gas lines, 10 miles of petroleum product lines, and one substation exist within the potential SDAs. There are no crude oil pipelines within the SDAs; however, there are two proposed crude oil pipelines and a transmission line that could potentially traverse the SDAs.

The project-induced demands on all of the energy utilities will not represent noticeable increases in demand and will not affect service reliability; no major system upgrades are anticipated. Short and long-term energy impacts will be negligible. Project-induced demand on No. 2 diesel use at Gila Bend AFAF will necessitate upgrades in the supply and storage systems.

4.2.5.6 Yuma Proving Ground

Short-term impacts to potable water treatment, wastewater, and solid waste systems in Yuma County will be low and not significant and long-term impacts will be negligible. Short and long-term energy impacts will be negligible.

Potable Water Treatment and Distribution. With MOB located at Yuma PG, project-induced demand in Yuma County will be 1.7 MGD (excluding onbase demands) in 1994 as a result of an offbase inmigrating population of 7,889.

With the beginning of the operations phase and the offbase inmigration of 703 persons, demand will decline to 0.15 MGD per year. This represents 9.5 and 0.75-percent increases, respectively, over the projected demands of 17.5 MGD in 1994 and 19.8 MGD in the year 2000. The capacity of systems servicing the county is 28.5 MGD. The systems will provide 8.5 MGD of excess average daily capacity through the year 2000. Municipal water treatment systems will continue to have excess average daily capacity available to meet project-induced demands. Project-induced demand for municipal potable water treatment will result in short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand at Yuma PG will be a total of 0.81 MGD in 1994 and during the operations phase will increase by 0.74 MGD, or by 101 percent over the projected demand of 0.73 MGD. The need for 0.81 MGD of additional capacity at Yuma PG will require new facilities.

Wastewater. The peak project-induced demand on municipal wastewater treatment in Yuma County will amount to 0.85 MGD (excluding onbase flows) in 1994. During the operations phase, demand will be 0.08 MGD. This represents 10.6 and 0.8-percent increases, respectively, over the projected demands of 8 MGD in 1994 and 9.6 MGD in the year 2000. The capacity of systems servicing the county will be 12.3 MGD. The system will provide 3.4 MGD of excess capacity in 1994 and 2.6 MGD in the year 2000. Short-term impacts to municipal wastewater treatment facilities in Yuma County will be low and not significant; long-term impacts will be negligible. Project-induced demand at Yuma PG will increase by 0.55 MGD in 1994 and by 0.72 MGD during the operations phase. This represents 142 and 185-percent increases over the projected demand of 0.39 MGD and will require an expansion of onbase treatment facilities.

Solid Waste. The peak project-induced demand for solid waste disposal in Yuma County will amount to 14,397 cy (excluding wastes generated onbase) in 1994. During the operations phase, demand will be 1,283 cy/yr. Project-induced demands represent 8.2 and 0.65-percent increases, respectively, over the projected demands of 175,897 cy in 1994 and 198,560 cy in the year 2000. The capacity of landfill sites is 160 acres, which will be adequate to handle waste flows resulting from the project-induced increases. The project-induced demand for municipal solid waste disposal will result in short-term, low, and not significant impacts and long-term, negligible impacts. Project-induced demand at Yuma PG will increase by a total of 6,053 cy in 1994 and by 6,738 cy in the year 2000. This represents 166 and 185-percent increases, respectively, over the projected demand of 3,650 cy/yr.

Energy Utilities. The peak project-induced demand for electricity in Yuma County will amount to 4.7 MW in 1994 and 0.4 MW per year during the operations phase (excluding onbase demands). This represents 0.1 and 0.01-percent increases, respectively, over the projected peak load for the Arizona Public Service Company. Electrical capacities are projected to be 4,680 MW in 1994 and 5,630 MW in the year 2000, providing a 10.2-percent reserve margin in 1994 and an 8-percent reserve margin in the year 2000. The Arizona Public Service Company will increase its generating capacity by the year 2000 and will meet both baseline and project-induced loads.

The Western Area Power Administration provides electricity to Yuma PG. In 1984, the base consumed 24,807,000 kWh. The project-induced demand at Yuma PG will amount to 35,152,000 kWh in 1994 and 45,794,000 kWh in the

year 2000. This represents 141 and 184-percent increases, respectively, in consumption. The contract with the Western Area Power Administration will have to be increased to meet the projected consumption.

The peak project-induced demand for natural gas in Yuma County will be 121,000 Mcf in 1994 and 10,800 Mcf per year in the operations phase (excluding onbase demands). This represents 0.4 and 0.03-percent increases, respectively, over the projected consumption levels in the county, based on county population projections. The Southwest Gas Corporation anticipates increased service capability in Yuma County through conversions from electricity and expansion of the distribution system. Fuel oil is used for onbase heating needs. The peak project-induced demand onbase will amount to 213,000 gallons in 1994 and 277,000 gallons in the operations phase. This represents 140 to 185-percent increases in annual usage, and will necessitate increases in the supply and storage systems and additions to the distribution system.

The peak project-induced demand for gasoline in Yuma County will increase consumption by 11 percent in 1994 and by 4 percent in the operations phase (including onbase demands). The project-induced demand for diesel fuel will increase consumption by 13.2 percent in 1994 and by 4 percent in the operations phase. The regional supply systems in this county should be adequate to meet the project-induced demands.

Corridors for transmission lines and pipelines traverse Yuma PG and the central portion of the region surrounding the base. Corridors are adjacent to Arizona State Highway 95. A total of 22 miles of transmission lines and 13 miles of natural gas pipelines occur within the potential SDAs. There are no oil or product pipelines within the SDAs; however, there is a proposed crude oil pipeline and two proposed transmission lines that could potentially traverse the SDAs.

The project-induced demands on any of the energy utilities represent no noticeable increase in demand and will not affect service reliability; no major system upgrades are anticipated. Short and long-term energy impacts will be negligible. The project-induced impact to onbase electricity consumption will necessitate a change in the contract rate of delivery from the Western Area Power Administration. Project-induced demand for fuel oil on Yuma PG will require additional supplies and changes in the system infrastructure.

4.2.6 Impacts of the No Action Alternative

The projected baseline populations in all the alternative basing locations are forecast to change at average annual growth rates that range from -0.1 to 3.1 percent. The adverse effects of this growth on water, wastewater, solid waste, and energy systems are identified in the following sections.

Potable Water Treatment and Distribution. Potable water treatment capacity will be available at all of the basing alternative locations without the project demands.

Wastewater. Wastewater treatment capacity will be exceeded at five of the basing alternative locations regardless of the project-induced demand. For the Arizona Complex (Gila Bend AFAF MOB alternative) and the Gila Bend

AFAF Hard Silo alternative, capacity in Maricopa County will be exceeded in 1990. For the New Mexico Complex (Holloman AFB MOB alternative), capacity in Otero County will be exceeded in 1990. For the South-Central California Complex (the Edwards AFB MOB alternative) and Edwards AFB Hard Silo alternative, capacity in the desert portion of Los Angeles County will be exceeded by 1990. For Fort Irwin NTC, the other South-Central California Complex alternative, capacity will be exceeded in 1998. For F.E. Warren AFB Minuteman and Hard Silo alternatives, capacity will be exceeded in 1994. By 1997, wastewater treatment capacity at the Davis-Monthan AFB Hard Silo alternative will be exceeded as a result of project-induced demand.

Solid Waste. Solid waste disposal capacity will be exceeded at four of the basing alternative locations regardless of the project-induced demands. For the Nevada Complex, the main landfill in Clark County will be closed in 1988 because of contractual requirements and a new facility must be sited. For F.E. Warren AFB Minuteman and Hard Silo alternatives, a new landfill will be required after 1990. Shortages in capacity will occur at Minot AFB and Ward County, North Dakota after 1996. The capacity of landfills servicing Whiteman AFB and Johnson and Pettis counties in Missouri will be exceeded in 1990.

Energy Utilities. Electrical capacity will be exceeded at three of the basing alternative locations regardless of the project-induced demands. For the Washington Complex, excess electric capacity will be absorbed by baseline growth in 1994. Shortages in electric supply will occur in 1996 for the Grand Forks AFB and Whiteman AFB MOB alternatives. For other energy elements, population growth will not exceed the projected capacity of the utility system.

4.2.7 Irreversible and Irretrievable Resource Commitments

Expansions of water, wastewater, and solid waste treatment and disposal facilities associated with the project-induced inmigrants will involve the dedication of county and municipal resources at an accelerated rate.

Project-induced energy requirements for construction and operations represent the only irreversible and irretrievable commitment of energy resources required for the proposed project. The acquisition of lands for the Hard Silo in Patterned Array basing mode may preclude the optimum placement of utility transmission lines and pipeline corridors.

4.2.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The expansion of utility systems will cause a short-term disturbance of the environment; however, these facilities will enhance man's ability to use his environment more productively because they will alleviate problems with capacity and will accommodate all present and future needs.

The quantities of energy required for proposed project construction and operations are small in a regional and national context. The use of these resources now will not materially affect their availability for future use.

4.3 Transportation

The proposed project has the potential to increase congestion on transportation systems in an area. The primary emphasis of the transportation analysis was placed on regional networks of federal and state highways.

4.3.1 Impact Analysis Methodology

The analysis of the effects of the proposed project on transportation is concentrated on the potential impacts of direct-worker commuting on regional primary roads. Since impacts to rail and airline service are expected to be minimal and not significant, no formal method of assessment was applied. Proposed project impacts to regional primary roads were examined in terms of peak-hour commuting levels of service (LOS) (Section 3.3.2 and Table 3.3.2-1). The analysis involved an estimation of the number of workers that will use specific lengths of primary roads, conversion of worker numbers to peak-hour traffic volumes in passenger cars per hour (pcph), addition of these volumes to then-year volumes, and estimation of the resultant with-project LOS. Levels of impact (LOIs) were then assessed with respect to the changes in speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety implicit in the LOS values. Project-induced changes that yielded substantially adverse conditions on a regional scale were considered significant.

4.3.1.1 Evaluation of Project Impacts

Numbers of direct workers and their classes of activity (construction, assembly and checkout, operations, etc.) were obtained from the proposed project description. Workers were assumed to live predominantly in settled communities with 1980 populations of 5,000 or more, or in similarly sized groups of smaller communities, and to commute to and from worksites by the most direct route on primary roads. Military personnel living onbase were assumed not to affect primary roads during the peak hour. Specific proportions of onbase/offbase accommodations were used for each Main Operating Base (MOB), and were consistent with the values adopted for the other environmental resources.

Workplaces were assumed to be in the general vicinity of the MOB and at offbase assembly points easily accessible by primary roads. The latter were chosen to cover a reasonable number of possible locations. The most direct routes from population centers to the worksites were then determined, and the corresponding distances measured. Each community was assumed to contribute to the workforce at a given site in proportion to its 1980 population and the willingness of its population to commute. Different functions were used to model the willingness of temporary (e.g., construction) and permanent (e.g., operations) personnel to commute. The proportional contribution of each community was then applied to the corresponding workforce to give an estimate of the number of commuters.

Commuters were converted to trips through application of ridership factors. For this analysis, all workers were assumed to commute by passenger car, with a ridership of 1.35 per vehicle for up to 15 miles, and 1.55 per vehicle for longer distances. These are reasonable values for these distance ranges, as shown by available survey data. Only those who will commute during peak hours were included.

Volumes on individual primary roadway sections were estimated by considering traffic from all affected communities and the potential additive effects of different worksites. Next, the resulting volume was added to then-year passenger car equivalent volume, and then-year LOS was subsequently calculated and compared with the without-project conditions. The calculation was done for the peak-employment year, which is expected to generate the largest short-term (1 or more years, but not enduring indefinitely) impacts, and for the first full operations year, which is expected to generate typical long-term impacts that may endure over the life of the project. If warranted by the estimated level and significance of impact, potential effects in other years were also estimated.

The assumption that all commuting is by primary road is necessary to keep the analysis within reasonable limits. However, it may result in overestimation of LOIs where alternative routes are available. This condition is particularly severe where MOBs are contiguous with major population centers and can be accessed by numerous existing or possible future routes. In such cases, the potential local impacts near the base, as traffic streams converge, is high, but the corresponding impacts are primarily local rather than regional.

A similar situation exists for the urban portions of primary roads that provide access to remote worksites. Within major population centers, numerous alternative routes are generally available for worker commuting, and traffic to or from remote worksites builds up or reduces nonuniformly on the urban stretches of primary roads. Only in rural areas is the predicted full volume of traffic experienced. Within the urban areas, the principal impact is to local, short-distance commuters, rather than to regional travelers.

These two conditions are special cases where impacts may be high and significant locally, but are not likely to be so regionally. Consequently, they have not been considered meaningful for this regional-scale study, and have not been analyzed and reported because they would give distorted indications of impact levels.

4.3.1.2 Determination of Levels of Impact

The LOI assignments are related to the changes in motorist safety and satisfaction associated either with changes in LOS rating (Table 3.3.2-1) or with appreciable increases in volume at degraded service levels. Some changes in LOS scores are more meaningful in this context than others. A change from LOS A to B, for example, results in comparatively little inconvenience, delay, or hazard. By contrast, a change from LOS E to F results in breakdown conditions: the level of annoyance is high, delays are severe, and the potential for collisions is sharply increased. An appreciable impact may be produced even without a change in LOS rating, however, if the roadway section is already at a degraded LOS rating (LOS D, E, or F) and additional traffic will result in annoyance, slowing, and increased hazard. This condition is also reflected in the LOI assignments. Impacts are considered negligible if the volume of traffic attributable to the proposed project is not appreciable (i.e., is less than that which would occur in 2 years of normal regional growth), regardless of the occurrence of a calculated change in LOS.

The LOIs reflecting these considerations are the following:

- o Negligible Impact -- No change in LOS for categories A, B, or C, even with addition of appreciable volumes of traffic. (Does not apply at LOS D, E, or F.) Although traffic volumes may increase, the motorist will perc˙ an essentially negligible difference in traffic operations.

- o Low Impact -- The LO. category declines from A to B, or B to C, or appreciable volume is added at LOS D. The motorist might perceive a slight change in traffic operations.

- o Moderate Impact -- The LOS category declines from A to C, C to D, or D to E, or appreciable volume is added at LOS E. The motorist will perceive a noticeable decrease in the quality of service of traffic operations.

- o High Impact -- The LOS category declines from A to D, A to E, A to F, B to D, B to E, B to F, C to E, C to F, D to F, or E to F, or appreciable volume is added at LOS F. The motorist will perceive a decided decrease in service quality of traffic operations, or existing LOS F conditions will be extended in duration and/or worsened.

4.3.1.3 Determination of Significance

The directly affected interests are those of the users of regional primary roads, represented by the sample population of users on the most likely affected road sections. A broader population may be affected by the need to fund road improvements to mitigate impacts, a topic not addressed directly in this Legislative Environmental Impact Statement (LEIS).

Service at LOS C is generally appropriate for planning and designing roadways, with service at LOS D or lower regarded as substandard. Operation at LOS F represents breakdown conditions and severely degraded service. At LOS E, service is below standard and minor incidents can cause a precipitous drop to LOS F. A change in service to LOS E or F, or addition of appreciable traffic volume to roadways operating at those levels, was considered potentially significant at a regional scale if it will occur for a year or more. Degradation of LOS to these levels will create public safety concerns and cause driver delays. A change to LOS D, which represents substandard but tolerable service, was considered potentially significant at a regional scale if it will continue indefinitely. The contribution of appreciable volumes at LOS D without a change in level was also considered potentially significant. This criterion applies only to long-term impacts.

The LOS is derived through application of procedures given in the Highway Capacity Manual published by the Transportation Research Board (1985). The LOS criteria typically apply to specific highway segments, to intersections, or to other localized areas. However, the LEIS is primarily concerned with broader regional considerations. Judgment is necessary in interpreting the regional context of the impacts identified in this way. For example, even though interstate or primary road segments may exhibit a definite LOS degradation, these changes may not be significant within a broad regional context.

Regional significance has consequently been inferred only if the affected sections are relatively long or a major part of the regional arterial network, if numerous regional-scale travelers are affected, or if the section involved is a key section because no alternative routes, or very inconvenient ones, are available. The determination of whether or not the identified impacts are of regional significance depends largely on professional judgment and is based on the considerations noted.

4.3.2 Impacts Common to All Locations

The extent to which project-generated traffic may result in appreciable impacts to regional transportation depends on three factors: the peak-hour volumes attributable to the proposed project, the relationships of the affected roadways to the regional network, and the capacities and without-project traffic levels on these roadways.

In the operations phase, a number of ground mobile launch control center vehicles will move periodically on roads within several hundred miles of the deployment area. These vehicles are expected to be within the size and weight limits established by the various states, and may be accompanied by a few smaller vehicles. Their presence on regional roads is expected to have negligible impacts to transportation.

Appreciable volumes of peak-hour commuting traffic will be generated by all three alternative basing modes during the construction phase. These volumes will be sufficient to cause significant local impacts, and may be sufficient to result in transportation impacts with regional significance, especially if they occur on long stretches or key links in the primary road system.

Regional impacts are most likely when project actions require major access by rural two-lane primary roads. Such roads have substantially less capacity than interstate highways, which commonly are divided, restricted-access facilities with at least two lanes in each direction. Project-induced traffic is more likely to result in degraded LOS on heavily used roadways than on lightly traveled ones; therefore, when the more severe LOIs occur, they also tend to affect the largest numbers of travelers.

Two different traffic streams must be considered during the construction phase: those centered on the MOB and those centered on worksites in the deployment area. Under some circumstances (e.g., when the MOB is remote from the population centers from which workers commute) these streams may overlap on some primary road segments. Such combined traffic streams have substantially greater impact potential than either stream considered separately. Conversely, when the MOB is immediately accessible from an urban area and can be reached by numerous routes, the potential for regional impact is substantially diminished.

Comparison of the total peak-hour volumes of traffic generated by the proposed project in the peak year with the capacity of a typical transportation facility gives an indication of the potential for impact. For the Hard Mobile modes, these peak volumes are in the general range of 1,600 to 2,200 pcph. For the Hard Silo mode, they may reach almost 3,000 pcph. For comparison, the optimum one-way (2-lane) capacity of a typical four-lane freeway is 4,000 pcph. Concentration of all peak-year traffic on a single road could

consequently use approximately half to almost three-quarters the one-way capacity of an interstate highway. This condition is not likely but is presented to give some appreciation of the context of the peak-hour volumes potentially generated. Total volumes drop rapidly year-to-year for the Hard Mobile modes, but are estimated to remain above 2,000 pcph for at least 4 years for the Hard Silo mode, which consequently has the greatest potential for short-term impacts.

In contrast to the construction phase, operations-phase traffic has comparatively low potential for regional impact, though some potential for local impact remains. Only the traffic stream centered on the MOB is important in this phase. During operations, project-generated hourly volumes to worksites in the deployment area are not only expected to be low, but also to avoid peak-traffic hours to a great extent. The MOB-centered, peak-hour streams will be roughly two to six times lower than those experienced in the peak-construction year, depending on the alternative.

Peak-hour volumes of operations-phase MOB-centered commuting are expected to be approximately 150 to 380 pcph for the Hard Silo mode, and approximately 300 to 800 pcph for the Hard Mobile modes. The differences in volumes reflect different proportions of onbase housing provided to military personnel. Consequently, in contrast to the conditions for the construction phase, the Hard Silo mode has much less long-term impact potential than the Hard Mobile modes. These volumes are still capable of causing localized congestion on heavily traveled roads or on transportation facilities with comparatively low capacities. Typical of the latter are the vehicular gates at military installations, where entry is controlled by sentries. When properly marked vehicles are permitted to pass such a gate without further inspection, capacities are typically in the range of 400 to 600 vehicles per hour; when individual identification is required by drivers and passengers, volumes may be as low as 200 to 400 vehicles per hour. The rough equivalence of the projected demand and lane capacity for such facilities is a general indication of the potential for localized long-term impacts during operations. There is only a comparatively small potential for significant impacts at a regional scale.

Heavy vehicle (particularly truck) traffic associated with the proposed project is not expected to result in significant regional impacts. Major truck traffic is expected to be related to construction activities and to deliveries of system-related materials and equipment. Much construction-related heavy vehicle activity will be confined to the immediate vicinity of the MOB or deployment-area worksites, and will not affect regional primary roads. If deliveries by truck do use the primary roads, they are unlikely to affect peak-hour traffic, since worksites are generally not in a condition to receive shipments at the beginning or end of a single-shift operation. Bulk shipments to the MOB will likely be by rail, since rail service to the base is considered essential. Where rail service is available to the deployment areas, it is likely to be used extensively, with attendant reductions in heavy vehicle traffic.

Truck traffic is likely to result in local impacts, particularly to minor roads. The potential for roadway deterioration is expected to be a more important issue in this context than degradation in LOS. Extensive use by heavy vehicles can result in deterioration to the surface (skid resistance and

roughness) and structure (cracks, breaks, potholes, etc.) of roadways. These are highly site-specific effects not amenable to analysis at a regional scale.

Significant impacts to railroads or airports are not expected for any of the alternatives. Rail lines may be constructed to MOBs without adequate existing service or to maintenance facilities in the deployment areas (except for the Hard Mobile Launcher at Minuteman Facilities alternative), but they will be constructed as part of the proposed project and will not cause adverse impacts to existing railroads. In fact, the added revenue created will benefit existing railroads. The increased demand for airline services associated with the proposed project or its related increase in population is not expected to cause significant impacts for any of the alternatives, since the additional demand is not expected to require any construction of new or expanded facilities. Negligible impacts to air traffic are expected since there will be no restrictions on overflights beyond those normally applied by the Federal Aviation Administration (FAA).

It was assumed that normal transportation procedures will be in effect, without application of special mitigation measures. However, relatively simple and comparatively inexpensive mitigations that can substantially reduce the expected impacts are available. Typical of these are adjustments in workshift timing, so that commuter traffic does not coincide with peak hours; staggered workshift timing, to spread commuter traffic over several hours; car or van pooling; and the provision of bus transportation, which may reduce passenger-car equivalent traffic by a factor of 16 or more. The additive effects of traffic flows to the MOB and to deployment-area sites may also be reduced by appropriate sequencing of construction activities where feasible.

Such mitigative measures, which will be analyzed where appropriate in subsequent site-specific EISs, can potentially reduce the impacts actually experienced to levels well below the conservatively high (unmitigated) impacts reported here. However, the relative impacts of the alternative modes are expected to remain unchanged.

4.3.2.1 Hard Mobile Launcher in Random Movement

In the peak-employment year (1990) for the Hard Mobile Launcher in Random Movement 200-missile alternatives, approximately 2,300 workers are expected to commute to the MOB and 1,165 workers to the deployment area during peak hours. These represent 1,490 and 750 passenger car equivalent trips, respectively. (Commuter and trip estimates are shown in Table 4.3.2-1.) Peak-hour commuting to the deployment area will drop rapidly with time, becoming essentially negligible by 1995. Peak-hour commuting to the MOB will also drop with time, but more irregularly, and will ultimately stabilize at a value between approximately 335 and 840 pcph in the peak hour, depending on the amount of onbase military housing provided. Short-term impacts with this mode are expected to be moderate to high, and may be significant at the regional level in a few locations. Long-term impacts may be negligible to high, but are not expected to be significant at the regional level.

For the two 50-missile alternatives (Florida and Washington complexes), fewer workers will be required, though the peak years are the same. Short-term, moderate, and long-term, negligible to moderate impacts are expected for these alternatives. The impacts are not expected to be significant at the regional level.

Table 4.3.2-1

ESTIMATED NUMBERS OF PEAK-HOUR COMMUTERS AND APPROXIMATE VEHICLE MOVEMENTS BY CALENDAR YEAR
HARD MOBILE LAUNCHER IN RANDOM MOVEMENT
(200 MISSILES)

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
					ESTIMATED PEAK-HOUR COMMUTERS				
To Main Operating Base	2,305-2,310	1,490-1,545	930-1,150	530-830	730-1,145	860-1,425	750-1,445	450-1,135	450-1,135
To Deployment Area	1,165	870	680	545	75	--	--	--	--
TOTAL:	3,470-3,475	2,360-2,415	1,610-1,830	1,075-1,375	805-1,220	860-1,425	750-1,445	450-1,135	450-1,135
					APPROXIMATE PEAK-HOUR VEHICLE MOVEMENTS				
To Main Operating Base	1,490-1,495	965-1,005	650-815	385-605	535-840	635-1,055	555-1,070	335-840	335-840
To Deployment Area	750	560	440	350	50	--	--	--	--
TOTAL:	2,240-2,245	1,525-1,565	1,090-1,255	735-955	585-890	635-1,055	555-1,070	335-840	335-840

Note: Ranges shown represent different proportions of military housing onbase.

4.3.2.2 Hard Mobile Launcher at Minuteman Facilities

In the peak-employment year (1990) for the Hard Mobile Launcher at Minuteman Facilities 200-missile alternatives approximately 2,430 workers are expected to commute to the MOB, and 85 workers are expected to commute to the deployment area during the peak hours. These represent roughly 1,570 and 55 passenger-car equivalent trips, respectively. (Commuter and trip estimates are shown in Table 4.3.2-2.) Peak-hour commuting to the deployment area will peak in 1993, with an estimated 405 workers and 260 trips, and will become essentially negligible by 1996. Peak-hour commuting to the MOB will drop irregularly with time, always remaining below peak-year volumes. It will ultimately stabilize at a value between approximately 280 and 700 pcph in the peak hour, depending on the amount of onbase military housing provided.

For this alternative, favorable local conditions tend to reduce the potential for impact as compared with the Random Movement mode, despite roughly similar traffic generation potentials. Roadways in the potential deployment areas tend to provide superior LOSs and to have appreciable volumes of reserve capacity before levels representing severe loss in service are encountered. Although short-term impacts may be high in some areas, they are expected to be low in others (vs. moderate at best for the Random Movement mode). Long-term impacts are expected to be low or negligible. Neither short-term nor long-term impacts are expected to be significant at the regional level.

Selected roads and bridges are to be upgraded in the deployment area in connection with this alternative. These upgrades are expected to result in an appreciable number of local improvements that are also expected to collectively result in beneficial impacts at a regional scale.

4.3.2.3 Hard Silo in Patterned Array

For the Hard Silo in Patterned Array basing mode, both total employment and commuting to the deployment area will peak in 1994, in contrast to the other two modes, which have 1990 as the peak-employment and commuting years. However, both employment and traffic volumes will be appreciable in 1990, with approximately 1,000 workers expected to commute to the MOB and 905 to the deployment area during peak hours. These represent 650 and 585 passenger-car equivalent trips, respectively. (Commuter and trip estimates are shown in Table 4.3.2-3.)

In 1994, commuters to the MOB are expected to number from 1,130 to 1,370, representing 820 to 995 peak-hour trips, depending on the amount of onbase military housing provided. Approximately 3,040 additional workers are expected to commute to the deployment area, representing 1,985 peak-hour trips.

After 1994, commuting to the deployment area during peak hours will decline to 2,440 in 1995; 1,480 in 1996, and 210 in 1997, before it becomes negligible. Commuting levels to the MOB will peak in 1995 at somewhat higher values than experienced in 1994. High levels will remain through 1996, decrease appreciably in 1997, and reach their operational values in 1998.

Although the Hard Silo alternative has the greatest worker requirements during construction, it has the smallest requirements during operations. In 1998 and thereafter, peak-hour commuters to the MOB are expected to number between 210 and 515, depending on onbase housing availability, representing 155 to 380 trips.

Table 4.3.2-2

ESTIMATED NUMBERS OF PEAK-HOUR COMMUTERS AND APPROXIMATE VEHICLE MOVEMENTS BY CALENDAR YEAR
HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES
(200 MISSILES)

	ESTIMATED PEAK-HOUR COMMUTERS								
Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
To Main Operating Base	2,430-2,435	1,405-1,430	975-1,075	445-600	460-720	810-1,240	685-1,270	375-945	375-945
To Deployment Area	85	100	255	405	260	130	5	--	--
TOTAL:	2,515-2,520	1,505-1,530	1,230-1,330	850-1,005	720-980	940-1,370	690-1,275	375-945	375-945
	APPROXIMATE PEAK-HOUR VEHICLE MOVEMENTS								
To Main Operating Base	1,570-1,575	910-930	670-745	325-440	335-525	595-915	510-940	280-700	280-700
To Deployment Area	55	65	165	260	170	85	5	--	--
TOTAL:	1,625-1,630	975-995	835-910	585-700	505-695	680-1,000	515-945	280-700	280-700

Note: Ranges shown represent different proportions of military housing onbase.

Table 4.3.2-3

ESTIMATED NUMBERS OF PEAK-HOUR COMMUTERS AND APPROXIMATE VEHICLE MOVEMENTS BY CALENDAR YEAR
HARD SILO IN PATTERNED ARRAY
(250 MISSILES)

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
	ESTIMATED PEAK-HOUR COMMUTERS								
To Main Operating Base	995-1,000	860-900	925-1,075	985-1,185	1,130-1,370	1,235-1,510	1,145-1,435	320-635	210-515
To Deployment Area	905	1,370	2,480	2,820	3,040	2,440	1,480	210	--
TOTAL:	1,900-1,905	2,230-2,270	3,405-3,555	3,805-4,005	4,170-4,410	3,675-3,950	2,625-2,915	530-845	210-515
	APPROXIMATE PEAK-HOUR VEHICLE MOVEMENTS								
To Main Operating Base	645-650	560-590	660-770	705-850	820-995	905-1,105	845-1,065	240-470	155-380
To Deployment Area	585	885	1,615	1,835	1,985	1,600	980	140	--
TOTAL:	1,230-1,235	1,445-1,475	2,275-2,385	2,540-2,685	2,800-2,980	2,505-2,705	1,825-2,045	380-610	155-380

Note: Ranges shown represent different proportions of military personnel housed onbase.

Conditions for the Hard Silo alternative are appreciably different from those of the Hard Mobile modes with respect to potential impacts to transportation. The potential for significant short-term impacts is higher in the construction phase, principally because of the comparatively large numbers of workers required in the deployment area and the sustained high levels of activity in that area over at least 5 years. By contrast, the potential for long-term impacts is lower than that for the Hard Mobile modes because of the lower numbers of operations personnel required. Short-term, high impacts that are significant at the regional level and long-term, moderate to negligible impacts that are not significant at the regional level are generally expected for this basing mode.

4.3.3 Impacts of Hard Mobile Launcher in Random Movement

4.3.3.1 Arizona Complex

The MOB for the Arizona Complex will be either Gila Bend Air Force Auxiliary Field (AFAF), located on Luke Air Force Range (AFR) south of Gila Bend, or Yuma Proving Ground (PG), north of Yuma, Arizona. With the MOB at Gila Bend AFAF, short-term impacts to transportation are expected to be high and significant at the regional level. Long-term impacts will be negligible at the regional level. With the MOB at Yuma PG, short-term, regional-level impacts will be moderate and significant. Long-term impacts will also be moderate but not significant at the regional level.

Most construction workers and operations personnel will likely commute to Gila Bend AFAF from metropolitan Phoenix, Arizona. Substantial numbers will travel via Interstate 10 from Phoenix, and then south via Arizona State Highway 85. (I-10, partially incomplete within Phoenix, is scheduled to be complete by 1990 as a multilane, divided, limited-access road.) A few workers may commute from Casa Grande via Interstate 8, and from Ajo, Arizona via State Highway 85.

Most construction workers and operations personnel housed offbase will likely commute to Yuma PG from Yuma, Arizona via U.S. 95. A few may commute from Somerton, Arizona (south of Yuma) also via U.S. 95, and still fewer from El Centro, California and its adjacent communities via Interstate 8 and U.S. 95.

Construction sites in the deployment area could be accessed via Interstate 8 from Yuma, Arizona, eastward to beyond Gila Bend; U.S. 95 between Interstates 8 and 10; and State Highway 85 from Gila Bend southward to Ajo. Commuting to these offbase worksites will be predominantly from metropolitan Phoenix and Yuma, Arizona. During the periods when activities are within commuting distance, appreciable numbers of workers could be drawn from Ajo and Casa Grande, Arizona. Moderate numbers could also be drawn from the communities near El Centro and Blythe, California (via I-10), and from Somerton, Arizona.

The largest changes in LOS related exclusively to offbase construction (i.e., without appreciable volumes of associated traffic to an MOB) will occur in 1990. The largest impacts that could reasonably occur in that year will be on U.S. 95 between Yuma, Arizona and its intersection with Interstate 10 (LOS A to D and C to D), and on State Highway 85 between Interstates 8 and 10

(LOS D to E). The short-term effect on State Highway 85, if it occurred, will be moderate and significant at the regional level. The affect on U.S. 95 will be high but not significant at the regional level.

With the MOB at Gila Bend AFAF, service on Interstate 10 west of Phoenix is projected to drop at least from LOS A to D, and on State Highway 85 between Interstates 8 and 10, from LOS D to F in 1990. The addition of deployment-area traffic, if present, could increase the change on Interstate 10 to LOS E. These regional-level changes represent short-term, high impacts that will be significant.

During the operations phase (1997 and thereafter), most personnel living offbase are expected to reside in nearby communities such as Gila Bend, or a conveniently situated new town. It is not considered realistic for the long-range commuting pattern of the early-construction phase to continue long term. As a result, long-term, regional impacts to transportation are expected to be negligible.

With the MOB at Yuma PG, service on U.S. 95 from the city limits northward to the Yuma PG access road could drop from LOS C to E or F in 1990, depending on the presence of deployment-area traffic. This change could continue for 1 or 2 additional years in the presence of concurrent MOB and deployment-area traffic on U.S. 95. The subsequent change from LOS C to D will persist throughout the construction phase. No other long-term changes in service levels are projected.

The projected decline on U.S. 95 from LOS C to E or F in 1990 represents a short-term, high impact. Because of the comparatively short length of a single roadway that is affected, and its comparatively low volume of long-distance travelers, this impact will not be significant at the regional level. However, a projected reduction of service from LOS D to E on State Highway 85 between Interstates 8 and 10 as a result of deployment-area construction traffic could result in short-term, moderate, and significant impacts at the regional level for the Yuma PG alternative. The impact to State Highway 85, because of its potential regional significance, is shown on Figure 2.0-1 (see Chapter 2.0) rather than the not significant impact that may occur to U.S. 95. The continuing peak-hour change in service on U.S. 95 between Yuma and the MOB (LOS C to D) in the operations phase represents a moderate impact that will not be significant at the regional level.

4.3.3.2 Florida Complex

The MOB for the Florida Complex will be Eglin Air Force Base (AFB), with the deployment area entirely onbase. Both short and long-term impacts to transportation will be moderate with this alternative and will not be significant at the regional level.

Most construction workers and operations personnel housed offbase will likely commute to the MOB from Fort Walton Beach, Valparaiso/Niceville, and Pensacola, Florida. Smaller communities such as Crestview, Florida could also contribute appreciable numbers, and a few workers could come from as far as Panama City, Florida and Mobile, Alabama. Substantial numbers will travel via Florida State Highway 85 between Fort Walton Beach and Valparaiso, and U.S. 98 between Pensacola and Fort Walton Beach.

Construction sites in the deployment area could be reached via primary routes Interstate 10 and U.S. 29, 98, and 331, and by Florida State Highways 85 and 87. Commuting to deployment-area worksites will be primarily from Fort Walton Beach, Pensacola, and Panama City, depending on location, with potential contributions from Valparaiso/Niceville and other smaller communities in the region, and from Mobile, Alabama for worksites in the western parts of the installation.

Principal access to deployment-area worksites could be via Interstate 10 between Pensacola and the U.S. 331 intersection, U.S. 29 and 98 between Pensacola and Panama City, and the stretches of U.S. 331 and State Highways 85 and 87 that join Interstate 10 and U.S. 98.

In 1990, commuting related to deployment-area construction alone could result in a drop in service from LOS B to C on U.S. 331 or State Highway 87 if commuters used these highways to reach the worksites. These effects will not be present by 1993.

Construction-worker commuting to the MOB in 1990 is expected to result in a change in service from LOS C to D on State Highway 85 immediately north of Fort Walton Beach (then upgraded to 6 lanes), and on U.S. 29 immediately south of Pensacola. No greater changes are expected on these roads in the presence of concurrent deployment-area-related traffic, but minor changes (e.g., LOS A to B) may occur locally on a few other roads. The change from LOS C to D on State Highway 85 is expected to persist into the operations phase.

The projected change from LOS C to D on U.S. 29 immediately south of Pensacola represents a short-term, moderate impact that is not significant at the regional level. Only short-term, low impacts, which will not be significant at the regional level, are projected for any other roads. The persistent change from LOS C to D on State Highway 85, projected to begin in 1990 and confined to a single stretch of road, represents a long-term, moderate, and not significant impact.

4.3.3.3 Nevada Complex

The MOB for the Nevada Complex will be either Indian Springs AFAF or Nellis AFB. With either MOB, short-term impacts to transportation may be high but not significant at the regional level. With the MOB at Indian Springs AFAF, long-term impacts will be low and not significant at the regional level. With the MOB at Nellis AFB, long-term impacts will be negligible.

Indian Springs AFAF is approximately 44 miles northwest of Las Vegas, Nevada via U.S. 95. Nellis AFB is approximately 4 miles northeast of Las Vegas via Nevada State Highway 604, which is not a primary road. Its regional access is via Interstate 15.

Most construction workers and operations personnel housed offbase will likely commute to either MOB from the greater Las Vegas vicinity, including its adjacent incorporated and unincorporated communities. Commuters to the Indian Springs AFAF vicinity will mainly travel on U.S. 95. Commuters to Nellis AFB from greater Las Vegas are assumed to use secondary and minor roads extensively, and to contribute only small volumes of additional traffic to the primary network.

Construction sites in the deployment area could be accessed via U.S. 95 between Las Vegas and Tonopah, Nevada; U.S. 6 east of Tonopah; and Interstate 15 and U.S. 93 north from Las Vegas to the U.S. 93/Nevada State Highway 375 intersection. State Highway 375, which joins U.S. 93 to U.S. 6 across the northeast boundary of the installations, is classified as a secondary road but is also a likely route for construction-phase traffic to the deployment areas. There are no communities of substantial size in the northern parts of the Region of Influence (ROI) (e.g., Tonopah had a 1980 population of 1,650); therefore, most workers were assumed to come from the metropolitan Las Vegas vicinity.

In 1990, commuting related to deployment-area construction alone could result in a drop in service from LOS A to B on Interstate 15 immediately north of Las Vegas, and/or from LOS A to B, C, or D on parts of one or more of the two-lane roads encircling the deployment area (e.g., U.S. 6, 93, or 95). The specific roads affected will depend on construction sequencing. The potential for impact will decrease in subsequent years, and will be negligible during operations.

Construction-worker commuting to the MOB at Indian Springs AFAF in 1990 is projected to result in changes in service from LOS A to D for a short stretch of rural U.S. 95 north of Las Vegas, and from LOS A to C for the remainder of the route to the MOB. With concurrent traffic to a deployment-area worksite, the corresponding change could be from LOS A to E. Increased levels of localized congestion could also be expected on the access roads and on U.S. 95 within Las Vegas. The changes in service on rural stretches of U.S. 95 will decrease in subsequent years, but are projected to become no lower than LOS A to B when the system is fully operational in 1997.

Neither construction nor operations-worker commuting to the MOB at Nellis AFB is expected to have an appreciable impact to roadways of regional importance, since other than primary roads are likely to be used for most commuting to this MOB. Increased congestion and local impacts may be expected within metropolitan Las Vegas.

Consequently, with the MOB at Indian Springs AFAF, short-term, high impacts to transportation are projected to result because of the LOS changes expected on U.S. 95. Because only a comparatively short section of the road is affected, these impacts will not be significant at the regional level. Impacts associated with related deployment-area construction may also be high; if they occur at this level, they will not involve seriously degraded service (LOS E or F) and will not be significant in the region. The continuing change from LOS A to B on U.S. 95 during operations represents a long-term, low impact that is not significant at the regional level.

With the MOB at Nellis AFB, local rather than regional short-term impacts are expected to occur as a result of MOB-centered, construction-phase commuting. (Such commuting is not expected to make extensive use of regionally important roads.) However, deployment-area commuting may result in short-term, high impacts that are not significant at the regional level. Similarly, long-term, negligible, regional-scale impacts are expected during the operations phase.

4.3.3.4 New Mexico Complex

The MOB for the New Mexico Complex will be Fort Bliss, Holloman AFB, or White Sands Missile Range Headquarters. With the MOB at Fort Bliss, short-term impacts to transportation are expected to be high but not significant at the regional level. Long-term impacts will be negligible in the region. With the MOB at Holloman AFB, both short and long-term impacts will be high, but neither will be significant at the regional level. With the MOB at White Sands Missile Range Headquarters, short-term impacts will be high and long-term impacts will be low; none of the impacts will be significant in the region.

Most construction workers and operations personnel housed offbase will likely commute to Fort Bliss from El Paso, Texas. There are numerous access routes to this MOB with its urban setting in El Paso. Commuting to Holloman AFB will be predominantly from Alamogordo, New Mexico; El Paso, Texas; and Las Cruces, New Mexico. This traffic is expected to follow U.S. 54 between El Paso, Texas and Alamogordo, New Mexico; Interstate 25 between Las Cruces, New Mexico and the U.S. 70/82 intersection; and U.S. 70/82 from the Interstate 25 intersection to Alamogordo, New Mexico. Commuting to White Sands Missile Range Headquarters will be predominantly from El Paso, Texas and Las Cruces and Alamogordo, New Mexico. This traffic is expected to follow Interstate 10 between El Paso and Las Cruces, Interstate 25 between Las Cruces and the U.S. 70/82 intersection, and U.S. 70/82 between Interstate 25 and Alamogordo.

Construction sites in the deployment area could be reached via U.S. 180 east of El Paso; U.S. 54 between El Paso and Carrizozo, north of Alamogordo; U.S. 70/82 between Las Cruces and Alamogordo; U.S. 380 between San Antonio (south of Socorro) and Carrizozo; and Interstates 10 and 25 between El Paso and Socorro. Commuting to offbase worksites will be predominantly from El Paso, Texas, and Alamogordo, Las Cruces, and Socorro, New Mexico, depending on site location.

Commuting related to deployment-area construction alone is projected to result in transitions to service levels no lower than LOS D in the peak year (1990). A change from LOS A or B to D could occur on sections of two-lane roads carrying offbase construction traffic, and a similar change from LOS C to D could occur on a short section of Interstate 10 north of El Paso.

Construction and operations-worker commuting to the Fort Bliss MOB during the construction phase is expected to result in increased local congestion within El Paso, but will not to have an appreciable short-term impact to roads of regional importance. Deployment-area construction traffic associated with this alternative may result in short-term, high impacts to regional roads (LOS A or B to D or C to D). These impacts will not persist and will not be significant at the regional level. Operations-phase traffic to Fort Bliss may similarly result in local congestion in El Paso, but is even less likely to have an appreciable influence on regionally important roads. Consequently, long-term impacts will be negligible at a regional scale.

Construction-worker commuting to the Holloman AFB MOB is projected to result in a transition from LOS B to E on U.S. 70/82 between Alamogordo, New Mexico and the Holloman AFB turnoff in 1990. This change may be as high as LOS B to F in the presence of concurrent traffic to a deployment-area worksite. The

projected change on this road segment will reach LOS B to D by 1997, and will persist during the operations phase.

Commuting to the MOB from El Paso via U.S. 54 through Alamogordo is also projected to result in short-term impacts to that roadway. Changes from LOS A to B and B to C are projected for segments of U.S. 54 between El Paso and Alamogordo in 1990 without concurrent deployment-area traffic. However, in the presence of such traffic, local changes can be as high as LOS B to E. No changes in LOS are projected for U.S. 54 subsequent to the construction phase.

The change in LOS from B to E on U.S. 70/82 between Alamogordo and Holloman AFB represents a short-term, high, local impact that will begin during the construction phase and continue at LOS B to D throughout the operations phase. Because of the short section of road involved, the associated impact is not judged to be significant at the regional level. Short-term impacts during construction include a potential for temporary LOS E or F service on U.S. 70/82 between Alamogordo and Holloman AFB, and for reductions in service to as low as LOS D or E on sections of U.S. 54 between El Paso and Alamogordo. The temporary reduction of service on U.S. 70/82 is not considered significant in the region because of the short section involved. The short-term reduction in service to LOS E on U.S. 54 is not judged to be significant for similar reasons.

Construction-worker commuting to the MOB at White Sands Missile Range Headquarters is projected to result in service changes in 1990 from LOS A to C and C to D on Interstate 10 between El Paso and Las Cruces; from LOS A to D on Interstate 25 immediately north of Las Cruces; and from LOS A to D on U.S. 70/82 from Interstate 25 to the base turnoff. With concurrent deployment-area traffic, the change in service on Interstate 25 north of Las Cruces could reach LOS A to E, and the service on U.S. 70/82 could also reach LOS A to E. By 1997, with full operations, changes from LOS A to B could persist on Interstate 25, immediately north of Las Cruces, and on U.S. 70/82 from Interstate 25 to the MOB.

The temporary changes in service on Interstates 10 and 25 and on U.S. 70/82 during the construction phase represent short-term, moderate to high impacts that are not considered to be significant at the regional level. The intensities of the impacts generally represent large, temporary changes in LOS rather than severely degraded service. Only a short section of Interstate 25 immediately north of Las Cruces will potentially reach the lower levels of service (LOS E), and this change will occur only if deployment-area traffic is coincident with MOB traffic in that year. Long-term impacts from the projected persistent change from LOS A to B on short sections of Interstate 25 and U.S. 70/82 will be low and not significant at the regional level.

4.3.3.5 South-Central California Complex

The MOB for the South-Central California Complex will be either Edwards AFB or Fort Irwin National Training Center (NTC). With the MOB at Edwards AFB, short-term impacts to transportation are expected to be high and significant at the regional level. Long-term impacts will also be high but not significant in the region. With the MOB at Fort Irwin NTC, regional-level, short-term impacts will be high and significant and long-term impacts will be negligible at the regional level.

Most construction workers will likely commute to Edwards AFB predominantly from the vicinities of nearby Palmdale, Lancaster, and Quartz Hill, California, and from the more remote but larger population centers of the greater Los Angeles area. Operations workers housed offbase will be more likely to commute from nearby communities. For this analysis, construction-worker commuting to Edwards AFB was assumed to be principally via Interstate 5 and California State Highway 14 from the western greater Los Angeles area and from Palmdale/Lancaster/Quartz Hill; via Interstates 15 and 215 and California State Highways 14 and 138 from the eastern greater Los Angeles area (San Bernardino and Ontario); and via California State Highway 58 from Barstow. Base access was assumed to be via the three existing gates on the north, west, and south sides of the base.

Most construction workers will likely commute to Fort Irwin NTC from Barstow; from other desert communities such as Victorville, Apple Valley, and Hesperia; and from the eastern greater Los Angeles area (San Bernardino and Ontario vicinities). Operations workers will be more likely to commute from the nearby communities. Most of the associated traffic will follow Interstate 15 (including its I-215 alternative) to the vicinity of Barstow, from which Fort Irwin NTC is reached via a paved minor road. Some traffic will also follow California State Highways 58 and 247. Operations workers housed offbase will likely commute principally from Barstow and nearby communities.

Construction sites in the deployment area could be reached via Interstates 15 and 40, U.S. 395, and California State Highways 14, 58, 62, 127, 138, 178, 190, and 247. Appreciable numbers of workers will be drawn from communities throughout the region when activities are located within reasonable commuting distance.

Commuting related to deployment-area construction alone is projected to result in transitions of no greater than one service level on rural primary roads. The lowest level reached will be LOS D. There is some potential for increased localized congestion in the peak year (1990) on short sections of roads within the urbanized metropolitan Los Angeles area providing service at levels as low as LOS F. The short-term impacts corresponding to these changes may be locally moderate to high but not significant at the regional level.

Construction-worker commuting to the MOB at Edwards AFB in 1990 is projected to result in changes in service on State Highway 14 from LOS B to C between Palmdale and Lancaster, from LOS B to E between Lancaster and State Highway 138, and from LOS A to D between State Highway 138 and Rosamond. A change from LOS C to D is also projected for State Highway 138 between Interstate 15 and State Highway 18, and from LOS B to C for part of Interstate 15 in the Cajon Pass north of San Bernardino. Coincident traffic to deployment-area worksites could result in further short-term reductions in service on State Highway 14 from LOS B to D, immediately to the north of Palmdale, and from LOS C to D immediately to its south.

Impacts to State Highway 14 are projected to persist into the operations phase (1998 and beyond), resulting in a change in service from LOS B to D between Lancaster and State Highway 138, and from LOS A to C between State Highway 138 and Rosamond.

With the MOB at Edwards AFB, the short-term changes in service on State Highways 14 and 138 represent high LOIs (LOS A or B to D or E) during the construction phase. Because of the potential effects to heavily traveled State Highway 14, which carries substantial volumes of commercial and recreational traffic, these impacts are considered to be significant at the regional level. The long-term, high, and local impact (LOS B to D) on State Highway 14 between Lancaster and State Highway 138 is not considered significant at the regional level. A comparatively short length of roadway is involved, and service levels, though substandard (LOS D), are not severely adverse (LOS E or F).

Construction-worker commuting to the MOB at Fort Irwin NTC in 1990 is projected to result in a change in service levels on Interstate 15 from LOS B to C from its junction with Interstate 215 to Barstow. An addition of coincident traffic to deployment-area worksites could result in a further reduction in service on Interstate 15 from LOS B to D (vs. B to C) between its junction with State Highway 138 and Barstow, and from LOS C to D on Interstate 215 south of its junction with Interstate 15. Coincident deployment-area traffic could also result in changes in service on U.S. 395 between Interstate 15 and State Highway 14 from LOS B or C to D and from LOS C or D to E. None of these changes will persist into the operations phase.

The potential changes in service on Interstate 15 and U.S. 395 in 1990 represent short-term, high impacts that are potentially significant at the regional level. Long-term impacts are expected to be negligible.

4.3.3.6 Washington Complex

The MOB for the Washington Complex will be Yakima Firing Center (FC). Short-term impacts to transportation will be moderate but not significant and long-term impacts will be negligible at the regional level.

Most construction workers will likely commute to Yakima FC from Yakima, Washington. Substantial numbers will travel via Interstate 82/U.S. 97, which overlap between Yakima and Ellensburg to its north. Others could commute from Ellensburg, also via Interstate 82/U.S. 97, and from small communities such as Toppenish and Sunnyside on Interstate 82 and U.S. 97 to the south and southeast.

Construction sites in the deployment area could be reached by Interstate 82 and 90, U.S. 12, and Washington State Highways 24, 240, and 241. Other roads could also be used. Commuting to offbase worksites will be predominantly from Yakima, Kennewick, Richland, Pasco, and other communities in the region, depending on the worksite locations.

Commuting related to deployment-area construction is projected to result in localized congestion within urban areas, with comparatively little impact to rural primary roads. For 1990, the largest projected changes in service are LOS A to B on the affected roadways.

Construction traffic to the MOB in 1990 is projected to result in a change in service on Interstate 82 north of Yakima from LOS A to B or A to C in 1990, depending on the presence or absence of concurrent traffic to deployment-area worksites. By 1997, and in subsequent years, operations-phase traffic is expected to add appreciable volumes to this roadway with no change in LOS.

The potential reduction in peak-hour service from LOS A to C on Interstate 82 between the urban limits of Yakima and the Yakima FC access road represents a short-term, moderate impact that is not considered significant for the region. Long-term impacts will be negligible at the regional level.

4.3.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.3.4.1 Ellsworth Air Force Base

Ellsworth AFB, 11 miles northeast of Rapid City, South Dakota, is reached via Interstate 90 and U.S. 14, which overlap in the vicinity of the base. The missile fields, to the north and east of the base, are accessible via Interstate 90; U.S. 14, 16, 85, and 212; and South Dakota State Highways 34 and 79. Short-term impacts to transportation will be high but not significant at the regional level with this alternative. Long-term, regional-level impacts will be low and not significant. Long-term, beneficial impacts could also result from associated road and bridge improvements.

Most construction workers and operations personnel housed offbase will likely commute to Ellsworth AFB from Rapid City, South Dakota. Substantial numbers could travel on Interstate 90/U.S. 14. Construction workers for offbase activities will also be drawn from Rapid City. Moderate numbers could be drawn from Belle Fourche, Lead, Spearfish, and Sturgis, South Dakota (combined 1980 populations of 19,457), when activities are northwest of the base, and a few could commute from Pierre, South Dakota (1980 population of 11,973) to activities east of the base. The roadways potentially affected are Interstate 90; U.S. 14, 85, and 212; and State Highways 34 and 79. Specifics will depend on selection of worksites to which workers will commute, and other primary roads could also be potentially affected.

Commuting related to deployment-area construction is projected to result in changes in service levels of no greater than LOS A to B on rural sections of regional primary roads. Commuting to the MOB from Rapid City via Interstate 90/U.S. 14 is projected to result in a change in service from LOS B to E in 1990 and from LOS B to C in 1993, with or without concurrent deployment-area traffic. A long-term change from LOS B to C is projected to persist during the operations phase.

The short-term, high impact to an approximate 6-mile stretch of Interstate 90/U.S. 14 (LOS B to E in 1990) is not considered to be significant at the regional level. The long-term impact to Interstate 90/U.S. 14 (LOS B to C) will be low and not significant at the regional level.

4.3.4.2 F.E. Warren Air Force Base

F.E. Warren AFB is immediately adjacent to Cheyenne, Wyoming, at the western edge of the city. It is reached by Interstates 25 and 80 and U.S. 30 (which overlaps I-80) and 85. The missile fields, to the north, east, and southeast of the base, are accessible via Interstates 25, 76, and 80; U.S. 26, 30, 85, and 385; and a number of additional primary roads, including Colorado, Nebraska, and Wyoming state-numbered routes. Short-term, regional-level impacts to transportation will be low and not significant. Long-term impacts will be negligible and beneficial at the regional level, depending on the scope of associated road and bridge improvements.

Most construction workers and operations personnel housed offbase will likely commute to F.E. Warren AFB from Cheyenne, Wyoming, using any of a number of alternative routes, depending on the access provided. Additional onbase construction workers could commute in appreciable numbers from Fort Collins, Greeley, and Loveland, Colorado, and from Laramie, Wyoming via Interstates 25 and 80 and U.S. 85. Operations workers are much less likely to do so.

Construction workers for offbase activities could be drawn from many of the smaller communities in the region when the worksites are within reasonable commuting distance. These workers could travel on any of the primary roads previously noted, depending on local conditions.

Commuting related to deployment-area construction alone is projected to cause changes in service of no greater than LOS A to B or B to C on the affected stretches of rural primary roads in the peak year (1993) for deployment-area activity.

Commuting to the MOB is projected to result in a change in service from LOS A to B in 1990 on a short stretch of U.S. 85 immediately south of Cheyenne and no change on rural primary roads in other years. Local congestion may occur within urban Cheyenne during the construction and operations phases, but will not be significant in the region.

Short-term impacts in the construction phase will be low (LOS A to B or B to C), restricted to at most a few roadways, and will not be significant at the regional level; long-term impacts will be negligible at a regional scale.

4.3.4.3 <u>Grand Forks Air Force Base</u>

Grand Forks AFB, 16 miles west of Grand Forks, North Dakota, is reached via U.S. 2. The community of Grand Forks is also reached via Interstate 29. The missile fields, to the west, northwest, and southwest of the base, are accessible via Interstate 94, U.S. 2 and 281, and North Dakota State Highways 1, 5, 17, 20, and 200. Short-term impacts to transportation will be high but not significant at the regional level. Long-term impacts will be negligible and beneficial in the region, depending on the scope of associated road and bridge improvements.

Most construction workers and operations personnel housed offbase will likely commute to Grand Forks AFB from the community of Grand Forks. Others could commute from smaller nearby communities such as Crookston, and a few may come from as far as Fargo, North Dakota to the south. Construction workers for offbase activities will also be drawn from Grand Forks, but the majority of them could come from other communities when offbase worksites are located nearby (e.g., from Fargo, North Dakota) and when the related activities are in the southern parts of the missile field.

Commuting related to deployment-area construction alone could cause a reduction in service from LOS A to B in the peak year (1993), but only on short sections of State Highway 5, and will occur only if the offbase worksites are appropriately situated; no other roads will be affected.

Commuting to the MOB from Grand Forks via U.S. 2 is projected to result in a change in service from LOS A to D in 1990 with or without coincident

deployment-area traffic. This change will no longer occur by 1993 unless concurrent deployment-area traffic is present, in which case the change could be from LOS A to B. No changes in LOS will persist into the operations phase.

The short-term change from LOS A to D on U.S. 2 in 1990 constitutes a high impact that is not considered to be significant at the regional level; long-term impacts will be negligible at a regional scale.

4.3.4.4 Malmstrom Air Force Base

Malmstrom AFB, 1.5 miles east of Great Falls, Montana, is reached via U.S. 87/89 and Montana State Highway 200, and locally via U.S. 87 Bypass (57th Street South). The missile fields, to the southeast and northwest, are accessible via Interstate 15; U.S. 2, 12, 87, 89, 191, and 287; and Montana State Highways 3, 19, 44, 66, 80, 81, and 200. Short-term impacts to transportation will be low and not significant at the regional level. Long-term impacts will be negligible in the region. Beneficial, long-term, regional impacts could also accompany the associated road and bridge improvements.

Most construction workers and operations personnel housed offbase will likely commute to Malmstrom AFB from Great Falls, traveling predominantly on urban roadways. Construction workers for offbase activities will also be drawn in substantial numbers from Great Falls. They could also commute from Lewistown (1980 population of 7,104), which is east of the base on U.S. 87, and from a group of smaller communities such as Conrad, Shelby, and Cut Bank (combined 1980 population of 9,904), which are northwest of the base on Interstate 15 and U.S. 2. Some workers are expected to commute from larger but more distant communities such as Billings and Helena. Most offbase construction traffic is expected to follow Interstate 15 and U.S. 87 and 89. This traffic is dependent on worksite selection.

Commuting related to deployment-area construction alone is projected to result in changes in service of no larger than LOS B to C on short stretches of U.S. 89 in 1993, the peak year, if activities are east or west of Great Falls and accessed by U.S. 87. Commuting to the MOB during construction and subsequent operations is expected to result in increased congestion within Great Falls only, and not to affect regional primary roads.

Short-term, regional-level impacts in the construction phase will be low (LOS B to C), restricted to short sections of U.S. 89 if they occur, and will not be significant. Long-term impacts will be negligible at a regional scale.

4.3.4.5 Minot Air Force Base

Minot AFB, 13 miles north of Minot, North Dakota, is reached regionally via U.S. 83. (The community of Minot is serviced by U.S. 2, 52, and 83.) The missile fields, which form an arc to the north, west, and south of the base, are accessible via U.S. 2, 52, 83, and 85, and North Dakota State Highways 3, 5, 23, and 200. Short-term impacts to transportation will be high but not significant at the regional level. Long-term, regional impacts will be low and not significant. Beneficial, long-term, regional impacts could also accompany the associated road and bridge improvements.

Most construction workers and operations personnel housed offbase will likely commute to Minot AFB from Minot. Substantial numbers could travel on U.S. 83. Construction workers for offbase activities will also be drawn in substantial numbers from Minot. Moderate numbers could be drawn from Bismarck and Williston, North Dakota, when construction activities are in nearby areas. The roadways potentially affected are those previously noted.

Commuting related to deployment-area construction is projected to result in transitions in service levels of no greater than LOS A to B or B to C on rural sections of regional primary roads in the peak-commuting year (1993) to deployment-area worksites.

Commuting to the MOB from Minot via U.S. 83 is projected to result in a change in service from LOS A to E in 1990, decreasing to LOS A to B by 1993, with or without concurrent deployment-area traffic. A long-term change from LOS A to B is projected to persist during the operations phase.

The projected short-term, high impact to U.S. 83 north of Minot, North Dakota (LOS A to E in 1990) is not considered to be significant at the regional level. The long-term impact to U.S. 83 north of Minot (LOS A to B) will be low and not significant at the regional level.

4.3.4.6 Whiteman Air Force Base

Whiteman AFB is 1.5 miles south of Knob Noster and approximately 68 miles east of Kansas City, Missouri. It is reached regionally via transcontinental U.S. 50, which is a four-lane divided highway that joins Kansas City to the west of the base and Sedalia, Missouri to its east. The missile fields, which surround the base, are entirely within Missouri. They are accessible via Interstate 70/U.S. 40 (which overlap); U.S. 24, 50, 54, 63, 65, 69, 71, 160, and 169; and a well-developed network of state-numbered routes.

Short-term impacts to transportation are expected to be high but not significant at the regional level. Long-term impacts will be low and not significant at the regional level. Beneficial, long-term impacts could also accompany the associated road and bridge improvements.

A majority of construction workers will likely commute to the base from metropolitan Kansas City, though appreciable numbers will also be derived from other communities in the region. Operations workers will likely commute from more nearby communities. From the Kansas City area, workers could follow either U.S. 50 directly, or follow Interstate 70 to its junction with Missouri State Highway 13 and then proceed southward to U.S. 50 to reach the base vicinity. Travel to the base from nearby Sedalia and Warrensburg is assumed to be via primary road U.S. 50. Construction sites in the deployment area could be reached via any of the primary roads previously noted. Construction workers for these offbase sites could be drawn from any of the numerous communities in the region, depending on worksite locations, including such distant communities as Springfield and Jefferson City.

Commuting related to deployment-area construction alone is projected to result in changes in service levels of no greater than LOS A to B on rural sections of a few primary roads. Changes of even this low magnitude are expected to occur only in the peak year (1993).

Commuting to the MOB from metropolitan Kansas City in 1990 is projected to result in changes in service from LOS B to C on Interstate 70 and from LOS A to B on U.S. 50 eastward to State Highway 13. Changes from LOS B to D are also projected for State Highway 13 between Interstate 70 and U.S. 50, and from LOS A to C on U.S. 50 from the State Highway 13 junction eastward to the MOB. The latter change could be as high as LOS A to D in the presence of concurrent traffic to a deployment-area worksite. These changes are expected either to disappear by 1993, or to be no larger than LOS B to C on State Highway 13 when concurrent deployment-area traffic is present. A change in service on State Highway 13 between Interstate 70 and U.S. 50 may recur in later years, and persist into the operations phase.

The temporary changes from LOS A to D and B to D on U.S. 50 and State Highway 13 in 1990 constitute short-term, high impacts. They will not persist at this level for more than 1 year and are not considered significant at the regional level. Other short-term, regional-level changes in service are expected to be low to moderate and not significant. The long-term, regional impact projected for State Highway 13 (LOS B to C) will be low and not significant.

4.3.5 Impacts of Hard Silo in Patterned Array

4.3.5.1 Davis-Monthan Air Force Base

The MOB at Davis-Monthan AFB, adjacent to Tucson, Arizona, could support deployment in any of its associated Suitable Deployment Areas (SDAs), all located in Arizona. Short-term, regional-level impacts to transportation are expected to be high and significant. Long-term impacts will be negligible at the regional level.

Most construction workers and operations personnel housed offbase will likely commute from the Tucson, Arizona area using any of a number of alternative routes, depending upon the access chosen for deployment. Construction sites in the deployment areas may be located in Cochise, Graham, Pima, Pinal, or Santa Cruz counties. Most of the potential sites are in rural areas. These sites could be reached from the Tucson area via Interstate 10 to the northwest and southeast, Interstate 19 to the south and U.S. 89 to the north, Arizona State Highway 86 to the west, and other regional primary roads farther from the base.

While most workers will be drawn from the Tucson area, they may also be drawn from the Phoenix area or from any of the numerous smaller communities in the region when the worksite is within a reasonable commuting distance.

During the construction phase, workers commuting to the potential offbase worksites in highly rural areas will generate high traffic impacts, and these impacts will be significant. For example, depending upon the SDA sites selected, the following LOSs are anticipated:

- LOS B to E on Interstate 10 northwest of Tucson;
- LOS B to E and LOS C to F on Interstate 10 southeast of Tucson and the addition of appreciable volumes to a section at LOS F;

- LOS B to E and C to F on State Highway 86 west of Tucson;
- LOS A to E on Interstate 19 south of Tucson; or
- LOS B to D on U.S. 89 north of Tucson.

Similar effects could be experienced on roads more distant from the base depending on the deployment site selected.

Impacts to the roads used for access to Hard Silo sites could begin at somewhat lower but appreciable levels in 1990, and continue through 1996. Although some construction will still be in progress in 1997, no LOS changes related to offbase construction are expected in that year.

Because of the high levels of traffic congestion that will result on some highways carrying workers from the Tucson area and other communities to rural SDA construction sites, short-term impacts are considered high and significant at the regional level. However, as the construction phase is completed and the operations phase begins, long-term highway impacts will become negligible because of the fewer commuters involved.

4.3.5.2 Edwards Air Force Base

The MOB at Edwards AFB, 20 miles east of Rosamond, California in the Mojave Desert north of the greater Los Angeles area, could support deployment in any of its associated SDAs, all located in California. Short-term impacts to transportation are expected to be high and significant at the regional level. Long-term, regional impacts will be low and not significant.

Construction workers will likely commute to Edwards AFB predominantly from the vicinities of nearby Palmdale, Lancaster, and Quartz Hill, California, and from the more remote but larger population centers of the greater Los Angeles area. Operations workers housed offbase will likely commute from nearby communities. Construction sites in the deployment areas may be located in predominantly rural settings in Kern, Los Angeles, or San Bernardino counties. For this analysis, construction workers were assumed to commute principally via Interstate 5 and California State Highway 14 from the greater western Los Angeles area; from Palmdale, Lancaster, and Quartz Hill; and via Interstates 15 and 215 and California State Highways 14 and 138 from the greater eastern Los Angeles area (San Bernardino and Ontario). Base access was assumed to be via Rosamond, to the west of the base, or existing north and south gates.

Construction sites in the deployment area could be reached via Interstate 15, U.S. 395, or California State Highways 14, 18, 58, and 138. Workers at off-base sites will commute from the Los Angeles metropolitan area, Palmdale, and Lancaster, and if the worksites are situated nearby, from other communities in the region, including Bakersfield, Ridgecrest, and Barstow, California.

Concurrent construction-worker commuting to the MOB and to offbase worksites is expected to be the largest source of potential impacts. Depending on the site selected, possible impacts in the peak-offbase construction year (1994) could include one or more but not all of the following changes:

- LOS A to E, LOS A to F, LOS B to F, and LOS C to E on sections of State Highway 14 between Lancaster and the Edwards AFB access road;

- LOS C to D on State Highway 14 between the Interstate 5 intersection and Lancaster;

- LOS A to E on State Highway 138 west of State Highway 14 to the worksite;

- LOS B to C on State Highway 58 west of Mojave, and some increase in local congestion within urban Bakersfield;

- LOS A to B and LOS B to C on State Highway 58 between Mojave and Barstow;

- LOS C to E on U.S. 395 between State Highways 18 and 58, and LOS D to E between Interstate 15 and State Highway 18;

- LOS D to E on State Highway 138 between Interstate 15 and State Highway 18; or

- LOS B to C and C to D on sections of Interstate 15 in the Cajon Pass area that provides access northward from the San Bernardino/Ontario metropolitan areas, with addition of appreciable volumes to a section of Interstate 215 in the San Bernardino vicinity projected to provide service at LOS F.

Other changes representing low to moderate impact levels will occur to other regional primary roads, depending on worksite location. The specific effects previously noted are also highly dependent on worksite location, and only a few will actually occur.

Regardless of the offbase construction site selected, changes in LOS representing high LOIs may be expected to regional primary roads not only in the peak year (1994), but in other years as well. As early as 1990, the initial-construction year, high LOIs may occur on State Highway 14 between Palmdale and Rosamond (LOS B to D and C to E) and on State Highway 138 between Interstate 15 and State Highway 18 (LOS D to E). Some LOIs on State Highway 14 between Palmdale and Rosamond may continue into the operations phase, with changes from LOS A to B and B to C projected for 1998.

The short-term, high impacts that are projected to occur on regional primary roads during the construction phase are considered to be significant at the regional level. These short-term impacts will endure for several years and affect heavily traveled roads that are also commercially important. The long-term impact to State Highway 14 north of Palmdale is projected to be low (LOS A to B and B to C) and not significant at the regional level.

4.3.5.3 F.E. Warren Air Force Base

The MOB at F.E. Warren AFB, immediately adjacent to Cheyenne, Wyoming, could support deployment in any of its associated SDAs, which are in southeastern Wyoming and southwestern Nebraska. Short-term impacts to transportation are expected to be high but not significant at the regional level. Regional, long-term impacts will be negligible.

Most construction workers and operations workers housed offbase will likely commute to F.E. Warren AFB from Cheyenne, Wyoming, using any of a number of alternative routes, depending on the access provided. Only a few onbase workers will be expected to commute from other communities. Construction sites in the deployment areas may be located in predominantly rural settings in Banner, Kimball, or Laramie counties. Construction sites in the deployment areas could be reached via Interstates 25 and 80 and U.S. 85, both north and south of Cheyenne. Workers at offbase sites will likely commute principally from Cheyenne, but could be drawn in appreciable numbers from other communities in the region when the worksite is within reasonable commuting distance.

Construction-worker commuting to offbase worksites is expected to be the largest source of potential impacts. Depending on the site selected, possible impacts in the peak offbase construction year (1994) could include one of the following changes:

- o LOS A to E, LOS A to B, and LOS B to C on U.S. 85 between Cheyenne and Torrington, Wyoming, with a related drop from LOS A to D on Interstate 25 immediately north of Cheyenne;
- o LOS A to D and LOS A to C on Interstate 25 north of Cheyenne; or
- o LOS A to E on U.S. 85 south of Cheyenne, Wyoming.

Impacts to U.S. 85 could begin as early as 1990. Changes in service could be as high as LOS A to C immediately south of Cheyenne, and LOS A to D to its north. No other potential regional-scale impacts are projected in 1990. Some changes in service level could persist on U.S. 85 north of Cheyenne until 1997 (LOS A to B) if the deployment-area worksite is reached by that route.

The short-term multistep changes from LOS A to LOS D or E that may occur during the construction phase constitute high LOIs that are not considered significant at the regional level. If the deployment area is accessed via Interstate 25 and secondary roads, the regional impacts will not be considered significant. The LOS will not be significantly degraded (not below LOS D) on Interstate 25, and the other impacts will be of local rather than regional significance, since impacts will not affect primary roads. Impacts to U.S. 85 south of Cheyenne, which could result in LOS E operation in 1994, will affect only a short section of a lightly traveled road for which a major alternative (I-25) is available for long-distance travel. The potential impact to this roadway is also not considered significant at the regional level. U.S. 85 north of Cheyenne is also lightly used, and only a short length of it will potentially be affected. Regional-scale significance of the possible impacts to this road is considered unlikely.

Commuting to the MOB construction site at F.E. Warren AFB could result in localized increases in congestion within urban Cheyenne, but is not expected to result in appreciable interference with regional travel. The availability of alternative urban routes makes the potential for short-term, significant impacts at a regional scale essentially negligible. The potential for long-term, regional impacts is even smaller during operations because of the comparatively few commuters involved.

4.3.5.4 Fort Bliss

The MOB at Fort Bliss near El Paso, Texas could support deployment in any of its associated SDAs, which are in Texas and adjoining areas of New Mexico to the north of El Paso. Short-term impacts to transportation are expected to be high and significant at the regional level. Regional, long-term impacts will be negligible.

Most construction workers and operations personnel housed offbase will likely commute to Fort Bliss from El Paso, Texas, using any of a number of alternative routes depending on the access provided. Construction sites in the deployment areas may be located in predominantly rural settings in Dona Ana or Otero counties, New Mexico, or El Paso or Hudspeth counties, Texas. Construction sites in the deployment areas could be reached via Interstate 10, both north and south of El Paso and west from Las Cruces; Interstate 25 north of Las Cruces, New Mexico; U.S. 62/180 east of El Paso; and U.S. 54 north of El Paso, Texas. Workers at offbase sites will be likely to commute principally from El Paso, but could also commute in substantial numbers from Las Cruces to sites near that city. Relatively few commuters are expected to be drawn from other communities in the region. Commuting to offbase worksites is expected to be the largest source of potential impacts.

Depending on the site selected, possible impacts in the peak offbase construction year (1994) could include one of the following changes:

- LOS B to F on Interstate 10 southeast of El Paso;
- LOS B to E on U.S. 62/180 east of El Paso;
- LOS A to E on U.S. 54 north of El Paso; or
- LOS A to C and LOS C to D on Interstate 10 north of El Paso.

Drops in LOS from A to E will also occur on Interstates 10 or 25 to the west and north of Las Cruces, respectively, if construction activities take place in the corresponding directions.

As early as 1990, impacts to these roads will begin at somewhat lower levels, with the largest change being from LOS C to D on Interstate 10 north of El Paso. By 1992, the impacts will be slightly less than those expected in the peak year. Service level changes will persist in 1996; by 1997, though some construction will still be in progress, only minimal LOS changes are expected from offbase construction activities.

The possible decreases in service to LOS E or F, if they occur, will represent short-term, high, and significant impacts at the regional level on the affected roadways. If the change is to a level no lower than LOS D, the impact, though high, is not expected to be significant at the regional level.

Commuting to the MOB construction site at Fort Bliss could result in a localized increase in congestion within urban El Paso, but is not expected to result in appreciable interference with regional travel. The availability of alternative urban routes makes the potential for short-term, significant impacts at a regional scale essentially negligible. The potential for

long-term regional impacts is even smaller during operations, because of the comparatively few commuters involved.

4.3.5.5 Gila Bend Air Force Auxiliary Field

The MOB at Gila Bend AFAF, approximately 4 miles south of Gila Bend and 58 miles southwest of Phoenix, Arizona, could support deployment in any of its associated SDAs, which are all located in Arizona. Short-term impacts to transportation are expected to be high and significant at the regional level with this alternative. Regional, long-term impacts are expected to be negligible.

Most construction workers and operations personnel will likely commute to the MOB from metropolitan Phoenix, Arizona. Substantial numbers will travel via Interstate 10 from Phoenix, and then south via Arizona State Highway 85. A few workers may commute via Interstate 8 from Casa Grande, and via State Highway 85 from Ajo, Arizona.

Construction sites in the deployment areas may be located in predominantly rural settings in La Paz or Yuma counties, Arizona, or Imperial or Riverside counties, California. Construction sites in the deployment areas could be reached via Interstates 8 and 10 and State Highway 85. Commuting to these offbase worksites will also be predominantly from metropolitan Phoenix. Appreciable numbers of workers could also be drawn from Casa Grande and/or Ajo, Arizona if worksites are situated within reasonable commuting distances of those communities.

Concurrent construction-worker commuting to the MOB and to offbase worksites is expected to be the largest source of potential impacts. Regardless of the specific deployment site selected in 1994, construction-worker commuting is projected to reduce peak-hour service on Interstate 10 west of Phoenix from LOS A to F, and on State Highway 85 between Interstates 8 and 10 from LOS D to E or F. Depending on the location of deployment-area activities, peak-hour service on affected sections of Interstate 8 could change from LOS A to C or D, and service on State Highway 85 south of Interstate 8 from LOS A to E. These impacts may be felt, though at lower levels, as early as 1990, with service on Interstate 10 west of Phoenix dropping from LOS A to C, and on affected sections of State Highway 85 from LOS D to E. They will continue through 1997 after peaking in 1994, though at much reduced levels in the last construction year.

The short-term, high impacts projected for the construction phase will influence substantial lengths of roads and appreciable volumes of traffic, including commercial traffic. Consequently, these regional-level impacts are considered to be significant.

During the operations phase (1998 and thereafter), most personnel living offbase are expected to reside in nearby communities such as Gila Bend. It is not considered realistic for the long-range commuting pattern of the early construction phase to continue long term. As a result, long-term impacts to transportation are expected to be negligible.

4.3.5.6 Yuma Proving Ground

The MOB at Yuma PG, north of Yuma, Arizona, could support deployment in any of its associated SDAs, which are in southwestern Arizona and adjacent areas of southeastern California. Short-term impacts to transportation are expected to be high and may be significant at the regional level. Regional, long-term impacts will be moderate but not significant.

Most construction workers and operations personnel housed offbase will likely commute to Yuma PG from Yuma, Arizona via U.S. 95. A few may commute from Somerton, Arizona (south of Yuma), also via U.S. 95, and still fewer from El Centro, California and its adjacent communities via Interstate 8 and U.S. 95.

Construction sites in the deployment areas may be located in predominantly rural settings in Maricopa, Pima, Pinal, or Yuma counties. Construction sites in the deployment areas could be reached via Interstates 8 and 10 and U.S. 95. Workers at the offbase sites will likely commute principally from Yuma, Arizona, but substantial numbers could also be derived from the communities near El Centro and Blythe, California if activities are within reasonable commuting distances.

Construction-worker commuting to offbase worksites is expected to be the largest source of potential impacts. Depending on the site selected, possible impacts in the peak offbase construction year (1994) could include one of the following changes:

- LOS A to C, LOS A to E, and LOS C to F on U.S. 95 north of Yuma PG;
- LOS A to D on Interstate 8 east of Yuma, Arizona; or
- LOS A to D on Interstate 8 west of Yuma.

These changes may be accompanied by smaller ones elsewhere in the region, for example, a degradation from LOS A to B and LOS C to D on sections of Interstate 10 between Blythe, California and the U.S. 95 intersection if activities are located in the northern part of the region and reached via U.S. 95.

Impacts to these roads will begin, though at somewhat lower levels, as early as 1990, with the largest potential changes in that year on U.S. 95: LOS A to C north of the MOB site, and LOS C to E between Yuma and the base with concurrent MOB traffic. By 1992, impacts will generally remain somewhat below that of the peak year, but will reach LOS A to E on the noted section of U.S. 95. Impacts related only to offbase construction traffic will be substantially reduced by 1996 as compared with the peak year, but will still be moderate to high locally.

Construction traffic to the MOB site will principally influence service on U.S. 95 between Yuma, Arizona and the turnoff to Yuma PG Headquarters. In 1990, the peak onbase construction year, service on rural portions of this road from the city limits northward are projected to change from LOS C to D in the absence of offbase construction traffic. These changes will persist through 1996. With offbase construction traffic added to base-related traffic, service on this part of U.S. 95 may be reduced to LOS E and possibly to LOS F for several consecutive years in the construction phase.

Regional-level, short-term impacts are expected to be high and significant if the deployment area is substantially north of Yuma PG Headquarters and accessed from U.S. 95. In this case, considerable lengths of U.S. 95 between Interstates 8 and 10 will experience LOS E or F service that may continue for several years. Although this road is comparatively lightly used by long-distance travelers, there are no convenient alternative routes, and interference with regional-scale travel may persist over substantial distances.

If the deployment area is accessed via Interstate 8 rather than U.S. 95, short-term impacts will still be high, but are not expected to be significant at the regional level. Substandard service (LOS D) could be experienced, but severely degraded levels (LOS E or F) will not be reached.

Commuting to the MOB site during the operations phase will result in a change from LOS C to D on U.S. 95 northward from the Yuma city limits to the Yuma PG turnoff. No changes are projected elsewhere. This effect represents a long-term, moderate impact to a comparatively short section of roadway that is lightly used for through-travel. Consequently, the impact is not considered to be significant at the regional level.

4.3.6 Impacts of the No Action Alternative

Under the No Action Alternative, major actions related to the intercontinental ballistic missile (ICBM) modernization program are unlikely in any areas other than present Minuteman missile deployment areas. The possible scope of Minuteman-related activities and their potential impacts to transportation are not known. Consequently, the baseline projections of Section 3.3 represent the reasonable implications of the No Action Alternative.

For the areas considered suitable for the Hard Mobile Launcher in Random Movement alternative, substandard LOSs are estimated to currently exist on primary roads influenced by urban conditions, or on two-lane rural roads with heavy traffic and/or unfavorable terrain. Severe degradation (LOS E or F) currently exists on primary roads influenced by urban conditions in El Paso, Texas and Phoenix, Arizona. Moderate degradation currently exists for Fort Walton Beach and Valparaiso, Florida; Las Vegas, Nevada; and Richland, Washington. No rural roadways are projected to be at LOS F. Parts of Florida State Highway 77 and California State Highway 138 may be at LOS E; and parts of U.S. 98 in Florida and a substantial length of Arizona State Highway 85, which may be potentially affected by the proposed project, are estimated to be at LOS D.

For the areas considered suitable for the Hard Mobile Launcher at Minuteman Facilities alternative, the situation is substantially different. The majority of roadways in most of the siting areas are at LOS A, with comparatively few at service levels below LOS B. Exceptions are in western South Dakota and western Missouri within the influence of Kansas City, where a very few stretches of roadway unlikely to be affected by the proposed project are at LOS D or E (none are at LOS F).

Conditions for the areas considered suitable for the Hard Silo in Patterned Array alternative are similar to those for the Hard Mobile Launcher in Random Movement alternative areas, particularly where the ROIs overlap for these two alternatives and the potentially affected roads are identical. Sections of

primary roads at levels as low as LOS F are estimated to currently exist within urban areas of Tucson, Arizona, as are roads in the greater Los Angeles, California area within the ROI for Edwards AFB (Hard Silo in Patterned Array basing mode).

4.3.7 Irreversible and Irretrievable Resource Commitments

The increases in vehicular traffic on regional roads associated with the proposed project will result in accelerated deterioration of the physical condition as well as the service levels of transportation facilities. This may necessitate rehabilitation or reconstruction of some sections before normal scheduled or expected dates. The degree to which such effects will be encountered are site specific and cannot be quantified at this time.

4.3.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term, project-generated traffic will result in some decrease in the comfort, convenience, and safety afforded regional users of primary roads, and some economic losses to travelers and shippers. Long-term, significant impacts will occur only on roads that are already congested and that will likely be improved by the responsible state authorities because of these preproject conditions.

4.4 Land Use

Deployment of the proposed Small Intercontinental Ballistic Missile (ICBM) system has the potential to alter existing land uses at each of the locations under consideration. The land use analysis consists of three elements: land use and status, regional recreation, and visual resources.

4.4.1 Impact Analysis Methodology

The methods used for analyzing the effects of the proposed project for each land use resource element include evaluation of project impacts, determination of levels of impact (LOIs), and determination of impact significance.

4.4.1.1 Evaluation of Project Impacts

Land Use and Status. For the land use and status element, five subelements were evaluated: onbase land use, onbase land status, offbase land use, offbase land status, and offbase plans and policies.

Direct effects on onbase land use were studied for all three basing modes. Deployment of the Small ICBM could result in the conversion of onbase lands currently outleased for nonmilitary uses (such as grazing) to military use. Impacts were based on the amount, percentage, and distribution of outleased lands within Main Operating Bases (MOBs), Random Movement Areas (RMAs), or onbase Suitable Deployment Areas (SDAs) and their distribution within the Region of Influence (ROI).

Direct effects on onbase land status resulting from the proposed project were studied for the Hard Mobile Launcher in Random Movement and the Hard Silo in Patterned Array basing modes. Deployment of the Small ICBM in these basing modes could affect onbase land status, specifically special status lands, including proposed wilderness areas or wilderness study areas. For onbase land status, the category and acreage of the various land status types, including special status lands within RMAs and onbase SDAs, were identified. Impacts were determined based on the amount and distribution of special status lands in the RMAs and onbase SDAs.

Direct effects on offbase land use were studied for the Hard Mobile Launcher at Minuteman Facilities and the Hard Silo in Patterned Array basing modes. Deployment of the Small ICBM in these basing modes could result in the conversion of offbase lands from agricultural to military use. Impacts were based on the amount and distribution of irrigated agriculture, nonirrigated agriculture, and rangeland in areas located adjacent to the transporter/erector (T/E) routes (for the Hard Mobile Launcher at Minuteman Facilities) or within SDAs.

Direct effects on offbase land status were studied for the Hard Silo in Patterned Array basing mode. Deployment of the Small ICBM in this basing mode could affect offbase land status, particularly other federal lands (non-military and non-Bureau of Land Management [BLM] lands) and lands under consideration for wilderness designation. The category and acreage of the various land status types within offbase SDAs were identified. Impacts were determined based upon the amount and distribution of other federal lands, proposed wilderness areas, and wilderness study areas within offbase SDAs.

Indirect effects on offbase plans and policies resulting from the proposed project were evaluated for all three basing modes, though no LOIs were determined. Indirect effects could occur in the MOB counties and affected communities where project-induced population could increase growth. The proposed project was appraised as to its consistency or inconsistency with reviewed plans and policies.

Regional Recreation. Regional recreation areas could be affected by increased recreation use resulting from project-induced populations. Increased use at recreation areas, particularly during seasonal and holiday weekends, could reduce the quality of the recreation experience and create unsafe and unhealthful conditions when use exceeds the carrying capacity of such areas. The baseline analysis identified recreation areas within approximately 150 travel miles of the potentially affected population centers and projected recreation use at developed campgrounds in these areas. In addition, the availability of recreation opportunities outside of developed sites (i.e., dispersed recreation) was analyzed.

Potential impacts to regional recreation areas were determined by evaluating the overall availability and characteristics of recreation areas in each region, the proximity of the areas to potentially affected population centers, and the current and projected use of these areas (e.g., use-to-capacity ratio at developed campgrounds). The change in campground use within the ROI resulting from the proposed project was determined by multiplying the project-induced population by a campsite-night generation factor. This value was adjusted, using the estimated percentage of dispersed camping that occurs in each ROI, to determine the number of campsite-nights generated at developed campgrounds. Based on a review of participation rates for outdoor recreation activities contained in various outdoor recreation studies and state comprehensive outdoor recreation plans, it was assumed that 0.3 campsite-nights will be generated by each inmigrant (i.e., on the average, 30% of the project-induced population will participate in camping 4 nights per year with a camping party size of 4).

Changes in campground use resulting from deployment of the Hard Mobile Launcher in Random Movement or Hard Mobile Launcher at Minuteman Facilities basing mode alternatives were evaluated for 1990, the peak year for project-induced construction employment; and for 1998, the year representing a steady-state when population inmigration will level off. Changes in campground use resulting from deployment of the Hard Silo in Patterned Array basing mode alternative were evaluated for 1994, the peak year for project-induced construction employment (also the peak year for total project-induced employment); and for 1998, the year representing a steady-state.

Recreation use at developed campgrounds was used as an indicator of impacts to regional recreation; changes in campground use were assumed to represent changes for other recreation activities. If campground use increased, it was assumed that overall participation in other activities will also increase, particularly because many related activities (e.g., boating, hunting, and fishing) are closely associated with camping activities.

Impacts to regional recreation were based on changes in the perceived quality of the recreation experience at regional recreation areas within the ROIs. Changes in perceived quality were associated with project-related increases in

population and the relative ability of recreation areas to absorb increases without inherent problems such as overcrowding, traffic congestion, littering, law enforcement, loss of serenity, and activity conflicts. These problems are all linked to increases in visitation and can result in a decline in the perceived quality of the recreation experience. Generally, recreation areas with use-to-capacity ratios greater than 0.35 are less able to absorb increased use, particularly during seasonal and holiday weekends. Recreation areas with higher use-to-capacity ratios (greater than 0.5) may incur declines in the recreation experience more frequently (e.g., on weekdays or off-season weekends). Large increases in visitation at such areas could result in overcrowded and congested conditions that may require implementation of temporary or permanent management responses (e.g., restrictions or limits on use, permitting, or closure).

Visual Resources. Deployment of the proposed project, in any basing mode, will have some physical effects upon the visual environment. The extent to which these effects impose changes on the visual environment and the sensitivity of the landscape to visual intrusion will determine the impacts to visual resources. Visual intrusions on the landscape that could be created by the proposed project include the Hard Mobile Launcher (HML) vehicles, dust rising from roadways or off-road areas used by the HMLs, vehicle shelters at the Minuteman launch facilities, Hard Silo operations structures, and newly constructed roadways. Sensitivity of the landscape to visual intrusion is defined by the proximity of the project to viewing areas, areas of special visual quality, and scenic highway areas; the number of viewers (measured as average annual daily traffic [AADT] on scenic highways); and the ability of the terrain to conceal project facilities and roadways.

For this analysis, only changes in the visual environment that could be observed by users of federal and state highways were analyzed. Users of some regional recreation areas could also possibly observe the project and its activities. However, because the number of such observers is not easily quantifiable, and their numbers would in all likelihood be small compared to highway observers, they are not included in the visual resources impact analysis. In addition, because of the size and color of the HML vehicles and proposed structures, only those areas within 5 miles of highways (viewshed areas) have been considered in the analysis (at a distance of 1 mi, a 10-ft-high vehicle would appear to have about the same height as a 7-inch-high object at 100 yd).

The type and extent of project visual intrusion on the landscape will depend on the basing mode selected. For the Hard Mobile Launcher in Random Movement basing mode, three effects will be observed: presence of the HML vehicle, newly constructed roadways that cross otherwise natural areas, and dust plumes created by HML vehicle movements. Roadway visibility will depend on the location of the observer, the density and height of natural vegetation in the area, and the extent to which rolling topography will conceal new roads or off-road disturbances created by HML vehicle wheels (or tracks). Dust plumes may be seen at much greater distances than roadways, but unlike roadways, they are temporary.

For the Hard Mobile Launcher at Minuteman Facilities basing mode, the only obvious visual intrusions will be caused by the shelter structures to be placed at existing Minuteman launch facilities. These structures will be

approximately 110 feet long, 30 feet wide, and 20 feet high, and made of a material similar to that used for grain storage structures commonly found in agricultural areas. A much smaller crew quarters structure will adjoin the HML shelters. Although the structures will be large, they will generally be visually compatible with existing farming structures on the landscape, and since they will be 3 to 5 miles apart, probably no more than three or four will be seen at a time from any location.

For the Hard Silo in Patterned Array basing mode, the most obvious visual intrusions, after construction equipment is moved away, may be the relatively large support structures including intrusion radar support buildings, antennas, and fencing around the silo arrays. As many as 250 silos, nearly flush with the ground surface, will be placed 1,500 to 2,000 feet apart within large fenced areas. Most of the terrain and vegetation within the fenced area will be disturbed and such disturbed areas could be seen at fairly long distances. Use of construction-phase heavy equipment will generate dust plumes that will cause visual impacts that will be greater than those that occur during the operations phase.

In summary, the extent of the proposed project impacts are based upon (1) the size of the viewshed areas, or the number of Minuteman launch facilities in the viewshed areas; (2) the size of scenic highway viewshed areas; (3) the size of special visual quality viewshed areas; (4) the number of users of scenic highways (i.e., AADT); and (5) the nature of the proposed development (basing modes).

4.4.1.2 Determination of Levels of Impact

Land Use and Status. The LOIs were determined for four of the five sub-elements: onbase land use, onbase land status, offbase land use, and offbase land status. An overall determination for the land use and status element was made for each alternative deployment location on the basis of the applicable LOI determinations.

The LOI definitions for onbase and offbase land use are the following:

- Negligible Impact -- Irrigated and nonirrigated agricultural lands within the MOBs, RMAs, SDAs, or adjacent to T/E routes are not present or are virtually nonexistent.

- Low Impact -- Irrigated and nonirrigated agricultural lands within the MOBs, RMAs, SDAs, or adjacent to T/E routes constitute only a small percentage of the ROI. There is a high probability that rangeland/grazing lands will primarily be used by the proposed project.

- Moderate Impact -- Irrigated and nonirrigated agricultural lands within the MOBs, RMAs, SDAs, or adjacent to T/E routes constitute a large percentage of the ROI. There is a high probability that both irrigated and nonirrigated agricultural lands as well as rangelands will be used by the proposed project.

- High Impact -- Irrigated and nonirrigated agricultural lands within the MOBs, RMAs, SDAs, or adjacent to T/E routes constitute a very large percentage of the ROI. There is a high probability that irrigated and nonirrigated agricultural lands will primarily be used by the proposed project.

The LOI definitions for onbase land status are the following:

- Negligible Impact -- There is a high probability that special status lands within Department of Defense (DOD) or Department of Energy (DOE) installations will not be used by the proposed project.

- Low Impact -- There is a high probability that use of special status lands within DOD or DOE installations will not affect existing or proposed use and management of the lands. The proposed project use may require changes to the Memoranda of Understanding (MOU).

- Moderate Impact -- There is a high probability that use of special status lands within DOD or DOE installations will affect but not eliminate or restrict existing or proposed use and management of the lands. The proposed project use may require changes to the MOU.

- High Impact -- There is a high probability that use of special status lands within DOD or DOE installations may result in elimination or restriction of existing or proposed use and management of the lands. The proposed project use may require changes to or redrafting of the MOU.

The LOI definitions for offbase land status are the following:

- Negligible Impact -- Other federal lands and/or lands under consideration for wilderness designation are not present or are virtually nonexistent within the SDAs.

- Low Impact -- Other federal lands and/or lands under consideration for wilderness designation constitute only a small percentage of the SDA. Only minor portions of these lands are expected to be used by the proposed project.

- Moderate Impact -- Other federal lands and/or lands under consideration for wilderness designation constitute a large percentage of the SDA. There is a high probability that major portions of these lands will be used by the proposed project.

- High Impact -- Other federal lands and/or lands under consideration for wilderness designation constitute a very large percentage of the SDA. There is a high probability that these lands will be used by the proposed project.

Regional Recreation. The LOI definitions for regional recreation are the following:

- Negligible Impact -- No increase in visitation, or an increase in visitation pressure will occur without a noticeable decline in the

perceived quality of the recreation experience. Recreation areas within the ROI will be able to absorb increased visitation pressure.

- Low Impact -- Increased visitation pressure will occur with an occasional noticeable decline in the perceived quality of the recreation experience.

- Moderate Impact -- Increased visitation pressure will occur with a frequent noticeable decline in the perceived quality of the recreation experience.

- High Impact -- Increased visitation pressure will occur with a frequent noticeable decline in the perceived quality of the recreation experience; could require temporary or permanent changes in the operation and management of the recreation area.

Visual Resources. The LOI for visual resources is determined by the extent of project intrusion into viewshed areas and by the number of highway users who could see that intrusion from scenic highways. The extent of project intrusion is considered minor when project facilities are not noticeable to the traveling public because they are small, or because they tend to be compatible with the existing landscape. Substantial visual intrusion occurs when the facilities become noticeable to the traveling public but are not objectionable; major intrusion occurs when facilities are sufficiently obvious on a sensitive landscape to be objectionable. The AADT on scenic highways in the potential deployment areas ranges from 400 in northern Montana to 40,000 in south-central California. For purposes of this analysis, an AADT of 4,000 represents a cut-off point below which the number of highway users is considered small. The LOI definitions for visual resources are as follows:

- Negligible Impact -- Proposed project facilities will create minor visual intrusion on a landscape which is exposed to a small number of highway users.

- Low Impact -- Proposed project facilities will create minor visual intrusion on a landscape which is exposed to a large number of highway users, or substantial visual intrusion on a landscape which is exposed to a small number of highway users.

- Moderate Impact -- Proposed project facilities will create substantial visual intrusion on a landscape which is exposed to a large number of highway users, or major visual intrusion on a landscape which is exposed to a small number of highway users.

- High Impact -- Proposed project facilities will create major visual intrusion on a landscape which is exposed to a large number of highway users.

4.4.1.3 Determination of Significance

Land Use and Status. Impacts to land use and status were considered significant if any of the following criteria were met:

- The project-related land use results in the potential disruption of the existing uses or management of special status lands;

- The project-related land use results in the potential use of a large quantity of land resulting in major disruptions to existing agricultural practices and transportation routing;

- The project results in a major acquisition of lands (i.e., public or private) that are in limited quantities within the region; and

- The proposed project may preclude the use of lands currently proposed for other land uses of national importance.

Regional Recreation. Impacts to regional recreation were considered significant if the following criterion was met:

- Public health and safety would be affected. Public health and safety could be compromised in recreation areas where increased use causes overcrowding, or when increased use exacerbates conditions in areas that are already overcrowded. This could result in unsafe conditions that could increase the potential for injury. Unsafe conditions occur most often when space is limited for an activity and there is too much demand for that space, or when the same space is used for conflicting activities (e.g., waterskiing and swimming).

Visual Resources. Effects on visual resources were considered significant if either of the following criteria were met:

- The proposed project will likely be highly controversial because of the extent of changes in the visual environment; and/or

- The proposed project will likely establish a precedent for future actions that could create adverse effects on the visual environment.

4.4.2 Impacts Common to All Locations

4.4.2.1 Hard Mobile Launcher in Random Movement

Land Use and Status. For all the MOBs, the Small ICBM mission's administrative and operations facilities will require undeveloped lands for the expansion of existing facilities or the construction of new ones. Construction of these facilities will temporarily disturb approximately 1,440 to 1,510 acres, but will permanently use only about 390 to 610 acres. Construction activities for the Small ICBM facilities within the deployment installations will temporarily disturb approximately 3,060 to 13,180 acres during the construction phase and will permanently use about 2,090 to 7,300 acres. Off-road HML operations will also disturb substantial portions of the deployment installations.

Offbase plans and policies were reviewed for all alternative MOB counties. In general, potential effects of proposed project construction and operations, and the associated development in support communities, were not considered to be inconsistent with reviewed plans and policies.

Regional Recreation. Recreation use within the ROI, for each location, will increase as a result of project-induced population increases. Campsite-nights will increase by less than 1.5 percent at all locations, with four locations incurring increases of less than 0.5 percent. Two locations (the Arizona and New Mexico complexes) have recreation areas near potentially affected population centers that may receive a higher proportion of the increased use. Large increases in use, particularly during seasonal and holiday weekends, may result in overcrowding, congestion, and activity conflict problems, or may exacerbate already crowded conditions.

Visual Resources. Visual intrusions common to all Hard Mobile Launcher in Random Movement basing mode locations include the HML vehicles when moving, newly constructed roads (these would be more visible in flat terrain), damage to natural terrain and vegetation resulting from off-road maneuvers, and fugitive dust plumes generated by the HML vehicles by both on and off-road maneuvers (depending on soil type). Dust plumes will be temporary but can be seen at greater distances. Also, visual impacts from road construction (movement of road-building equipment) will be temporary and mainly related to fugitive dust. Controlling dust through watering is more amenable to construction than to operations activities.

The MOB facilities will be constructed on existing military bases, and will generally be compatible with surrounding structures. In many instances, they may be hidden from public view by existing onbase structures. Visual impacts from MOB construction will be negligible.

4.4.2.2 Hard Mobile Launcher at Minuteman Facilities

Land Use and Status. For all the MOBs, the Small ICBM mission's administrative and operations facilities will require undeveloped lands for the expansion of existing facilities or the construction of new ones. Construction of these facilities will temporarily disturb approximately 1,140 acres, but will permanently use only about 400 acres. For all areas, deployment of the HMLs at Minuteman facilities within the launch facility deployment area may require small quantities of additional land adjacent to existing Minuteman facilities and improvement of some roads and bridges, temporarily disturbing approximately 100 acres and permanently using approximately 1,480 to 1,860 acres.

Offbase plans and policies were reviewed for all alternative locations. Potential effects of proposed project construction and operations and the associated development in support communities were not considered to be inconsistent with reviewed plans and policies.

Regional Recreation. Recreation use within the ROI for each location will increase as a result of project-induced population growth. Campsite-nights will increase by approximately 3 percent at four locations and by less than 1 percent at the other two locations. The F.E. Warren Air Force Base (AFB) and Grand Forks AFB ROIs have recreation areas near potentially affected population centers that may receive a higher proportion of the increased use.

Visual Resources. At the Minuteman launch facilities, the primary visual intrusion will be the large HML vehicle shelters that will not be out of character with grain storage structures commonly found in agricultural areas. Some of road and bridge improvements may be required to accommodate occasional

HML movements. Such activities will cause only minor visual effects during construction.

4.4.2.3 Hard Silo in Patterned Array

Land Use and Status. For all the MOBs, the Small ICBM mission's administrative and operations facilities will require undeveloped lands for the expansion of existing facilities or the construction of new ones. Construction of these facilities will temporarily disturb approximately 960 acres, and will permanently use about 740 acres. Construction of facilities for this basing mode within the deployment area will require the permanent use of approximately 18,000 acres (28 square miles [sq mi]) of land for deployment of 250 missiles.

Deployment in this basing mode may also result in the disruption of farming and ranching activities during the construction and operations phases of the proposed project. Potential impacts include impeding access to farming or ranching areas and movement along rural roads; vehicle collisions with stray livestock; stress effects on livestock associated with dust (e.g., dust pneumonia and teeth abrasion), vehicle movement, and noise; and disruption of agricultural practices associated with field maintenance activities including irrigation networks, erosion control, and range improvement programs. In addition, placement of the 18,000-acre array may require the realignment of county and rural road networks which may result in changes in travel routes for nearby residents.

Offbase plans and policies were reviewed for all alternative locations. In general, potential effects of proposed project construction and operations and the associated development in support communities were not considered to be inconsistent with reviewed plans and policies, with the exception of the F.E. Warren AFB.

Regional Recreation. Recreation use within the ROI for each location will increase as a result of project-induced population increases. Campsite-nights will increase by less than 2 percent at all locations, with five locations incurring increases of less than 1 percent. Two locations, F.E. Warren AFB and Gila Bend Air Force Auxiliary Field (AFAF), have recreation areas near potentially affected population centers that will likely receive a higher proportion of the increased use.

Visual Resources. At the silo arrays, the most obvious visual intrusions will be the relatively large support structures which will be out of character with small structures (generally ranch houses) commonly found in these areas. The structures will include intrusion radar support buildings, antennas, and fencing around the silo array. Most of the terrain and vegetation within the 28-sq-mi array will be disturbed. Such large disturbed areas could be seen at distances of at least 5 miles in relatively flat terrain. Greater distance between highway users and the silo array will lessen the visual impact. Fugitive dust plumes are expected during the construction phase, despite customary road construction mitigation efforts (watering of roads).

4.4.3 Impacts of Hard Mobile Launcher in Random Movement

Impacts of the Hard Mobile Launcher in Random Movement basing mode on each land use resource element at each alternative base location are presented in this section. Table 4.4.3-1 provides a summary of the impact analysis data.

4.4.3.1 Arizona Complex

For the Arizona Complex, regardless of the MOB selected, short-term land use and status impacts of the proposed project will be negligible and long-term impacts will be high and significant. Both short and long-term regional recreation impacts will be low and not significant with the MOB at Gila Bend AFAF and negligible with the MOB at Yuma Proving Ground (PG). Short and long-term visual resources impacts will be negligible regardless of the MOB selected.

Land Use and Status. Construction activities at either MOB location will result in the temporary disturbance of approximately 1,510 acres and the permanent disturbance of 610 acres. In addition, construction activities within the deployment areas will temporarily disturb approximately 13,180 acres and permanently disturb 7,300 acres. Since no onbase agricultural lands are present within either MOB location or the deployment areas, onbase land use impacts will be negligible.

The RMA within Luke Air Force Range (AFR) includes approximately 771,600 acres, 29 percent of the total installation area. Special status lands, which make up 29 percent of the RMA, include a portion of the Cabeza Prieta National Wildlife Refuge (226,600 acres), located in the southern part of Luke AFR. Approximately 187,000 acres of the Cabeza Prieta National Wildlife Refuge are under consideration for wilderness designation. Use of these lands for HML movements may require the Air Force to redraft the co-use agreement with the U.S. Fish and Wildlife Service (USFWS), which prohibits off-road vehicle travel. The current use of these lands (a wildlife refuge) may be disrupted by introduction of HMLs. In addition, portions of the Cabeza Prieta National Wildlife Refuge have been proposed for wilderness designation. It is expected that HML travel will be confined to existing public roads and rights-of-way not presently part of the wilderness proposal. However, in the unlikely event that additional access is necessary to support HML operations, the wilderness proposal may have to be modified (e.g., the road corridor may have to be widened). This possibility, combined with potential disruptions to the operation of the wildlife refuge, will result in long-term, high, and significant impacts to onbase land status.

The RMA within Yuma PG includes approximately 356,100 acres (42%) of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

For the Arizona Complex as a whole, regardless of the MOB selected, the proposed project will result in short-term, negligible impacts, and long-term, high, and potentially significant impacts at the regional and national level, if special status lands are used for HML movements.

Table 4.4.3-1

SUMMARY OF LAND USE IMPACT ANALYSIS DATA FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT BASING MODE

	Arizona Complex	Florida Complex	Nevada Complex	New Mexico Complex	South-Central California Complex	Washington Complex
Land Use and Status						
Random Movement Area (acres)	1,127,700	191,900	1,121,200	1,149,100	580,100[a]	247,000
Special Status Lands (acres)	226,600	0	321,900	60,300	0	64,600
Regional Recreation						
Campsite-Night Demand[1]	1,470	1,150	1,770	1,770	1,470	580
Use-to-Capacity Ratio (Without Project, %)[2]	41.0%[b]	38.8%	41.0%	48.1%	32.8%	33.3%
Use-to-Capacity Ratio (With Project, %)[3]	41.3%[b]	39.0%	41.2%	48.7%	32.8%	33.3%
Visual Resources						
Viewshed Area (acres)	279,000	187,500	103,700	258,600	82,600	197,100
HMLs in Viewshed Area[4]	55	34	20	50	16	39
HMLs in Special Visual Quality Viewshed Areas[4]	1	5	0	3	3	2
HMLs in Scenic Highway Viewshed Areas	0	2	5	7	7	3
Average Annual Daily Traffic on Scenic Highways	*	13,400-24,350	1,360-3,140	3,300-11,900	5,300-20,000	13,400

Notes: [1]Project-induced campsite-night demand, 1998.

[2]Use-to-capacity ratio without the proposed project, 1998.

[3]Use-to-capacity ratio with the proposed project, 1998.

[4]Assumes 8 sq mi per HML.

[a]With Fort Irwin NTC as the MOB, the RMA includes portions of China Lake NWC, Edwards AFB, Fort Irwin NTC, and Twentynine Palms MCAGCC. With Edwards AFB as the MOB, the RMA is 463,500 acres, including portions of China Lake NWC, Edwards AFB, and Fort Irwin NTC.

[b]For the Gila Bend AFAF ROI. For the Yuma PG ROI, campsite-night demand is 1,470 and the use-to-capacity ratios are 27.8 and 28.0, respectively.

*No scenic highways in ROI.

Regional Recreation. With the MOB located at Gila Bend AFAF, developed campground use within the ROI is expected to increase by about 890 campsite-nights in 1990 as a result of a project-induced population of approximately 5,900, a 0.4-percent increase over the projected use of 213,900 campsite-nights. The use-to-capacity ratio for the ROI will increase from 32.7 to 32.9 percent because of the project-induced campground use. In 1998, developed campground use within the ROI is expected to increase by about 1,470 campsite-nights based on a project-induced population of approximately 9,800, a 0.6-percent increase above the projected use of 268,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 41.1 to 41.3 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because Painted Rocks State Park will likely receive a higher proportion of the use as a result of its proximity to the town of Gila Bend and because it is also the only developed recreation area within 60 miles of Gila Bend.

With the MOB located at Yuma PG, developed campground use within the ROI is expected to increase by about 890 campsite-nights in 1990 based on a project-induced population of approximately 5,900, a 0.5-percent increase above the projected use of 195,700 campsite-nights. The use-to-capacity ratio for the ROI will increase from 24.4 to 24.5 percent as a result of the project-induced campground use. In 1998, developed campground use within the ROI is expected to increase by about 1,470 campsite-nights as a result of a project-induced population increase of approximately 9,800, an increase of 0.7 percent over the projected use of 222,900 campsite-nights. The use-to-capacity ratio for the ROI will increase from 27.8 to 28 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat terrain and good to excellent visibility in the region (except during the infrequent wind-blown dust periods), broad vistas can be seen by highway users. About 279,000 acres, or 25 percent of the total RMA, will be in viewshed areas (RMAs within 5 mi of state and federal highway). Approximately 1 percent of this area has special visual quality. None of the 450 miles of highways in the ROI traversing the viewshed areas are scenic highways. At the rate of 8 sq mi of RMA per HML, 55 HMLs and associated roads could be seen within the viewshed areas, and only 1 HML could be seen within special visual quality viewshed areas. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.3.2 Florida Complex

For the Florida Complex, the proposed project will result in short and long-term, negligible impacts to land use and status and regional recreation. Short-term impacts to visual resources will be negligible, and long-term impacts will be low and not significant.

Land Use and Status. Construction activities at the Eglin AFB MOB will result in the temporary disturbance of approximately 1,440 acres and the permanent disturbance of approximately 390 acres. In addition, deployment-area construction activities will temporarily disturb approximately 3,060 acres and permanently disturb about 2,090 acres. Since no onbase agricultural lands are present, onbase land use impacts will be negligible.

The RMA within Eglin AFB includes approximately 191,900 acres, 41 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

For the Florida Complex, the proposed project will result in short and long-term, negligible impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 1,230 campsite-nights based on a project-induced population of approximately 4,200, a 0.5-percent increase above the projected use of 253,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 34.7 to 34.9 percent as a result of the project-induced campground use. In 1998, developed campground use within the ROI is expected to increase by about 1,150 campsite-nights as a result of a project-induced population of approximately 3,900, a 0.4-percent increase over the projected use of 283,200 campsite-nights. The use-to-capacity ratio for the ROI will increase from 38.8 to 38.9 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is good in the region, broad vistas are limited because of the rolling terrain. About 187,500 acres, or 90 percent of the total RMA, will be in the viewshed areas. Approximately 13 percent of this area has special visual quality. Of the 190 miles of highways traversing the viewshed areas, only a 30-mile stretch of U.S. 98 is a scenic highway, with an AADT ranging from 13,400 to 24,350. At the rate of 8 sq mi of RMA per HML, 34 HMLs and associated roads will be within the viewshed areas. Only two HMLs could be seen in scenic highway viewshed areas and only five in special visual quality viewshed areas. Therefore, short-term impacts to visual resources will be negligible, and long-term impacts will be low and not significant.

4.4.3.3 Nevada Complex

For the Nevada Complex, regardless of the MOB selected, short-term land use and status impacts of the proposed project will be negligible, and long-term impacts will be high and significant. The proposed project will result in short and long-term, negligible impacts to regional recreation and visual resources.

Land Use and Status. Construction activities at either MOB location will result in the temporary disturbance of approximately 1,510 acres and the permanent disturbance of approximately 610 acres. In addition, construction activities within the deployment areas will temporarily disturb approximately 13,180 acres and permanently disturb about 7,300 acres. Since no onbase agricultural lands are present within either MOB location or the deployment areas, onbase land use impacts will be negligible.

The RMA within Nellis AFR includes approximately 830,300 acres, 28 percent of the total installation area. Special status lands, which make up 321,900 acres or 39 percent of the RMA, include approximately 118,300 acres within the Nevada Wild Horse Range and approximately 203,600 acres within the Desert National Wildlife Range. Approximately 189,400 acres (93%) of the Desert National Wildlife Range within the RMA is under consideration for wilderness designation. In addition, the RMA includes the entire portion of

the Yucca Mountain Site located within Nellis AFR (other portions of this site are located on the Nevada Test Site and on BLM lands), and use of these lands by the project may be in conflict with the proposed use by the DOE of the Yucca Mountain Site for the siting of a commercial spent fuel and high-level nuclear waste repository.

The co-use agreement for the Nevada Wild Horse Range does not prohibit off-road vehicle travel, though use of these lands by the proposed project may require the Air Force to redraft the co-use agreement with the BLM, since the current use of these lands, to preserve and manage wild horses and burros, could be disrupted by introduction of the HMLs.

The co-use agreement for the Desert National Wildlife Range, in general, prohibits off-road vehicle travel. Use of these lands for HML movements may require the Air Force to redraft the co-use agreement with the USFWS. The current use of these lands, to preserve and protect the desert bighorn sheep, could be disrupted by introduction of the HMLs. In addition, the designation of portions of the Desert National Wildlife Range as a wilderness area may be precluded because of the introduction of HMLs. Consequently, long-term impacts to onbase land status within Nellis AFR will be high and potentially significant at the regional and national levels.

The RMA within the Nevada Test Site includes approximately 290,900 acres, 34 percent of the total installation area. No special status lands exist within the RMA; however, the RMA includes the entire portion of the Yucca Mountain Site located within the Nevada Test Site, and use of these lands by the project may be in conflict with the proposed use of the Yucca Mountain Site by the DOE. Consequently, long-term impacts to onbase land status within the Nevada Test Site will be high and potentially significant at the national level.

For the Nevada Complex as a whole, regardless of the MOB selected, the proposed project will result in short-term, negligible impacts and long-term, high, and potentially significant impacts at the regional and national levels, if special status lands or lands under consideration for uses of national importance are used for HML movements.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 870 campsite-nights because of a project-induced population of approximately 4,800, a 0.3-percent increase above the projected use of 351,200 campsite-nights. The use-to-capacity ratio for the ROI will increase from 32.5 to 32.6 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 1,770 campsite-nights as a result of a project-induced population of approximately 9,800, a 0.4-percent increase over the projected use of 442,900 campsite-nights. The use-to-capacity ratio for the ROI will increase from 41 to 41.2 percent. Regardless of the MOB selected, the proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat terrain and good to excellent visibility in the region, broad vistas are visible to highway users. About 103,700 acres, or 9 percent of the total RMA, will be in viewshed areas. None of the viewshed areas have special visual quality. Of the 180 miles of highways traversing the viewshed areas, approximately 100 miles (56%) are scenic

highways, with an AADT range of about 1,360 to 3,140. At the rate of 8 sq mi of RMA per HML, 20 HMLs and associated roads could be seen within the viewshed areas, and 5 within scenic highway viewshed areas. Since none of the viewshed areas are considered to be of special visual quality, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.3.4 New Mexico Complex

For the New Mexico Complex, regardless of the MOB selected, short-term land use and status impacts of the proposed project will be low and not significant, and long-term impacts will be moderate and significant. Short and long-term regional recreation impacts will be low and not significant with the MOB at Holloman AFB or White Sands Missile Range Headquarters, and short and long-term impacts will be negligible with the MOB at Fort Bliss. Short-term impacts to visual resources will be negligible, and long-term impacts will be low and not significant, regardless of the MOB selected.

Land Use and Status. Construction activities at any of the three MOB locations will result in the temporary disturbance of approximately 1,510 acres and the permanent disturbance of approximately 610 acres. In addition, deployment-area construction activities will temporarily disturb approximately 13,180 acres and permanently disturb about 7,300 acres. Within Fort Bliss, approximately 271,000 acres in the eastern part of McGregor Range are outleased by the BLM for grazing. As a result of construction activities or HML movements, 223,360 acres of outleased grazing lands within the RMA may be used, necessitating either the modification or termination of the co-use agreements. Since the proposed project will potentially use grazing lands, which are the primary agricultural land use in the ROI, short and long-term impacts to onbase land use will be low and not significant.

The RMA within Fort Bliss includes approximately 431,900 acres, 39 percent of the total installation area. Special status lands, which make up 1.3 percent of the RMA, consist of approximately 4,500 acres within the Lincoln National Forest, located in the northeast part of the McGregor Range. The co-use agreement, for approximately 6,600 acres of the Lincoln National Forest, would not prohibit off-road HML movements. However, use of these lands by the proposed project may restrict public access, thereby disrupting the current uses of these special status lands, primarily recreation. Consequently, long-term impacts to onbase land status within Fort Bliss will be high and potentially significant at the regional level.

The RMA within Holloman AFB includes approximately 17,000 acres, 33 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

The RMA within White Sands Missile Range includes approximately 700,200 acres, 37 percent of the total installation area. Special status lands, which make up 55,800 acres or 8 percent of the RMA, include a portion of the Jornada Experimental Range (52,000 acres), under co-use with the U.S. Department of Agriculture (USDA), and a portion of the San Andres National Wildlife Refuge (3,800 acres), under co-use with the USDA and USFWS. The co-use agreement for the Jornada Experimental Range would not prohibit off-road HML movements. Use of these lands by the proposed project may require the Air Force to redraft the co-use agreement with the USDA, since the western portion of the Jornada

Range (within White Sands Missile Range) is used by USDA for research, erosion control, and grazing. The use of these lands may be affected by HML movements resulting in long-term, moderate impacts. The use of the eastern portion of the Jornada Range for HML movements will result in long-term, low impacts because White Sands Missile Range currently has exclusive use of these lands.

The use of the western portion of the San Andres National Wildlife Refuge for HML movements may require the Air Force to redraft a new co-use agreement, since the current use, to preserve wildlife (primarily bighorn sheep), is controlled by the USDA and USFWS, and access is controlled by the USDA and U.S. Army. The use of these lands for HML movements will result in long-term, high impacts.

Impacts to onbase land status within White Sands Missile Range will be long-term, moderate, and potentially significant at the regional and national levels, if special status lands are used for HML movements.

For the New Mexico Complex as a whole, regardless of the MOB selected, the proposed project will result in short-term, low, and not significant impacts, and long-term, moderate, and potentially significant impacts at the regional and national levels, if special status lands are used for HML movements.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 940 campsite-nights based on a project-induced population of approximately 5,200, a 0.8-percent increase over the projected use of 122,200 campsite-nights. The use-to-capacity ratio for the ROI will increase from 40.5 to 40.8 percent as a result of the project-induced campground use. In 1998, developed campground use is expected to increase by about 1,770 campsite-nights as a result of a project-induced population of approximately 9,800, a 1.2-percent increase above the projected use of 145,100 campsite-nights. The use-to-capacity ratio for the ROI will increase from 48.1 to 48.7 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because recreation areas near the potentially affected population centers (with the MOB at Holloman AFB or White Sands Missile Range Headquarters) will likely receive a higher proportion of the use, particularly the Lincoln National Forest and Caballo Lake and Elephant Butte Lake state parks. The proposed project will result in short and long-term, negligible impacts with the MOB located at Fort Bliss.

Visual Resources. Because of the flat terrain and good to excellent visibility in the region, broad vistas are visible to highway users. About 258,600 acres, or 22 percent of the total RMA, will be in viewshed areas. Approximately 5.9 percent of this area has special visual quality. Of the 220 miles of highways traversing the viewshed area, approximately 90 miles (41%) are scenic highways (including U.S. 54 and U.S. 70/82). The AADT on the scenic highways ranges from about 3,300 to 11,900. At the rate of 8 sq mi of RMA per HML, 50 HMLs and associated roads will fall within the viewshed areas. Seven HMLs could be seen within scenic highway viewshed areas and only three within special visual quality viewshed areas. Therefore, short-term impacts to visual resources will be negligible, and long-term impacts will be low and not significant.

4.4.3.5 South-Central California Complex

For the South-Central California Complex, regardless of the MOB selected, the proposed project will result in short and long-term, low, and not significant impacts to land use and status. The project will result in short and long-term, negligible impacts to regional recreation and visual resources.

Land Use and Status. Construction activities at either MOB location will result in the temporary disturbance of approximately 1,510 acres and the permanent disturbance of approximately 610 acres. In addition, deployment-area construction activities will temporarily disturb approximately 13,180 acres and permanently disturb about 7,300 acres. Within the southern portion of the China Lake Naval Weapons Center (NWC) Mojave B South Range, approximately 98,000 acres are available for grazing but are not currently being used for this purpose. As a result of construction activities or HML movements, approximately 26,300 acres of these grazing lands within the RMA may be used, necessitating either the modification or termination of the co-use agreements. Therefore, short and long-term impacts to onbase land use will be low and not significant, since the proposed project will potentially use grazing lands, which is the primary agricultural land use in the ROI.

The RMA within China Lake NWC includes approximately 231,000 acres, 21 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

The RMA within Edwards AFB includes approximately 82,500 acres, 27 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

The RMA within Fort Irwin National Training Center (NTC) includes approximately 150,000 acres, 22 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

The RMA within Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC) includes approximately 116,600 acres, 20 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impacts will be negligible.

For the South-Central California Complex as a whole, regardless of the MOB selected, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 610 campsite-nights based on a project-induced population of approximately 4,100, a 0.1-percent increase over the projected use of 773,600 campsite-nights. The use-to-capacity ratio for the ROI will not increase discernibly because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 1,470 campsite-nights as a result of a project-induced population of approximately 9,800, a 0.2-percent increase above the projected use of 831,900 campsite-nights. The use-to-capacity ratio for the ROI will not increase noticeably because of the project-induced campground use. Regardless of the MOB selected, the proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat terrain and fair to good visibility in the region, broad vistas can be seen from highways. About 82,600 acres, or 14 percent of the total RMA, will be in viewshed areas, of which approximately 16 percent has special visual quality. Of the 170 miles of highways traversing the viewshed areas, approximately 60 miles (35%) are scenic highways. The AADT on these scenic highways ranges from about 5,300 to approximately 20,000. At the rate of 8 sq mi of RMA per HML, 16 HMLs and associated roads will be within the viewshed areas. Seven HMLs could be seen in scenic highway areas and three in special visual quality viewshed areas. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.3.6 Washington Complex

For the Washington Complex, short-term land use and status impacts of the proposed project will be low and not significant, and long-term impacts will be high and significant. Short and long-term regional recreation impacts will be negligible. Short-term impacts on visual resources will be negligible, and long-term impacts will be low and not significant.

Land Use and Status. Construction activities at the Yakima Firing Center (FC) MOB will result in the temporary disturbance of approximately 1,440 acres and the permanent disturbance of approximately 390 acres. In addition, construction activities within the deployment areas will temporarily disturb approximately 3,060 acres and permanently disturb about 2,090 acres. Within Yakima FC, approximately 200,000 acres are outleased for grazing. As a result of construction activities or HML movements, portions of these lands may be used, necessitating either the modification or termination of the co-use agreements. Short and long-term impacts to onbase land use will be low, since the proposed project will potentially use grazing lands, which is a primary agricultural land use in the ROI.

The RMA within the DOE Hanford Site includes approximately 123,400 acres, 34 percent of the total installation area. Special status lands, which make up 64,600 acres or 52 percent of the RMA, include portions of the Saddle Mountain National Wildlife Refuge (14,700 acres) and the Wahluke Slope State Wildlife Recreation Area (49,900 acres). In addition, the RMA includes a portion of the site under consideration by DOE for a commercial spent fuel and high-level nuclear waste repository. Use of these lands by the project may be in conflict with the proposed use of the site by DOE. Use of the Saddle Mountain National Wildlife Refuge for HML movement may require the Air Force to redraft the co-use agreement between the USFWS and DOE, which prohibits off-road vehicle travel. The current use of these lands as a buffer between the DOE Hanford Site and surrounding communities will be disrupted by introduction of the HMLs. Consequently, long-term impacts to onbase land status will be high and potentially significant at the regional and national levels.

The current use of the Wahluke Slope State Wildlife Recreation Area (also used as a buffer between the DOE Hanford Site and the surrounding communities, and a public hunting and fishing area) will most likely be disrupted by introduction of the HMLs, resulting in long-term, high, and significant impacts at the regional level.

The Arid Lands Ecology Reserve lies within the DOE Hanford Site RMA. Since this special status land is excluded from consideration for HML movement, onbase land status impacts will be negligible.

The RMA within Yakima FC includes approximately 123,600 acres, 47 percent of the total installation area. No special status lands exist within the RMA; therefore, onbase land status impact will be negligible.

For the Washington Complex as a whole, the proposed project will result in short-term, low, and not significant impacts to land use and status. Long-term impacts will be high and potentially significant at the regional level, if special status lands or lands under consideration for uses of national importance are used for the HML movements.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 510 campsite-nights as a result of a project-induced population of approximately 3,400, a 0.1-percent increase over the projected use of 460,100 campsite-nights. The use-to-capacity ratio for the ROI will not increase discernibly because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 580 campsite-nights based on a project-induced population of approximately 3,900, a 0.1-percent increase above the projected use of 507,600 campsite-nights. The use-to-capacity ratio for the ROI will not increase noticeably because of project-induced campground use. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat terrain and good to excellent visibility in the region, broad vistas are visible to highway users. About 197,100 acres, or 80 percent of the total RMA, will be in viewshed areas. Approximately 4 percent of this area has special visual quality. Of the approximately 260 miles of highways traversing the viewshed areas, approximately 15 miles (6%) is a scenic highway (I-82). The AADT on Interstate 82 is about 13,400. At the rate of 8 sq mi of RMA per HML, 39 HMLs and associated roads will be within the viewshed areas. Three HMLs could be seen from scenic highway viewshed areas and two could be seen in special visual quality viewshed areas. Therefore, short-term impacts to visual resources will be negligible and long-term impacts will be low and not significant.

4.4.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

Impacts of the Hard Mobile Launcher at Minuteman Facilities basing mode on each land use resource element at each alternative location are presented in this section. Table 4.4.4-1 provides a summary of the impact analysis data.

4.4.4.1 Ellsworth Air Force Base

The proposed project will result in short and long-term, low, and not significant impacts to land use and status, and short and long-term, negligible impacts to regional recreation and visual resources.

Land Use and Status. Construction activities at Ellsworth AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 390 acres. Potential short and long-term impacts to onbase land use (i.e., outleased agricultural lands used for hay baling and mowing operations) will be low, because of the minimal land disturbance projected and its effect on the ROI.

Table 4.4.4-1

SUMMARY OF LAND USE IMPACT ANALYSIS DATA FOR THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES BASING MODE

	Ellsworth AFB	F.E. Warren AFB	Grand Forks AFB	Malmstrom AFB	Minot AFB	Whiteman AFB
Land Use and Status						
Area Disturbed (acres)[1]	3,110	3,500	3,110	3,500	3,110	3,110
Regional Recreation						
Campsite-Night Demand[2]	2,120	1,710	2,110	1,220	2,120	2,050
Use-to-Capacity Ratio (Without Project, %)[3]	29.7%	44.9%	26.6%	20.7%	27.5%	29.5%
Use-to-Capacity Ratio (With Project, %)[4]	30.3%	45.1%	27.4%	21.3%	28.5%	29.6%
Visual Resources						
Launch Facilities in Viewshed Areas	100	107	150	159	150	150
Launch Facilities in Special Visual Quality Viewshed Areas	27	37	0	10	8	5
Launch Facilities in Scenic Highway Viewshed Areas	25	18	28	10	18	26
Average Annual Daily Traffic on Scenic Highways	600-6,360	680-4,830	600-5,990	330-24,600	850-2,600	1,230-6,050

Notes: [1]Approximate land area disturbed (both temporary and permanent) by Small ICBM facilities and roadway construction.

[2]Project-induced campsite-night demand, 1998.

[3]Use-to-capacity ratio without the project, 1998.

[4]Use-to-capacity ratio with the project, 1998.

Deployment of the HMLs in the Ellsworth AFB launch facility deployment area will require some road and bridge improvements for the operation of HML vehicles, and will temporarily disturb approximately 100 acres and permanently disturb approximately 1,480 acres. The land area adjacent to the T/E roadways is primarily grassland and agricultural land. Acquisition of these lands for proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the Ellsworth AFB alternative, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 1,390 campsite-nights as a result of a project-induced population of approximately 4,700, a 1.4-percent increase over the projected use of 97,900 campsite-nights. The use-to-capacity ratio for the ROI will increase from 27.5 to 27.9 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 2,120 campsite-nights based on a project-induced population of approximately 7,200, a 2-percent increase above the projected use of 105,800 campsite-nights. The use-to-capacity ratio for the ROI will increase from 29.7 to 30.3 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is good to excellent in the region, the rolling terrain limits the viewing distance of highway users. Of the 150 Minuteman launch facilities, only 100 (67%) are located in viewshed areas (Minuteman facilities within 5 mi of federal and state highways). Of the 540 miles of highways traversing the viewshed areas, about 140 miles (26%) are scenic highways. The AADT on the scenic highways ranges from about 600 to approximately 6,360. Of the 150 launch facilities, only 25 are located in scenic highway viewshed areas and only 27 in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in the Midwest. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.4.2 F.E. Warren Air Force Base

The proposed project will result in short and long-term, low, and not significant impacts to land use and status and regional recreation, and short and long-term, negligible impacts to visual resources.

Land Use and Status. Construction activities at F.E. Warren AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 400 acres. Potential short and long-term impacts to onbase land use (i.e., horse grazing areas) will be low, because of the minimal land disturbance projected and its effect on the ROI.

Deployment of the HMLs in the F.E. Warren AFB launch facility deployment area will require some road and bridge improvements for HML vehicle operations, and will temporarily disturb approximately 100 acres and permanently disturb approximately 1,860 acres. The land area adjacent to the T/E roadways is primarily short-grass prairie and agricultural land. Acquisition of these

lands for the proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the F.E. Warren AFB alternative, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 910 campsite-nights based on a project-induced population of approximately 4,300, a 0.4-percent increase above the projected use of 244,200 campsite-nights. The use-to-capacity ratio for the ROI will increase from 37.4 to 37.5 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 1,710 campsite-nights as a result of a project-induced population of approximately 8,100, a 0.6-percent increase over the projected usage of 293,000 campsite-nights. The use-to-capacity ratio for the ROI will increase from 44.9 to 45.1 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because recreation areas in proximity to Cheyenne will likely receive a higher proportion of the use, particularly Curt Gowdy State Park and the Medicine Bow National Forest.

Visual Resources. Although visibility is good to excellent in the region, the moderately rolling terrain limits the viewing distance of highway users. Of the 200 Minuteman launch facilities, 107 (54%) are located in viewshed areas. Of the 560 miles of highways traversing the viewshed areas, about 60 miles (11%) are scenic highways. The AADT on the scenic highways ranges from approximately 680 to about 4,830. Of the 200 launch facilities, only 18 are located in scenic highway viewshed areas and only 37 in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in this area. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.4.3 Grand Forks Air Force Base

The proposed project will result in short and long-term, low, and not significant impacts to land use and status and regional recreation, and short and long-term, negligible impacts to visual resources.

Land Use and Status. Construction activities at Grand Forks AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 390 acres. Potential short and long-term impacts to onbase land use (i.e., outleased pastureland) will be low, because of the minimal land disturbance projected and its effect on the ROI.

Deployment of the HMLs in the Grand Forks AFB launch facility deployment area will require some road and bridge improvements for operation of HML vehicles, and will temporarily disturb approximately 100 acres and permanently disturb about 1,480 acres. The land area adjacent to the T/E roadways is primarily agricultural land. Acquisition of these lands for proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the Grand Forks AFB alternative, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 1,370 campsite-nights as a result of a project-induced population of approximately 4,700, a 1.9-percent increase above the projected use of 71,100 campsite-nights. The use-to-capacity ratio for the ROI will increase from 25 to 25.5 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 2,120 campsite-nights based on a project-induced population of approximately 8,100, a 2.8-percent increase over the projected use of 75,800 campsite-nights. The use-to-capacity ratio for the ROI will increase from 26.6 to 27.4 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because recreation areas in proximity to Grand Forks will likely receive a higher proportion of the use, particularly Turtle River and Icelandic state parks.

Visual Resources. Although visibility is good to excellent in the region, the undulating terrain limits the viewing distance of highway users. All of the 150 Minuteman launch facilities are located in viewshed areas. Of the 760 miles of highways traversing the viewshed areas, about 180 miles (24%) are scenic highways. The AADT on the scenic highways ranges from about 600 to approximately 5,990. Of the 150 launch facilities, only 28 are located in the scenic highway viewshed areas and none are in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in the Midwest. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.4.4 Malmstrom Air Force Base

The proposed project will result in short and long-term, low, and not significant impacts to land use and status, and short and long-term, negligible impacts to regional recreation. Short-term impacts to visual resources will be negligible and long-term impacts will be low and not significant.

Land Use and Status. Construction activities at Malmstrom AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 400 acres. Potential short and long-term impacts to onbase land use (i.e., outleased horse grazing lands) will be low as a result of the minimal land disturbance projected and its effect on the ROI.

Deployment of the HMLs in the Malmstrom AFB launch facility deployment area will require some road and bridge improvements for operation of the HML vehicles, and will temporarily disturb approximately 100 acres and permanently disturb about 1,860 acres. The land area adjacent to the T/E roadways is primarily native grassland and agricultural land. Acquisition of these lands for proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the Malmstrom AFB alternative, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 610 campsite-nights based on a project-induced population of approximately 4,100, a 1.5-percent increase above the projected use of 40,800 campsite-nights. The use-to-capacity ratio for the ROI will increase from 19.6 to 19.8 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 1,220 campsite-nights as a result of a project-induced population of approximately 8,100, a 2.8-percent increase over the projected use of 43,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 20.7 to 21.3 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is good to excellent in the region, the rolling terrain limits the viewing distance of highway users. Of the 200 Minuteman launch facilities, 159 (80%) are located in viewshed areas. Of the 710 miles of highways traversing the viewshed areas, approximately 310 miles (44%) are scenic highways. The AADT on these highways ranges from about 330 to over 24,600. Of the 200 launch facilities, only 10 are located in the scenic highway viewshed areas and 10 in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in agricultural areas. Therefore, short-term impacts of the proposed project to visual resources will be negligible, and long-term impacts will be low and not significant.

4.4.4.5 Minot Air Force Base

The proposed project will result in short and long-term, low, and not significant impacts to land use and status, and short and long-term, negligible impacts to regional recreation and visual resources.

Land Use and Status. Construction activities at Minot AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 390 acres. Potential short and long-term impacts to onbase land use (i.e., outleased hay production and pastureland) will be low, due to the minimal land disturbance projected and its effect on the ROI.

Deployment of the HMLs in the Minot AFB launch facility deployment area will require some road and bridge improvements for operation of the HML vehicles, and will temporarily disturb approximately 100 acres and permanently disturb about 1,480 acres. The land area adjacent to the T/E roadways is primarily agricultural land. Acquisition of these lands for proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the Minot AFB alternative, the proposed project will result in short and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 1,400 campsite-nights as a result of a project-induced population of approximately 4,800, a 2.4-percent increase above the projected use of 59,000 campsite-nights. The use-to-capacity ratio for the ROI will increase from 26.1 to 26.7 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by

about 2,120 campsite-nights based on a project-induced population of approximately 7,200, a 3.4-percent increase over the projected use of 62,200 campsite-nights. The use-to-capacity ratio for the ROI will increase from 27.5 to 28.5 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is good to excellent in the region, the undulating terrain limits the viewing distance of highway users. All of the 150 Minuteman launch facilities are located in viewshed areas. Of the 860 miles of highways traversing the viewshed areas, about 60 miles (7%) are scenic highways. The AADT on the scenic highways ranges from about 850 to approximately 2,600. Of the 150 launch facilities, only 18 are located in the scenic highway viewshed areas and only 8 in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in the Midwest. Therefore, short and long-term impacts to visual resources will be negligible.

4.4.4.6 Whiteman Air Force Base

The proposed project will result in short-term, negligible and long-term, low, and not significant impacts to land use and status, and short and long-term, negligible impacts to regional recreation and visual resources.

Land Use and Status. Construction activities at Whiteman AFB will result in the temporary disturbance of approximately 1,140 acres and the permanent disturbance of about 390 acres. Since no onbase agricultural lands are present, impacts are projected to be negligible.

Deployment of the HMLs in the Whiteman AFB launch facility deployment area will require some road and bridge improvements for operation of the HML vehicles, and will temporarily disturb approximately 100 acres and permanently disturb about 1,480 acres. The land area adjacent to the T/E roadways is primarily agricultural land. Acquisition of these lands for proposed project use will result in long-term, low, and not significant impacts to offbase land use as a result of the minimal land disturbance projected to occur and its effect on the ROI.

For the Whiteman AFB alternative, the proposed project will result in short-term, negligible and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1990, developed campground use within the ROI is expected to increase by about 1,200 campsite-nights as a result of a project-induced population of approximately 4,200, a 0.3-percent increase over the projected use of 459,600 campsite-nights. The use-to-capacity ratio for the ROI will increase from 29.5 to 29.6 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 2,050 campsite-nights based on a project-induced population of approximately 7,200, a 0.5-percent increase above the projected use of 458,900 campsite-nights. The use-to-capacity ratio for the ROI will increase from 29.5 to 29.6 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is fair to good in the region, the undulating terrain limits the viewing distance of highway users. All of the 150 Minuteman launch facilities are located in viewshed areas. Of the 860 miles of highways traversing the viewshed areas, about 155 miles (18%) are scenic highways. The AADT on the scenic highways ranges from approximately 1,230 to about 6,050. Of the 150 launch facilities, only 26 are located in scenic highway viewshed areas and only 5 in special visual quality viewshed areas. In addition, the HML vehicle structures will not be out-of-character with grain storage structures commonly found in agricultural areas. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.5 Impacts of Hard Silo in Patterned Array

Impacts of the Hard Silo in Patterned Array basing mode on each land use resource element at each alternative location are presented in this section. Table 4.4.5-1 provides a summary of the impact analysis data.

4.4.5.1 Davis-Monthan Air Force Base

Short-term impacts of the proposed project on land use and status will be negligible, and long-term impacts will be low and not significant. The proposed project will result in short and long-term, negligible impacts to regional recreation and short and long-term, low, and not significant impacts to visual resources.

Land Use and Status. Construction activities at Davis-Monthan AFB will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Since no onbase agricultural lands are present, onbase land use impacts are projected to be negligible.

The onbase SDA within Davis-Monthan AFB includes 85 percent (9,200 acres) of the installation area. No special status lands exist within the base area; therefore, onbase land status impacts will be negligible.

The total SDA includes approximately 70,400 acres (4.9%) of irrigated agricultural land, 1,355,500 acres (94.4%) of rangeland, and 9,400 acres (0.7%) of urban disturbed land. Construction of this basing mode will require permanent use of approximately 18,000 acres (1% of the SDA). Irrigated agricultural lands, which make up a small percentage of the SDA, are concentrated in the northwest portion and are not likely to be disturbed. Therefore, the probability of affecting rangeland is high, resulting in long-term, low, and not significant impacts to offbase land use.

The offbase SDA includes approximately 816,100 acres (57.2%) of state, local, and other lands; 449,600 acres (31.5%) of private lands; 96,500 acres (6.8%) of BLM lands; 58,600 acres (4.1%) of other federal lands; and 5,300 acres (0.4%) of military lands. A portion of the Fort Huachuca Military Reservation is included within the SDA. Other federal lands present within the SDA include portions of the Coronado National Forest (17,800 acres) and a majority of the lands within the USDA Santa Rita Experimental Range (40,800 acres). Since these special status lands constitute only a small percentage (4.1%) of the SDA, there is a high probability that none or only minor portions of these lands will be used for the proposed project. Consequently, impacts to offbase land status will be long-term, low, and not significant.

AD-A173 827 LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT SMALL INTERCONTINENTAL BALLISTIC MISSILE PROGRAM(U) AIR FORCE REGIONAL CIVIL ENGINEER NORTON AFB CA BALLISTIC MISSILE SUPPORT NOV 86 6/9

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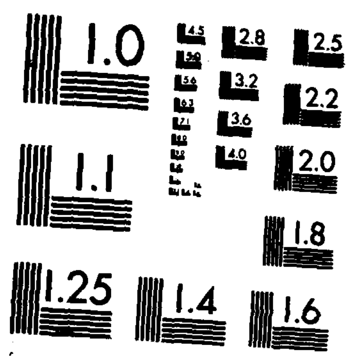

ICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 4.4.5-1

SUMMARY OF LAND USE IMPACT ANALYSIS DATA FOR THE HARD SILO IN PATTERNED ARRAY BASING MODE

	Davis-Monthan AFB	Edwards AFB	F.E. Warren AFB	Fort Bliss	Gila Bend AFAF	Yuma PG
Land Use and Status						
Suitable Deployment Area (acres)	1,435,300	811,100	137,400	1,292,800	1,443,400	967,700
Private Land (%)[1]	31%	78%	95%	25%	25%	5%
Irrigated and Nonirrigated Cropland (%)[2]	5%	11%	50%	0%	14%	0%
Regional Recreation						
Campsite-Night Demand[3]	1,220	1,240	2,220	2,070	1,490	850
Use-to-Capacity (Without Project, %)[4]	35.6%	31.7%	41.0%	44.2%	36.9%	26.0%
Use-to-Capacity (With Project, %)[5]	35.9%	31.7%	41.3%	44.9%	37.1%	26.1%
Visual Resources						
Viewshed Area (acres)[6]	892,800	620,800	105,600	540,800	582,400	185,600
Special Visual Quality Viewshed Areas (acres)	169,600	0	0	26,900	16,000	42,200
Scenic Highway Viewshed Areas (acres)	192,000	46,100	0	8,300	0	0
Average Annual Daily Traffic on Scenic Highways	1,100-24,750	670-39,500	*	7,920-13,630	*	*

Notes: [1]Private land as a percent of the SDA.

[2]Irrigated and nonirrigated cropland as a percent of the SDA.

[3]Project-induced campsite demand, 1994.

[4]Use-to-capacity ratio without the project, 1994.

[5]Use-to-capacity ratio with the project, 1994.

[6]Acres of viewshed area in the total SDA.

*No scenic highways in the ROI.

For the Davis-Monthan AFB alternative, the proposed project will result in short-term, negligible and long-term, low, and not significant impacts at the regional level on land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 1,220 campsite-nights based on a project-induced population of approximately 10,100, a 0.7-percent increase over the projected use of 178,100 campsite-nights. The use-to-capacity ratio for the ROI will increase from 35.6 to 35.9 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 530 campsite-nights as a result of a project-induced population of approximately 4,400, a 0.3-percent increase above the projected usage of 196,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 39.3 to 39.4 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility is good to excellent in the region, the undulating terrain limits the vistas seen by highway users. About 892,800 acres (62%) of the SDA will be in viewshed areas (SDAs within 5 mi of federal and state highways). Approximately 19 percent of this area has special visual quality. Of the approximately 320 miles of highways traversing the viewshed areas, about 300 miles (94%) are scenic highways. The AADT on these scenic highways ranges from approximately 1,100 to about 24,750. The approximately 18,000-acre fenced area required for the 250 silos and the support facilities represents 2 percent of the viewshed areas. There are 542,500 acres within the SDA that are not in the viewshed area. Considerable fugitive dust will be generated by heavy equipment during the construction phase. Therefore, the project will result in short and long-term, low, and not significant impacts to visual resources.

4.4.5.2 Edwards Air Force Base

Short-term impacts of the proposed project to land use and status will be negligible, and long-term impacts will be low and not significant. The proposed project will result in short and long-term, negligible impacts to regional recreation and short and long-term, low, and not significant impacts to visual resources.

Land Use and Status. Construction activities at Edwards AFB will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Since no onbase agricultural lands are present, onbase land use impacts are projected to be negligible.

The onbase SDA within Edwards AFB includes 9 percent (27,900 acres) of the installation area. No special status lands exist within the base area; therefore, onbase land status impacts will be negligible.

The total SDA includes approximately 88,100 acres (10.9%) of irrigated agricultural land, 701,500 acres (86.5%) of rangeland, and 21,500 acres (2.6%) of urban disturbed land. Construction of this basing mode will require permanent use of approximately 18,000 acres (2% of the SDA). Irrigated agricultural lands, which make up approximately 11 percent of the SDA, are concentrated in the western portion of the SDA and are not likely to be disturbed. Consequently, the probability of affecting rangeland is high, resulting in long-term, low, and not significant impacts to offbase land use.

The offbase SDA includes approximately 617,100 acres (78.8%) of private lands, 145,700 acres (18.6%) of BLM lands, 16,800 acres (2.1%) of military lands, 2,900 acres (0.4%) of other federal lands, and 700 acres (0.1%) of state, local, and other lands. A portion of the China Lake NWC Mojave B South Range is included within the SDA. Other federal and public domain lands present within the SDA include a portion of the San Bernardino National Forest and a portion of the BLM Golden Valley Wilderness Study Area. Since these special status lands constitute only a small percentage (0.4%) of the SDA, the probability of affecting these lands is remote. Consequently, impacts to offbase land status will be negligible.

For the Edwards AFB alternative, the proposed project will result in short-term, negligible and long-term, low, and not significant impacts at the regional level on land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 1,240 campsite-nights as a result of a project-induced population of approximately 8,200, a 0.2-percent increase above the projected use of 804,100 campsite-nights. The use-to-capacity ratio for the ROI will not increase noticeably because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 660 campsite-nights based on a project-induced population of approximately 4,400, a 0.1-percent increase over the projected use of 831,900 campsite-nights. The use-to-capacity ratio for the ROI will not increase discernibly because of the project-induced campground use. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat terrain and the fair to good visibility in the region, broad vistas can be seen by highway users. About 620,800 acres (76%) of the SDA will be in viewshed areas, and none has special visual quality. Of the approximately 340 miles of highways traversing the viewshed area, about 145 miles (43%) are scenic highways. The AADT on these scenic highways ranges from approximately 670 to about 39,500. The approximately 18,000-acre fenced area required for 250 silos and support facilities represents 3 percent of the viewshed areas. During the construction phase, heavy equipment will generate considerable fugitive dust. There are 190,300 acres within the SDA that are not in the viewshed area. Therefore, the proposed project will result in short and long-term, low, and not significant impacts to visual resources.

4.4.5.3 F.E. Warren Air Force Base

The proposed project will result in short-term, low, and not significant impacts, and long-term, moderate and significant impacts to land use and status. The proposed project will result in short and long-term, low, and not significant impacts to regional recreation, and short and long-term, negligible impacts to visual resources.

Land Use and Status. Construction activities at F.E. Warren AFB will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Potential short and long-term impacts to onbase land use (i.e., horse grazing areas) will be low, because of the minimal land disturbance projected and its effect on the ROI.

No portions of the installation area are included within the SDA for the F.E. Warren AFB deployment area; therefore, no onbase land status impacts are anticipated.

The SDA includes approximately 400 acres (0.3%) of irrigated agricultural land, 69,000 acres (50.2%) of nonirrigated agricultural land, 66,900 acres (48.7%) of rangeland, and 1,100 acres (0.8%) of urban disturbed land. Construction of this basing mode will require permanent use of approximately 18,000 acres (13% of the SDA). Rangeland is the primary land use for the majority of the SDA in south-central and western Laramie County. Nonirrigated agricultural land is the primary land use of the SDA lands in Banner and Kimball counties, Nebraska, and eastern Laramie County, Wyoming, with many rural roads interspersed throughout these areas. Consequently, the probability of affecting nonirrigated agriculture and transportation routing is high, resulting in long-term, moderate, and significant impacts to offbase land use.

The SDA includes approximately 130,900 acres (95.3%) of private lands and 6,500 acres (4.7%) of state, local, and other lands. No other federal and public domain lands exist within the SDA; therefore, potential offbase land status impacts will be negligible.

For F.E. Warren AFB, the effects of Hard Silo in Patterned Array construction (i.e., removing agricultural lands from production) are inconsistent with Laramie County's comprehensive land use plan, which supports the maintenance of the county's agricultural character.

For the F.E. Warren AFB alternative, the project will result in short-term, low, and not significant impacts, and long-term, moderate, and significant impacts to land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 2,220 campsite-nights as a result of a project-induced population of approximately 10,600, a 0.8-percent increase above the projected use of 267,700 campsite-nights. The use-to-capacity ratio for the ROI will increase from 41 to 41.3 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 920 campsite-nights based on a project-induced population of approximately 4,500, a 0.3-percent increase over the projected use of 293,000 campsite-nights. The use-to-capacity ratio for the ROI will increase from 44.9 to 45 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because recreation areas in proximity to Cheyenne will likely receive a higher proportion of the use, particularly Curt Gowdy State Park and the Medicine Bow National Forest.

Visual Resources. Although visibility is good to excellent in the region, the undulating terrain limits vistas visible to highway users. About 105,600 acres (77%) of the SDA will be in viewshed areas and none has special visual quality. There are no designated scenic highways in the area. The approximately 18,000-acre fenced area required for 250 silos and support facilities represents 18 percent of the defined viewshed areas; there are 31,800 acres within the SDA that are not in viewshed areas. Therefore, the proposed

project will result in short and long-term, negligible impacts to visual resources.

4.4.5.4 Fort Bliss

Short-term impacts of the proposed project to land use and status will be negligible, and long-term impacts will be low and not significant. The proposed project will result in short and long-term, negligible impacts to regional recreation and short and long-term, low, and not significant impacts to visual resources.

Land Use and Status. Construction activities at Fort Bliss will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Potential impacts to onbase land use will be negligible, since no agricultural lands (i.e., grazing lands) are within the SDA or are located near the base cantonment area.

The onbase SDA within Fort Bliss includes 38 percent (426,100 acres) of the installation area. No special status lands present within the base boundaries are included within the SDA; therefore, onbase land status impacts will be negligible.

The total SDA includes approximately 1,289,000 acres (99.7%) of rangeland and 3,800 acres (0.3%) of urban disturbed land. Construction of this basing mode will require permanent use of approximately 18,000 acres (1% of the SDA). Irrigated and nonirrigated croplands are not present within the SDA; consequently, the probability of affecting rangeland is high, resulting in long-term, low, and not significant impacts to offbase land use.

The offbase SDA includes approximately 375,300 acres (43.3%) of BLM lands; 330,000 (38.1%) acres of private lands; 93,100 acres (10.7%) of state, local, and other lands; 67,500 acres (7.8%) of military lands; and 800 acres (0.1%) of other federal lands. The southern portion of White Sands Missile Range is included within the SDA. In addition, the southeastern portion of the Jornada Experimental Range and portions of the BLM Aden Lava Flow and West Potrillo Mountains wilderness study areas are included in the SDA. Since these special status lands constitute only a small percentage (0.2%) of the SDA, the probability of affecting these lands is remote. Therefore, impacts to offbase land status will be negligible.

For the Fort Bliss alternative, the proposed project will result in short-term, negligible and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 2,070 campsite-nights based on a project-induced population of approximately 11,500, a 1.6-percent increase over the projected use of 133,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 44.2 to 44.9 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 790 campsite-nights as a result of a project-induced population of approximately 4,400, a 0.6-percent increase above the projected use of 145,100 campsite-nights. The use-to-capacity ratio for the ROI will increase from 48.1 to 48.4 percent. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Because of the flat to gently rolling terrain and the good to excellent visibility in the region, broad vistas are visible to highway users. About 540,800 acres (42%) of the SDA will be in viewshed areas. Approximately 5 percent of this area has special visual quality. Of the approximately 370 miles of highways traversing the viewshed areas, about 100 miles (27%) are scenic highways. The AADT on these scenic highways ranges from 7,920 to 13,630. The approximately 18,000-acre fenced area required for 250 silos and support facilities represents 4 percent of the viewshed areas; there are 752,000 acres within the SDA that are not in viewshed areas. During the construction phase, heavy equipment will generate considerable fugitive dust. Therefore, the proposed project will result in short and long-term, low, and not significant impacts to visual resources.

4.4.5.5 Gila Bend Air Force Auxiliary Field

Short-term impacts of the proposed project to land use and status will be negligible, and long-term impacts will be low and not significant. The proposed project will result in short and long-term, low, and not significant impacts to regional recreation, and short and long-term, negligible impacts to visual resources.

Land Use and Status. Construction activities at Gila Bend AFAF will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Since no onbase agricultural lands are present, onbase land use impacts are projected to be negligible.

The onbase SDA within Gila Bend AFAF includes all (approximately 1,900 acres) of the installation area. No special status lands exist within the base area; therefore, onbase land status impacts will be negligible.

The total SDA includes approximately 196,200 acres (13.6%) of irrigated agricultural land, 1,245,700 acres (86.3%) of rangeland, and 1,500 acres (0.1%) of urban disturbed land. Construction of this basing mode will require permanent use of approximately 18,000 acres (1% of the SDA). Irrigated agricultural lands (approximately 14% of the SDA) are concentrated in areas to the west, north, and east of the installation. Consequently, the probability of affecting these lands is low, resulting in long-term, low, and not significant impacts to offbase land use.

The offbase SDA includes approximately 562,700 acres (39.0%) of BLM lands, 412,600 acres (36%) of military lands, 355,700 acres (24.7%) of private lands, and 110,500 acres (7.7%) of state, local, and other lands. A portion of Luke AFR is included within the SDA. Portions of 11 BLM wilderness study areas are within the SDA. Since these lands constitute only a small percentage (5%) of the SDA, there is a high probability that none or only minor portions of these lands will be used for the proposed project. Consequently, impacts to offbase land status will be long-term, low, and not significant.

For the Gila Bend AFAF alternative, the proposed project will result in short-term, negligible impacts, and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 1,490 campsite-nights as a result of a project-

induced population of approximately 9,900, a 0.6-percent increase over the projected use of 241,400 campsite-nights. The use-to-capacity ratio for the ROI will increase from 36.9 to 37.1 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 660 campsite-nights based on a project-induced population of approximately 4,400, a 0.3-percent increase over the projected use of 268,300 campsite-nights. The use-to-capacity ratio for the ROI will increase from 41 to 41.2 percent. Although the overall increased recreation use within the ROI will be small, the proposed project will result in short and long-term, low, and not significant impacts to regional recreation because Painted Rocks State Park will likely receive a higher proportion of the use as a result of its proximity to the town of Gila Bend and because it is the only developed recreation area within 60 miles.

Visual Resources. Because of the flat terrain and the fair to good visibility in the region, broad vistas are visible by highway users. About 582,400 acres (40%) of the SDA will be in viewshed areas. Approximately 3 percent of this area has special visual quality. None of the highways traversing the viewshed areas are scenic highways. The approximately 18,000-acre fenced area required for 250 silos and support facilities represents 3 percent of the viewshed areas; there are 861,000 acres within the SDA that are not in viewshed areas. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.5.6 Yuma Proving Ground

The proposed project will result in short-term, negligible impacts, and long-term, low, and not significant impacts to land use and status. Short and long-term, negligible impacts to regional recreation and visual resources are expected to occur.

Land Use and Status. Construction activities at Yuma PG will result in the temporary disturbance of approximately 960 acres and the permanent disturbance of about 740 acres. Since no onbase agricultural lands are present, onbase land use impacts are projected to be negligible.

The onbase SDA within Yuma PG includes 26 percent (219,100 acres) of the installation area. No special status lands exist within the base area; therefore, onbase land status impacts will be negligible.

The SDA consists entirely of rangeland. No irrigated or nonirrigated agricultural lands exist within the SDA. Construction of this basing mode will require permanent use of approximately 18,000 acres (2% of the SDA). The proposed project use of rangeland will result in a long-term, low, and not significant impact to offbase land use.

The offbase SDA includes approximately 410,000 acres (54.8%) of military lands, 273,900 acres (36.6%) of BLM lands, 37,700 acres (5.0%) of private lands, and 27,000 acres (3.6%) of state, local, and other lands. Portions of the Chocolate Mountain Aerial Gunnery Range and Luke AFR, and portions of three BLM wilderness study areas are within the SDA. Since these lands constitute only a small percentage (5%) of the SDA, there is a high probability that none or only minor portions of these lands will be used by the proposed project. Consequently, offbase land status impacts will be long-term, low, and not significant.

For the Yuma PG alternative, the proposed project will result in short-term, negligible impacts, and long-term, low, and not significant impacts to land use and status.

Regional Recreation. In 1994, developed campground use within the ROI is expected to increase by about 850 campsite-nights as a result of a project-induced population of approximately 11,280, a 0.4-percent increase above the projected use of 208,800 campsite-nights. The use-to-capacity ratio for the ROI will increase from 26 to 26.1 percent because of the project-induced campground use. In 1998, developed campground use is expected to increase by about 330 campsite-nights as a result of a project-induced population of approximately 4,400, which is a 0.2-percent increase over the projected use of 222,900 campsite-nights. The use-to-capacity ratio for the ROI will not increase discernibly because of the project-induced campground use. The proposed project will result in short and long-term, negligible impacts to regional recreation.

Visual Resources. Although visibility in the area is good to excellent, the flat to mostly rolling terrain limits vistas seen by highway users. About 185,600 acres (19%) of the SDA will be in viewshed areas. Approximately 23 percent of this area has special visual quality. There are no scenic highways traversing the viewshed areas. The approximately 18,000-acre fenced area required for 250 silos and support facilities represents 10 percent of the viewshed areas; there are 782,100 acres not in viewshed areas where the proposed project could be located. Therefore, the proposed project will result in short and long-term, negligible impacts to visual resources.

4.4.6 Impacts of the No Action Alternative

Land Use and Status. Under this alternative, existing offbase land uses and status will, for the most part, continue. Most regions are experiencing steady to decreasing agricultural trends. Except for the future projects cited in Section 3.4, existing onbase land uses will also continue.

Regional Recreation. Recreation use will increase in each ROI as a result of regional population growth (with the exception of the Whiteman AFB ROI, where projected population decreases may result in a corresponding decline in recreation use). In addition, while recreation use increases, it is expected that the development and construction of new recreation facilities, including campground facilities, will be minimal because of fiscal restrictions at all levels of government. Therefore, existing recreation facilities will be more heavily used than they are currently. Changes in the amount of recreation use and increases in use-to-capacity ratios will vary for each region, with some regions incurring large increases in use and a potential corresponding decline in the quality of recreation experience.

In some regions, particularly in the Southwest and Northwest, the availability of large amounts of BLM and national forest lands and some state lands for dispersed recreation provides an alternative to recreation at developed sites. Recreation on these lands has and will continue to increase as developed areas become more heavily used and the public becomes more aware of the recreation opportunities these lands offer. This could result, in some instances, in the overuse of specific dispersed recreation areas.

Visual Resources. The No Action Alternative will allow the existing desert landscape settings to remain undisturbed in those portions of the southwestern part of the country where the project is proposed for deployment, and it will allow the ranching and farming visual setting to remain undisturbed in the midwestern states and Washington. Under this alternative, the Florida Complex area will continue its present wooded, semirural visual setting.

4.4.7 Irreversible and Irretrievable Resource Commitments

Proposed project actions will result in an irreversible and irretrievable commitment of resources, if lands used for the proposed project include lands under consideration for wilderness designation (i.e., proposed wilderness areas and wilderness study areas). The use of these lands will result in an irreversible and irretrievable loss of the wilderness value of these lands.

4.4.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Deployment of the proposed project, particularly the Hard Silo in Patterned Array basing mode, may result in the use of agriculturally productive lands (i.e., irrigated, nonirrigated, and grazing). The use of these lands will narrow the range of future uses of the land to the extent that the long-term productivity of the project-disturbed lands is diminished. In addition, project deployment may result in the intrusion of project-related facilities onto previously undisturbed visual landscapes.

4.5 Cultural and Paleontological Resources

The proposed deployment of the Small Intercontinental Ballistic Missile (ICBM) system has the potential to affect cultural and paleontological resources. Prehistoric, historic, and American Indian cultural resources have been included in the impact analysis.

4.5.1 Impact Analysis Methodology

The impact analysis methodology for cultural and paleontological resources consists of three phases: evaluation of potential project impacts, determination of levels of impact (LOIs), and determination of the significance of impacts.

4.5.1.1 Evaluation of Project Impacts

The procedures used to evaluate impacts were similar for all resource elements. Existing data were used to estimate densities and/or distributions of resources and the results were summarized on maps. Overlays of projected direct impact areas were then superimposed on the maps to estimate possible impacts. Impacts were determined by estimating numbers and/or kinds of resources within direct impact areas and comparing these estimates to total resources within the entire Region of Influence (ROI).

Prehistoric Cultural Resources. Existing data and predictive models developed during previous studies were used to identify probable site distributions. When data quality permitted, resource densities were estimated within landform zones or in relation to specific environmental features (e.g., proximity to water sources) using the following procedure:

- The average density of known prehistoric archaeological sites was measured by environmental strata (landform, vegetation type, access to water, or a combination of these).
- The total areas of the appropriate environmental strata in the ROI were determined.
- The average densities per stratum were multiplied by total area of that stratum within the ROI to estimate potential numbers of resources.
- Prehistoric archaeological sites or districts located in the deployment area and that are listed in or eligible for inclusion in the National Register of Historic Places (NRHP) were identified from the Federal Register. Estimates of the potential numbers of NRHP sites were then made by determining the percentage of known eligible sites within the deployment areas and extrapolating that proportion onto projected site totals.

Historic and Architectural Resources. Prediction of historic resource distributions and impacts was complicated by the fact that quantitative density estimates were less often available. In most cases, professional judgments regarding likely site distributions were based on locational patterns of known sites and on the occurrence of resources appropriate for known historic

activities (e.g., proximity to transportation routes, mineral resources, and surface water).

American Indian Cultural Resources. Existing data and projections of potential American Indian cultural resources from prehistoric and historic cultural resources were used to predict American Indian cultural resources in the ROI. Previous studies have identified six resources important to American Indians:

- Native flora and fauna used for economic and ceremonial purposes;
- Sacred sites and areas (e.g., burials, cremations, and ceremonial rituals);
- Mineral resources;
- Archaeological sites and artifacts;
- Ancestral homelands (traditional use areas); and
- Water.

Previous research indicates that impacts to American Indian resources do not occur solely as a result of destruction of a resource element. Issues of equal concern are the potential for sacred places to be desecrated by the presence of non-Indians, and the reduction of access to traditional use areas or sites. When existing data permitted, potential impacts were assessed according to the following criteria:

- Proximity -- Estimates of the distance of direct impact zones to known or potential resources.
- Accessibility -- Location and extent of the resources in relation to direct impact zones were used as a measure of potential changes in their accessibility.
- Sensitivity -- The sensitivity of resources to damage or loss was used as an indicator of impacts in direct impact zones.

Paleontological Resources. Existing data and projections of likely fossil-bearing formations were used to identify known and estimate potential locations of paleontological resources.

4.5.1.2 Determination of Levels of Impact

Direct impacts will occur to both cultural and paleontological resources during proposed project construction and operations that will result in above and below-ground disturbance. All impacts discussed for cultural resources are considered to be of long duration, even though they may occur in the construction phase of the proposed project. The construction effects are considered to be adverse and permanent because soil disturbances can eliminate a site's potential to yield scientific information. Additional long-term direct impacts may occur during the 20-year operations phase and are considered cumulative. Evaluation of LOI is based primarily on direct impacts, with consideration given to indirect impacts when necessary.

Prehistoric Cultural Resources. The LOIs were determined by estimating the relative numbers of resources within the ROI likely to occur in direct impact areas. The importance of the cultural resource base to the public and to the scientific community is directly related to the number of sites important in the history or prehistory of an area. Such sites are defined as NRHP-eligible properties and are protected by law. The LOI to the resource base is therefore indicated by the number of NRHP-eligible sites in the affected area. Many archaeological sites can be expected to occur in any given region but, because the total numbers of sites in the direct impact areas are unknown, impact assessments have been made by using resource density zones.

In defining LOIs, the relative terms of high, medium, and low density are applied to resource zones. Because of the wide range of variability in resource distributions and quality of existing baseline data among the deployment areas, the modifiers are relative to each ROI. High-density zones at different deployment areas might exhibit different absolute densities and still be high relative to their respective ROIs. Quantitative clarifications of the terms are supplied wherever existing data were sufficient; but, for comparative purposes, general parameters can be outlined for each density level. High-density resource zones usually contain a minimum of ten sites per square mile (sq mi), and densities may be more than three times as high in some areas. Medium densities generally range from five to nine sites per sq mi, and low-density zones contain fewer than five sites per sq mi.

The following four LOIs were assigned:

- Negligible Impact -- No NRHP-eligible resources are likely to be affected.

- Low Impact -- Disturbed areas are small as compared to the total ROI, or, where disturbed areas are larger, low-density resource zones occur over more than 50 percent of the total direct impact area. Few NRHP-eligible sites are expected to be affected, and there is a good potential for avoidance through alternative siting.

- Moderate Impact -- The size of disturbed areas, combined with resource densities, indicates that some NRHP-eligible sites are likely to be affected. High-density zones exist, but moderate to low densities cover more than 50 percent of the disturbed areas.

- High Impact -- Disturbed areas are dominated by high-density resource zones; low density zones cover less than 25 percent of the Random Movement Areas (RMAs) or Suitable Deployment Areas (SDAs). When combined with high resource densities, the deployment configuration severely limits the potential for avoidance, and many NRHP-eligible sites are likely to be affected.

Historic and Architectural Resources. Criteria for LOI determination were the same as for prehistoric resources except that evaluations were more often directed at sites rather than resource zones.

American Indian Cultural Resources. Basic ethnographic and ethnohistorical studies have been conducted throughout the country, and broad-scale background data are available for most proposed deployment areas. Such studies provide

information on tribal distributions and traditional lifeways, but only rarely are data available on the location of specific sacred areas. While it was possible to identify which deployment areas were part of American Indian traditional use areas, it was generally not possible to identify specific resource locations within deployment areas. Such data will be obtainable mainly through site-specific ethnographic surveys. The estimation of resource densities was precluded and a qualitative approach incorporating professional judgment was employed to evaluate potential project-induced changes to American Indian cultural resources. The following four LOIs were assigned:

- Negligible Impact -- No projected changes in the resource other than normal deterioration and no deprivation or reduction in access to resources important to American Indian groups.

- Low Impact -- A slight reduction in the diversity and quality of the resource base that might potentially be restored and that could not diminish access or use for economic, social, or religious purposes.

- Moderate Impact -- A reduction in diversity and quality of the resource that might be restorable and that could temporarily diminish access or use for economic, social, or religious purposes.

- High Impact -- An irreversible or long-term reduction in diversity and quality of the resource that could permanently diminish access or use for economic, social, or religious purposes.

Because of the humanistic component of many resources within American Indian areas, professional judgment was incorporated to assess the more intangible characteristics of the resource.

Paleontological Resources. Paleontological resources LOIs were determined by estimating the relative likelihood of affecting important fossil materials. Paleontological materials are not specifically protected by cultural resources regulations, and formal criteria for evaluating their relative importance do not exist. In practice, paleontological resources are important mainly for their potential to provide new scientific information on paleoenvironments or the evolutionary history of plants and animals. The relative rarity of a resource is also a factor when considering whether the disturbance of a given resource would constitute the loss of important scientific information. In general, vertebrate fossil materials, associated vertebrate and invertebrate remains, and diverse invertebrate assemblages have high research potentials. Deposits with low-diversity invertebrate assemblages or sparse distributions of fossils are less important.

In assigning LOIs, the areal distribution of projected fossil-bearing deposits in the direct impact area was considered in relation to their occurrence throughout the ROI. The following four LOIs were assigned:

- Negligible Impact -- No known or projected resources with high research potential are expected to be affected.

- Low Impact -- Disturbed areas are small relative to the total extent of fossil-bearing deposits in the region, and fossil localities are likely to be widely dispersed. Few resources with high research potential are likely to be affected.

- Moderate Impact -- Important resources are known or projected to occur in the disturbed area, but their distribution indicates that avoidance may be possible.

- High Impact -- Important paleontological localities are known within the disturbed area, and the distribution of the deposits indicates that additional localities may occur in the proposed RMAs or SDAs. The size and/or configuration of the area to be affected suggest that avoidance may be difficult.

4.5.1.3 Determination of Significance

Prehistoric Cultural Resources. The National Environmental Policy Act (NEPA) criteria of context and intensity were employed to assess the significance of potential impacts. A regional data base was used to estimate the numbers and kinds of NRHP resources that might be affected. When possible, estimates of the proportion of the resource base likely to be eligible were obtained from existing reports and overviews. When appropriate data were lacking, the regional research orientations were examined, and types of sites were identified which might provide information relative to those research concerns (Code of Federal Regulations, 36 CFR 60.4[d]). A judgmental assessment of the proportion of those site types in the *ROI* was then made. Potential impacts were considered significant if either of the following conditions applied:

- The proposed project may adversely affect NRHP-eligible resources or may cause loss or destruction of important scientific, cultural, or historical resources; or

- The proposed project could substantially add to existing disturbance of resources in the ROI.

Historic and Architectural Resources. Procedures for determining significance are the same as for prehistoric cultural resources.

American Indian Cultural Resources. Impacts were considered significant if professional judgment indicated that either of the following conditions could occur as a result of the proposed project:

- A potential for affecting known or projected sacred sites; or

- The possibility of reduced access to traditional use areas or sacred sites.

Additionally, where a documented history of American Indian concern for sacred sites was identified, this history was considered noteworthy, and consequently, was a contributor to the significance determination because of the increased likelihood that American Indians may identify previously unknown sacred sites in the area.

Paleontological Resources. The NRHP criteria for identifying eligible resources are not relevant to paleontological materials. The level of importance of various types of fossil occurrences is related to their research potential. The following criteria developed for previous large-scale assessments (Engineering-Science 1985) provided general guidelines for this study. Deposits with a high level of importance/potential include the following:

- Areas with a formation containing numerous vertebrate fossil localities and/or specimens, particularly if the specimens represent a diverse vertebrate assemblage;

- Areas with a formation containing associated vertebrate and invertebrate or plant fossil localities and/or specimens;

- Areas with a formation containing vertebrate specimens representing comparatively rare species; and

- Areas with a formation containing abundant, diverse invertebrate assemblages.

4.5.2 Impacts Common to All Locations

Analysis and characterization of project impacts incorporate the key assumptions conditioning the level and significance of impact assessments. These assumptions include assessments about reliability of current inventory data, and statements about variability in ongoing, nonproject-related effects on resources. These assumptions are the following:

- Existing secondary data provide a reasonable approximation of the kinds of resources that may be expected to occur in areas where inventory data are lacking; and

- Unrecorded or unevaluated resources may exist within the ROI that possess important scientific and/or humanistic values making them eligible for inclusion in the NRHP.

Impacts to cultural and paleontological resources result from ground disturbance during a proposed project's planning, construction, and operations phases. Sources of impacts include, but are not limited to, excavation for structures, building of access roads and fences, and vandalism and/or unauthorized artifact collecting. Since cultural resources are nonrenewable, all impacts are considered to be of long duration.

Sites on or near the surface in sand or desert pavement areas may be disturbed or destroyed through crushing from the weight of the Hard Mobile Launcher (HML) and/or churning of the surface from the wheels or tracks. In addition, hearth material could be disturbed so that radiocarbon dating techniques could not be used. When artifacts are moved and their provenience can no longer be ascertained, a site's integrity is destroyed, thereby reducing its research potential. Mitigative measures for NRHP-eligible sites could include avoidance of areas fenced for their protection. However, in other high-density areas, suitable mitigation might involve data recovery such as mapping, surface collection, or excavation.

Generally, historic and architectural resources eligible for or listed in the NRHP are located in urban or well-developed areas outside of the RMAs. The NRHP properties in the RMA can probably be posted or fenced for avoidance and when such measures are taken, impacts are expected to be negligible or low.

Potential impacts to paleontological resources may occur as a result of off-road HML operations and include crushing, breaking, and/or displacing the material. In most proposed deployment areas, it should be possible to avoid fossil localities through alternative siting.

Few direct impacts to American Indian cultural resources are expected since current access conditions should not be affected by the proposed project. However, American Indian concerns may be high in some areas. Should concerns arise, consultation will be undertaken with appropriate groups of American Indians to determine mitigation measures.

Impacts to resources used by or of concern to contemporary American Indians are of two primary kinds: ground disturbance associated with construction and pilfering by people who have temporary access to previously restricted areas. Native flora and fauna traditionally used for religious ceremonies and food, medicine, and construction materials may be affected by proposed project construction and operations. Sacred and ceremonial areas, such as mountain peaks, springs, petroglyphs, and archaeological sites, may lose their value as a result of intrusion by persons other than American Indians. Such intrusions can be difficult to anticipate because knowledge of sacred areas is privileged information which is usually closely guarded from outsiders. The potential exists to affect sacred sites not yet known to the scientific community. The type of impact varies by basing mode, including damage caused by off-road movement of the Hard Mobile Launcher in Random Movement basing mode and construction or widening of existing roads in the Hard Mobile Launcher at Minuteman Facilities basing mode.

Possible mitigations consist of measures to avoid or lessen impacts to significant NRHP-eligible or listed cultural resources and important paleontological materials. The principal form of possible mitigation is to avoid sites and areas of known cultural or religious significance. There is evidence that avoidance and protection procedures developed by the U.S. Army for use at Fort Bliss, Fort Irwin, Fort Hood, and Fort Lewis are effective, even though extensive off-road tracked vehicle traffic occurs. Off-limits districts are defined around large clusters of significant resources and are protected in a variety of ways. Off-limits areas are blocked out on all field operations maps and they can also be incorporated into the electronic tracking system for individual vehicles. Additionally, districts are protected by a combination of posted warnings, fences, tank obstacles, ditches, and berms. Field operations are monitored regularly to identify any unnecessary environmental damage. The procedures have been successful, and with appropriate modifications, could provide a useful model for a similar approach to Small ICBM deployment operations. Additional mitigative measures may include surface data recovery, excavation, and interpretive programs.

Long-term, beneficial impacts to prehistoric resources may occur as a result of the Environmental Impact Analysis Process (EIAP). In some areas, evaluation of regional and site-specific data may involve the synthesis of results from a variety of smaller, unrelated studies. The results of any

preconstruction field surveys will expand the regional data base, and some sensitive areas now open to the public may be fenced and protected (especially near Hard Silo facilities).

4.5.2.1 Hard Mobile Launcher in Random Movement

For the 200-missile alternative locations, construction of proposed project facilities is expected to permanently disturb 7,910 acres of land (610 acres at the Main Operating Base [MOB] and 7,300 acres at the deployment area). An additional 14,690 acres (1,510 acres at the MOB and 13,180 acres at the deployment area) will be disturbed by construction. Over the 20-year life of the proposed project, off-road HML operations are expected to disturb 175 to 350 sq mi in the RMA.

For the 50-missile alternative locations (Florida and Washington complexes), construction is expected to permanently disturb 2,480 acres of land (390 acres at the MOB and 2,090 acres at the deployment area). An additional 4,500 acres (1,440 acres at the MOB and 3,060 acres at the deployment area) will be disturbed during construction. Over the 20-year life of the proposed project, off-road HML operations are expected to disturb 50 to 100 sq mi in the RMA, including plowing or grading associated with parking of the HML in hardened, ground-hugging configuration. Long-term impacts may occur when small areas of land are disturbed for construction of communication towers.

The HML operations may occasionally be extended into the Command Dispersal Area of each deployment installation, an additional area approximately equal in size to the RMA. These operations will result in the same type of disturbance as for normal operations in the RMA. The impacts will be minor in comparison to those of normal operations, however, because use of the Command Dispersal Area will be very infrequent and of short duration. Use of the Command Dispersal Area will be addressed as a site-specific issue in the next tier of analysis.

Off-road operation of HMLs in the RMAs is expected to cause substantial impacts to prehistoric cultural resources, especially in the Arizona, Nevada, New Mexico, and South-Central California complexes, where resource densities are high. Impacts to other cultural resources will vary by location.

4.5.2.2 Hard Mobile Launcher at Minuteman Facilities

For the 200-missile alternative locations (Malmstrom and F.E. Warren Air Force Bases [AFBs]), construction of proposed project facilities is expected to permanently disturb 2,260 acres of land (400 acres at the MOB and 1,860 acres in the deployment area). An additional 1,140 acres will be disturbed during construction at the MOB and 100 acres in the deployment area. At locations where 170 HMLs will be deployed, construction is expected to disturb 1,870 acres permanently and an additional 1,240 acres during construction.

Although no off-road HML movements are projected, direct impacts may occur at all locations if road widening and additional MOB facility construction take place. Possible beneficial impacts may occur. Surveys in previously unknown areas will add to the data base, and some sites may be protected by fences or through avoidance. Where excavation is necessary, the recovered materials may yield scientific information important in prehistory and history.

Presently unknown and potentially NRHP-eligible sites may be discovered during construction of facilities at the MOB or by road modification. Possible mitigative measures for such sites are recordation, excavation and recovery, and analysis of artifacts, as appropriate.

4.5.2.3 Hard Silo in Patterned Array

Construction of silos and related facilities is expected to permanently disturb 18,000 acres of land in the deployment area. An additional 1,700 acres (740 acres permanently, 960 acres temporarily) of land is expected to be disturbed by construction at the MOB.

High known site densities at Davis-Monthan AFB, Yuma Proving Ground (PG), and Fort Bliss suggest that direct impacts to NRHP-eligible resources will occur. The most likely impact is damage to or destruction of an NRHP-eligible site during site and facility construction, thereby reducing or eliminating its value to the data base.

Impacts to cultural and paleontological resources caused by ground disturbance during construction are expected to range from negligible to low because alternative siting is possible within the deployment areas, thereby permitting avoidance of known sites. If a site is discovered during construction, it may be possible to move to another area; if avoidance is not possible, excavation will be necessary.

4.5.3 Impacts of Hard Mobile Launcher in Random Movement

4.5.3.1 Arizona Complex

Regardless of whether Gila Bend Air Force Auxiliary Field (AFAF) or Yuma PG is selected as the MOB for this complex, impacts to prehistoric cultural resources will be high and significant because of known and/or predicted high site density. Potential impacts to American Indian cultural resources and paleontological resources will also be high and significant. Impacts to historic and architectural resources are expected to be negligible.

Prehistoric Cultural Resources. The RMA contains upper alluvial/colluvial fans, upper bajada zones, playas adjacent to washes, and springs and other water sources which are also the locations of highest site density. Alluvial/colluvial fans make up approximately 65 percent of the RMA on Luke Air Force Range (AFR) and 66 percent of the RMA on Yuma PG. The RMAs at both installations contain numerous northwest-southeast trending mountain ranges which are unsuitable for HML operations. On Luke AFR, the Gila, Tinajas Altas, Mohawk, Growler, Cabeza Prieta, Sierra Pinta, and Sand Tank mountains comprise 27 percent of the RMA. At Yuma PG, the Trigo, Muggins, Tank, and Dome Rock mountains constitute 32 percent of the RMA. With so much of the RMA consisting of steep terrain, HML movement will be more concentrated in the remaining areas, precisely those with high site densities.

Few surveys have been completed in the Arizona Complex (13% of Yuma PG in the northwest and southern portions of the base; an undetermined but small amount on Luke AFR, none at Gila Bend AFAF); therefore, the data are sufficient to make only general predictions of expected site density. On Luke AFR, more than 75 percent (approximately 80 sites) of the recorded sites are within the RMA,

and on Yuma PG, 66 percent (137 sites) of the known sites are within the RMA. Site density at Yuma PG may be estimated based on two surveys. The U.S. Army Corps of Engineers (COE) surveyed a 4-kilometer (km) long and 400-meter wide rectangle in 1984. During that survey, 92 sites and 4 trails were recorded, all located on desert pavement. All of these sites appear to be eligible for inclusion in the NRHP. The second report is the Yuma District Plan prepared by the Bureau of Land Management (BLM), which documented site densities ranging from 1 site per acre near the Colorado River to 0.04 per acre on interfluvial plains, for an average density of 25 per sq mi throughout the district.

At Luke AFB, a linear survey of two trench segments and a buffer zone located 45 sites and 36 isolated finds in the upper bajada zone (pediment) on the eastern side of the Mohawk Mountains. Highest site density was found in this area just below and against the mountains. Lowest site density was found in the valleys where playas are located, and scouring and erosion are more frequent.

The occurrence of similar topography throughout the region suggests that an equally large number of unknown prehistoric archaeological sites can be expected in the RMA, and the potential for disturbing some NRHP-eligible sites and/or districts may be high. Off-road movement of the HMLs could cause damage to archaeological sites, particularly in areas of sand, light-weight soils, and desert pavement (e.g., those in this RMA), which are especially sensitive to crushing or churning by heavy weight or repeated use by off-road vehicles. Although day-to-day HML activities will occur within an 8-sq-mi operating area, random movement in that area will make avoidance of archaeological sites difficult. It may be possible to relocate some operating areas, but high site densities are projected for most of the RMA, and many sites are likely to be affected regardless of attempts at alternative siting. Potential impacts to NRHP-eligible prehistoric resources in the Arizona Complex are projected to be high and significant.

Historic and Architectural Resources. Approximately 50 historic sites or districts in the ROI are eligible for or listed in the NRHP. A total inventory has not been made, and presently unrecognized NRHP-eligible architectural structures probably exist. Most of these structures are located in urban areas outside the RMA. The remaining sites, both known and unknown, will probably be subjected to negligible impacts either because avoidance is possible or because they are located outside the RMA. A historic trail, El Camino del Diablo, is listed in the NRHP; a portion of it falls within the RMA of Luke AFR. If a portion of this trail were destroyed, the effect may be adverse and significant. Otherwise, impacts to historic and architectural resources will be negligible.

American Indian Cultural Resources. Some potential sacred or ceremonial areas have been identified in the ROI. Potential sacred areas may be found within the RMA, specifically on Yuma PG, which contains Tyson Wash (ethnobotanical areas) and La Posa Plain (petroglyph sites, trails, mines, and nests of sacred birds); both are areas traditionally held sacred by Colorado River Indians. American Indian groups have not had recent access to Luke AFR and Yuma PG, and it is difficult to identify specific sacred sites. However, generalizing from areas on or near reservations, potential sacred areas may include mountain peaks, springs, petroglyph sites, and large prehistoric sites. Within

50 miles are the Dome Rock Mountains petroglyphs, considered sacred by the Colorado River Indians, and the Kofa Mountains, also considered important to the Colorado River Indians, Maricopa, and Yavapai because of the rock art sites and sacred areas. Disturbance of such areas may destroy their value for ceremonial or religious purposes, an impact that will be considered high and significant.

Paleontological Resources. Numerous paleontological resources exist in the ROI with known resources throughout Yuma County. Quaternary Pleistocene vertebrate assemblages are exposed in unconsolidated deposits between mountains, while Miocene-age invertebrates and terrestrial plants have been exposed in deep washes. Off-road movement of the HMLs could destroy vertebrate fossils that are on or near the surface. Although a relatively small number of vertebrate faunal localities occur in the complex, most are located within the RMA. In this particular case, the opportunities for avoidance through alternative siting appear to be limited. Since it is not clear that avoidance will be likely, impacts are projected to be high. Impacts to Pleistocene vertebrate materials will be significant because of their high research potential.

4.5.3.2 Florida Complex

Impacts to prehistoric cultural resources and historic and architectural resources will be moderate and significant. Impacts to American Indian cultural resources and paleontological resources are projected to be low and significant.

Prehistoric Cultural Resources. Landforms in the ROI include coastal zones along Choctawhatchee Bay, upland/lowland ecotones or transitions along the Yellow River, and areas close to potable water such as Point Lookout Creek and Alaqua Creek. Prehistoric resources are distributed primarily along coastal zones, at upland/lowland transitions in bay and river settings, and in areas within 150 meters of potable water sources such as rivers, streams, springs, and seeps. About 12 percent of the ROI has been inventoried for cultural resources and 368 sites have been recorded. Approximately 3,066 sites may occur in the entire ROI. No prehistoric sites are listed in the NRHP but 34 sites and the Basin Bayou Historic District, which includes 15 prehistoric sites, may be potentially eligible for the NRHP. Since about 13 percent of the data base represents potentially NRHP-eligible sites, an estimated 398 prehistoric sites in the ROI may be eligible for the NRHP. Most of these sites are likely to occur in high and medium-density zones.

High-density resource zones in the RMA consist of coastal areas on East Bay, upland/lowland transitions along the Yellow River and Choctawhatchee Bay, and upland areas within 150 meters of Choctawhatchee Bay. Site densities are estimated at approximately 31.8 sites per sq mi for these high-density zones. The RMA has higher proportions of high and medium-density resource zones (about 50%) than the ROI as a whole (35%). The high-density zones comprise 25 percent or about 77 sq mi of the RMA and are likely to yield a large number of NRHP-eligible sites. Medium-density zones, also about 25 percent of the RMA, consist of the Yellow River floodplain, the Yellow River upland areas less than 150 meters from water, and the East Bay coastal lowlands and upland/lowland transition. Site densities for medium-density zones are estimated at 5.04 sites per sq mi. Low-density zones in the RMA (about 50%)

consist of Yellow River, East Bay, and Choctawhatchee Bay uplands more than 150 meters from water, where site densities are estimated at 0.58 sites per sq mi.

The LOI is considered moderate since 50 percent of the RMA contains medium and high-density resource zones with some low-density areas providing the potential for alternate siting. Road construction activities and base facility modifications may disturb prehistoric resources through excavation. Impacts are considered significant because they could affect those areas likely to contain the highest proportion of potentially NRHP-eligible sites.

Historic and Architectural Resources. Historic resources are distributed primarily as isolated settlements along valleys such as the Yellow River and Alaqua Creek, and lumber camps and communities located near the heads of drainages. No historic or architectural resources are listed in the NRHP but three historic sites and the New Home Historic District have been suggested as being potentially eligible for the NRHP. Approximately 6 percent of the 191 recorded historic sites have been determined potentially eligible.

Most historic and architectural sites will occur along river and stream valleys, such as the Yellow River, which are likely to contain a higher proportion of potentially NRHP-eligible sites. Even though valleys make up most of the ROI, impacts are projected to be moderate since relocation into low-density areas may be possible. Impacts to historic and architectural resources are considered significant because of the potential to disturb NRHP-eligible sites.

American Indian Cultural Resources. Portions of the ROI have been occupied or used by Chatot, Apalachee, Amacano, Caparaz, Chine, Oconee, Tamathli, Yuchi, Pensacola, Yamassee, Cherokee, Choctaw, Creek, Koasati, and Seminole tribal groups. Very little site-specific ethnographic inquiry has been conducted for the ROI, and no known American Indian cultural resources have been identified. However, the Trail of Tears, the route of forced removal of southeastern Indian groups, is located along the northeast portion of the RMA, and sacred or burial areas associated with the trail may exist. In recognition of the potential that some areas of concern may be identified, and that a slight reduction in the quality of the resources could occur, impacts are projected to be low. Impacts to American Indian cultural resources will be significant if sacred sites are involved.

Paleontological Resources. Existing resource summaries for Eglin AFB contain incomplete references to one 60-acre fossil bed. However, most outcrops in the area are of the Citronelle Formation, a virtually unfossiliferous sandstone deposit. Without a more complete description of the reported fossil bed, its potential is difficult to evaluate. If the deposits shown on the base are Citronelle Formation, impacts will be negligible. If they contain the underlying Miocene strata with their diverse invertebrate assemblages, impacts will be low and significant.

4.5.3.3 Nevada Complex

Regardless of the MOB selected for this complex, impacts to prehistoric cultural resources will be moderate and significant. Impacts to historic and architectural resources will be low and significant. Low and significant

impacts may also be expected for American Indian cultural resources and paleontological resources.

<u>Prehistoric Cultural Resources</u>. Prehistoric site densities in the Nevada Complex ROI range from a low of 4 sites per sq mi in desert scrub areas to a high of 38 per sq mi in upland pinyon-juniper areas. Approximately 1,700 sites have been recorded in only 3 percent of the ROI, and it can be projected that a total of more than 150,000 archaeological sites remain to be recorded within the complex. Only two known prehistoric sites, or less than 0.2 percent of the total recorded sites, are listed in the NRHP. More NRHP-eligible sites probably occur within the ROI because NRHP sites appear to be underrepresented in the area. The NRHP-listed Sheep Range Archaeological District is located adjacent to the entire eastern boundary of Nellis AFR, in a pinyon-juniper zone expected to contain large numbers of sites.

The RMA of Nellis AFR includes mountain areas (29.79%), alluvial/colluvial fans (40.44%), hills (13.28%), and smaller percentages of lacustrine plain, shallow colluvial valleys, lava flows, plateaus, and playas. The archaeologically sensitive pinyon-juniper vegetation zone comprises 19.8 percent of the Nellis AFR RMA and 22.4 percent of the Nevada Test Site RMA. The RMA of Nellis AFR South duplicates the approximate percentages of resource density zones found in the entire ROI (10% high-density resource zone, 25% medium, and 65% low). The only two NRHP sites on Nellis AFR, Tim Springs Petroglyph Site and Pintwater Cave (nomination pending), are located in the Pintwater Mountains and are excluded from the RMA. The likelihood of finding additional NRHP-eligible sites in similar terrain exists, but they will also be outside the RMA in this portion of the ROI. The RMA of Nellis AFR North contains a higher proportion of high (approximately 35%) and medium-density (20%) resource zones than Nellis AFR South. Most of the playas are excluded from the RMA, but a large part of the Kawich Mountain Range on the north side of Nellis AFR North is included. The highest site densities and greatest potential for NRHP sites occur in these upland areas. Landforms other than mountains in the RMA have lower site densities but may have areas of high site density near water sources (playas, springs, and ephemeral washes). The potential exists for encountering some NRHP-eligible sites within the RMA, but sufficient low-density areas occur so that avoidance will be possible.

Within the Nevada Test Site, the RMA contains the highest proportion (approximately 50%) of high-density resource zones within the Nevada Complex. This is due to the inclusion of portions of the Belted and Kawich ranges and the playa on Frenchman Flat, where high-density archaeological resources could occur; other playa and mountainous areas are excluded from the RMA. Approximately 30 percent of the RMA lies within zones expected to contain low resource densities. Nellis AFB is located entirely within a low-density resource zone, so the likelihood of encountering NRHP-eligible prehistoric sites is negligible. Although Nellis AFB is excluded from the RMA, possible impacts could occur as a result of additional base construction. The base has not been surveyed for archaeological resources.

Indian Springs AFAF is also excluded from the RMA, but impacts could occur as a result of base construction, if it is selected as the MOB. It is estimated that these impacts will be high and significant because Indian Springs is located on the southern boundary of the installation. Complex, large, prehistoric sites are known to occur near springs, and the area of Indian

Springs AFAF is small enough that relocation of any additional construction in order to avoid impacts may be difficult.

Potential impacts to prehistoric resources in various parts of the Nevada Complex are projected to be moderate because high prehistoric site densities may exist in portions of the RMA, but sufficient low-density areas may provide alternative siting locations to avoid some impacts. The impacts will be significant because NRHP-eligible sites will occur in some portions of the RMA.

Historic and Architectural Resources. Relatively few historic sites have been encountered and recorded within the Nevada Complex and only one, a portion of the Emigrant Trail, is listed in the NRHP. This early road, only portions of which have been documented, is within the RMA and could be adversely affected. Sites such as this which are associated with events that have made a significant contribution to the broad patterns of national or regional history (Code of Federal Regulations, 36 CFR 60.4[a]) are considered significant sites. The LOI for historic and architectural resources for the Nevada Complex is projected to be low because few historic sites are represented within the total site count in the ROI. However, these resources may be significant historically as they may either be associated with important historic events or represent distinctive characteristics of a historic type, period, or method of construction.

American Indian Cultural Resources. Some areas of potential importance to the Western Shoshone or Southern Paiute are located within the Nevada Complex ROI. Substantial areas of pinyon-juniper forests exist in the ROI that are likely to have been a traditional resource zone for Indians in the area. Although the pinyon-juniper resource zone is duplicated outside the RMA, specific pinyon localities are only productive every few years, and a large forest area was typically exploited. Given the likelihood that some portions of the RMA were traditional resource zones, the possibility also exists that sacred areas may be identified within the RMA. No reservations are located near the ROI, but some Paiutes live on reservations in nearby Las Vegas and the Moapa Valley. Recent site-specific ethnographic studies near the ROI have established a precedent for working with the Paiute in identifying areas important to them, and they could express concern over the proposed project. Potential impacts to American Indian cultural resources are estimated to be low because of the potential for affecting a few sacred or economic areas. Impacts will be significant if sacred sites are affected. Additionally, there is a history of concern on the part of American Indian groups in the area.

Paleontological Resources. The Tule Springs Paleontological Locality, a Pleistocene vertebrate deposit containing mammoth, horse, bison, and camel, is 10 miles southeast of Nellis AFR. Similar Pleistocene vertebrate materials, important because of their scarcity, could also occur within the ROI. Consequently, low and significant impacts are projected.

4.5.3.4 New Mexico Complex

Impacts to prehistoric cultural resources will be high and significant. Impacts to historic and architectural resources will be low and not significant for Holloman AFB and White Sands Missile Range Headquarters. Impacts to historic and architectural resources at Fort Bliss will be low and

significant. Moderate and significant impacts to American Indian cultural resources are projected, and paleontological resources will experience potentially high and significant impacts.

Prehistoric Cultural Resources. The RMA contains arroyos, small shallow playas on basin floors, and alluvial/colluvial fans which are also the locations of highest archaeological site density. Alluvial/colluvial fans make up approximately 30 percent of the RMA on Fort Bliss and 40 percent of the RMA on White Sands Missile Range. On Holloman AFB, approximately 77 percent of the RMA is alluvial/colluvial plain. Site density is similar on alluvial fans (6.5 per sq kilometer [km]) and basin floors (6.2 per sq km), but in general, larger and more complex sites (e.g., pueblos, pithouse villages, and long-term base camps) are located on alluvial fans. The fans are likely to contain most of the NRHP-eligible sites in the RMA because of the greater potential for complex sites to yield relevant scientific information. Equally detailed data are not available for White Sands Missile Range and Holloman AFB, but it is reasonable to expect similar densities based on topographic features. At Fort Bliss, 36 areas have been designated "limited use" areas. They are protected from impacts during tracked vehicle training exercises, and have proven to be a workable method of archaeological site and/or district avoidance. Similar measures may be feasible in the future as one means of mitigating impacts to NRHP-eligible sites.

Given known site counts in excess of 11,000 and predictions of from 50,000 to 100,000 unrecorded sites in the complex, HML movements could destroy or damage a large number of sites causing the potential impacts to be high. Off-road movement of the HMLs could cause damage to archaeological sites, particularly in areas of sand or light-weight soils such as those found in this complex. More high-density areas are known to exist at Fort Bliss than at White Sands Missile Range and the rest of the ROI because a larger area of Fort Bliss has been surveyed. The high-density zones comprise approximately 55 percent of the RMA and are likely to yield a large number of NRHP-eligible sites. Approximately 2 percent (240) of the known sites have been determined eligible for inclusion in the NRHP. Therefore, it is possible to predict that up to an additional 2,000 NRHP-eligible sites may occur in the New Mexico Complex.

Impacts related to construction at the base and in the deployment area will probably be moderate because avoidance of archaeological sites is possible. However, impacts from HML movements could be high because random off-road travel is likely to affect large numbers of NRHP-eligible sites. Previously proposed large-scale military projects in the region which involved extensive ground disturbance have caused a high level of public concern. When Border Star '81, a military training exercise, was proposed, the local archaeological society threatened a suit which resulted in a Programmatic Memorandum of Agreement (PMOA) signed by the Advisory Council on Historic Preservation, Fort Bliss, U.S. Army Training and Doctrine Command, the Texas and New Mexico State Historic Preservation Officers, and the Department of the Army. The PMOA called for an Historic Preservation Plan for Fort Bliss (subsequently released in 1982), guidelines for future exercises, monitoring of ground-disturbing activities, and compliance with the National Historic Preservation Act's Section 106 procedures. This latter stipulation effectively excluded McGregor Range from the Border Star '81 exercise, thereby protecting its resources until the planning stage could be completed with establishment of the base

preservation plan. Impacts to NRHP-eligible prehistoric resources in the ROI are projected to be high and significant.

Historic and Architectural Resources. Approximately 20 historic sites or districts in the ROI have been determined eligible for or listed in the NRHP. Although a total inventory has not been made, more than 100 historic sites have already been identified. As many as 60 of these sites may be eligible for the NRHP. However, most of the historic sites are structures located in urban areas outside the RMA and avoidance is possible. Some destruction caused by off-road HML movements could occur to historic trails. Overall, the impacts to historic and architectural resources will be low because of the possibility of avoidance. These impacts will not be significant except at Fort Bliss.

American Indian Cultural Resources. A rock formation called tsedazei, known to be sacred to the Mescalero Apache, is within the RMA. Other sacred areas are a playa in the gypsum sands near Holloman AFB, and two mountains, San Augustin and Salinas peaks. Similar areas, presently unidentified, may exist. White Sands Missile Range and Holloman AFB were the homeland of the Mescalero Apache for many years, and their reservation is outside the ROI, 17 miles to the northeast. Disturbances to sacred areas could destroy their value for ceremonial or religious purposes; such impacts are permanent and will be significant.

Neither tsedazei nor the gypsum sands area is expected to be disturbed by HML movements. However, impacts to American Indian resources not yet identified, in the form of disturbance to sacred sites, is possible, especially during the operations phase. The researchers whose work identified the known sites mentioned here are aware of other sacred areas which have yet to be documented in print. Nevertheless, sacred areas are most likely to be located in mountain zones outside the RMA. Overall, impacts to American Indian cultural resources, if they occur, are expected to be moderate and significant.

Paleontological Resources. Numerous paleontological resources exist in the ROI. The only known resource within the RMA is on the western margin of pluvial Lake Otero on White Sands Missile Range. Megafauna footprint casts are eroding from the gypsum deposits, and fossiliferous material has been recorded in arroyo cuts. Off-road movement of the HMLs could destroy materials that are on or near the surface; such impacts could be high and significant. Known resources on Fort Bliss are in the Franklin Mountains, outside of the RMA, where there is no potential impact. Overall, the impacts to known paleontological resources will be high and significant if the rare vertebrate deposits on the White Sands Missile Range are affected.

4.5.3.5 South-Central California Complex

Regardless of whether Edwards AFB or Fort Irwin National Training Center (NTC) is selected as the MOB for this complex, impacts to prehistoric cultural, historic and architectural, and American Indian cultural resources will be moderate and significant. Impacts to paleontological resources will be low and significant.

Prehistoric Cultural Resources. Site densities within the resource density zones for the South-Central California Complex range from zero to 4, 4 to 8,

and 8 to 22 per sq mi for low, medium, and high-density zones, respectively. High-density areas occur around playas and springs, in upland pinyon-juniper zones, near key resources like the Sugarloaf Mountain obsidian source, and in the extensive petroglyph canyons of China Lake Naval Weapons Center (NWC). Medium-density areas are defined in buffer zones within 1 to 2 miles of springs, or 1 mile of ephemeral washes and on pediment, alluvial/colluvial fans, and plains with ephemeral or permanent water sources. All other areas are low-density zones.

The RMA within the complex is located on alluvial/colluvial fans, shallow colluvial valleys, hills, pediments, dry playas, lacustrine plains, and some mesa tops, buttes, and mountains. Landform percentages within the RMA vary from base to base. On Fort Irwin NTC and Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC), fans comprise the majority of the landscape (61.7% and 73.9%, respectively), followed by hills (12.4% and 13.2%) and mountains (15.9% and 7.6%). On Edwards AFB, alluvial/colluvial fans (27.7%), pediments (29.7%), and lacustrine plains (30.3%) comprise the major percentages of RMA landforms. Mountains (50.6%), fans (29.1%), pediments (4.5%), and hills (5.3%) form the RMA landforms of China Lake NWC. Alluvial/colluvial fan and plain, lacustrine plain, and pediment landforms contain high archaeological site densities near water or lithic raw material sources.

Within the RMA of China Lake NWC, the approximate percentages of high, medium, and low-resource zones are 25, 25, and 50 percent, respectively. This distribution is similar to that found throughout the ROI where high-density zones comprise 20 percent; medium, 25 percent; and low, 55 percent. Approximately 8 to 10 percent of China Lake NWC has been surveyed for archaeological resources, with much of it directed at investigating early man in North America. Predictions, based on landform and hydrology, can be made for resource density zones on the remainder of the installation. High-density areas outside the RMA include some of the extensive petroglyphs in Big and Little Petroglyph Canyons (National Historic Landmarks also listed in the NRHP), most of the lava areas where similar petroglyphs may occur, most playa edges where high-site densities could occur, and pinyon-juniper zones near Maturango and Coso peaks. Coso Hot Springs, a NRHP site, is within the RMA. Some projected high-density resource areas such as springs, and some intermittent washes are included within the RMA. The extremely dense prehistoric site areas around the obsidian sources of Sugarloaf Mountain and portions of Big and Little Petroglyph Canyons are within the RMA and will be affected.

The Mojave B Range of China Lake NWC contains fewer high-density resource areas (5%) but more medium-density resource zones (50%) within the RMA than China Lake NWC. Most of Panamint, Superior, and Pilot Knob valleys, and most springs within the installation, are excluded from the RMA. Some springs are included as well as some portions of the Slate Range, where archaeological sites within the RMA of the Mojave B Range exist.

More archaeological survey and excavation has been conducted for Fort Irwin NTC than for any other installation within the complex; 20 percent of the base has been examined for archaeological resources. The RMA on Fort Irwin NTC excludes most playa edges (except for Goldstone Lake), some springs (Garlic, Drinkwater, Leach, and Desert King), and Tiefort Basin, where archaeological site densities may be high. Included within the RMA are Bitter, Cave,

Arrestre, and Jack Springs, where site densities are probably high and possibly eligible for the NRHP; Bitter Springs is already listed in the NRHP. The proportion of high-density resource zones likely to be affected by HML activities is low (5% of the total RMA area), while medium-density zones comprise 45 percent of the RMA. It is likely that some NRHP-eligible sites will be affected.

On Edwards AFB, most playas are excluded from the RMA, but some playa edges could be affected. Approximately 8 percent of the base has been surveyed for archaeological resources, allowing for generalizations to be made regarding resource distribution on the remainder of the base. Slightly more low-density resource zones (65% of the total RMA) appear on Edwards AFB than on other installations within the complex; therefore, avoidance of high and medium-density zones may be possible. The potential exists for affecting some NRHP-eligible sites on Edwards AFB, but it is not expected to be high.

No archaeological surveys have been conducted on Twentynine Palms MCAGCC. Resource density projections in this area are based solely on work in adjacent areas. The installation appears to have few high-density resource zones (5%), but approximately 50 percent of the RMA contains medium-density zones. The potential exists for extensive petroglyph sites, such as those found on China Lake NWC, to be identified where similar terrain and basalt flows are found. Most mountainous areas are excluded from the RMA except for the Argos Mountains. Some playa shores are excluded, but numerous intermittent streams where archaeological sites could occur are included in the RMA. Because little archaeological work has previously been conducted within Twentynine Palms MCAGCC, more preliminary archaeological surveys may be necessary than for other bases within the complex. The potential exists for affecting some NRHP-eligible sites within the installation.

Installations within the complex have 5 to 25-percent high-density resource zones within the RMA. Medium-density resource zones range from 25 to 50 percent of the total RMA. All installations have some low-density resource zones (45-65%) and avoidance of some medium or high-density resource zones in all installations is possible.

Overall potential impacts to prehistoric cultural resources are projected to be moderate, except for China Lake NWC, because some high and medium-density resource zones may be adversely affected. At China Lake NWC, impacts to prehistoric resources will be high because of the potential to affect known NRHP and National Historic Landmark sites within the RMA. Additionally, the smaller area of low-density zones reduces the potential for avoidance. Impacts will be significant because some regions with high densities of NRHP-eligible sites occur in the RMA, such as the Sugarloaf Mountain obsidian quarries and Big and Little Petroglyph Canyons within China Lake NWC, playa areas in Edwards AFB, and springs within Fort Irwin NTC and Mojave B Range of China Lake NWC. Professional concern over the research potential of sites in this complex has resulted in close scrutiny of current cultural resource investigations within this complex.

Historic and Architectural Resources. Historic trails cross some portions of the complex (e.g., Fort Irwin NTC, China Lake NWC, and Edwards AFB), and historic mines occur on all the installations. Some identified NRHP-eligible historic sites are located on Fort Irwin NTC such as Crackerjack and Avawatz

historic site areas. Most of the Avawatz Historic District is outside the RMA, but some of the associated mines and structures may be within the RMA and may be directly affected. Coso Hot Springs, listed in the NRHP, is within the RMA on China Lake NWC and may be affected. Amity and Early springs, both historic and potential NRHP sites, are outside the RMA on China Lake NWC. Rogers Dry Lake, a National Historic Landmark and NRHP site, is outside the RMA and will not be affected. Other potential NRHP-eligible historic sites may be within the RMA. Potential impacts to historic and archaeological resources will be moderate and significant because of the potential for affecting NRHP-eligible properties. The high level of professional concern for prehistoric sites in the ROI extends to historic properties as well.

American Indian Cultural Resources. Some areas important to American Indian groups (Panamint Shoshone, Northern Paiute, Kitanemuk, Serrano, Kawaiisu, Tataviam, Mojave, Gabrielino, Vanyume, and Chemehuevi) known to have inhabited portions of the complex have been identified. Although no ethnographic investigations have been conducted on most of the bases within the complex, some have been completed for Coso Hot Springs on China Lake NWC because of its importance to the Koso (Panamint Shoshone). This important site is within the RMA. Other areas such as mountain peaks, trails, caves, springs, or burial and cremation sites may be affected within the RMA. Impacts to American Indian cultural resources are expected to be moderate because of the potential for identifying additional sacred and traditional use areas. There is a correspondingly greater chance of effects resulting in a reduction of the quality of the resource. Impacts are judged to be significant because of the potential to affect some areas important to American Indian groups in the area and their history of expressing concern over areas important to them.

Paleontological Resources. Some Pleistocene paleontological resources have been identified along relict shorelines on installations in the Mojave Desert. These include diverse vertebrate fossil remains around China Lake on China Lake NWC and the important middle Miocene Barstow Formation near China Lake NWC and Fort Irwin NTC. Similar deposits could also occur within the ROI. Potential impacts to paleontological resources are expected to be low because a few recorded paleontological resources within the RMA may be affected. All playas with China Lake NWC are outside the RMA and will not be affected. They will be significant because vertebrate remains are rare and considered important paleontologically.

4.5.3.6 Washington Complex

Impacts to prehistoric cultural resources will be moderate and significant. Historic and architectural resources will be subjected to low and not significant impacts. Potential high and significant impacts could occur to American Indian cultural resources. Impacts to paleontological resources will be low and significant.

Prehistoric Cultural Resources. Most known prehistoric sites (including NRHP sites) are located on the lower benches, islands, and alluvial flats on the Columbia River, which is also the area projected to be of highest prehistoric resource density. Deep, stratified sites are also more likely to occur near the Columbia River and are the most likely candidates for inclusion in the NRHP (7 of 9 current NRHP sites in the area are on the Columbia River). The potential for some NRHP sites to be located on upland plains away from the

Columbia River exists, but there are fewer sites in such areas. The Columbia River floodplain is a key environmental zone that provides a focus for cultural resources in the ROI. To the extent that the floodplain zone is affected, impacts to rare or NRHP-eligible properties in this area will be significant. The RMA of the Department of Energy (DOE) Hanford Site and Yakima Firing Center (FC) both contain portions of the Columbia River floodplain, and the proposed project may potentially affect this important resource zone.

Approximately 8 percent of the DOE Hanford Site and 14 percent of Yakima FC have been surveyed for archaeological resources, allowing predictions, based on landform and hydrology, to be made for high, medium, and low-density resource zones on the remainder of the installations. Approximately 4.5 sites per sq mi are estimated for the high-density resource zones such as the lower benches, islands, and alluvial flats of the Columbia River. Site densities away from the river are estimated at 1 site per sq mi in medium-density areas, such as canyon bottoms, and 0.5 sites per sq mi in upland flats. The RMA of Yakima FC has higher proportions of medium and high-density resource zones (approximately 70%) than the ROI (approximately 40%) because it encompasses most of the high-density Columbia River floodplain and the Horse Creek-North Fork Squaw Creek zones. A higher proportion of low-density resource zones (approximately 90%), and a lower proportion of the Columbia River floodplain (approximately 5%) within the RMA make DOE Hanford Site much less prone to impacts than Yakima FC. Sufficient low-density resource zones are found within the RMA of both Yakima FC (approximately 30%) and the DOE Hanford Site (approximately 90%), so that avoidance of higher-density zones is possible, particularly in the DOE Hanford Site.

Given current prehistoric site counts of 307 for the Washington Complex and estimating the total area surveyed for cultural resources thus far, it is estimated that 2,700 potential prehistoric sites may be within the ROI. If the proportion of known sites that are listed in the NRHP is taken as a guideline, approximately 3 percent, or 81 sites, may be potentially eligible for the NRHP. The greatest portion of these should be on or near the Columbia River or along other alluvial valleys (e.g., Cold Creek). However, since most archaeological surveys to date have concentrated along the Columbia River and most archaeological resources in these areas have probably been identified, these numbers may be inflated.

The LOI for this complex has been determined based on the potential for affecting NRHP-eligible sites, which may yield information important to the prehistory of the region. Some of the high-density resource riverine areas in the complex are within the proposed RMA, but many low-density areas occur within the RMA, thus allowing alternative areas for HML movement that may avoid most impacts. Impacts to prehistoric cultural resources within the Washington Complex are projected to be moderate because some medium and high-density zones in Yakima FC will be affected. Low-density zones within the RMA may permit avoidance through alternative siting. Impacts will be significant because of the likelihood of affecting NRHP sites.

<u>Historic and Architectural Resources</u>. Few historic and architectural resources have been identified within the ROI. Most historic structures have been destroyed within the installations. Archaeological remains of historic Angloamerican or American Indian sites also exist within the ROI but are fewer

in number. Some sites near the Columbia River may be buried by as much as 0.5 meter of alluvial silt. One site, the Rattlesnake Springs site where the Perkins Massacre occurred, has been listed in the NRHP in part for its historic value. This site is outside the proposed RMA and will not be affected. Because of the low number of currently recorded historic sites and current NRHP-historic sites within the ROI, the LOI for historic and architectural resources has been determined low and not significant.

American Indian Cultural Resources. The Yakima and Wanapum, currently some of the most traditional American Indian groups in Washington, may be directly affected by the proposed project. Most Wanapum live at Priest Rapids Dam, immediately adjacent to Yakima FC, and enjoy relatively easy access to sacred and economic areas on the installation, including the Wanapum cemetery. Ethnographic investigations in the area are general, vague, and date primarily to the late nineteenth and early twentieth centuries. They do not document all potential areas for which the Wanapum or Yakima may have concerns. The proposed project may affect Wanapum access to sacred areas, such as their cemetery, and to their gathering of sacred plants from the installation. The Wanapum, as part of the Yakima Nation, have joined other American Indian groups in the area in suing the states of Oregon and Washington over off-reservation fishing rights. The courts found in favor of the Indians on the basis of existing treaties, which superseded the states' rights to regulate fishing. The Wanapum have established uses on Yakima FC, which include their cemetery, hunting, and plant gathering, and they would probably also be concerned with maintaining these use privileges. Given the current use of Yakima FC by the Wanapum, their traditional views, and their residence immediately adjacent to Yakima FC, the LOI for American Indian resources in the Washington Complex has the potential to be high and significant.

Paleontological Resources. Some portions of the Ginkgo Formation, which yields petrified wood, may be duplicated in the ROI. It is currently identified and protected at Ginkgo Petrified State Park, 5 miles north of Yakima FC. Impacts are projected to be low and significant, as the potential exists for the formation to also occur within the ROI.

4.5.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.5.4.1 Ellsworth Air Force Base

Impacts to all cultural and paleontological resources are expected to be low and significant.

Prehistoric Cultural Resources. Relatively little of the ROI (less than 2%) has been surveyed for prehistoric resources. However, inventories in adjacent Harding County and along the Belle Fourche River indicate site densities along major rivers and streams of 6.32 sites per sq mi and 5.41 sites per sq mi, respectively. The existing inventories do not reflect systematic coverage of all environmental zones; the rolling prairies grasslands and interstream divides have not been adequately sampled because of low-site visibility and funding constraints. In adjacent areas, particularly the Western Powder River Basin Survey, site densities were summarized for four ecological strata: mountain zone, 2.5 sites per sq mi; foothills zone, 2.9 sites per sq mi; basin grasslands, 1.6 sites per sq mi; and basin ridges, 2.4 sites per sq mi. Professional judgment suggests that, in general, relative prehistoric site

densities may be defined by two zones in the ROI. Higher density occurs within 1 mile of stream and river valleys, such as the Belle Fourche, and may be two to three times greater than in surrounding areas. Low-density areas consist of the rolling prairie grasslands in the remainder of the ROI. None of the approximately 300 recorded prehistoric sites in the ROI have been listed in the NRHP, but many may be potentially eligible. In most cases, testing and evaluation phases of inventories were not funded, and determinations of NRHP eligibility were not made on the limited information available.

Direct impact areas in the ROI total 3,110 acres; less than 5 percent or about 156 acres occur in the high-density resources zones. Ninety-five percent or 2,954 acres occur in low-density resource zones. The LOI is considered low since direct impact areas cross few high-density resource zones. Most of the direct impact areas occur within the rolling prairie grasslands in expected low-density resource zones. Construction-phase activities, such as upgrading roads or modifying launch and MOB facilities, may affect prehistoric sites, though avoidance may be possible in some areas. Impacts are considered significant since the proposed project would contribute to the disturbance or loss of potential NRHP-eligible resources.

Historic and Architectural Resources. Approximately 75 historic and architectural resources are recorded in the ROI. Less than 1 percent of the ROI has been inventoried for historic resources, and systematic inventories resulting in accurate site densities and detailed settlement patterns have not been conducted. However, most recorded historic and architectural sites occur in community settings which may not coincide with direct impact areas. About 39 properties or 52 percent of the known resources in the ROI are listed in or are potentially eligible for the NRHP. This percentage is artificially high and reflects biased recording of NRHP-eligible standing structures and architectural resources.

The LOI for historic and architectural resources in the ROI is considered low because few NRHP-eligible or potentially eligible sites are expected to occur in the direct impact areas along existing roads. Some avoidance of resources near existing launch facilities and at the MOB may be possible. Effects of construction-phase activities will be significant because they will contribute to the loss of resources.

American Indian Cultural Resources. Portions of the ROI have been used by Arikara, Hidatsa, Mandan, Cheyenne, Ponca, Teton and Yankton Dakota (Sioux), Kiowa, Comanche, Kiowa-Apache, Crow and Shoshone tribal groups. Very little site-specific ethnographic inquiry has been conducted in the ROI, and only Bear Butte, a ceremonial and sacred area used by both the Cheyenne and Teton Dakota (Sioux), has been identified. American Indian concerns regarding Bear Butte have been expressed, particularly in regard to flight paths over the butte. In addition, the Dakota (Sioux) recently sued the U.S. Forest Service (USFS) to obtain a special use permit for Dakota religious practices on USFS lands just outside the ROI. The court ruled in favor of the Lakota Nation, and a special use permit was issued for the establishment of the Yellow Thunder camp in the Black Hills, west of Rapid City. Additional American Indian resources may yet be identified in the area.

Few American Indian cultural resources are expected to occur in the direct impact areas. The LOI is considered low because access or use of American

Indian resources would not be diminished, and any reduction of the quality of the resource base would be slight. Potential impacts may be significant if sacred areas or burials are disturbed.

Paleontological Resources. The most productive paleontological formation in the region is the White River group located in Jackson and Pennington counties in the southeastern portion of the ROI. Extensive White River Formation outcrops occur south of the ROI in the South Dakota Badlands and northern Nebraska. Few paleontological localities are expected to occur in the direct impact areas on the northern edge of the formation outcrop and impacts to paleontological resources are considered to be low. Impacts are likely to be significant because of the diversity of vertebrate assemblages in the Brule and Chadron formations of the White River group.

4.5.4.2 F.E. Warren Air Force Base

Impacts to all cultural and paleontological resources are expected to be low and significant.

Prehistoric Cultural Resources. Only 1 percent of the ROI has been inventoried, but broad site distribution patterns have been determined through several linear inventories. Along the ETSI pipeline, higher site densities were recorded in areas of greater vegetation diversity such as along river valleys and escarpments; 6 out of 11 prehistoric sites or 54 percent of the inventory occurred in expected high vegetative diversity zones. A similar pattern emerged from the comparison of site density figures for two transmission line inventories. The Laramie River to Ault Line has a site density of 8.45 sites per sq mi, and site density on the Archer Line was 4.32 sites per sq mi. It was suggested that the difference in densities reflects the difference in the frequency of ecological zones, contained in the two study areas. The Ault Line crosses more ecological zones and 76 percent (N=10) of the prehistoric sites occur adjacent to drainages. The existing linear inventories suggest differential site distribution based on environmental diversity; however, larger inventory samples with more detailed environmental strata are necessary to adequately determine finer definitions of site densities. Based on these inventories and the Western Powder River Basin Survey, where site densities for four ecological zones were determined, relative prehistoric site density zones can be defined for the ROI. High-density zones occur along areas of higher vegetative diversity such as along stream valleys and escarpments. Low-density zones include the rolling prairie uplands, which may contain half as many sites.

Direct impact areas in the ROI total 3,500 acres, and less than 10 percent or about 350 acres occur in the high-density zones. Ninety percent or 3,150 acres, occur in the low-density resource zones. The LOI is considered low because direct impact areas cross few high-density resource zones. Most of the direct impacts will occur in the rolling prairie uplands, which are projected low-density resource zones. Construction-phase activities, such as road widening and base and launch facility construction, may disturb prehistoric sites, but avoidance may be possible in some cases. Impacts to known and projected prehistoric resources are considered significant since the proposed project could contribute to the disturbance or loss of the resource base.

Historic and Architectural Resources. Historic and architectural sites within the ROI occur at densities ranging from 1 site per 50 acres to 1 site per 148 acres. Less than 1 percent of the ROI has been systematically inventoried for historic resources. About 150 properties or 19 percent of the known resources in the ROI counties are listed in or are potentially eligible for the NRHP. This percentage is artificially high and may reflect biased recording of NRHP-eligible standing structures and architectural resources in the ROI counties. Within the ROI, only 11 historic sites are listed in the NRHP; all are located in community settings.

F.E. Warren AFB (the MOB) contains a National Historic District that includes both Fort D.A. Russell and Cheyenne Depot. Historic activity areas, such as target ranges associated with the cavalry occupation but located beyond the district boundary, may be potentially eligible for inclusion in the NRHP. Although F.E. Warren AFB contains a National Historic District, the LOI is considered low since intensive inventories have been completed for the MOB, and avoidance of known resources is possible.

In general, the LOI for historic and architectural resources in the ROI is considered low because few NRHP-eligible or potentially eligible sites are expected to be affected in the deployment area, and some avoidance of resources at the MOB may be possible. Construction-phase activities at the MOB may disturb or destroy historic resources located outside the National Historic District boundary. Impacts to historic and architectural resources may be significant by contributing to the loss of resources.

American Indian Cultural Resources. Portions of the ROI have been used by Shoshone, Cheyenne, Comanche, Crow, Plains Apache, Kiowa, Arapaho, and Dakota (Sioux) tribal groups. Few site-specific ethnographic inquiries have been conducted in the ROI, and no known American Indian cultural resources have been identified. In the past, however, American Indian concern for burials has led to consultation with Air Force representatives for the Peacekeeper project. The consultation resulted in the identification of sensitive areas and establishment of a policy of avoidance of burials and procedures for reburial if human remains were accidentally encountered. A hilltop cairn site was evaluated for burials by a Lakota Medicine Man on a cultural resource inventory for the Peacekeeper project. American Indian resources may yet be identified through further research in the area.

In recognition of the potential for the occurrence of American Indian cultural resources, the LOI is considered to be low. Few resources are expected to occur within the direct impact areas, access would not be diminished, and any reduction in the quality of the resource is expected to be slight. Impacts to American Indian cultural resources would be considered significant if sacred areas or burials are disturbed.

Paleontological Resources. The most productive fossil-bearing formations in the ROI are the Ogallala, Arikaree, and White River. Outcrops of the Ogallala Formation occur in Laramie County, Wyoming; Banner and Kimball counties, Nebraska; and Weld County, Colorado. Arikaree Formation outcrops in Platte and Goshen counties, Wyoming and in Banner County, Nebraska. The White River Formation occurs in Platte and Goshen counties, Wyoming and Weld County, Colorado. The majority of the formations outcrop in areas along the northern portion of the ROI.

Since few paleontological localities are expected in direct impact areas in the majority of the ROI, impacts to paleontological resources are considered to be low. Impacts are potentially significant because of the diversity of vertebrate assemblages in the Ogallala, Arikaree, and White River formations.

4.5.4.3 Grand Forks Air Force Base

Impacts to prehistoric cultural resources, historic and architectural resources, and American Indian cultural resources will be low and significant. Impacts to paleontological resources will be low and not significant.

Prehistoric Cultural Resources. Less than 1 percent of the ROI has been studied and surveys have concentrated around major river and stream valleys resulting in the underrepresentation of upland contexts in the area. However, trends in site distribution have been suggested through several studies in the ROI. A survey along the Pembina River indicates site densities of ten per sq mi along the river, with 72 percent of the sites in Cavalier County occurring on colluvial fans or floodplains, and 28 percent occurring on the bluffs and ridgetops of the Pembina Escarpment. A survey on the Forest River documents prehistoric sites clustered along the river, with 5 out of 33 sites occurring in adjacent beachstrand areas of Lake Agassiz. Surveys in the ROI do not represent all environmental settings, and upland contexts are underrepresented because of the emphasis on major river drainages. Based on these findings, relative prehistoric site density zones can be defined for the ROI. High-density zones occur along stream or river valleys such as the Pembina or Sheyenne rivers. Medium-density zones occur along the beachstrands on the prairie edge and along the bluff and ridgetops. Low-density zones include the remaining portions of the ROI that encompasses the flat plains of the Red River Valley and the Drift Prairie. A total of 200 prehistoric sites have been recorded in the ROI, but only ten sites or 5 percent are listed in or are potentially eligible for the NRHP.

Direct impact areas in the ROI total 3,110 acres, and less than 15 percent or about 466 acres occur in high or medium-density resource zones. Eighty-five percent or 2,644 acres occur in low-density resource zones. Therefore, the LOI should be low because most high and medium-density areas will not be directly affected by the proposed project. Impacts to known prehistoric resources are considered significant since the proposed project could contribute to the disturbance or loss of resources.

Historic and Architectural Resources. Approximately 80 historic and architectural resources are recorded in the ROI. About 20 sites or 25 percent of the known resources in the ROI are listed in or are potentially eligible for the NRHP. This percentage is artificially high and reflects biased recording of NRHP-eligible standing structures and architectural resources. Historic settlement patterns defined for the Pembina River project indicate settlement in the floodplains and bottomlands of river valleys in the late nineteenth century. Earlier and later settlements were located along the bluffs and ridgetops. Systematic surveys for historic resources are generally lacking in the ROI, and less than 1 percent of the ROI has been inventoried.

The LOI for historic and architectural resources in the ROI is projected to be low because few NRHP-eligible or potentially eligible sites are expected to be affected by MOB construction or facility upgrading. Impacts to historic and

architectural resources may be considered significant since the proposed project could contribute to the disturbance or loss of resources.

American Indian Cultural Resources. Assiniboine, Yanktonai Dakota (Sioux), Chippewa, Cree, and Cheyenne tribal groups have occupied the ROI. Two sacred areas related to topographic features in the Devils Lake area have been documented about 10 miles west of the ROI. The Fort Totten Reservation is to the west of the ROI and additional American Indian cultural resources may yet be identified in the ROI through further research.

Relatively few American Indian cultural resources are likely to occur in the direct impact areas near existing facilities. The LOI will be low because access or use of American Indian cultural resources would not be diminished, and any reduction in the quality of the resource base would be slight. Impacts to American Indian cultural resources will be significant if sacred or ceremonial sites, or burials, were disturbed.

Paleontological Resources. Paleontological materials in the ROI may occur in Pleistocene glacial deposits in Grand Forks County. Pierre Shale deposits occur in Baines and Cavalier counties, and the Niobrara and Carlile formations in Cavalier County. Projected paleontological localities are few in number and occur mainly in the northern portion of the ROI along the Pembina Escarpment. The probability that any of the localities will occur in the direct impact areas around launch facilities seems low, and the LOI is judged to be low. Impacts to paleontological resources are not considered significant because the formations contain invertebrate assemblages which do not indicate high research potential.

4.5.4.4 Malmstrom Air Force Base

Impacts to prehistoric cultural and historic and architectural resources are expected to be low and significant. American Indian cultural and paleontological resources may experience high and significant impacts.

Prehistoric Cultural Resources. In the northern part of the ROI, small isolated mountain groups and rolling, glaciated plains broken by major stream courses predominate. In this area, typical sites are tipi rings, lithic scatters, and rock cairns scattered across the plains, and site density is high (6-7 sites per section). The central part of the ROI consists of four physiographic regions: nonglaciated sagebrush/grass plains, pine breaks, tablelands and escarpments, and forested isolated mountain groups. In the grass plains, sites are located relative to topographic features, and site density averages three to four sites per section but varies with proximity to major waterways. Site density is low (2-3 per section) in the pine breaks, tablelands, and escarpments, and lower in the mountain region (1-2 per section). The southern portion of the ROI contains site types and distributions similar to those in the central area. The physiography is grasslands and plains, and habitation and procurement sites are located near bison drives and permanent water in breaks and escarpments. Site densities are low, 2 to 3 per section.

Although a few large overviews and hundreds of small surveys and test excavations have been conducted in central Montana, no work has been done on Malmstrom AFB, and most of the ROI has not been surveyed. More than 300 sites

have been identified in the ROI, and based on site density figures ranging from two to seven per section in the BLM's Lewistown District, it is likely that hundreds more have yet to be discovered. Some of these sites will be eligible for inclusion in the NRHP.

Most impacts to sites will occur during road construction or widening and launch facility or MOB modification. A small portion of the total ROI is in the direct impact area, and only 12 percent of the direct impact areas occur in high or medium-density resource zones on terraces of larger drainages. Several NRHP-eligible sites are located within the ROI, but they are outside of direct impact areas. Additional NRHP-eligible sites, such as multicomponent habitation/manufacturing sites and burials, may be discovered during construction, and impacts will be considered significant. The LOI is expected to be low because few sites should be affected by new construction, and avoidance will be possible in some cases.

Historic and Architectural Resources. Approximately 24 historic or architectural resources are listed in the NRHP. Many other sites, represented by ranch structures, railroad buildings, and trading posts, are potentially eligible. Most of these are located in urban areas and will not be subjected to impacts. Adverse low and significant impacts may occur to historic resources located near launch facilities and access roads.

American Indian Cultural Resources. American Indian groups known to have occupied or hunted in the ROI include the Shoshone, Bannock, Pend d'Oreille, Northern Paiute, Kutenai, Blackfeet (Piegan and Blood), Flathead (Salish), Nez Perce, Crow, Atsina or Gros Ventre, Chippewa-Cree, Assiniboine, Yanktonai Sioux, Arapaho, and Cheyenne. The northwestern boundary of the ROI is near the Blackfeet Indian Reservation.

Examples of sacred or ceremonial areas that can be expected in the ROI are a Piegan sun dance site near the confluence of the Sun and Missouri rivers; vision quest sites, usually located on ridges or other elevated areas; pictograph/petroglyph sites; stone circles larger than 7.5 meters in diameter that represent ceremonial structures; and burials. The most likely types of sites that might be encountered during construction or road widening are stone circles and burials in plains areas and on the terraces of drainages. Specific locations of such areas have not been identified within the ROI, but the Blackfeet, Kutenai, and Flathead are known to have used them historically. A recent demonstration of American Indian concern is the Northern Lights controversy, which involved litigation between the Kutenai and a private company that proposed to build a dam. The Kutenai believed that the dam would destroy a sacred site, identified as the center of their universe and their point of origin as a people. Represented by the Native American Rights Fund, the Kutenai succeeded in preventing construction.

Disturbances to sacred areas can destroy their value for ceremonial or religious purposes. The LOI will be high, causing an irreversible or long-term reduction in diversity and quality of the resource that could permanently diminish access or use for religious, social, or economic purposes; such effects will be significant because of the potential for affecting known sacred sites, and a history of controversy involving American Indian issues in the region.

Paleontological Resources. Four important paleontological sites have been identified in the ROI, each containing rare vertebrate assemblages. The most spectacular deposit was found on a ranch 4 to 5 miles west of Choteau in Teton County, on the Rocky Mountain front in the Teton River drainage. This site, dating from the Cretaceous, is in the Two Medicine and Marias River formations and consists of intact skeletons of juveniles and adults, eggs, and nest structures of dinosaurs. The only other known site of this type was found in the Gobi Desert in Mongolia in 1923. The second known deposit is southeast of Harlowton in Wheatland County. The site contains a fossil assemblage of one of the smallest flesh-eating dinosaurs in the New World, *Microvenator*, and is the only known specimen. The assemblage also contains a partial skeleton of an ornithopod (flightless, birdlike reptile) dinosaur, *Tenontosaurus*. The Early Cretaceous deposit is in the Cloverly Formation, and the site has been nominated for the Registry of National Landmarks.

A third fossiliferous deposit dating from the Tertiary has been identified south of Conrad in Pondera County. This assemblage consists of fossil mammals, birds, and reptiles and has "the best potential statewide for containing significant vertebrate fossils." The final known deposits are in the Kootenai Formation (Cretaceous) north of Great Falls and contain fossil plants, freshwater pelecypods, gastropods, and bones of fish, turtles, and dinosaurs. In addition to these rare and important assemblages, Tertiary deposits within the Jefferson and Missouri River drainage systems have yielded many examples of reptile, bird, and mammal remains, providing information on the evolution of the horse, primates, and other species. One important site outside but near the ROI is at the confluence of the Missouri and Judith rivers. This Late Cretaceous deposit lies in the Judith River Formation and is a partial hadrosaurian skeleton. The deposit may extend into the ROI along the Judith River drainage.

Only a small percentage of the ROI (perhaps 5%) is known to contain vertebrate materials; however, similar formations in other portions of the ROI may hold similar deposits. Depending on the placement of roadways for HML movements, disturbance of these assemblages may occur during road construction or widening. Avoidance may be possible, but impacts will be high and significant if the rare vertebrate deposits are affected.

4.5.4.5 Minot Air Force Base

Impacts to cultural and paleontological resources are expected to be low and significant.

Prehistoric Cultural Resources. Approximately 1 percent of the ROI has been inventoried, with the majority of the cultural resources surveys concentrating along the Souris River/Lake Darling project. Approximately 65 sites have been recorded in various Souris River/Lake Darling projects. Indications are that higher site densities would be expected but that much of the prehistoric resource base was destroyed during the 1930s construction of Lake Darling. Site densities for the Missouri Coteau were estimated at 0.52 site per linear mile, or about one-third of the densities recorded along drainages. A site density of 0.031 site per linear mile was also derived for the Drift Prairie portion of the ROI. Based on surveys in the area, relative prehistoric site density zones have been determined and consist of high-density zones along stream and river valleys such as the Souris and Des Lacs rivers, medium-

density zones on the Missouri Coteau, and low-density zones on the remaining Drift Prairie and Coteau Slope. Only one site in the ROI has been listed in the NRHP, though many others may be potentially eligible.

Direct impact areas in the ROI total 3,110 acres; less than 20 percent or 622 acres occur in high and medium-density resource zones. Eighty percent, or 2,488 acres occur in low-density resource zones. The LOI is considered low since few high and medium-density zones occur in the direct impact areas, with the remaining areas providing good opportunities for avoidance. Impacts to known prehistoric resources are considered significant since the proposed project could contribute to the disturbance or loss of resources.

Historic and Architectural Resources. About 130 historic and architectural resources have been recorded in the ROI. Only ten sites have been listed in or are potentially eligible for the NRHP. Less than 1 percent of the ROI has been inventoried for historic resources, and the results are biased toward standing structures. The LOI for historic and architectural resources in the ROI is considered low because NRHP-eligible sites are expected to occur in community settings, outside the direct impact areas. Impacts to historic and architectural resources may be significant since the proposed project could contribute to the disturbance or loss of resources.

American Indian Cultural Resources. Assiniboine, Arikara, Hidatsa, Mandan, Chippewa, and Yanktonai Dakota (Sioux) tribal groups have occupied or used portions of the ROI. The potential exists for the presence of American Indian cultural resources because about 9 percent of the launch facilities and access roads occur on the Fort Berthold Reservation. Ceremonial earthlodges, burials, and sacred areas may yet be identified in the ROI through further research.

Since early populations of Arikara, Hidatsa, and Mandan were confined to Like-a-Fishhook Village for safety reasons, few American Indian cultural resources may be expected to occur in the deployment areas on the northeast portion of the reservation. The LOI is considered low because access or use of American Indian cultural resources would not be diminished, and any reduction in the quality of the resource base would be slight. Impacts to American Indian cultural resources will be significant if sacred or ceremonial sites or burials are disturbed.

Paleontological Resources. Fossil-bearing formations in the ROI consist of the Coleharbor Formation in Burke County; the Tongue River and Sentinel Butte formations in McLean, Mountrail, and Ward counties; and the Cannonball Formation in McHenry, Sheridan, and Ward counties. Paleontological localities occur primarily along stream valleys, in settings that are generally outside the direct impact areas near existing roads and launch facilities. Therefore, the LOI is expected to be low. Impacts to paleontological resources are likely to be significant if the Cannonball Formation outcrops are affected since they are limited to exposures in the extreme southeast portion of the ROI and would provide information on the last continental marine sea.

4.5.4.6 Whiteman Air Force Base

Impacts to prehistoric cultural resources will be moderate and significant. Impacts to historic architectural resources, American Indian cultural resources, and paleontological resources will be low and significant.

Prehistoric Cultural Resources. Approximately 5 percent of the ROI has been inventoried with surveys associated with large dam and reservoir projects such as Harry S Truman Dam. Upland contexts in the area are underrepresented in the inventory sample. Site densities were derived for the various stream segments (9 of 22 are located in the ROI), ranging from 2.7 sites per sq mi on Deepwater Creek in western Henry County to 34.5 sites per sq mi on Salt Creek in central St. Clair County. Based on inventories for the Harry S Truman Dam and Reservoir project, broad zones of relative site density may be suggested for the ROI. High-density zones occur along river and stream floodplains, such as the Missouri, Osage, and Blackwater rivers, and on bluffs and higher elevations adjacent to floodplains. Low-density zones encompass the rest of the ROI including the uplands. Only two prehistoric sites and the Mellor Village and Mounds Archaeological District are listed in the NRHP. However, it has been recommended that the entire prehistoric resource base associated with Harry S Truman Reservoir (approximately 1,700 sites) be nominated to the NRHP as an archaeological district.

Direct impact areas in the ROI total 3,110 acres; less than 25 percent or approximately 778 acres occur in high-density zones along rivers and streams. Seventy-five percent or 2,332 acres occur in low-density resource zones. The LOI is expected to be moderate because the high-density zone may be adversely affected and avoidance of prehistoric cultural resources may be possible in some cases. Construction-phase activities, such as road widening, launch facility modification, or MOB modification, may affect prehistoric sites. Impacts to known prehistoric sites are considered significant because the proposed project could contribute to the disturbance or loss of resources.

Historic and Architectural Resources. Less than 1 percent of the ROI has been systematically inventoried for historic resources, and the data base is biased toward architectural resources (e.g., 500 architectural sites recorded during the Harry S Truman project). About 24 sites are listed in the NRHP with the vast majority consisting of architectural resources located in community settings. The LOI for historic and architectural resources in the ROI is considered low because few NRHP-eligible or potentially eligible sites are expected to occur in rural (noncommunity) settings and, avoidance of clusters of sites should be possible. Impacts to historic and architectural resources may be significant since the proposed project could contribute to the disturbances or loss of NRHP-eligible or potentially eligible sites.

American Indian Cultural Resources. Portions of the ROI have been used or occupied by the Osage, Missouri, and Kickapoo tribal groups. Historic villages, such as Big Osage and Little Osage villages on river terraces in Saline and Vernon counties, and historic trails that cross the uplands, have been identified. Additional American Indian cultural resources may be identified in the ROI through further research.

Relatively few American Indian cultural resources are expected to occur in the direct impact areas since most disturbance will be in upland zones. The LOI is considered low because access or use of American Indian cultural resources would not be diminished. Impacts to American Indian cultural resources will be significant if sacred or ceremonial sites, or burials, are disturbed.

Paleontological Resources. Late Pleistocene floral and faunal assemblages have been recovered approximately 20 miles south of the ROI in spring deposits

on the Pomme de Terre River. No late Pleistocene fossils have been identified in the ROI, though the potential exists for the occurrence of similar deposits along river floodplains and low terraces. Given that late Pleistocene materials would be recovered from floodplain and terrace settings, few localities are expected in the upland direct impact areas. Impacts to paleontological resources are considered low. Any impacts to late Pleistocene deposits are likely to be significant because of the high research potential provided by the association of vertebrate and floral materials.

4.5.5 Impacts of Hard Silo in Patterned Array

4.5.5.1 Davis-Monthan Air Force Base

Impacts to prehistoric resources at Davis-Monthan AFB are expected to be high and significant. Impacts to American Indian cultural resources are projected to be moderate and significant. Historic and architectural and paleontological resources are likely to experience low and significant impacts.

Prehistoric Cultural Resources. Landforms within the SDA include alluvial/colluvial fans, large rivers and their tributaries (Santa Cruz and San Pedro), and large washes (e.g., Brawley, Tanque Verde, and Pantano). These are the locations of highest site density based upon available data, analysis of site density maps, and professional judgment; all of the SDA is expected to be extremely sensitive. The SDAs consist of alluvial/colluvial fans (83%), floodplains/washes/alluvial-colluvial plains (13%), and hills/mountains (4%). Because populations tended to settle where arable land and water were available, site density is high on alluvial fans and floodplains/washes. The average density in this area is four to five sites per section covering 80 to 90 percent of the section. Site complexes are major villages with hamlets, agricultural features, and plant gathering/processing and hunting camps radiating out from around the center for distances of 2 to 3 miles, sometimes covering almost an entire township. One prehistoric archaeological district, Cocoraque Butte, is listed in the NRHP and is included in the SDA. There are likely to be many additional NRHP-eligible sites in the ROI, given known high site densities and complexity. Although only about 31 sq mi are likely to be fenced and partially disturbed, the potential for disturbing NRHP-listed or eligible sites is high. Other project-related activities, such as construction of access roads, may disturb additional archaeological resources. Within the SDAs, washes and small creeks, trending generally east-to-west, parallel each other closely; therefore, it is virtually impossible to move the impact area north or south without affecting sites in the alternative area. Depending upon the final site selection, potential impacts to NRHP-eligible prehistoric resources within the ROI are expected to be high and significant.

Historic and Architectural Resources. Approximately 39 historic sites, districts, or Multiple Resource Areas within the ROI are listed in or are eligible for the NRHP. Most of these are in urban areas outside the SDA. The few remaining sites are in rural settings or on Davis-Monthan AFB and may be subject to adverse impacts of regional or national significance. San Xavier del Bac Mission, an NRHP-listed property on the San Xavier Indian Reservation, is surrounded by an SDA and may experience impacts from project-related construction. However, overall potential impacts to NRHP-eligible resources are expected to be low and significant.

American Indian Cultural Resources. American Indian groups known to have occupied the ROI are the Tohono O'odham (formerly Papago), Pima, Apache, and Sobaipuri. Although no sacred areas are known to occur within the SDA, the importance of mountain peaks and springs in religious and ceremonial symbolism has been recognized, and there is a possibility of the existence of sacred areas. An example of this type of resource is Baboquivari Peak on the Tohono O'odham Nation, just outside the ROI. This peak is known to have religious significance to American Indians and has been identified as the center of the Tohono O'odham physical universe and the seat of their origin myth. The Tohono O'odham gathered saguaro fruit, agave, and other edible foods from mountainous areas, as well as eagle down for sacred and ceremonial use. Prayer bundles and prayer sticks were also located in mountainous areas or other places away from villages or habitation sites. The ephemeral nature of these sites causes difficulty in identifying them except within a general area. Because the San Xavier Reservation is nearly surrounded by the SDA and because eagle nests and saguaro are located outside the reservation, it is likely that sacred and traditional use areas occur in the SDA. Access to sacred or traditional use areas will probably remain unchanged, and some avoidance should be possible through alternative siting. Impacts to sacred areas could destroy their value for ceremonial or religious purposes, and will be moderate and significant.

Paleontological Resources. Paleontological resources with moderate-to-high scientific importance are known within the ROI and SDA (e.g., Pliocene and Pleistocene vertebrate fossiliferous material on the San Pedro River). Some potential adverse, significant impacts could occur. Avoidance through alternative siting may be possible to some extent, but impacts are still expected to be low and significant.

4.5.5.2 Edwards Air Force Base

Impacts to prehistoric cultural and historic and architectural resources within the Edwards AFB ROI are expected to be low and significant. American Indian cultural and paleontological resources will probably experience negligible impacts.

Prehistoric Cultural Resources. Landforms within the SDA of Edwards AFB include alluvial/colluvial fans (17.2%), alluvial/colluvial plains (14.4%), lacustrine plains (9.7%), and smaller amounts of pediments (3.2%), shallow colluvial valleys (0.3%), and hills (1%). All of these landforms may contain high densities of prehistoric archaeological resources near water sources. Approximately 8 percent of Edwards AFB and less than 1 percent of the surrounding ROI have been surveyed for archaeological resources. In the high mountain forest areas not covered in the earlier section, topographic features in combination with water sources determined high and medium-density zones. For example, in a narrow, steep canyon, the resource density zone fit the available level terrain and was not arbitrarily measured in 1 or 2-mile buffers around the water source. Level ridgetops in the mountains were added as medium-density resource areas because archaeological sites may occur in these areas. Based upon previous archaeological work, the resource density zones for the SDA appear to closely approximate the proportions of resource density zones for the ROI (SDA = 5% high-density resource zone, 35% medium, and 60% low; ROI = 10% high, 25% medium, and 65% low). All playa areas, mountain passes, and the Mojave River have been excluded from the SDA. These

especially high-density resource zones will not be affected. Some alluvial/colluvial fans and plains and lacustrine plains below the mountains and springs, also high-density resource areas, are included within the SDA.

There are nine sites and four archaeological districts within the ROI, but it appears that only one district, Last Chance Canyon, occurs in the proposed SDA. Depending upon the final site selection, potential impacts to NRHP and NRHP-eligible sites within the ROI will range from negligible to high. Lacustrine areas in the south-central portion of the base contain the highest density of potentially eligible cultural resources at Edwards AFB. However, the Rogers and Rosamond Lake areas are not within the proposed SDAs. The most likely impacts will be low because of the potential for avoidance through alternative siting. Impacts will be significant because a NRHP district is within the SDA, and additional eligible sites are likely to be identified.

Historic and Architectural Resources. Seven historic sites within the ROI are listed in the NRHP, and one is a National Historic Landmark. The Twenty Mule Team Borax Wagon Road is in the ROI; all except a portion of the road is outside the SDA. The terminus of the wagon road is a California State Historic Landmark and is located within the city of Mojave, also within the SDA. Rogers Dry Lake, a National Historic Landmark and NRHP site, is outside the SDA. Known NRHP sites are scattered across the ROI and include trails, roads, structures, districts, and camps. Impacts to historic and architectural resources within the ROI could occur, but the LOI is projected to be low because of the potential for avoidance through alternative siting. Impacts will be significant because of the location of known NRHP and potential NRHP sites within the SDA.

American Indian Cultural Resources. Some areas of potential importance to Kawaiisu, Chemehuevi, Tubatulabal, Koso, Vanyume, Kitanemuk, Serrano, Gabrielino, or Tataviam have been identified within the ROI. Mountain zones within the ROI, such as the El Paso Mountain area identified by the BLM as an Area of Critical Environmental Concern for its American Indian values, may have special significance for American Indians in the area. These are outside the SDA and will not be affected. Future ethnographic studies may identify sacred or economic areas within the ROI. No reservations are located within the ROI, but some are immediately outside (e.g., the San Manuel and Morongo Indian reservations), and some American Indians live in cities within and near the ROI. All identified and projected areas of importance to American Indians are located in mountains, canyons, or near water sources. Because the SDA is confined to basin floor zones, no projected resources should be affected and impacts are expected to be negligible.

Paleontological Resources. Paleontological resources identified in mountain ranges within the ROI include the Miocene fauna and flora in the eastern Tehachapi Mountains and Permian foraminifera in the El Paso Mountains. These deposits occur outside the SDA and will not be affected. Rainbow Basin, known for its middle Miocene Barstow Formation, is also outside the ROI. A related area, Fossil Canyon, is within the ROI but outside the SDA and will not be affected. Similar deposits could also occur within the ROI, but negligible impacts to paleontological resources are expected because alternative siting locations could avoid impacts.

4.5.5.3 F.E. Warren Air Force Base

Impacts to cultural and paleontological resources will be low and significant.

Prehistoric Cultural Resources. Only about 1 percent of the ROI has been surveyed, but generalized site distributions can be suggested based on several studies in the area. Along the ETSI pipeline in eastern Wyoming, higher site densities were recorded in areas of greater vegetative diversity such as along stream valleys and escarpments; 54 percent of the sites occurred in these areas. The Boxelder project inventory also suggested higher site densities along stream valleys and ridgetops. The Rawhide Energy project analysis also indicated a correlation of habitation sites with proximity to water. Comparisons of site densities along two transmission line surveys (Ault Line, 8.45 sites per sq mi and Archer Line, 4.32 sites per sq mi) reflects the difference in frequency of environmental zones. Based on these inventories and the Western Powder River Basin Survey, where site densities for foothills/mountain zones were determined to range between 2.5 and 2.9 sites per sq mi, relative prehistoric site density zones were defined for the ROI. High-density zones occur along areas of higher vegetative diversity, such as stream valleys like Crow Creek, and along escarpments, such as the Goshen Hole Rim and Chalk Bluffs; medium-density zones occur along the foothills and the Laramie Mountains; and low-density zones consist of the remainder of the ROI and include the rolling prairies and uplands. Only 40 prehistoric sites are listed in or are potentially eligible for the NRHP in the ROI counties.

The SDA includes about 3 percent of the total ROI and contains only 4 sq mi of high-density resource zones. The SDA has a lower proportion of high-density zones than the rest of the ROI and no medium-density zones. The high-density resource zones along Bushnell Creek above Horse Creek are most likely to yield a higher percentage of NRHP-eligible or potentially eligible sites than other areas. The remaining areas of the SDA consist of low-density resource zones. Although only 30.7 sq mi are likely to be fenced and disturbed, the potential for affecting some NRHP-eligible prehistoric sites in low-density zones exists. The LOI is considered low because many low-density zones occur in the SDA and will provide alternative siting locations in order to avoid areas of high density. Impacts to prehistoric resources are considered significant since the proposed project would substantially contribute to the disturbance or loss of resources.

Historic and Architectural Resources. Overall, historic and architectural resource densities in the ROI may range from one site per 50 acres to one site per 148 acres. Less than 1 percent of the ROI has been inventoried and large-scale systematic inventories have not been conducted. Approximately 55 sites are listed in the NRHP and represent architectural resources recorded in community settings such as Laramie, Cheyenne, and Fort Collins.

Few NRHP-eligible or potentially eligible sites are expected to occur in the SDA, and the LOI for historic and architectural resources in the uplands of the SDA is projected to be low. However, F.E. Warren AFB (the MOB) contains a National Register Historic District including both Fort D.A. Russell and Cheyenne Depot. Historic activity areas, such as target ranges associated with the cavalry occupation but located beyond the district boundary, may be potentially eligible for the NRHP. Intensive surveys have been completed for the MOB and avoidance of some known resources is possible. Construction-phase

activities could affect historic resources both in the SDA and on the MOB, but because the likelihood of impacts in the SDA is low, the overall LOI is projected to be low. Impacts are considered significant since they may contribute to the loss of NRHP-eligible resources.

American Indian Cultural Resources. Shoshone, Cheyenne, Comanche, Crow, Plains Apache, Kiowa, Arapaho, and Dakota (Sioux) tribal groups have used or occupied portions of the ROI. Very little site-specific ethnographic inquiry has been conducted for the ROI, and no known American Indian cultural resources have been identified. However, American Indian concerns for burials have been expressed in the ROI; a hilltop cairn site was evaluated for burials by a Lakota Medicine Man on a cultural resource inventory for the Peacekeeper project. No specific Indian cultural sites were identified as a result of that research but, in recognition of the potential for American Indian cultural resources, impacts are considered to be low. Access or use would not be diminished, and any reduction in the quality of the resource is expected to be slight. Impacts to American Indian cultural resources will be significant if sacred or ceremonial areas, or burials are disturbed.

Paleontological Resources. The most productive fossil-bearing formations in the ROI are the Ogallala, Arikaree, and White River. Outcrops of all three formations may occur in the Horse Creek breaks on the northeastern edge of the SDA. Since few outcrops are expected to occur in the majority of the SDA and alternative siting is possible, impacts to paleontological resources are considered low. Impacts may be considered significant because of the high scientific potential associated with the diverse vertebrate assemblages in the Ogallala, Arikaree, and White River formations.

4.5.5.4 Fort Bliss

Impacts to prehistoric cultural resources, historic and architectural resources, and paleontological resources will be low and significant. Impacts to American Indian cultural resources will be negligible.

Prehistoric Cultural Resources. Landforms within the SDA of Fort Bliss include alluvial/colluvial fans, arroyos, sand dunes, and small shallow playas, which are the locations of highest archaeological site density. The remaining areas are hills or mountains. Some portions of Fort Bliss (approximately 30% of the total MOB or about 336,000 acres) have been surveyed, and more than 10,000 sites have been recorded. Based on collected data, analysis of site density maps, and professional judgment, similar site densities can be predicted throughout the SDA, which consists of about 45 percent of the ROI. Average site density in the surveyed areas is six sites per sq km (17 per sq mi). An unknown number of individual sites and groups of sites defined as districts have been determined to be eligible for the NRHP. A minimum of 2 percent of recorded sites appear to be NRHP eligible, and that figure may rise to 10 percent as additional data are collected and analyzed. Many of the high-density resource areas are outside the SDA; however, large areas outside of Fort Bliss and southeast of the Rio Grande, and on Fort Bliss (within and just south of McGregor Range), are within the ROI. Although only 31 sq mi are likely to be fenced and partially disturbed, the potential for disturbing some NRHP-eligible sites in the area is high. Other project-related activities, such as the construction of access roads, may disturb additional archaeological resources. Alternative siting

locations within the SDA may avoid some high-density areas. Depending upon the final site selection, potential impacts to NRHP-eligible prehistoric resources within the Fort Bliss ROI are expected to be low and significant.

Historic and Architectural Resources. Approximately 33 historic sites or districts within the ROI are listed in or eligible for inclusion in the NRHP, and more than 100 historic sites have been recorded. Most of these sites are in urban areas outside the SDA. The remaining sites are in rural settings or on military installations and may be subject to adverse impacts of regional or national significance. Many alternative siting locations occur within the SDA, permitting avoidance of historic or architectural resources. Potential impacts to NRHP-eligible resources are expected to be low and significant.

American Indian Cultural Resources. American Indian groups known to have occupied the ROI are the Jumano and Mescalero Apache. White Sands Missile Range was the traditional homeland of the Mescalero Apache. Today the Mescalero Reservation is outside the ROI, and no known sacred areas occur within the SDA. Historic Apache sites have not been identified because they are almost identical to Late Archaic sites. Sacred areas are most likely to be located in mountain zones outside the SDAs. Negligible impacts to American Indian cultural resources are expected within the ROI.

Paleontological Resources. Although paleontological resources with moderate-to-high scientific importance have been reported by paleontologists within the ROI, they are primarily located outside the SDA. The exception is the southern Tularosa Basin where outcrops of Silurian to Lower Permian resources occur. Within the SDA, some significant, adverse impacts may occur. Known vertebrate materials along the Rio Grande margin occur in other areas in sufficient quantities; therefore, minimal losses of scientific information will occur should deposits within the SDA be affected. Many suitable alternative siting locations are available so that impacts to paleontological resources may be reduced and will be low and significant.

4.5.5.5 Gila Bend Air Force Auxiliary Field

Impacts to prehistoric cultural resources are expected to be moderate and significant. Historic and architectural resources may experience impacts that will be low and significant. American Indian cultural resources could be subjected to impacts that will be moderate and significant, while paleontological resources will receive negligible impacts.

Prehistoric Cultural Resources. Landforms within the SDA include terraces, desert floors, and large washes. These are the locations of known and predicted highest site density, and 86 percent of the SDA consists of these landforms. Washes tend to parallel each other at short distances and generally trend either east-west or northwest-southeast in the SDAs. Site types are varied, ranging from small ceramic and lithic scatters to villages with platform mounds and/or ball courts. Site density in this area is high, with one estimate of 16 to 18 per sq mi. Other project-related activities (e.g., access roads) may also disturb archaeological sites. Site disturbance may be reduced by selecting alternative siting locations within the 31-sq-mi deployment area. Four prehistoric sites or districts in the ROI are listed in the NRHP; none are located within the SDA. Depending upon the final site selection, potential impacts to NRHP-eligible prehistoric resources within Gila Bend AFAF are expected to be moderate and significant.

Historic and Architectural Resources. Approximately 250 historic sites and 86 sites with both historic and prehistoric components have been identified in Maricopa County, most of which is included in the ROI. Many of these sites are located in urban areas outside the SDA. The remaining sites are in rural settings and could be subjected to effects. Because most sites can be avoided, potential impacts to NRHP-eligible properties are expected to be low and significant.

American Indian Cultural Resources. American Indian groups known to have occupied the ROI include the Pima, Tohono O'odham, and Maricopa. Portions or all of the Tohono O'odham, Ak-Chin, Gila River, and Gila Bend Indian reservations are included in the ROI but do not occur in the SDA. Although no known sacred areas have been identified within the SDA, the importance of mountain peaks and flora, fauna, and springs in Indian ceremonials is recognized. Because of the large number of Indian groups known to have used the ROI, and their continued residence in the area, it seems likely that sacred areas may be identified within the ROI. Impacts to sacred sites can destroy their value for religious purposes, but some potential exists for avoidance through alternative siting. Local Indian groups have communicated their concern to the Air Force regarding frequent low flights over the Ak-Chin Reservation that have resulted in structural damage and disruption of the quiet life style of this Tohono O'odham-Pima community. Therefore, impacts are considered to be moderate and significant.

Paleontological Resources. Paleontological resources of moderate-to-high scientific importance have been documented in the ROI. Most of these deposits are outside the SDA and will not be affected. Avoidance by choosing alternative siting locations is possible, so that expected impacts will be negligible.

4.5.5.6 Yuma Proving Ground

Impacts to prehistoric cultural resources within the Yuma PG ROI will be moderate and significant. Impacts to historic and architectural resources will be low and not significant. American Indian cultural resources will experience moderate and significant impacts. Impacts to paleontological resources are expected to be low but not significant.

Prehistoric Cultural Resources. Existing archaeological data cover approximately 13 percent (less than 1% intensive) of Yuma PG and less than 3 percent of the surrounding ROI. Prehistoric site location in the ROI is influenced primarily by access to water and secondarily by access to plant and animal resources. Archaeological resource density zones have been projected by estimating the percentages of density zones for areas not surveyed within the ROI. The SDA contains alluvial/colluvial fans (91% of the total SDA), sand dunes (7%), hills (0.5%), and other miscellaneous landforms (1.5%). Near water sources, these landforms are also areas likely to contain high densities of archaeological sites. The high-density zones comprise approximately 50 percent of the SDA and may yield some NRHP-eligible sites. Only seven prehistoric NRHP sites are known in the ROI but potential NRHP-prehistoric sites exist and may be affected.

Prehistoric site densities in the ROI can be very high when compared to other areas in North America. One site per acre (640 per sq mi) has been estimated

for high-density areas near the Colorado River, and 11.2 sites per sq mi have been recorded along the shorelines of Lake Cahuilla. The average site density in the ROI is estimated at 25 sites per sq mi.

With site densities so high, the low number of prehistoric NRHP sites is probably not an accurate reflection of the NRHP-eligible sites in the ROI. Although only about 31 sq mi are likely to be fenced and partially disturbed, the potential for disturbing some NRHP-eligible sites is great in the high-density areas.

Other project-related facilities (e.g., access roads) may disturb additional archaeological resources. Beneficial impacts may include project-related investigations that will identify and examine currently unknown archaeological resources, and restricting access to lands currently open to the public. Depending upon final site selection, potential impacts to NRHP-eligible sites within the ROI may range from moderate to high, with most likely impacts projected to be moderate because of the potential for avoidance. Impacts will be significant because of the potential for disturbing some NRHP-eligible properties.

Historic and Architectural Resources. Few potential impacts of national or regional importance are expected because most NRHP-eligible historic and architectural resources are located within the city of Yuma or along the Colorado and Gila River floodplains outside the SDA. Fifty-one historic sites within the ROI are listed in the NRHP, but only one, El Camino del Diablo, is within the SDA and may be potentially affected. Impacts could also occur to unidentified mining, ranching, or military facilities which may be NRHP eligible. Based on known densities and distributions of cultural resources and NRHP sites, impacts are expected to be low and not significant.

American Indian Cultural Resources. Many American Indian groups have historically documented economic and sacred areas within the Yuma PG ROI. These groups include Mojave, Quechan (Yuma), Cocopa, Halchidhoma, Chemehuevi, Yavapai, Sand Papago, and Tipai (Kamia). Those groups remaining in the area on reservations are the Quechan and Cocopa on the Cocopa and Fort Yuma Indian reservations near Yuma, and the Chemehuevi, Mojave, and Yuman on the Colorado River Indian Reservation, 6 miles north of the ROI. Other American Indians belonging to these groups are on reservations away from the ROI or in urban areas off reservations.

Although numerous ethnographies are available on American Indian groups in the area, no site-specific ethnographic inquiries have been conducted in the ROI. Some specific sacred areas such as the Cargo Muchacho Mountains have been identified, but detailed data are lacking for much of the ROI. Most mountain ranges which may have sacred areas are excluded from the SDA but some springs, petroglyphs, and large prehistoric sites, also important to American Indians in the area, may be within the SDA. The fencing and partial disturbance of a 31-sq-mi area, that has previously not been affected or fenced, may potentially affect areas sacred to American Indian groups. Alternative siting locations may avoid affects to these sacred areas. The Colorado River Indian Tribes jointly sued a private developer who wished to stabilize the western bank of the Colorado River opposite the Colorado River Indian Reservation. The court found that the action would indirectly affect archaeological sites on the reservation and violate NEPA and the National Historic Preservation

Act. These sites were also considered to have spiritual value to the tribes. Because of the large number of American Indian groups known to have inhabited the ROI, the residence of some of these groups within the ROI, and the fact that these groups have exhibited concern in the past regarding projects affecting areas important to them, the LOI is projected to be moderate. This LOI determination also considers that alternative siting locations to avoid impacts are possible. These impacts will be significant if American Indians are denied access to sacred areas or traditional plant and lithic resources currently obtained from these areas.

Paleontological Resources. Quaternary and Pleistocene assemblages may exist in terrestrial deposits between mountains which also occur within some portions of the SDA. The potential exists for finding previously unrecorded fossils and formations within the SDA, but because few fossils have been documented, the LOI is projected as low.

Recorded fossils in the area are restricted to the Tertiary period. Because these are also represented in an area greater than the ROI (southern Colorado River and California desert areas), impacts are not considered to be significant.

4.5.6 Impacts of the No Action Alternative

Under the No Action Alternative, the scope of existing activities will not cause changes in projected conditions in the deployment areas. Ongoing nonproject-related effects on resources will be caused by natural erosional processes, unauthorized collection, and impacts resulting from currently authorized projects. Except in the Nevada and Washington complexes where nuclear repository sites are proposed, no major projects are currently identified.

4.5.7 Irreversible and Irretrievable Resource Commitments

Construction and operation of the Small ICBM project could result in either irreversible or irretrievable commitment of certain resources. An irreversible commitment is one that cannot be changed once it occurs; an irretrievable commitment means that the resource cannot be recovered or reused.

Prehistoric Cultural Resources. Both irreversible and irretrievable commitments will occur if NRHP-eligible prehistoric sites are destroyed or damaged during construction and operations. The preferred method of mitigation is avoidance; if avoidance is not possible, data recovery (e.g., mapping, surface collection, or excavation) may be necessary. While such efforts do yield useful data, avoidance is preferred because future technological advances in the discipline will permit future researchers to make more effective use of the resources.

Historic and Architectural Resources. Both irreversible and irretrievable commitments will occur if NRHP-eligible historic sites and architectural resources are destroyed during construction and operations. Mitigation of effects might consist of excavation of historic archaeological sites, or simply meeting the requirements of the Historic American Buildings Survey for recording historic structures for listing in the NRHP.

American Indian Cultural Resources. Both irreversible and irretrievable commitments will occur if sacred or ceremonial areas are destroyed during construction and operations. Any impact may destroy the sacred importance of the area.

Paleontological Resources. Both irreversible and irretrievable commitments will occur if paleontological sites with high levels of research potential are destroyed during construction and operations.

4.5.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Additional information gained during project-related surveys of archaeological, historic, architectural, and paleontological resources may contribute to the data base and improve man's knowledge of the area's history. This will enhance the long-term productivity of cultural resources information in the proposed project areas. Posting of known high-density areas can protect sites from potential damage, and reducing public access to some areas may lessen vandalism and looting.

4.6 Biological Resources and Threatened and Endangered Species

The impact analysis process for biological resources includes consideration of vegetation, wildlife, aquatic habitats, unique and sensitive habitats, and threatened and endangered species.

4.6.1 Impact Analysis Methodology

The methods used for analyzing the effects of the proposed project on each element of biological resources include evaluation of potential project impacts, determination of levels of impact (LOIs), and determination of impact significance.

4.6.1.1 Evaluation of Project Impacts

The methods used to quantify and evaluate proposed project impacts to each of the biological elements are described in the following sections. The impact evaluations involved determining the location and sizes of habitats expected to be disturbed by construction and operations, identifying the biological resources that may be potentially affected in these disturbed areas, analyzing the types of biological impacts that could result from expected physical project effects, and estimating the biological or ecological importance of these impacts. These evaluations included determining whether the impacts will be (1) directly caused by the project or indirectly project-induced (as a result of project-induced recreation or development); (2) caused by construction, operations, or both; and (3) of short duration (short term) or long duration (long term).

Vegetation. Boundaries of the Random Movement Areas (RMAs), Suitable Deployment Areas (SDAs), and Main Operating Bases (MOBs) were combined with baseline vegetation maps in a computer-assisted Geographic Information System (GIS), and the potential overlap between proposed project facilities and existing vegetation types was determined. Analysis of direct impacts to vegetation types that have the potential to be affected by deployment of the Hard Mobile Launcher at Minuteman Facilities basing mode did not employ GIS and was restricted to types occurring along Hard Mobile Launcher (HML) transit routes, near launch facilities, and on the MOB. U.S. Geological Survey (USGS) land use and land cover maps and manually interpreted satellite imagery were the primary sources of vegetation information. Potential impacts, and the duration of impacts indicated by overlaps of project facilities and existing vegetation were described and quantified. The vegetation types and approximate area of each type potentially disturbed during construction were quantified based on the relative abundance in the MOB and the deployment area. The amounts of vegetation permanently removed, temporarily scarified, or otherwise directly disturbed were determined. Areas and locations where offsite disturbances are likely to occur were also estimated. Adverse effects from off-road vehicle movement and other recreational uses were evaluated where appropriate. Individual plant communities, particularly unique communities, were analyzed separately.

Potential impacts to plants from construction or operations, including removal, crushing, breakage of branches and main stems, root exposure, and dust pollution, were assessed. Analysis of disturbances to plant habitats included effects from soil erosion and compaction, soil structure disturbance,

and altered water infiltration rates and waterholding capacity. The intensity and likelihood of plant community disturbance, its duration, and its persistence were estimated. Where communities contained species of special or economic importance, effects on these species were described individually. The potential for revegetation, either naturally or man-induced, was estimated for each major vegetation type. Where at least some revegetation was possible, the persistence of project-induced effects was estimated to be shorter than where revegetation was not possible.

Wildlife. Direct impacts to wildlife, which include interference with behavior, biology, or life history requirements, were evaluated as to source (i.e., construction or operations) and whether they were short or long term. Direct disturbances were estimated by determining the overlap between the ranges of various game species and the MOB and/or deployment area. The type of direct disturbance (i.e., habitat loss, displacement, loss of food sources, mortality, or interference with activities) was noted for all wildlife species. Distribution data for nongame species were usually unavailable; consequently, the severity of disturbance to nongame species as a group was estimated based on the diversity of nongame communities expected to be affected. The severity of nongame disturbance was judged to increase with increasing diversity. Diversity was used to characterize the nongame community because it is an indicator of the number of species and number of ecological relationships that could be affected by the proposed project. Therefore, impacts to a diverse community are likely to have more ecological ramifications than impacts to a simple community. In general, species diversity is also considered important as a measure of the ecological development and naturalness of a community; diverse communities are often, but not always, older and/or less disturbed than simple communities. For these reasons, diverse communities are usually considered more ecologically valuable than simple communities.

Nongame diversity was determined to be low, moderate, or high for each major vegetation type, focusing primarily on types in the potential direct impact area. In some of the study areas, these ratings were obtained from the literature. In other areas, these ratings were based on data of wildlife species known to occur in the vegetation type, or on the structural diversity or special ecological features of the vegetation type. In general, the diversity of wildlife species using an area increases as the structural diversity of the plant community in the area increases. For example, plant communities with grass, shrub, and tree layers tend to support a more diverse wildlife community than do plant communities with only one layer, such as grassland. Special communities, such as riparian types, may comprise a small percentage of the land area in a region, yet they provide some of the most important and varied types of wildlife habitats. In all cases, diversity ratings were placed in context by comparing the diversity of each vegetation type to the diversity of other common vegetation types of the region.

Indirect impacts to wildlife expected from project-induced recreational activities were also assessed by comparing game species distributions with the likely locations for recreational activities. Potential indirect impacts to both game and nongame species were evaluated. Indirect impacts could result from use of recreational off-road vehicles, other types of recreation, and increased poaching, which cause disturbance of seasonally important habitats and mortality or displacement of wildlife. Species particularly susceptible to disturbance were noted.

Aquatic Habitats. Aquatic habitats in the Region of Influence (ROI) were first identified as to whether they occurred in the potential direct or indirect impact area using the GIS overlay technique. Potential effects in the direct impact area were then determined to be a result of construction or operations. Operations impacts were a more important consideration for the Hard Mobile Launcher in Random Movement basing mode, because operations are more likely to disturb habitats within the RMA. Aquatic habitats in the indirect impact area were included if they will be potentially affected by factors associated with project-induced growth.

The second step was to identify the type of impact on a per habitat basis. The type of impact was largely dependent upon the source of the disturbance (construction, operations, or indirect) and included disturbances such as sedimentation, trampling, and overuse. Next, the degree of impact was considered based on the amount of habitat disturbed, the quality of the habitat, amount of similar habitat in the region, and whether the habitat exhibited special biological importance on a regional or local scale. The GIS data base was used to calculate the number, length, and/or area of wetlands, as appropriate (by their U.S. Fish and Wildlife Service [USFWS] wetland codes), that may be affected. Fisheries data were processed in a tabular data base. The duration of disturbance was then determined from the previous two factors, as well as from regional environmental conditions. Impacts were judged to be short term if recovery was expected to occur within 5 years following a single disturbance. Long-term impacts required a longer recovery period, were not expected to allow complete recovery of the aquatic habitat, or were expected to maintain the habitat in a degraded state because of the repetitive nature of the disturbance. The determination of likelihood of direct impacts was based on the feasibility of minimizing impacts to aquatic habitats through use of appropriate construction methods, siting, and restriction of operations. The likelihood of indirect impacts occurring was based on a combined evaluation of the projected increase in area population as a result of the proposed project, type of aquatic habitat and whether its use was for recreation or development, number and distribution of similar habitats in the region, and distance from the MOB.

Unique and Sensitive Habitats. Unique and sensitive habitats occurring in the potential direct and indirect impact areas were identified through the GIS system. Analysis of indirect impacts was performed for construction and operations disturbances. Habitats within the ROI that will receive potential indirect impacts were located with the GIS system and a tabular data base.

The type of disturbance was investigated on a per habitat basis. Construction, operations, and indirect effects each will create disturbances to the unique habitats such as habitat clearing and displacement of sensitive species. However, the potential threat to biological uniqueness or sensitivity from these impacts varied according to the key features of each habitat. The degree of impact per habitat was a function of the amount of habitat that will be removed from its unique status because of the disturbance. The GIS data were used to calculate the amount of area disturbed, where applicable. The duration of impacts was rated as short or long term. Short-term impacts were those expected to recover within 5 years of the disturbance, and long-term impacts will result in the habitats remaining degraded for a longer period. The final consideration was the likelihood of reducing or avoiding impacts to unique and sensitive habitats. The major

mechanisms for minimizing direct impacts were avoiding sensitive portions of the habitat through siting and operational restrictions and reducing disturbances through the use of sound construction methods. The likelihood of indirect impacts was assessed largely on the distance of the unique habitat from the MOB and degree of regulation or existing use restrictions on the habitat (which would preclude some types of indirect effects).

Threatened and Endangered Species. Project-related impacts to threatened and endangered species and their habitats were determined for all federally listed species, species that are candidates or proposed for federal listing, and state-listed species present in the direct and indirect impact areas. Information on locations of species was compared with boundaries of MOBs, SDAs, and RMAs to determine which species occurred in the direct impact area. The presence of additional species in other areas of the ROI was determined by comparing location information with boundaries of the ROI. Potential short and long-term impacts that may result from construction and operations were determined for species or groups of species present in the MOB or deployment area. Potential long-term impacts that may result from population growth and recreational pressures were determined for species or groups of species present in other parts of the ROI. The types of impacts evaluated included direct mortality, displacement, loss of habitat or a habitat component, noise pollution, disturbance of daily/seasonal movements or activities, or stress. Because even subtle or small perturbations to these species or their habitats could have disproportionately large effects on their populations as a result of their threatened and endangered status, a high level of detail was sometimes necessary to adequately assess proposed project effects and produce an acceptable biological assessment. Cumulative effects, including all direct and indirect effects likely to result from the proposed project, effects of other actions likely to occur as a consequence of the project, and consequences of other actions independent of the project, were also addressed.

4.6.1.2 Determination of Levels of Impact

At each alternative location, the expected overall impact to each biological element (vegetation, wildlife, aquatic habitats, unique and sensitive habitats, and threatened and endangered species) was determined to be negligible, low, moderate, or high. The LOI was determined to represent the regional biological magnitude of the expected impacts; that is, the effect on the condition of populations and habitats, and integrity of ecological systems in the region. The LOIs are defined in the following:

- Negligible Impact -- No impact is expected, or the impact is expected to be so small as to be essentially unnoticeable at the regional level.
- Low Impact -- The impact is noticeable, but the proposed project is expected to have essentially no adverse effect on the condition of populations and habitats and integrity of ecological systems on a regional basis.
- Moderate Impact -- The proposed project begins to adversely affect the condition of populations and habitats and integrity of ecological systems on a regional basis.

- High Impact -- The proposed project has a substantial adverse effect on the condition of populations and habitats and integrity of ecological systems on a regional basis.

The factors used in determining LOI for each biological element are described in the following sections.

Vegetation. The LOI determination was based on the quantity and type of vegetation potentially affected:

- Number of acres cleared or severely disturbed, considering the types of vegetation affected and their abundance in the region;

- Number of acres partially disturbed (for example, due to off-road HML operations);

- Potential for project-indirect impacts to vegetation of the ROI as a function of an increase in the population of the ROI; and

- Likelihood of avoiding impacts through siting of facilities and activities.

Wildlife. The LOI determination was based on the quantity of game and nongame habitat potentially disturbed, and the expected degree of displacement and mortality of wildlife:

- Approximate area of year-long game habitat disturbed, considering the abundance of the habitat type in the ROI;

- Approximate area of seasonally important game habitat disturbed, considering the abundance of the habitat type in the ROI;

- Approximate areas of low, medium, or high diversity nongame habitat disturbed, considering the abundance of the habitat type in the ROI;

- Approximate number of directly displaced/killed game animals;

- Increased hunting/poaching of game species, as a function of current levels of these activities and expected population increases in the ROI; and

- Likelihood of avoiding impacts through siting of facilities and activities.

Aquatic Habitats. The LOI determination was based on the quantity of both wetlands and fish habitat potentially affected, and the expected increase in use of aquatic habitats in the ROI:

- Number of small wetlands (less than 320 acres) that have the potential to be directly affected;

- Area of large wetlands (greater than 320 acres) that have the potential to be directly affected;

- Length of linear wetlands that have the potential to be directly affected;
- Abundance of wetlands in the ROI;
- Areas and/or lengths of fish habitats that have the potential to be directly affected, considering abundance of such habitats in the ROI;
- Number of fish species potentially affected;
- Increased use of aquatic habitats as a function of increased population in the ROI; and
- Likelihood of avoiding impacts through siting of facilities and activities.

Unique and Sensitive Habitats. The LOI determination was based on the number of habitats that have the potential to be directly affected and the expected increase in use of habitats in the ROI:

- Number of unique and sensitive habitats that have the potential to be directly affected, considering the abundance of such habitats in the ROI;
- Increased use of unique and sensitive habitats as a function of increased population in the ROI; and
- Likelihood of avoiding impacts through siting of facilities and activities.

Threatened and Endangered Species. The LOI determination was based on the number of federally listed and state-listed species potentially affected, and the estimated potential for impact to designated critical habitats:

- The number of federal-listed, federal-proposed/candidate, and state-listed species that have the potential to be directly or indirectly affected;
- The extent to which the distribution of a potentially affected species is restricted to the direct or indirect impact area;
- The extent to which designated critical habitat is potentially affected; and
- Likelihood of avoiding impacts through siting of facilities and activities.

In determining the LOI for threatened and endangered species, species occurring in the potential direct impact area were projected to receive greater impacts than species occurring in indirect impact areas. In addition, potential impacts to federally listed species and species proposed for federal listing were weighed more heavily than impacts to federal-candidate species, which were in turn weighed more heavily than impacts to state-protected

species. This hierarchy reflects the degree of endangerment of the various categories of protected species.

These factors were evaluated for each element using the data and analyses described in Section 4.6.1.1. These factor evaluations were then synthesized to assess the overall potential for the proposed project to affect the regional biological status of each element. An LOI was then assigned for each element as previously described. The LOI was determined for both short and long-term impacts. A short-term impact was defined as a transitory impact from which the resource will essentially recover within 5 years after the end of construction. Long-term impacts will persist for more than 5 years after the end of construction, or result from long-term operations. Operations are not expected to have any transitory (short-term) impacts because disturbance from operations will occur repeatedly over a long period.

4.6.1.3 Determination of Significance

Expected proposed project impacts to each biological element were rated as either significant or not significant, at both the regional and national level. The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) state that an assessment of significance requires consideration of both the intensity and context of an impact. For biological impacts, the concepts of intensity and context are embodied in an evaluation of the wider ecological and social importance of an impact at the local, regional, or national level. The wider ecological importance for an impact refers to its potential to affect a wider array of biological resources that are ecologically related to the directly affected resources. The social importance of a biological impact refers to its potential to affect the scientific, recreational, economic, or aesthetic value of the biological resources of the region. This potential is reflected to a large extent in the level of concern an impact elicits from natural resource management agencies and scientific authorities. For this analysis, the regional and national levels are the appropriate contexts for the assessment of impact significance.

All impacts to biological elements were determined to be significant or not significant based on an assessment of their wider ecological and social importance. The following factors were considered in determining the significance of all elements:

- Uniqueness; ecological, scientific, recreational, or economic value; current level of disturbance of affected resource; and resulting level of concern the impacts would be expected to elicit from natural resource management agencies or scientific authorities;

- The extent to which the proposed project will add to existing disturbance of resources in the region; and

- Recovery potential.

In determining the current level of disturbance of biological resources, disturbance of vegetation and wildlife caused by existing and past missions at several of the MOBs and deployment installations was considered. At some installations, these disturbances have resulted from tests of military

vehicles, troop training and maneuvers, and artillery and gunnery use. These activities are most extensive at Fort Irwin National Training Center (NTC), Fort Bliss, and Yakima Firing Center (FC). At other installations, low-flying military aircraft and air-to-ground firing and bombing startle and possibly kill wildlife. These activities are most extensive at Luke Air Force Range (AFR), Nellis AFR, and China Lake Naval Weapons Center (NWC). Because the RMAs have been sited to avoid conflict with existing missions, the disturbances previously described are likely to apply to a relatively minor portion of the RMA on any given installation. Therefore, for the present analysis, it was assumed that the biota and habitat of most of the RMA on the installations previously discussed are relatively undisturbed.

The following additional factors were considered in determining the significance for wildlife:

- Loss of important habitat components (feeding, nesting, breeding, cover, and water); and

- Sensitivity of the species to type of disturbance.

An additional factor considered in determining significance for aquatic habitats was the degree of protection or management of the habitat. A factor considered in determining significance for unique and sensitive habitats was the type or classification (e.g., wilderness areas, research natural areas, and designated natural areas) and level of protection of affected habitats.

For threatened and endangered species, the following additional factors were used in determining significance:

- Loss of important habitat components (feeding, nesting, breeding, cover, and water).

- Sensitivity of species to type of disturbance.

- The estimated feasibility of mitigating impacts to protected threatened and endangered species, so that the continued existence of these species will not be jeopardized, through the general measures described in Section 4.6.2. This considers both project and species requirements.

Evaluation of the final factor for threatened and endangered species should be considered preliminary, because the exact location of species in impact areas will not be known until site-specific studies are conducted, and because the extent to which the proposed project can be modified to avoid impacts to these species is not yet known in detail.

These factors, derived from the ten indicators of intensity contained in the CEQ guidelines, were evaluated to determine whether the regional ecological and social effects were sufficient to warrant the impact being rated as significant at the regional level. This determination included an estimate of whether the expected impacts are of sufficient concern to be considered regionally significant by natural resource management agencies and scientific authorities. Impacts were rated as nationally significant if they were judged likely to have ecological or social effects beyond the region or to threaten

the national status of certain biological resources, and therefore likely to be of concern at the national level.

4.6.2 Impacts Common to All Locations

Many, but not all, of the types of biological impacts expected to result from the proposed project will be similar for all basing modes and locations, though the magnitude of these impacts will vary among basing modes and locations. Both direct and indirect impacts were considered.

Direct impacts are those resulting directly from proposed project actions, as opposed to those resulting from project-induced growth and development in the region. Direct impacts can result from construction of project facilities or from operation of the system once deployed. Operations impacts vary considerably among basing modes, and so are described separately under each basing mode. Types of construction impacts are similar for all basing modes.

Construction will result in varying degrees of disturbance to vegetation, depending on the type of construction activity, basing mode, MOB, and deployment area. Construction of new facilities and roads will result in both short and long-term disturbance of vegetation from activities such as scraping, leveling, and excavation. Long-term impacts to vegetation include destruction of plants and plant cover, destruction of soil structure, soil compaction, decreased water infiltration rates, and accelerated soil erosion. Dust pollution may adversely affect sensitive plant species in surrounding areas. Short-term disturbance may occur in areas where off-road construction and support vehicles will travel. Off-road travel results in crushing and breakage of plants, removal of roots from substrate, burial of plants, and adverse soil impacts as previously discussed. The degree of disturbance will vary depending on frequency and intensity of travel, soil and vegetation type, and recovery potential of the site. Typically, deployment areas in the arid Southwest have vegetation types that recover slowly from disturbance because of slow growth rates, which is the principal reason that most construction impacts will be long term.

Construction of new facilities and roads and road upgrading will result in long-term wildlife habitat disturbance such as loss or modification of cover, food resources, water, and sites necessary for reproduction. Movement of construction and support vehicles will kill burrowing animals and less mobile species, as well as collapse burrows and crush nests or dens. Construction activities will cause the more mobile species to move into surrounding habitats because of loss or disturbance to their original habitat. Because surrounding areas are likely to be at carrying capacity or to be suboptimal habitat for the displaced species, total animal numbers are likely to decline to reflect the capacity of the remaining habitat. Additionally, construction activities will require large amounts of sub-base materials (i.e., sand and gravel), which may lead to further long-term habitat loss within the SDA and/or ROI. Short-term disruption of threatened and endangered animal species activities, such as daily and seasonal movements, feeding, and reproduction, will occur because of the large increase in vehicular traffic and noise levels that will accompany construction. This disruption could be particularly severe for species that are especially sensitive to disturbance. Dust pollution, noise pollution, and general human disturbance are likely to cause stress and/or to cause animals to avoid the area. Stress during critical reproductive periods can be particularly adverse.

Construction activities may adversely affect particularly sensitive species (e.g., desert bighorn sheep and mountain lions) directly, even if the habitat of these species is not disturbed physically. Noise, vehicular movements, and human presence in areas adjacent to sensitive species habitats may disturb individual animals and cause them to vacate primary habitat, potentially reducing reproductive success.

Construction activities associated with structures, roads, and bridges will produce short-term impacts to aquatic habitats because of increased sedimentation. Sediments entering aquatic systems may kill or displace some aquatic species by fouling their respiratory or feeding mechanisms, through behavioral disturbances, or by decreasing primary production because of increased turbidity. Some emergent plants may also be adversely affected by these sediments. Intermittent aquatic habitats may be affected by sedimentation if it results in a transition to less productive upland habitat. Recovery from these short-term impacts is expected to occur shortly after the disturbance ends. These impacts will become long term if the sediments persist in the system more than 5 years. This type of long-term impact will be a result of direct filling of an aquatic habitat such as may occur at road crossings. Habitats removed or degraded in this manner will cause a loss of productivity in the affected area and potentially in adjacent areas. These potential short and long-term impacts could be reduced by siting construction to avoid sensitive aquatic habitats and by using sound construction techniques to minimize these types of impacts.

Short-term impacts to unique and sensitive habitats may occur from the temporary displacement of sensitive plant or animal populations by construction activities. This displacement may be as a result of temporary land clearing and surface disturbance, or the increased movement of people and machinery. Recovery from this type of short-term effect will begin after the disturbance ends, though restoration may be required to remove long-term threats to the biological uniqueness of the habitat. Long-term impacts associated with construction will result from the permanent removal of sensitive habitat and the potential for disturbances that directly affect only a portion of the habitat, but indirectly affect the uniqueness of the greater part of the habitat. These potential short and long-term impacts are likely to be reduced by siting construction areas to avoid sensitive habitats and by using construction techniques that minimize disturbance of the habitat.

Threatened and endangered species, and any designated critical habitat that occurs in the construction area, may be affected by construction in the same ways as described for vegetation, wildlife species, and wildlife habitat. Threatened and endangered species are designated as such because they are in danger of becoming extinct in all or part of their range. Therefore, impacts to these species can be particularly adverse. The reasons for the precarious status of these species are varied. Some of the major threats include loss of habitat, overcollection, pesticide and other chemical contamination, and competition from introduced species. Most species are subject to more than one kind of threat, and many experience cumulative adverse effects from impacts in several parts of their range. Many species exhibit low reproductive success, which is often compounded by the problems of low replacement potential and increasingly isolated and disjunct populations. Therefore, most threatened and endangered species exhibit poor or limited ability to recover from disturbance or adverse impacts. Threatened and endangered species often have very strict habitat requirements. Many have evolved in habitats that are

unique and limited in distribution. Displacement or transplantation to other habitats is only occasionally satisfactory. Many of the potential direct impacts from the proposed project could be reduced or eliminated by locating buildings, roads, support facilities, and operations away from areas inhabited by threatened and endangered species, and by minimizing off-road activities, general habitat destruction, and excessively loud construction activities.

Indirect impacts are a function of project-induced population growth and are, therefore, common to all basing modes with respect to the type of impact that may occur for each element. These impacts are essentially long term and may occur throughout the life of the proposed project. The degree of impact is largely site specific and is based on the percentage of increased population growth caused by the proposed project and the distance of potentially affected areas from locations where the project-induced population resides. Areas close to major population centers are likely to receive more indirect effects, while impacts to distant areas may not be perceptible.

New development resulting from project-induced population growth will result in the removal of natural vegetation in the areas developed and a probable reduction in biological productivity. Increased recreational use of off-road vehicles (legal and illegal) will crush and break plants and cause surface disturbance. Off-road vehicle impacts may be locally large. Increased camping and hiking may result in minor trampling and crushing of vegetation, and minor surface disturbances such as soil compaction.

Urban expansion and development will lead to a loss of wildlife habitat. Degradation of the habitat due to recreational pressure, as previously described, will disturb wildlife communities. Increased human presence (hikers, hunters, and other users) will increase the stress to wildlife populations. These impacts are generally expected to be minor, but may be greater on a local basis.

Development may lead to the destruction or degradation of aquatic habitats. Increased fishing pressure may result in changes in species composition of an aquatic habitat or changes in the management of some habitats (such as the transition to put-and-take fisheries from native fish populations). Other recreational activities (e.g., boating, swimming, and camping) may directly degrade an aquatic habitat. These types of impacts are expected to be small because the project-induced growth will be low for most basing modes, and most of the aquatic habitats that are likely to receive recreational impacts are regulated by government agencies. The future of privately owned aquatic habitats is not known because potential development is dependent upon the individual landowner.

Most unique and sensitive habitats are regulated by government agencies; therefore, indirect impacts are likely to be limited through the management of the habitat by the regulating agency. Access to privately owned habitats is often restricted; however, private land may be subject to future development. The small increase in population may result in a small increase in illegal activities, such as poaching or unpermitted off-road vehicle use, that could degrade a sensitive habitat by threatening sensitive plant and animal populations or by disturbing the land cover of the habitat.

Threatened and endangered species may be disturbed as a result of the increased use of off-road vehicles in seasonally important or critical habitats. Greater human pressure resulting from increased recreational activities (e.g., hiking and camping) could have similar effects. Poaching and illegal collection of plants are expected to increase with added population. These indirect impacts to threatened and endangered species are expected to be minor because of the relatively small project-induced increase in population that is expected.

4.6.2.1 Hard Mobile Launcher in Random Movement

At 200-missile deployment locations, construction of proposed project facilities is expected to permanently displace 7,910 acres of vegetation and wildlife habitat (610 acres at the MOB and 7,300 acres at the deployment area). An additional 14,690 acres (1,510 acres at the MOB and 13,180 acres at the deployment area) of habitat will be temporarily disturbed by construction. Over the 20-year life of the proposed project, off-road HML operations are expected to disturb 175 to 350 square miles (sq mi) of habitat in the RMA. At some deployment installations, vegetation and habitat of a portion of the RMA may already have been disturbed by previous missions or projects, as described in Section 4.6.1.3.

For the 50-HML locations (Eglin Air Force Base [AFB] and Yakima FC/Department of Energy [DOE] Hanford Site), construction is expected to permanently displace 2,480 acres of habitat (390 acres at the MOB and 2,090 acres at the deployment area). An additional 4,500 acres (1,440 acres at the MOB and 3,060 acres at the deployment area) of habitat will be disturbed temporarily during construction. Over the 20-year life of the proposed project, off-road HML operations are expected to disturb 50 to 100 sq mi of habitat in the RMA. Small areas of habitat will be disturbed in the long term because of communication tower and access road construction in mountainous areas or other elevated sites. Local, temporary disturbance of wildlife will also result.

The largest source of temporary disturbance from the Hard Mobile Launcher in Random Movement basing mode will be road construction. Improvements and preparation of new roads are likely to increase erosion and sedimentation in and near aquatic habitats. These short-term impacts will vary according to the degree of impact within each area.

Operation of the Hard Mobile Launcher in Random Movement basing mode will result in major, long-term impacts to vegetation over the 20-year life of the proposed project because of off-road HML travel. Long-term, off-road impacts include crushing and breaking plants, removal of roots from substrate, exposure of roots to desiccation, and burial of plants. Long-term impacts to plant habitat include destruction of soil structure, soil compaction, decreased water infiltration, and accelerated soil erosion. Parking of HMLs in a hardened configuration will result in long-term plant loss and soil disturbance because of the necessity to level the parking area.

Major impacts to wildlife and wildlife habitat are expected to occur during the 20-year operations phase of this basing mode. Extensive long-term loss of habitat or habitat components will occur as a result of vegetation and ground surface disturbance from the off-road HML movements. Disturbance will vary depending on soil and vegetation types, recovery potential of the plant and

animal communities, and number of times the site is disturbed. Mortality is expected for burrowing species and less mobile species occurring in the path of HMLs. Movement and presence of the HMLs, noise, dust, and general human presence may cause long-term disturbance to wildlife in general. Daily and/or seasonal movements or activities may also be disturbed. Adverse impacts may occur to particularly sensitive species (such as desert bighorn sheep and mountain lions) in areas adjacent to the HML operations area, because the noise, dust, and visual impacts of operations could cause sensitive species to vacate primary habitat and possibly suffer reduced reproductive success.

Off-road operation of HMLs may include the crossing of aquatic habitats, resulting in direct disturbance of these habitats at the point of crossing and sedimentation downstream in flowing waters or in nearby standing waters. Direct disturbance could include direct physical damage, destruction of aquatic flora and fauna, and local sedimentation with resulting biological effects (Section 4.6.2). Occasional crossing will lead to short-term impacts; however, repeated crossings that may occur during operations will produce long-term disruption and decreased productivity in the affected habitat. The HML operations may result in long-term loss of ground cover (especially in arid regions) and erosion, which will lead to sedimentation in aquatic habitats. Disturbance of highly erodible soils near aquatic habitats (of special concern in arid regions where many perennial aquatic resources are small) could cause some small aquatic habitats to be transformed, through excessive erosion, to terrestrial habitats. Compaction of soils surrounding aquatic habitats will lead to decreased throughflow of groundwater, threatening the seasonal availability of water in aquatic habitats. It will also increase runoff during wet periods and lead to increased sedimentation and scouring of the aquatic habitat. Short and long-term operations impacts can be reduced by prohibiting HML movements in sensitive aquatic habitats.

Repeated disturbance of a unique or sensitive habitat by off-road HMLs will degrade the habitat and threaten its uniqueness, which is often based on the presence of undisturbed plant and animal populations. HML operations near a unique or sensitive habitat could result in long-term disturbances such as increased erosion. Occasional operations of a similar nature near a unique habitat may result in short-term disturbances if recurrences are far enough apart to allow for recovery of the habitat. These short and long-term impacts could be reduced through the siting of structures during construction, the use of proper construction methods, and by prohibiting HML operations in or near sensitive habitats.

Off-road HML movements will cause long-term loss and/or damage to habitats and food sources used by threatened and endangered species. These effects will be particularly severe in areas that receive repeated HML use. The HMLs may also disturb seasonally important areas in the short or long term. Threatened and endangered species activities (i.e., daily and seasonal movement, feeding, and reproduction) will also be disrupted in the long term by HML activities. Some species are particularly sensitive to any disturbances and may be affected by the HMLs even if their habitats are in areas adjacent to the RMA. Long-term displacement of animal species, particularly those that are highly mobile, will probably occur within the RMA. Displacement may be to adjacent habitats or completely out of the area, which may be the case with raptors and large mammalian species. These HML-related impacts could be avoided or minimized by

restricting HML movements to areas that do not support threatened and endangered species. Further mitigative action could be implemented by specifically avoiding seasonally important areas. Designated critical habitat occurs only on the New Mexico Complex, where there is very little potential for effects on the critical habitat (Section 4.6.3.4).

The HML operations may occasionally be extended into the Command Dispersal Area of each deployment installation, an additional area approximately equal in size to the RMA. These operations will result in the same type of disturbance to the habitats and biota of the Command Dispersal Area as that previously described for normal operations. However, these impacts will be minor in comparison to those of normal operations because use of the Command Dispersal Area will be infrequent and of short duration.

4.6.2.2 Hard Mobile Launcher at Minuteman Facilities

At 200-HML deployment locations (Malmstrom and F.E. Warren AFBs), construction of proposed project facilities is expected to permanently displace 2,260 acres of vegetation and wildlife habitat (400 acres at the MOB and 1,860 acres in the deployment area). Approximately 300 bridges, culverts, or other drainage crossings in each deployment area will be upgraded to support the HMLs. Some roads in the deployment area will also be upgraded. An additional 1,240 acres of habitat will be temporarily disturbed by construction at the MOB and in the deployment area.

At 170-HML deployment locations, construction is expected to permanently displace 1,870 acres of vegetation and wildlife habitat (390 acres at the MOB and 1,480 acres in the deployment area). An additional 1,240 acres of habitat will be temporarily disturbed by construction at the MOB and in the deployment area.

Deployment of the Hard Mobile Launcher at Minuteman Facilities basing mode will result in relatively minor construction-related disturbances to vegetation. The small amount of area expected to be disturbed for road widening has already been disturbed during original road construction or road maintenance. Off-road vehicle disturbance during construction is expected to affect only minor amounts of vegetation. Construction impacts are generally similar to those described in Section 4.6.2. The vegetation types at the locations considered for this basing mode generally have good potential for recovery from disturbance. Agricultural lands with minor soil profile disturbance may be returned to production quickly. Where native vegetation is disturbed, reseeded, or allowed to revegetate, the recovery rate will vary depending on the degree of disturbance, soil and vegetation types, and recovery potential of the site. Minor short-term dust pollution may result from construction and could be deleterious to native vegetation and domestic crops.

Construction for the upgrading of bridges or culverts in the deployment area will result in disturbance of aquatic habitats at each point of construction, as well as downstream disturbance from increased sedimentation and occasional addition of construction materials that may physically alter the habitat. Heavy rain may amplify these impacts. Direct impacts of this type are expected to be limited to the construction phase, with habitat recovery occurring within 1 or 2 years. Upgrading of stream crossings will also cause disturbance to aquatic, wildlife, and riparian habitats, including disruption of

feeding and reproductive behavior, displacement of individuals, and loss of habitat. In addition, construction of new facilities and upgrading of roads will result in minor disturbance and loss of wildlife and other biological elements. Areas to be disturbed by new facilities and road upgrading will be relatively small and are likely to be adjacent to already disturbed areas; therefore, they are likely to provide wildlife habitat of marginal value. Other construction impacts are similar to those described for all basing modes.

Impacts to vegetation and wildlife from operation of this basing mode are expected to be low or negligible. Mortality from vehicle/animal collisions will be minimal. Vehicle movement and noise may also cause minor disturbance of daily/seasonal animal movements or activities and minor stress.

Operations for this basing mode will be essentially restricted to base operations areas, HML transit routes, and launch facilities, so that impacts to aquatic and unique and sensitive habitats are not expected. There is a small potential for habitats located near these facilities to be disturbed by noise, dust, or general human presence resulting from operations activities, but very few unique and sensitive habitats are located near these areas.

The primary long-term effect to threatened and endangered species for this basing mode will be minor incidental interference with feeding, reproduction, and daily and seasonal movements of threatened and endangered species. These disturbances will result from day-to-day operation of maintenance vehicles, human activities, and increased noise levels. Short-term disturbances to threatened and endangered species and their habitats may also result from movements of maintenance/support vehicles; however, these impacts will be temporary and infrequent. Road kills may also occur occasionally.

Operations impacts associated with the Minuteman basing mode can be minimized by reducing daily activities in areas near threatened and endangered species during critical periods (e.g., reproduction seasons and migrations).

4.6.2.3 Hard Silo in Patterned Array

At all locations, construction of silos and related facilities is expected to permanently displace 18,000 acres of vegetation and wildlife habitat in the deployment area. An additional 1,700 acres (740 acres permanently, 960 acres temporarily) of habitat are expected to be disturbed by construction at the MOB.

Construction of the Hard Silo in Patterned Array basing mode will result in the permanent clearance and other severe disturbance of vegetation for construction of facilities and roads over large areas. Impacts from these activities are similar to those described in Section 4.6.2. Temporary disturbance will result from off-road travel by construction and support vehicles. Because of the poor recovery potential common to most of the vegetation types of the areas considered for deployment, even temporary disturbance will have long-term effects. However, temporary disturbance to vegetation in the F.E. Warren AFB deployment area will be short term, because vegetation types expected to be affected at this location have relatively high recovery rates.

Impacts to wildlife from construction of new facilities and roads and road upgrading for this basing mode will be substantial because of the large areas of wildlife habitat expected to be disturbed. The types of impacts that are likely to occur are described in Section 4.6.2. Fences around silo arrays (2 miles wide and 3 to 10 miles long) will be long-term barriers to movement of the more mobile wildlife species. Because deployment areas in the arid Southwest typically have vegetation types that recover slowly from disturbance, most construction impacts to wildlife habitat will be long term.

Types of potential construction-related impacts to aquatic habitats are described in Section 4.6.2. This basing mode may cause construction-related impacts to aquatic habitats because of the large amount of material removed for silo construction and the need to deposit that material as fill. Impacts of this type are expected to be small because of the arid conditions at most bases and can be reduced by minimizing the amount of fill allowed to enter aquatic habitats.

Unique and sensitive habitats may receive large impacts (short and long term) from construction because of the potential removal of large areas of sensitive habitat for silo construction. It should be possible to reduce these impacts (Section 4.6.2) by avoiding sensitive habitats through the siting effort.

Construction of this basing mode could cause permanent disturbance or displacement of threatened and endangered species. In general, types of construction-related impacts to threatened and endangered species will be similar to those described for the Hard Mobile Launcher in Random Movement basing mode.

Minor impacts to both vegetation and wildlife during operations may result from project-related vehicle movement. Restricting travel to existing roads will reduce habitat loss and mortality. However, normal road travel will result in animal mortality, noise, dust, and overall general disturbance of wildlife. Depending on the frequency of travel by support vehicles and sensitivities of the species in the area, disruption of daily/seasonal movements and activities may also occur.

Operations impacts to aquatic habitats for this basing mode are expected to be minor, because operations activities will be largely limited to the MOB operations area, the deployment-area facilities, and connecting roads. Operations activities will not result in long-term impacts to unique and sensitive habitats because they will occur on access roads and within the boundaries of the base and launch facilities. Therefore, long-term disturbances to these habitats are not expected. Operations may result in minor, short-term impacts as a result of the disturbance of sensitive animal populations in nearby habitats. Movement on the roads and at the launch facilities will not occur at a frequency sufficient to threaten the biological uniqueness of these habitats. These short and long-term impacts could be reduced during siting, by the use of proper construction methods, and by prohibiting the placement of launch facilities in extremely sensitive habitats.

Operation of this basing mode is expected to have only minor impacts on threatened and endangered species. Day-to-day operations in the deployment area will cause long-term interferences with threatened and endangered species, as well as displacing these species to adjacent areas. Species that

are highly mobile (i.e., birds and large mammals) or that are particularly sensitive to disturbances may leave the area. Minor, short-term disturbances may also occur from infrequent movements of missile transporters, maintenance vehicles, and human activities in the area.

Locating silos in areas not inhabited by threatened and endangered species and minimizing activities near seasonally important or critical habitats would greatly reduce the potential for affecting these species.

4.6.3 Impacts of Hard Mobile Launcher in Random Movement

4.6.3.1 Arizona Complex

Potential adverse impacts of the proposed project on vegetation, wildlife, unique and sensitive habitats, and threatened and endangered species are expected to be significant in this region. Long-term impacts to threatened and endangered species are also considered significant at the national level because of the potential for disturbance of the Sonoran pronghorn. Short-term impacts to these species will be moderate and not significant. Long-term impacts to vegetation, wildlife, unique and sensitive habitats, and threatened and endangered species will be high and significant. Short-term impacts will be low and not significant for vegetation and moderate and significant for wildlife. Short-term impacts to unique and sensitive habitats will be low and significant. Short and long-term impacts to aquatic habitats will be negligible. Regional impacts to biology are not expected to be dependent on the MOB selected.

Vegetation. Implementation of the proposed project at the Arizona Complex will directly affect large areas of native Sonoran Desert vegetation. Approximately 7,910 acres of vegetation will be permanently disturbed during construction of facilities at the MOB and in the RMA. An additional 14,690 acres of vegetation will be temporarily disturbed to varying degrees during construction. Because of the slow recovery rate typical of vegetation types in the arid Southwest, even temporary disturbance will have long-term effects. The majority of impacts to vegetation are expected during the operations phase, when 175 to 350 sq mi of the RMA may be disturbed by off-road HML operations during the 20-year life of the proposed project. Based on the relative abundance of vegetation types in the RMA, approximately 82 percent of the area potentially disturbed is likely to be the creosote bush-bursage type and 17 percent is likely to be the paloverde-cactus shrub type. In addition, 5,000 acres (less than 1% of the RMA) of regionally important desert wash habitat may be disturbed. Long-term, indirect impacts are expected to be low to moderate as a result of the projected minor population growth and the dispersed nature of most recreational activities. Recreational off-road vehicle use in arid areas may result in considerable long-term impacts. Although these vegetation types are relatively common in the region, the large area potentially disturbed represents a major impact to native vegetation, habitat, and biological productivity of the area. This is considered a long-term, high impact. Short-term impacts will be low because few impacts will be transient.

The Sonoran Desert is a fragile ecosystem with poor potential for recovery from disturbance. The potentially high degree of disturbance to vegetation is likely to be of concern to natural resource management agencies and scientific

authorities. Major losses of native vegetation have occurred in the ROI from urban and agricultural expansion and second (recreational) home development. Cumulative losses that may result from this project and other projects in the region will likely be considerable. Because of the major impacts expected to the vegetation and biological production of the area, the poor recovery potential and fragile nature of the Sonoran Desert ecosystem, and the level of concern the expected impacts may generate among natural resource management agencies, the overall regional-level, long-term impact to vegetation will be significant. Short-term impacts will not be significant.

Wildlife. Short and long-term impacts to wildlife in the area will be associated with both the construction and operations phases of this basing mode. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. Communications tower and access road construction in mountainous areas may disturb or displace wildlife species such as the mountain lion. However, direct habitat loss due to HML operations is not likely for these species because HMLs will not operate in mountainous regions of the RMA. Mountain lion, mule deer, and white-tailed deer also occur in other areas within the ROI and will receive indirect impacts from the expected project-induced population growth (0.1-0.3%).

In the direct impact area, the diversity of nongame species is moderate in the creosote-tarbush vegetation type and high in the paloverde-cactus shrub type. Direct impacts to nongame species in the direct impact area will be long term and substantial because of the relatively high nongame diversity of the vegetation types affected.

Construction activities will cause the loss or disturbance of large areas of habitat and the displacement or mortality of numerous wildlife, resulting in major disruptions to wildlife communities in the region. Although wildlife are currently disturbed by low-flying aircraft, HML operations will cause much greater disruption of wildlife habitat over the life of the proposed project; therefore, short-term impacts to wildlife will be moderate and long-term impacts will be high. The considerable loss of wildlife habitat is likely to be of concern to natural resource management agencies. Furthermore, cumulative effects will occur to wildlife in the area throughout the life of the proposed project. Therefore, short and long-term, regional impacts are expected to be significant.

Aquatic Habitats. In addition to isolated, small springs and stock tanks, only 16 miles of desert wash habitat have been identified in the potential direct impact area. Desert wash habitats are common in the greater study area, but less common than in deserts that receive greater annual rainfall. Construction activities will not cause any large short or long-term impacts at the MOB or in the RMAs because of the small number of aquatic habitats and likelihood of reducing impacts through construction design and methods. Minor, long-term impacts could result during system operations from off-road crossings of these desert washes, which would directly disturb the biota of the wash and increase sedimentation. The expected 0.1 to 0.3-percent project-related population increase will not create large, indirect impacts to aquatic resources in the ROI. Public use of many wetlands on the Colorado and Gila rivers is restricted (limiting potential disturbance), and accessible areas can withstand the increased use.

The proposed project is expected to have few environmental consequences for aquatic habitats because of the small amount of this habitat in the potential direct impact area, the small probability of construction or operations in these habitats, and the lack of indirect impacts. Therefore, the overall short and long-term impacts will be negligible. Expected short and long-term impacts to aquatic habitats and biota are not likely to be of concern to natural resource management agencies or add substantially to cumulative impacts to aquatic habitats in the region, and so are considered to not be significant at the regional level.

Unique and Sensitive Habitats. Eight of the 295 identified unique habitats in the ROI occur in the RMAs, and 6 additional habitats occur near the RMAs. The RMAs cover the northern edge and central portion of Cabeza Prieta National Wildlife Refuge (292 sq mi on proposed wilderness area and 62 sq mi on other land in the refuge), and include three areas designated as research natural areas and designated natural areas within the refuge. The RMAs also cover four natural areas on Luke AFR (including 90 sq mi of the Mohawk Mountains and Sand Dunes Designated Natural Area). Minor, short-term impacts in these areas will result from the direct disturbance of sensitive plant and animal communities during construction activities. The HML operations are expected to create long-term, high impacts to these habitats from the repeated, direct disturbance of large, presently undisturbed areas. Construction and operations will be removed from unique habitats that are outside of the RMAs; therefore, little or no impact will occur to these habitats. The majority of unique habitats in the remaining ROI are wilderness areas, wilderness study areas, and designated natural areas, and have restricted public access; therefore, it is unlikely that the 0.1 to 0.3-percent project-related population increase will create any major disturbances in these habitats. The large number of areas available for public use will also help to reduce any potential indirect impacts.

Short-term impacts will be low because of the small area disturbed and lack of effect to the biological uniqueness of these habitats. However, long-term impacts will be high because HML operations will permanently disturb large areas of six unique habitats, greatly reducing their biological value. The areas that may receive high impacts from the proposed project represent ecologically critical areas that are of special concern to the USFWS, the State of Arizona, and the scientific community. Based on these factors, the low potential for habitat recovery, and the potential effect to a proposed wilderness area, the short and long-term impacts will be significant at the regional, but not national, level.

Threatened and Endangered Species. The endangered Sonoran pronghorn and important habitat for this species occur in the RMA on Luke AFR and on the Cabeza Prieta National Wildlife Refuge. Lowlands, the preferred habitat of the Sonoran pronghorn, are prime deployment areas for the HML. There is substantial overlap between pronghorn habitat and the RMA. Approximately 85 to 90 Sonoran pronghorn occur in the potential direct impact area. The remainder of the world's population occurs in Mexico and is estimated at 200 to 300. Construction activities are likely to result in short-term, moderate impacts to the Sonoran pronghorn populations. In addition, human presence and vehicle movement during both construction and operations will probably disrupt daily and seasonal movements and activities of the species. Operations activities will also cause major long-term loss of habitat.

The endangered American peregrine falcon and wood stork occur as occasional migrant species on Luke AFR and Yuma Proving Ground (PG), and may experience minor, short and long-term disturbance and loss of food sources. They may also avoid the area because of the high degree of human activity and vehicle movement. The seven federally listed animal and two plant species present or thought to be present in other areas of the ROI will not be indirectly affected by urban expansion or by increased recreational activities. One federally listed plant species (Tumamoc globeberry), 6 federal-candidate plants, 7 animal species that are candidates or are proposed for federal listing, 2 state-protected animal species, and 12 state-listed plant species occur or are believed to occur in the direct impact area. Most of these species have a high potential for experiencing major, adverse, short and long-term impacts, primarily from off-road HML movements, and to a lesser degree, from construction activities. Twelve federal-candidate wildlife species, 15 state-protected wildlife species, 12 state-listed (Arizona) plant species, and over 50 federal-candidate plant species occur in other parts of the ROI, and like the federally listed species, have a low likelihood for experiencing long-term, indirect impacts.

The strong likelihood of severely affecting the endangered Sonoran pronghorn and its habitat, and a similar likelihood of causing major adverse impacts to many federal-candidate/proposed species and state-listed species, causes the overall long-term impact to threatened and endangered species to be high. Short-term impacts will be moderate.

Because of the current sensitive status of threatened and endangered species, a high level of concern by natural resource management agencies and scientific authorities is expected. Long-term operations of the proposed project are likely to cause a major, adverse impact to the United States population of the endangered Sonoran pronghorn, and may create a substantial threat to the continued occurrence of this species in the United States. Substantial loss of habitat and food resources is expected. Because of the large overlap between the range of this species and the RMA, the likelihood of avoiding major impacts to the species is low. This, in conjunction with the potential project impacts, adds to the cumulative impacts that are already of concern for such species in the region, and results in regional-level, long-term, significant impacts to threatened and endangered species. The potential for adverse impacts to the only United States population of the Sonoran pronghorn is significant at the national level. Short-term impacts are not considered significant.

4.6.3.2 Florida Complex

Potential long-term impacts of the proposed project to vegetation, wildlife, aquatic habitats, and threatened and endangered species are expected to be high and significant in this region. Short-term impacts to wildlife, aquatic habitats, and threatened and endangered species will be moderate and significant. Short-term impacts to vegetation will be moderate but not significant. Although short-term, low impacts and long-term, moderate impacts to unique and sensitive habitats are expected, it is not anticipated that these impacts will be significant.

Vegetation. Construction of structures and roads at the MOB and deployment area will result in the temporary disturbance of approximately 4,500 acres of

vegetation and permanent disturbance of an additional 2,480 acres. Because of the good recovery potential of the vegetation types common to this area, locations where vegetation will be temporarily disturbed are likely to revegetate over a relatively brief period of time. The majority of disturbance will result from HML operations. It is estimated that 50 to 100 sq mi of the RMAs will be directly disturbed by off-road vehicle movement during the 20-year life of the proposed project. These impacts will be primarily long term. Based on the relative abundance in the RMAs, it is estimated that 81 percent of the area disturbed will consist of southern mixed forests, and 18 percent will support southern floodplain forests. The remaining 1 percent includes urban/disturbed areas, cultivated areas, and water bodies.

Indirect, long-term impacts are expected to be minor because of the abundance of available recreational sites, probable dispersed nature of the recreational activities, and good recovery potential of the vegetation. The vegetation types potentially disturbed contribute significantly to the biological productivity of the area and provide valuable habitat for numerous biota. Although these types are relatively common in the region, the large area expected to be disturbed represents a short-term, moderate impact and a long-term, high impact to vegetation.

The potentially high degree of disturbance to vegetation and habitat is likely to be of concern to natural resource management agencies and scientific authorities. Loss of vegetation from the proposed project, in conjunction with losses that may result from other projects in the region, will likely be considerable. Because of the large amount of area potentially disturbed and the level of concern among natural resource management agencies, the expected effects are likely to generate long-term impacts to vegetation that will be significant at the regional level. Short-term impacts to vegetation are not considered significant because of the good recovery potential of the vegetation types in the area.

Wildlife. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. Wildlife species inhabiting temporarily disturbed areas will receive direct, short-term impacts, whereas those species in permanently disturbed habitats will receive direct, long-term impacts. The majority of impacts will occur during the operations phase, with large areas of the RMAs being disturbed by HML off-road movements.

The diverse avian, mammalian, amphibian, and reptilian fauna that occur in the habitats within the RMA will receive direct, long-term impacts during the life of the proposed project. The primary big game species potentially affected are the white-tailed deer and black bear, but there is also a wide assemblage of nongame species that occur in the area. The diversity of nongame species in the habitats directly affected (i.e., southern mixed forest and southern floodplain forest) is high compared to other vegetation types in the region such as mud flats (moderate diversity), sand pipe (moderate diversity), and coastal strand (high diversity). Indirect, long-term impacts resulting from project-induced population growth (0.4-0.5%) will occur within the ROI; however, they are expected to be minimal.

The wildlife communities in the region will be disrupted because of the large area of habitat that will be lost or disturbed and the large number of wildlife that will be killed or permanently displaced. Greater disturbance will

occur during the operations phase. Therefore, short-term impacts to wildlife will be moderate and long-term impacts will be high. It is probable the expected impacts will be of concern to natural resource management agencies because of the large area of diverse wildlife and habitat affected. These impacts may also add to the cumulative effects on wildlife in the area over the life of the proposed project. Based on these criteria, short and long-term impacts to wildlife will be significant at the regional level.

Aquatic Habitats. The RMAs encompass 55 linear miles of stream habitat (most has associated palustrine [bottomland] forest), 22,080 acres of palustrine forest, 640 acres of estuarine marsh, and 672 acres of open water. Although regionally common, these aquatic resources represent relatively pristine habitats that have been spared from past development. Construction could produce short-term impacts to these aquatic resources because of temporary increases in sedimentation that will directly affect important fish, insect, and crustacean populations. Water withdrawn from streams for construction could reduce flow below acceptable levels, affecting aquatic species in the short term. Construction of bridges and landfill associated with road and building construction will create long-term impacts because of the direct displacement of aquatic habitat and its associated fauna (including sensitive fish populations). Off-road HML operations are likely to affect aquatic resources in the long term. Off-road crossings of aquatic habitats will kill some aquatic biota, increase turbidity, and cause physical disruption. Off-road operation within the watershed will cause the ground to be susceptible to increased erosion. The high rainfall levels that are common to this region of the United States will increase erosion, leading to habitat loss and degradation from sedimentation. These short and long-term impacts could be reduced by restricting operations near wetlands and on erodible soils (especially during the wet season), and through the use of sound construction methods. Aquatic recreational resources are abundant in the remaining ROI, and it is unlikely that the expected 0.4 to 0.5-percent project-induced population increase will create large, indirect impacts to these resources.

Long-term impacts will be high because of the potential degradation of wetland and fisheries resources by off-road HML operations, the low probability of reducing these impacts, and the amplification of these impacts from regional climatic factors resulting in permanent reduction of regional wetlands production. The short-term impacts will be moderate because construction will affect fewer aquatic habitats than operations, but will still result in considerable adverse ecological consequences for the important aquatic systems of the area. These impacts will be of concern to the USFWS, the State of Florida, and the scientific community. Wetlands are considered ecologically critical and protected habitats. Past developments have removed much wetland habitat from production, and future growth in the region threatens these habitats. Based on these cumulative impacts, disturbances of aquatic habitats will be of special concern. Therefore, regional-level, short and long-term impacts will be significant.

Unique and Sensitive Habitats. Thirteen of the over 100 unique habitats that have been identified in the ROI occur on RMAs or Eglin AFB. Eleven of these areas represent habitats (primarily aquatic and wetland, but also including forested upland sites) that have been maintained in their natural state by Eglin AFB. Several of these areas are entirely within RMAs. Although construction and operations are not expected to occur directly in major wetlands,

these habitats may be degraded as a result of surface disturbance (in uplands and small aquatic habitats) and sedimentation. Many of these potential impacts are discussed in the aquatic habitats element. Construction-related short and long-term impacts will be small because of the small area disturbed and the likelihood of avoiding biologically sensitive portions of these unique habitats. Even if HMLs are prohibited from operating in the sensitive portions of these habitats, some long-term impacts from HML operations are likely to occur from the disturbance of surrounding habitat. Small portions of the floodplain of the Shoal River, an Outstanding Florida Water of interest to the Florida Department of Natural Resources and the USFWS, occur in the RMA; however, it is unlikely that construction or operations will occur in the sensitive wetland portions of this habitat. Little or no impacts are expected to occur to Rocky Bayou State Park, an Outstanding Florida Water and State Aquatic Preserve, because only a small part of this area lies in the RMA, and it is likely that this area will be avoided by construction and operations because of its wetland habitat. The projected 0.4 to 0.5-percent project-related population increase is not expected to have high, indirect impacts to unique habitats in the remaining ROI, many of which are managed to preserve their biological heritage.

The overall short-term impact will be low and the long-term impact will be moderate. This is based on the environmental consequences resulting from the large number of areas that may be affected, the good likelihood of reducing some impacts to these habitats, and the general improbability of reducing all impacts to these habitats. These habitats are of interest to the Florida Department of Natural Resources, the USFWS, and the scientific community. The potential impacts are unlikely to cause substantial concern to natural resource management agencies because of the likelihood of reducing many of the impacts through siting and the lack of cumulative impacts in the RMA. The proposed project will not contribute substantially to cumulative impacts to unique and sensitive habitats in the region. Therefore, these regional, short and long-term impacts will not be significant.

Threatened and Endangered Species. Approximately 20 colonies of the endangered red cockaded woodpecker are known to occur on Eglin AFB. Its present range includes scattered locations throughout the Southeast. Adverse, short and long-term impacts to this tree-nesting species and its habitat are highly probable during both construction and operations. An additional endangered species, the Okaloosa darter, occurs in small streams and creeks on Eglin AFB, and there is a strong possibility of it being affected by road construction and upgrading and by stream crossings during operations. Ninety percent of the range of the Okaloosa darter occurs on Eglin AFB. The threatened indigo snake occurs in both dry and moist habitats in the region, and because of its ground-dwelling nature, has a high probability of receiving short and long-term impacts during construction and operations. The snake is known to occur in southeast Georgia, peninsular Florida, and disjunctively in the Florida Panhandle.

Three federally listed species, the bald eagle, peregrine falcon, and eastern brown pelican, are transients at Eglin AFB. The bald eagle has occasionally nested at Eglin AFB. The presence of man and the operation of construction equipment and HMLs are likely to discourage use of large portions of the area by these species over the life of the proposed project.

Three additional federally listed wildlife species (wood stork, Florida Everglade kite, and Bachman's warbler) occur in areas adjacent to the RMA, and therefore, may occur in the direct impact area occasionally. Six federal-candidate plants are known to occur onbase. Sixteen additional state-listed (Florida) plants may occur in the direct impact area. Two animal species proposed for federal listing (Choctawhatchee beach mouse and Perdido beach mouse) and three candidate animal species occur in the direct impact area. Only three state-protected wildlife species are thought to occur onbase. Twelve additional federally listed wildlife species, 18 federal-candidate wildlife species, 18 wildlife species listed by the State of Florida (but not federally listed), 4 federally listed plants, 61 federal-candidate plants, and 31 state-listed (Florida and Georgia) plants are found elsewhere in the ROI, but are unlikely to receive substantial long-term impacts because of the anticipated dispersed nature of recreational activities.

Short-term impacts to threatened and endangered species will be moderate and long-term impacts will be high because of the high probability of the proposed project affecting colonies of the endangered red cockaded woodpecker, the likelihood of affecting the endangered Okaloosa darter and the threatened indigo snake, and the potential loss of habitat for three additional endangered species.

Given the current sensitive status of threatened and endangered species, expected impacts are likely to result in a high level of concern by natural resource management agencies and scientific authorities. Suitable habitat for many of these species has been decreasing since colonial times because of lumbering, agricultural activity, and urban expansion. Project impacts are likely to add substantially to cumulative impacts to such species in the region. The feasibility of mitigating project impacts to remove threats to the continued existence of all protected species is low. In consideration of all these factors, long-term impacts to threatened and endangered species will be significant at the regional level. Short-term impacts will also be significant primarily because of construction impacts and temporary loss of habitat of the Okaloosa darter.

4.6.3.3 Nevada Complex

Potential long-term impacts of the proposed project on vegetation, wildlife, and unique and sensitive habitats are expected to be high and significant in this region. Short-term impacts to vegetation will be low and not significant. There will be short-term, low impacts and long-term, moderate impacts to threatened and endangered species; these impacts will not be significant. Wildlife is expected to experience short-term, moderate, and significant impacts. Short-term impacts to unique and sensitive habitats will be low and significant. Short and long-term impacts to aquatic habitats are expected to be low and not significant. Regional impacts to biology are not expected to be dependent on the MOB selected.

Vegetation. Vegetation types representative of the Mojave Desert and the Great Basin will be disturbed during construction and operation of the proposed project. Direct impacts from construction will result in the permanent disturbance of 7,910 acres and temporary disturbance of an additional 14,690 acres on the MOB and RMAs. Long-term impacts from both temporary and permanent disturbance will occur because of the slow recovery

rates characteristic of semiarid vegetation. Direct impacts from operations will potentially disturb 175 to 350 sq mi of the RMAs. Based on the relative abundance in the RMAs, these vegetation types have the following likelihood of sustaining long-term disturbance: saltbush-greasewood, 32 percent; creosote bush, 22 percent; sagebrush, 22 percent; pinyon-juniper, 20 percent; and communities with Joshua tree overstories, 3 percent. Long-term, indirect impacts from increased population growth and recreation are expected to be low. The low, project-related population growth expected indicates that associated recreational pressure will also be low. In addition, much of this recreation will be concentrated in the Lake Mead Recreation Area, where vegetation cover is minimal. The vegetation types that may be directly affected by the proposed project are relatively common in the region. The large amount of vegetation potentially lost represents a major impact to the biological community and productivity of the area. This is considered a long-term, high impact to the vegetation and wildlife habitat of the area. Short-term impacts will be low because few impacts will be transient.

Vegetation of disturbed sites in arid to semiarid regions typically exhibits slow recovery rates from disturbance. The disturbance to vegetation expected to result from the proposed project is likely to be of concern to natural resource management agencies and scientific authorities. Cumulative impacts from this project and other projects in the region will likely be considerable. Because of the large impacts expected to occur to the native vegetation of the area, the slow recovery rate of semiarid vegetation types, and the level of concern expected among natural resource management agencies, the overall regional-level, long-term impacts to vegetation will be significant. Short-term impacts are not considered significant.

Wildlife. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. Major game species located within the direct impact area include desert bighorn sheep, pronghorn, and mule deer. These species will receive short-term, direct impacts during construction, and direct, long-term impacts during operations from off-road HML movements. Direct habitat loss from HML operations is not likely for desert bighorn, since this species inhabits mountainous areas where HML operations are not likely to occur. However, this species may be adversely affected by HML operations because it occurs in habitats adjacent to RMA and is highly sensitive to human disturbance and noise. Communication tower construction in mountainous areas may also cause some potential impacts to these species.

Nongame species in the direct impact area will be similarly affected. Nongame diversity in the most common vegetation communities of the direct impact area varies from moderate to high. The creosote bush, blackbush, Joshua tree-creosote, and saltbush communities have moderate wildlife diversities, while the riparian-desert wash communities support a high diversity of species. Wildlife species occurring in other areas of the ROI (i.e., mountain lion, feral burro, and wild horses), as well as small nongame species, may receive minor, long-term, indirect impacts during the life of the proposed project from anticipated population growth (0.6-1.2%).

Construction activities will kill or displace numerous wildlife as a result of the loss or disruption of a large area of habitat. Wildlife currently receive some impacts from low-flying aircraft; however, HML operations will cause much

greater disturbances over the life of the proposed project. The major disruption to the wildlife communities from construction and operations will result in a short-term, moderate impact and a long-term, high impact. The expected impacts will be of concern among natural resource management agencies because of the large areas that will be disturbed. In addition, the proposed project will add to the cumulative impacts for wildlife in the area during the life of the proposed project. Based on these criteria, short and long-term impacts will be significant at the regional level.

Aquatic Habitats. The RMAs contain 123 miles of desert wash and 17,523 acres of playa habitat (both habitat types are regionally common). Although these aquatic habitats are generally unsuitable for structures, sedimentation could produce short-term impacts, and persistent sediments could create long-term impacts from the permanent loss of lowland habitat. Long-term impacts will result from HML operations in these habitats as a result of the direct disturbance of vegetation (the primary biological feature of both habitats) and increased sedimentation (leading to a long-term reduction in habitat value). The desert washes represent a small portion of the RMAs, and direct disturbances will be primarily a result of off-road crossings. Playas, when dry, represent a greater area and a habitat more conducive to HML operations than other areas. Therefore, a large amount of direct disturbance to playa habitats in the RMAs is expected. These short and long-term impacts can be reduced by using sound construction techniques and through siting of operations. Lake Mead and the Colorado River represent the major recreational and fisheries habitats in the ROI that are likely to receive indirect impacts from increased population growth. These aquatic resources are large and capable of accommodating the relatively small increased use that will result from the proposed project. Sensitive fish populations in Ash Meadows, the Amargosa River, and Pahranagat Valley are on managed public lands and will not receive large, indirect impacts from the project.

Because of the small amount of regionally common desert wash potentially affected, the large amount of playa habitat in the ROI, and the lack of impacts to other major aquatic resources, environmental consequences will be minor. Therefore, short and long-term impacts will be low. Cumulative effects are expected to be minor in the potential direct impact area. The impacts from the proposed project will not make a major contribution in this respect, precluding the cause for concern about aquatic habitats. Growth and development in the remaining ROI will be concentrated at several population centers. The expected project-induced indirect impacts will add little to these cumulative impacts and not produce substantial concern among aquatic resources management agencies. Therefore, regional-level, short and long-term impacts to aquatic habitats are rated not significant.

Unique and Sensitive Habitats. Two of the over 75 unique habitats that have been identified in the ROI lie within the RMAs. Papoose Lake is located in an RMA in the northwest corner of the Desert National Wildlife Range. Although construction activities are not likely to affect this RMA, HML operations will probably degrade its research value because of surface disturbance. Large areas of RMA (318 sq mi) lie on the western part of the Desert National Wildlife Range (a proposed wilderness area), which is currently in co-use with Nellis AFR. Road construction will produce short-term disturbances to a relatively small area within the range, with a strong potential for complete recovery (this may require a long period of time because of the arid

conditions and resulting slow growth). Minor, long-term impacts will result where habitat is permanently removed by roads or structures. The HML operations (especially off-road) will disturb portions of the RMA on the Desert National Wildlife Range (296 sq mi of RMA occurs on proposed wilderness area), degrading its unique biological characteristics. This area would otherwise remain undisturbed. Potential impacts to the Papoose Lake Research Natural Area may be reduced through operational constraints and the use of sound construction methods. These constraints will also reduce impacts to the Desert National Wildlife Range; however, these impacts are likely to remain large. Most of the unique habitats in the remaining ROI are managed by agencies and will not be disturbed to a great extent by indirect impacts. A few areas, such as the Las Vegas Wash, are subject to pressure by development. However, the expected 0.6 to 1.2-percent project-induced population increase is unlikely to make a major contribution to cumulative impacts that may affect these habitats.

Although only a few habitats will be affected by the project, these habitats will experience major biological degradation that would not occur from other, cumulative factors, and represent very important, biologically unique areas. Therefore, the overall short-term impacts for this element will be low and long-term impacts will be high. These impacts will not be greatly reduced by minor program constraints. Impacts to the Desert National Wildlife Range will be of concern to the USFWS, the Bureau of Land Management (BLM), Nevada Department of Wildlife, and the scientific community. Based on these factors, short and long-term impacts will be significant at the regional level.

Threatened and Endangered Species. Two species that are federally listed as endangered, the bald eagle and the peregrine falcon, are occasional migrants on Nellis AFR and the Nevada Test Site, and may occur in other areas of the ROI. Presence of the HMLs and construction equipment in the RMA will likely cause these species to avoid the area during both construction and operations, and cause loss of habitat and prey for the peregrine falcon. Four federal-candidate animal species and 12 plant species are known or believed to occur on Nellis AFR or the Nevada Test Site. These species may be affected by construction and are likely to receive major impacts by off-road HML movements. Similar substantial impacts from construction and off-road travel are possible for the four state-listed animal species in the direct impact area. Impacts to many of these taxa may be avoided through siting of facilities and activities.

Seventeen federally listed fish species, 9 federally listed plant species, 8 federal-candidate animal species, 37 federal-candidate plant species, and 5 state-protected animal species are thought to occur in the ROI. Because of their rarity, the remoteness of their habitat, and the anticipated dispersed nature of project-related recreation, long-term impacts to these species are not likely.

Because of the substantial potential of adversely affecting several federal-candidate species and state-protected species by causing disturbance and loss of habitat, as well as the minor potential to affect federally listed species, the overall long-term impacts to threatened and endangered species will be moderate. Short-term impacts will be low.

Adverse impacts to threatened and endangered species are likely to be of concern to natural resource management agencies and scientific authorities because of the biological sensitivity of these species. However, there exists a good likelihood of satisfactorily avoiding or reducing adverse impacts to many species so that the continued existence of most or all of the potentially affected species will not be jeopardized. Therefore, overall short and long-term impacts to threatened and endangered species are considered not significant.

4.6.3.4 New Mexico Complex

Potential project-related long-term impacts to vegetation and wildlife are expected to be high and significant at this location. There will be long-term, moderate, but not significant impacts to aquatic habitats, and long-term, moderate, but significant impacts to threatened and endangered species. Unique and sensitive habitats will experience short and long-term, low, but not significant impacts. There will be short-term, low, but not significant impacts to vegetation, aquatic resources, and threatened and endangered species, and short-term, moderate, and significant impacts to wildlife. Regional impacts to biology are not expected to be dependent on the MOB selected.

Vegetation. Road and building construction at the MOB and in the deployment area will result in the temporary disturbance of 14,690 acres of vegetation and the permanent disturbance of an additional 7,910 acres. Because of the slow recovery rates typical of vegetation types common to the region, most impacts from temporary disturbance will be long term. The majority of disturbance will occur during operations, when approximately 175 to 350 sq mi of the RMAs will be directly disturbed by off-road vehicle movement during the 20-year life of the proposed project. These impacts will be long term. Based on the relative abundance of vegetation types in the RMAs, the disturbance of vegetation will be distributed approximately as follows: grama-tobosa shrub-steppe, 36 percent; creosote bush-tarbush, 27 percent; mesquite-sandsage, 18 percent; and pinyon-juniper, 14 percent. Long-term, indirect impacts to vegetation are expected to be low. Minor, project-induced population growth and numerous recreational opportunities available in the region indicate that recreation-related impacts are likely to be minor and dispersed. The vegetation types potentially disturbed are relatively common types of the region. However, this loss of large amounts of vegetation represents a major disturbance to the ecosystems, biological productivity, and habitats of the area. This is considered a long-term, high impact to vegetation. Short-term impacts will be low because few impacts will be transient.

The Chihuahuan Desert has more limited distribution in the United States than other deserts in North America. Most of the Chihuahuan Desert lies in Mexico. Like other arid environments, the Chihuahuan Desert is a fragile ecosystem with poor recovery potential from disturbance. The potentially high degree of disturbance to vegetation and wildlife habitat is likely to be of concern to natural resource management agencies and scientific authorities. Cumulative losses of vegetation and wildlife habitat from the proposed project and other projects in the region may be considerable. Although some areas of the RMA may have been disturbed by previous military exercises and activities, the large project-related impacts expected to the native vegetation of the area, the low recovery potential and fragile nature of the Chihuahuan Desert, and

the level of concern likely among natural resource management agencies indicate that overall regional-level, long-term impacts to vegetation will be significant. Short-term impacts will not be significant.

Wildlife. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. Major game species occurring in the direct impact area include mule deer, pronghorn, and oryx. The proposed project is likely to have considerable short and long-term impacts to mule deer, including disturbance of high-density range and winter range, and loss of habitat. Operations in the grama-tobosa shrub steppe will cause short and long-term, moderate disturbance and loss of habitat for numerous wildlife species. Communication tower construction in mountainous areas may cause loss of habitat and otherwise disturb species inhabiting these areas. A small number of oryx are present in the central part of White Sands Missile Range and may receive short and long-term, low impacts.

Nongame species diversity in the most common vegetation types of the area ranges from low to high. The grama-tobosa shrub steppe is rated as low, while the creosote bush type has moderate species diversity. The mesquite-sandsage type has moderate bird diversity and low mammal diversity. The pinyon-juniper, riparian, and pseudoriparian types have the highest diversity of species. Because of the large number of acres potentially disturbed, short and long-term impacts to nongame wildlife will be considerable. Indirect impacts to wildlife are expected to be minor because of the minor urban growth expected and because the abundant recreational opportunities available will result in dispersed, rather than concentrated, recreation.

Most of the habitat types and animals expected to be lost or disturbed are relatively common in the region, but the large amount of habitat potentially disturbed and the large number of animals potentially killed, displaced, or otherwise disturbed represent a short-term, moderate impact and a long-term, high impact to the wildlife and ecosystems of the area.

The potentially high degree of disturbance to wildlife habitat and loss of wildlife is likely to be of concern to natural resource management agencies. The cumulative loss of wildlife and habitat from the proposed project, in combination with losses from future projects, is likely to be considerable. Because of the anticipated major impacts to wildlife and wildlife habitat, the low recovery potential of the Chihuahuan Desert, and the agency concern the impacts may generate, the overall short and long-term impacts to wildlife are considered significant.

Aquatic Habitats. The proposed project could potentially affect three regionally unique, permanent aquatic habitats (Malpais Spring and Marsh, Salt Creek, and Lost River), 191 miles of regionally common desert wash habitat, and 1,043 acres of playa habitat. Short and long-term impacts to these habitats from construction and operations could result in physical alteration, disturbance of vegetation and wildlife, and increased sedimentation. The habitats in Salt Creek and Lost River are formed from shallow pools that intersect the groundwater table and are susceptible to filling from sediments. Indirect impacts from increased recreational use will be greatest in the perennial streams of the Sacramento Mountains, which have only a few miles of fishable waters. Other aquatic recreational resources in the ROI can tolerate a moderate increase in use that may result from the expected 0.5 to 1.1-percent increase in proposed project population.

The overall short-term impacts for aquatic habitats will be low and long-term impacts will be moderate. This is based on the environmental consequences resulting from the potential long-term impacts to Malpais Spring and Marsh, Salt Creek, and Lost River; the overall quantity of aquatic habitats potentially affected; the abundance of these habitat types in the region; and the relative likelihood of avoiding short and long-term impacts to aquatic habitats. The recovery potential for occasional impact events will be good in Malpais Spring and Marsh, Salt Creek, and the Lost River. Impacts to these habitats are of special interest to the USFWS, New Mexico Department of Game and Fish, and members of the scientific community. Regional-level, short and long-term impacts will not be significant because of the recovery potential for occasional impacts, the ability to avoid major impacts, and the absence of cumulative impacts.

Unique and Sensitive Habitats. Five of the 63 unique habitats in the ROI occur on RMAs, and three habitats occur adjacent to RMAs. Potential short and long-term impacts to Malpais Spring and Marsh, Salt Creek, and the Lost River (three habitats on RMAs) are described in the aquatic habitats and threatened and endangered species (White Sands pupfish habitat) sections. The narrow portion of the Malpais lava flow in the RMA is likely to experience limited, short-term disturbance from road construction. Although RMA occurs on the lower elevations of San Andres National Wildlife Refuge, operations will be excluded from the refuge and will not result in impacts to the refuge. The HML construction and operations will jeopardize, in the short and long term, the biological research and erosion control value of the western 34,480 acres of the area co-used by White Sands Missile Range and Jornada Experimental Range (Agricultural Research Service). The eastern 49,520 acres of the co-use area will not be affected because it is now used exclusively by White Sands Missile Range. These impacts will be small because the primary research area of the range lies outside White Sands Missile Range. The HML operations will not affect the wilderness value of Antelope, Jornada del Muerto, and the Organ Mountains wilderness study areas (adjacent to RMAs) with respect to biological resources. Uses of the majority of unique habitats in the remaining ROI are controlled by various agencies, limiting potential impacts from population increases.

Potential direct impacts to three unique habitats could be reduced through operational management, and potential impacts to three additional habitats will be small, resulting in minor biological effects and short and long-term, low impacts. All of the potential impacts to these unique areas will be regional. Five of the unique habitats occurring on RMAs are of interest to the USFWS, the New Mexico Department of Game and Fish, and the scientific community. The Jornada Range is of interest to the Agricultural Research Service and the scientific community. Because the goals of these unique areas will not be seriously jeopardized by the potential impacts from the proposed project, and cumulative impacts are minor, short and long-term impacts are determined to not be significant.

Threatened and Endangered Species. Three federally listed plants may occur in the RMA. Todsen's pennyroyal, an endangered species, occurs on White Sands Missile Range. Two 1-square-kilometer sections have been designated as critical habitat for this species in Rhodes Canyon in the San Andres Mountains. The HML operations and construction are unlikely to affect this critical habitat because of its small size and steep terrain. Kuenzler

hedgehog cactus may occur in RMA in the Sacramento Mountains area. Sneed's pincushion cactus is known to occur within the western boundary of Fort Bliss and may occur on RMA. Six federal-candidate plants and seven additional species protected by the State of New Mexico may also occur in the RMA. Potential impacts to these plants during construction and operations could be substantial. Careful siting of facilities and activities can greatly reduce these impacts. However, the number of protected species to be avoided is large and impacts to some plants are likely.

Peregrine falcons (federally listed) may nest on White Sands Missile Range or Fort Bliss, possibly in or near RMA, and it is almost certain that peregrines occur and forage in proposed RMA at times. Impacts to the peregrine falcon and the bald eagle, which may also occur on the complex, will include minor, short and long-term disturbance and loss of prey. The White Sands pupfish, a federal-candidate species, is found in Salt Creek and Malpais and Mound Springs, which are located in the RMA. Although HMLs are not likely to operate directly in these habitats, nearby HML operations may result in direct, long-term impacts from sedimentation and other degradation of the pupfish's habitat. Nine additional federal-candidate animal species, the Penasco chipmunk, spotted bat, Swainson's hawk, ferruginous hawk, White Sands woodrat, long-billed curlew, Organ Mountain chipmunk, white-faced ibis, and Sacramento Mountain salamander, may occur in the direct impact area.

Ten state-protected wildlife species occur in the potential direct impact area and could receive direct, long-term impacts. Five federally listed wildlife species, 14 federal-candidate wildlife species, 41 state-protected wildlife species, 4 federally listed plants, 1 proposed plant, 17 federal-candidate plants, and 9 additional plants listed by the State of New Mexico as endangered that occur in the ROI will have a low likelihood of receiving indirect, long-term impacts. One state-protected species, the desert bighorn sheep, occurs in habitat adjacent to the RMA and is particularly sensitive to disturbance. Therefore, this species may be adversely affected by noise, traffic, and human presence resulting from construction activities and HML operations. Communication tower construction in mountainous areas may also increase the likelihood of this species being adversely affected.

The likelihood of affecting threatened and endangered species and their habitats, as well as similarly affecting federal-candidate and state-listed species, creates an overall long-term, moderate impact. Short-term impacts will be low because few impacts will be transient. Adverse impacts to threatened and endangered species or critical habitat are likely to be of concern to natural resource management agencies and scientific authorities because of the biological sensitivity of these species. In addition, project impacts are likely to add substantially to cumulative impacts to these species in the region. Because of the large number of species potentially affected and the variety of habitats and locations where they occur, the feasibility of mitigating impacts so as not to threaten the continued existence of all protected species is poor. Therefore, long-term impacts are considered to be significant. Short-term impacts are not expected to be significant.

4.6.3.5 <u>South-Central California Complex</u>

Potential long-term impacts of the proposed project to vegetation and wildlife are expected to be high and significant in this region. Short and long-term,

low, and not significant impacts to aquatic habitats, and short and long-term, moderate, and not significant impacts to unique and sensitive habitats are expected. Short-term, low, and not significant impacts are also expected for vegetation and threatened and endangered species. Long-term impacts to threatened and endangered species will be moderate but not significant, and short-term impacts to wildlife will be moderate and significant. Regional impacts to biology are not expected to be dependent on the MOB selected.

Vegetation. Implementation of this basing mode at the South-Central California Complex will directly affect large areas of desert vegetation. Approximately 14,690 acres will be temporarily disturbed during construction at the MOB and in the deployment area. In addition, 7,910 acres will be permanently disturbed during construction. Vegetation types of the arid to semiarid regions generally have poor recovery potential from disturbance. The types expected to be affected in this region are no exception. Therefore, even temporary disturbance will result in long-term impacts to vegetation. The majority of impacts are expected to occur during the operations phase, when 175 to 350 sq mi of the RMA may be disturbed by off-road HML movement during the 20-year life of the proposed project. Based on the relative abundance of vegetation types in the RMA, these following types have the likelihood of being affected: creosote bush, 74 percent; blackbrush, 10 percent; Joshua tree-blackbrush, 8 percent; and saltbush, 7 percent. Impacts from off-road travel will vary from moderate to severe, and will generally be long term. Minor, long-term, indirect impacts may result from project-induced population growth and increased recreation. Recreational off-road vehicle use, a popular pastime in the California deserts, is expected to increase. The limited camping and hiking opportunities in the region already experience major, and often maximum, use. Although the vegetation types that occur on the bases and in the RMAs are relatively common in the region, and some areas of the RMA may have been disturbed by previous military exercises and activities, the large areas expected to be lost or disturbed represent a long-term, high impact to the vegetation of the area. The consequences of such major disturbances to vegetation include loss of habitat for numerous terrestrial organisms, major disturbance to the ecosystems of the area, and loss of biological productivity. Short-term impacts are expected to be low because few impacts will be transient.

The anticipated large degree of disturbance to vegetation is likely to be of concern to natural resource management agencies and scientific authorities. Major losses of many native types have previously occurred in the region from urban and agricultural growth. This trend is expected to continue and, in conjunction with losses from the proposed project, will result in substantial cumulative losses. Because of potentially large impacts to vegetation of the area, the poor recovery potential and fragile nature of arid and semiarid vegetation types, and the level of concern likely among natural resource management agencies, overall long-term impacts to vegetation will be significant at the regional level. Short-term impacts are not considered significant.

Wildlife. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. Species onsite and in adjacent areas will receive short-term, direct impacts from construction activities, whereas the majority of long-term impacts for this basing mode will occur during the operations phase from on and off-road HML movements.

Species such as bighorn sheep (has special protected status), mountain lion, mule deer, feral burros, and wild horses, which inhabit the RMA, will be directly affected. Desert bighorn sheep and mountain lions are particularly sensitive to disturbance. Wildlife species in the remainder of the ROI are likely to receive minor, long-term, indirect impacts because of the slight project-induced population growth expected for the area (0.0-0.1%).

The diversity of nongame species within the major vegetation types to be affected (i.e., creosote bush, Joshua tree-creosote bush, and salt bush) is moderate. Nongame species within the RMA are expected to experience direct, long-term impacts.

Wildlife currently experience disturbance from low-flying aircraft in some areas of the RMA; however, the HML operations will cause greater disturbance to wildlife communities in the direct impact area. Both construction and operations activities will cause the elimination or disturbance of a large number of wildlife and large areas of habitat for both big game and nongame species. This will result in a major disruption to the wildlife communities in the region, which represents a short-term, moderate impact and a long-term, high impact. The loss of a large amount of habitat will be of concern to natural resource management agencies. In addition, the potential for adding to the cumulative impacts to wildlife over the duration of the project will result in short and long-term impacts that will be significant at the regional level.

Aquatic Habitats. Although the study region is arid, ephemeral aquatic habitats are common in the ROI (19 mi of desert wash, 7,878 acres of playa habitat, 3 mi of marsh, and several small marshes occur on RMAs). Short and long-term construction impacts to these habitats could result from sedimentation. Short and long-term impacts to desert washes will not be large because of their small number in the RMA and their general unsuitability for HML operations (other than crossings). Playa habitats are abundant in the RMA and, when dry, may be suitable for HML operations because of their flat topography. The primary impact of HML movements on playa habitats will be direct disturbance (short and long term) of plants and animals. Small springs or seeps (important aquatic resources in the RMAs) are isolated and tend to occur in areas that will preclude direct impact by HML operations. The expected 0.0 to 0.1-percent project-induced population increase is not likely to create large, indirect impacts because of the high degree of use and management already occurring in most aquatic habitats of the ROI. Small increases in off-road vehicle use are expected to result in long-term, indirect impacts because of minor increased sedimentation (wetland and fisheries habitat along the Mojave River is especially sensitive to these impacts). Public lands in these areas are managed by the BLM, and large, indirect disturbances from the proposed project are unlikely.

The short and long-term impacts to aquatic habitats will be low. This is based on the large number of ephemeral aquatic habitats in the ROI, the small likelihood of affecting permanent aquatic habitats, the minor level of indirect impacts expected, and the resulting small environmental consequences for aquatic habitats. These short and long-term impacts will also not be significant on a regional level because of the small likelihood for affecting aquatic resources, the lack of disturbance to regionally important wetlands, the low possibility of disturbance of sensitive fish populations, and the lack of cumulative impacts.

Unique and Sensitive Habitats. Of the over 300 designated unique areas that have been identified in the ROI, 6 occur on RMAs and 24 occur near RMAs. Two of the unique areas are associated with mountain habitats that contain sensitive animal populations (primarily desert bighorn sheep). These areas are not likely to receive any impacts from HML operations or construction because of their steep topography. The lower slopes may receive direct disturbances (decreasing habitat value and biological uniqueness) in the short and long term from construction and operations. Edwards AFB, considered a unique area by Los Angeles County because of its vegetation and playas, will have habitat directly disturbed within the RMAs during construction and operations. However, large areas of Edwards AFB will not be affected. Piute Ponds (a Los Angeles County Significant Ecological Area) occur on Edwards AFB in RMA. Operations are not likely to take place directly in the ponds, but increased erosion may affect their habitat quality. It is likely that these impacts can be reduced by limiting operations in the immediate vicinity of the ponds.

Most of the areas identified by Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC) as desert tortoise habitat occur in the RMAs. Construction will result in temporary and permanent removal of small portions of this habitat. Off-road HML operations in this area are likely to make it unsuitable as desert tortoise habitat through direct disturbance to vegetation and terrain and mortality of desert tortoises. Neither construction nor operations are expected to affect unique habitats near RMAs. It is likely that short and long-term impacts can be reduced in these unique habitats during the siting of construction activities and by placing constraints on the operation of HMLs in critical portions of these habitats. The majority of the unique habitats in the remaining ROI are wilderness study areas and Areas of Critical Environmental Concern, and public use of these lands is regulated by the governing agency (primarily the BLM). Indirect impacts are expected to be minor because of this regulated use and because additional land (capable of withstanding increased use) is available for recreation in the ROI.

Project-induced environmental effects may occur because of the large potential impacts to desert tortoise habitat in the RMAs, though impacts to other unique habitats are improbable. The short and long-term impacts will be moderate. These impacts are likely to be of concern to the BLM, USFWS, and the scientific community. The threat to desert tortoise habitat on Twentynine Palms MCAGCC may be of special concern to these groups. The recovery potential of this habitat will be good if HML operations are restricted to occasional intrusions. Several other large areas in the ROI have been designated by state and federal agencies as protected habitat for the desert tortoise, which reduces the threat to the uniqueness of the habitat on Twentynine Palms MCAGCC. Therefore, regional-level, short and long-term impacts will not be significant.

Threatened and Endangered Species. The bald eagle and peregrine falcon, both federally listed, are migratory in the complex vicinity and may occasionally occur in the direct impact area. Nine federal-candidate animal species and five federal-candidate plant species are also expected to occur in the RMA. These plants, in addition to wildlife species with relatively slow mobility, could be killed during both the construction and operations phases of the proposed project, and may also suffer habitat loss. Disturbance to the bald eagle, peregrine falcon, and many of the federal-candidate plants and animals can be minimized through alternate siting of facilities and activities. No

state-protected wildlife species that are not also federal candidates are known to occur in the direct impact area. Potential impacts to protected species will be both short and long term.

Thirteen federally listed animal species, 6 federally listed plant species, 18 federal-candidate animal species (including 2 proposed for listing), 134 federal-candidate plant species, and 7 state-protected animal species are believed to occur elsewhere in the ROI. The Mohave chub, a federally listed fish species, occurs in one marsh system (Lark Seep Lagoon) and associated drainages in the indirect impact area of China Lake NWC. Long-term impacts to these species from increased population growth and recreational pressure are possible. Many of the species are desert species potentially affected by one of the area's most popular recreational activities, off-road vehicle use. Based on the potential for substantial direct impacts to a federally listed species, many candidate species, and a state-listed species, as well as considerable potential indirect disturbance to many other species, the overall long-term impacts will be moderate. Short-term impacts are considered low because few impacts will be transient.

Impacts to listed threatened and endangered species, federal-candidate species, and state-listed species are sensitive and controversial issues. However, there is a reasonable likelihood for avoiding or reducing impacts to potentially affected species at this complex so that the continued existence of protected species will not be threatened. Because of these considerations, the overall short and long-term impacts to threatened and endangered species are rated as not significant.

4.6.3.6 Washington Complex

Potential long-term impacts of the proposed project on vegetation, wildlife, and unique and sensitive habitats are expected to be high and significant in this region. Long-term impacts to threatened and endangered species will be moderate and not significant; short-term impacts to these species will be low and not significant. Short-term impacts to vegetation and unique and sensitive habitats will also be low and not significant. There will be short-term, moderate, and significant impacts to wildlife. Short-term impacts to aquatic habitats are expected to be low and not significant. Long-term impacts to aquatic habitats will be moderate and not significant.

Vegetation. Roads and building construction at the MOB and deployment area will result in the temporary disturbance of 4,500 acres of vegetation and the permanent disturbance of an additional 2,480 acres. Because of the semiarid climate of the region, the recovery potential for most of the vegetation of the region is poor to fair. Consequently, much of the temporary disturbance will have long-term impacts and short-term impacts are considered low. The majority of disturbance will result from operations. An estimated 50 to 100 sq mi of the RMAs will be directly disturbed by off-road vehicle movement during the 20-year life of the proposed project. Based on the relative abundance in the RMAs, the sagebrush-steppe type will comprise nearly 98 percent of the disturbed area; the remaining area is agricultural land. Long-term indirect impacts to vegetation which may result from the proposed project are expected to be minor because of the abundance of recreational opportunities in the area and the probable dispersed nature of the recreation. Although this vegetation type and variations of this type are relatively abundant in the

area, the large area expected to be directly disturbed represents a long-term, high impact to vegetation. Disturbance of such a large area of vegetation is likely to cause a major loss of habitat for many species, loss of biological productivity, loss of watershed protection, and general disturbance of the ecosystems of the area.

The semiarid climate of the Columbia Basin causes recovery rates to be relatively slow for most vegetation types in the area. The potential high degree of disturbance to vegetation is likely to be of concern to natural resource management agencies and scientific authorities. Previous conversion of native vegetation to agricultural production has occurred extensively in the region. Losses from the proposed project, in conjunction with losses that may result from other projects in the region, will be cumulatively significant. Although some areas of the RMA may have been disturbed by previous military exercises and activities, the major impact to the vegetation of the area, the slow recovery rates characteristic of semiarid Columbia Basin vegetation, and the level of concern among natural resource management agencies the impacts may generate indicate that overall long-term impacts to vegetation will be significant at the regional level. Short-term impacts are rated not significant.

Wildlife. The area of wildlife habitat that will be disturbed by construction and operations is the same as described for vegetation. The diverse habitats found in the direct impact area are inhabited by major game species such as mountain lion, mule deer, pronghorn (on Yakima FC), and elk (which uses the shrub-steppe vegetation for winter forage). These species will receive short-term, direct and indirect impacts during construction. The majority of direct, long-term impacts will occur during the off-road operations of HMLs.

Other major game species in the ROI include black bear, northwestern white-tailed deer, and Columbia black-tailed deer, which will receive indirect, long-term impacts as a result of project-induced population growth expected for the area (0.5-1.0%). Nongame diversity for the sagebrush-steppe vegetation type, which covers about 98 percent of the direct impact area, is moderate.

Numerous big game and nongame species will be affected during both the construction and operations phases, by either direct mortality, displacement, or loss/disruption of a large area of habitat. Operations will cause greater effects than construction, with a corresponding disruption of wildlife communities and habitats (including seasonally important habitat). Therefore, the short-term impacts will be moderate and the long-term impacts will be high.

In addition, the impacts to wildlife and the loss of large amounts of habitat may cause concern to natural resource management agencies. The proposed project will potentially add to the cumulative impacts to wildlife in the region. The overall regional-level impacts to wildlife are anticipated to be significant.

Aquatic Habitats. The RMAs contain 7 miles of palustrine wetlands with emergent vegetation (streams in Yakima FC) and 1,235 acres of large river habitat (the western portion of the Hanford Reach of the Columbia River). Several

ponds and marshes also occur on the DOE Hanford Site. Construction of structures, roads, and bridges may create short-term impacts in these habitats from sedimentation. Off-road HML operations are likely to produce the greatest long-term impact to aquatic habitats in and near the RMAs. Direct crossing of small streams will increase turbidity and sedimentation in the stream. Although there are no native year-round fish populations known in the streams on Yakima FC (including Alkali Creek, Borden Springs, and Hansen Creek), the increased turbidity could result in lowered productivity because of interference with other members of the stream community (especially algae and insects, and possibly vascular plants). General off-road operations in the vicinity of perennial and dry streams will lead to long-term increases in sedimentation (which could affect the streams onbase as well as segments of the Columbia and Yakima rivers). Base activities already cause occasional increases in turbidity in these two large rivers, and additional turbidity from regular HML operations may be sufficient to affect aquatic productivity. These short and long-term impacts are likely to be reduced by restricting HML operations in the vicinity of streams and larger washes, and in the greater vicinity of the local watershed during periods of high runoff. The local recreational fisheries are abundant and the expected 0.5 to 1-percent project-induced population increase will produce only minor, indirect impacts to these resources.

The overall short-term impacts will be low. This is based on the consideration that, though some impacts to aquatic habitats are possible, they can be reduced to acceptable levels by using sound construction practices. Long-term impacts will be moderate because of the likelihood of increased sediment loads in major rivers as a result of operations activities. Prohibiting HML operations in some localities and during certain times of the year will reduce some of these detrimental biological consequences. Potential cumulative effects, such as operations on the two bases, and growth and development in the greater ROI, are expected to be small. Based on the low impact and the lack of cumulative effects, these short and long-term disturbances are not expected to be of special concern to natural resource management agencies. Therefore, regional-level, short and long-term impacts as a result of the proposed project will not be significant.

Unique and Sensitive Habitats. Six of the approximately 50 unique habitats that have been identified in the ROI occur on RMAs. Alkali Creek, Borden Springs, and Hansen Creek (three sensitive wetlands identified by Yakima FC) and the Hanford Reach of the Columbia River (near RMAs on the DOE Hanford Site) may receive impacts as discussed in the aquatic habitats element. The RMAs cover all of the Saddle Mountain National Wildlife Refuge and Wahluke Slopes State Wildlife Recreation Area, and border the Arid Lands Ecology Reserve, all located on the DOE Hanford Site. The biological uniqueness of these three areas is associated with the undisturbed, arid vegetation of this region. Short and long-term impacts from construction of roads and structures will be minor in these areas because of the small number of such facilities planned for the RMA. Construction and operations will be restricted from the Arid Lands Ecology Reserve; therefore, no impacts will occur. Off-road HML operations will disturb large amounts of unique vegetation and displace sensitive animal populations in the long term. These major, long-term impacts could be reduced to a small extent through operational constraints; however, they are still likely to remain high. Most of the unique habitats in the greater ROI are managed on public lands, and therefore, should receive only minor, indirect impacts from the proposed project.

Disturbances from the proposed project are expected to substantially degrade unique areas because of the large potential to affect two unique habitats on the DOE Hanford Site and the improbability of reducing impacts to these habitats. The overall long-term impact will be high. The overall short-term impact will be low because only small areas of the habitats will be disturbed by temporary impacts. These areas are of special concern to the USFWS, the Washington State Game Department, and the scientific community. The expected impacts are likely to be of special concern to these agencies because HML operations will destroy the biological basis for the entire portion of two of these habitats and part of a third habitat. Because of the repetitive nature of impacts from HML operations, there is little likelihood for recovery in the disturbed habitat. Therefore, regional-level, long-term impacts will be significant and regional-level, short-term impacts will not be significant.

Threatened and Endangered Species. The endangered bald eagle may be discouraged from using Yakima FC and the DOE Hanford Site because of construction and operations activities. The occasional migrant status of the eagle on the complex indicates that the likelihood of adverse impacts is uncertain, but both short and long-term impacts will occur. The ferruginous hawk, a federal-candidate species, occurs on Yakima FC and is likely to experience disturbance from human presence, vehicle movement, and loss of habitat and prey. Four additional federal-candidate wildlife species, the long-billed curlew, sage grouse, ferruginous hawk, and Swainson's hawk, also occur on Yakima FC and the DOE Hanford Site. Two sage grouse leks are also known to exist on the DOE Hanford Site. Five federal-candidate plant species are present on the installations; four of these species may also experience considerable disturbance during construction and over the 20-year operations period of the proposed project. Both construction and operations impacts will be short and long term. Ten additional state-listed plants that are not under consideration for federal listing are also known to occur on the complex and may be affected by the project.

The white pelican, sandhill crane, and pygmy rabbit are state-listed (but not federally listed) species that occur on the DOE Hanford Site. The state-listed spotted owl may occur on Yakima FC. The white pelican, spotted owl, and sandhill crane are not likely to receive substantial impacts. However, the pygmy rabbit has a greater potential of losing substantial habitat (food and cover) during construction and operations. Potential adverse short and long-term impacts to onbase species may be reduced through alternative siting of facilities and activities.

Four federally listed species (peregrine falcon, grizzly bear, gray wolf, and Columbia white-tailed deer), 4 federal-candidate animal species, 38 federal-candidate plant species, 8 state-listed animal species, and over 100 state-listed plant species are believed to occur elsewhere in the ROI. Because of the abundant recreational opportunities in the region, the anticipated dispersed nature of recreational activities, and the rarity and remoteness of many of the species, indirect impacts to these species are unlikely.

Overall long-term impacts are considered moderate because of the likelihood for directly affecting several federal-candidate species and state-listed species, and possibly a federally listed species, and for causing substantial disturbance to or loss of their habitats. Short-term impacts (e.g., mortality during construction) will be low. Although impacts to threatened and

endangered species are sensitive issues and may cause a high level of concern among natural resource agencies and scientific authorities, the feasibility of avoiding or reducing impacts to potentially affected species through siting of facilities and operations is substantial. Therefore, short and long-term impacts to threatened and endangered species are considered not significant.

4.6.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.6.4.1 Ellsworth Air Force Base

Potential project-related short and long-term impacts to threatened and endangered species will be low and not significant. Short-term impacts to aquatic habitats will be moderate and long-term impacts will be low. Short and long-term impacts will be low for vegetation and wildlife and negligible for unique and sensitive habitats. Short-term impacts will be significant at the regional level for aquatic habitats and not significant for all other elements.

Vegetation. Construction activities will result in the temporary disturbance of 1,140 acres and the permanent loss of an additional 390 acres of predominantly grassland vegetation on Ellsworth AFB. Another approximate 1,580 acres in the deployment area will sustain short and long-term disturbance from road and bridge upgrading. Based on the relative abundance in the deployment area, approximately 56 percent of the area disturbed will be grassland and 43 percent will be agricultural land (cropland or pasture). Less than 1 percent of the area disturbed will be forestland. Much of the roadside area, where road upgrading will occur, has already been disturbed and, in some cases, is disturbed on a regular basis. Long-term, indirect impacts are expected to be minor because of the projected small population increase and associated recreational pressures. Because of the small amount of area expected to be disturbed and the associated minor loss of biological productivity and habitat, the short and long-term impacts to vegetation are considered to be low.

The native mid and short-grass prairie vegetation, which may be disturbed during construction, is relatively common throughout the region. While substantial land use changes have occurred in the past, the minor disturbance from the proposed project is not expected to be of concern to natural resource management agencies. Cumulative losses from the project and from future projects are not expected to be substantial. Therefore, the overall short and long-term impacts to vegetation will not be significant.

Wildlife. The area of wildlife habitat that will be temporarily and permanently disturbed by construction is the same as described for vegetation. Construction of support facilities at the MOB and upgrading existing roads and bridges will directly disturb nongame species found in the direct impact area in the long term. However, these impacts will be minor because of the relatively small amount of area affected. Direct, long-term disturbance is also expected to occur during the operations phase as a result of the anticipated increase in vehicle movements, but it will be minor because of the infrequent disturbance anticipated.

Direct, short-term effects will occur from construction activities at the launch facilities in the form of temporary disturbance of wildlife species in

adjacent areas. The major vegetative type in the direct impact area is grassland, which supports a low nongame diversity as compared to other vegetation types in the region including coniferous forest (moderate diversity), grassland/shrubland (moderate diversity), and riparian (high diversity). In addition, upgrading of bridges within the deployment area may cause additional localized impacts to aquatic wildlife species and riparian habitats.

Big game species occur primarily in the outer ROI and include mule deer, white-tailed deer, elk, bison, pronghorn, bighorn sheep, and mountain goat (bighorn and mountain goat have been recently introduced). These big game species, as well as nongame species in the area, will receive indirect, long-term disturbances from project-induced population growth for the duration of the proposed project. These disturbances may be important since the population growth is expected to range from 1.9 to 4.7 percent over the life of the project.

Overall, a small amount of wildlife habitat will be lost or disrupted during construction at the MOB, with a corresponding small number of wildlife species affected; operations disruption will be even less. No major disruptions to wildlife or habitat are expected. Therefore, short and long-term impacts will be low. The proposed project's low impacts to wildlife will not add to cumulative impacts for the region since development is expected to be moderate during the life of the project. Furthermore, it is unlikely the expected impacts will create concern among natural resource management agencies. Taking these factors into consideration, regional-level, short and long-term impacts will not be significant.

Aquatic Habitats. The HML transit routes intersect 15 major aquatic resources (5 lakes and 10 wetlands with emergent vegetation), major aquatic habitats occur within 1 mile of 27 launch facilities, and several ponds and small marshy areas occur onbase. Upgrades of bridges, culverts, or other stream crossing and construction along the HML transit routes will produce impacts to aquatic resources from direct disturbance of habitat and increased sedimentation and turbidity. These short-term disturbances will affect both fisheries and wetlands, and will be concentrated in the western deployment area, where streams are more abundant. Recovery is expected to begin when the disturbance ends, and should be complete in 1 or 2 years. Construction may result in the permanent encroachment or removal of some wetland habitats, though these will be relatively small areas. Both short and long-term impacts can be reduced through siting and the use of construction techniques that minimize these effects.

Operations onbase may produce short-term impacts, primarily from increased erosion. Operations on the access roads and launch facilities will not affect aquatic habitats. Indirect impacts from the expected project-induced growth of 1.9 to 4.7 percent will not create large impacts to the regionally abundant aquatic resources. Many of the more pristine aquatic resources in the ROI occur within national forests or the boundaries of other regulated areas, and are therefore sheltered from most indirect impacts.

Short-term impacts are rated moderate, primarily because of the large number of aquatic habitats that will be disturbed by bridge and culvert upgrading at stream crossings. Long-term impacts will be low because of the small number of these impacts, the likelihood of recovery from short-duration impacts, and

the lack of indirect impacts (resulting in few environmental consequences). The regional-level, short-term impacts will be significant, because taken together, they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems in the region that will be of special concern to natural resource management agencies. Regional-level, long-term impacts will not be significant because they will not cause concern among natural resource management agencies and because cumulative effects will be minor.

Unique and Sensitive Habitats. Four of the 18 unique and sensitive habitats in the ROI occur in the deployment area. None of these unique areas contain portions of HML transit routes or launch facilities. Therefore, no impacts from construction or operations are expected. Five of the unique habitats in the ROI are privately owned and not in the vicinity of the MOB. It is unlikely that the project-induced growth of 1.9 to 4.7 percent will lead to indirect, development-related impacts to these habitats. Access to each of the areas is either regulated or restricted, which will also keep indirect impacts at a minor level.

The overall short and long-term impacts will be negligible because of the lack of impact and adverse environmental consequences. The proposed project will not contribute to cumulative impacts in the region and should not cause concern among natural resource management agencies with respect to unique and sensitive habitats. Therefore, regional-level impacts will not be significant.

Threatened and Endangered Species. Four endangered bird species, the bald eagle, American peregrine falcon, Arctic peregrine falcon, and whooping crane, are migratory in the area and may occasionally occur onbase. Construction of facilities may potentially result in short and long-term, minor disturbance of these species and/or loss of habitat. Operations activities are not likely to affect these species. There is good likelihood of avoiding both construction and operations impacts to these species through careful siting of facilities and activities.

The range of the endangered black-footed ferret extends into the region, but impacts to this species are highly unlikely because of its extreme rarity, and are easily avoidable through siting of facilities. Five federal wildlife candidates (ferruginous hawk, Swainson's hawk, long-billed curlew, interior least tern, and northern swift fox) and one state-protected species (osprey) may occur onbase and are susceptible to both short and long-term impacts. Two federal-candidate plants (*Eriogonum visheri* and *Astragalus barrii*) and one plant considered rare by the South Dakota Natural Heritage Program (*Gentiana affinis*) are known to occur in the deployment area, but the likelihood of causing direct short or long-term impacts to these species is low. However, upgrading of bridges in the deployment area may cause some localized impacts to riparian habitats and protected species associated with aquatic habitats (bald eagle, whooping crane, long-billed curlew, interior least tern, and osprey). Seven federal-candidate animal species, the 2 federal-candidate plant species previously mentioned, 17 South Dakota-listed animal species, 1 Nebraska-listed animal species, and 41 state-listed plant species occur in the ROI. Substantial long-term impacts to these species are not likely because of the minor urban growth and recreational pressures expected.

The overall short and long-term impacts to threatened and endangered species will be low because of the low likelihood of affecting threatened and endangered species and the minor degree of disturbance expected. The minor impacts expected from the proposed project are not likely to add substantially to cumulative impacts in the region, nor to be of concern to natural resource management agencies and scientific authorities. The project is not likely to jeopardize the continued existence of any protected species. Therefore, short and long-term impacts are not considered significant.

4.6.4.2 F.E. Warren Air Force Base

Potential project-related short and long-term impacts to threatened and endangered species will be low and are expected to not be significant at the regional level. Short-term impacts to aquatic habitats will be moderate and long-term impacts will be low. Short and long-term impacts will be low for vegetation and wildlife and negligible for unique and sensitive habitats. Short-term impacts to aquatic habitats will be significant at the regional level and not significant for the other elements.

Vegetation. Construction of new facilities on F.E. Warren AFB will result in the loss of minor amounts of vegetation (1,140 acres temporarily and 400 acres permanently). The vegetation disturbed will be predominantly short-grass prairie. An additional 1,860 acres of vegetation will be permanently lost for road and bridge upgrading in the deployment area. Based on relative abundance in the area, agricultural land and short-grass prairie are almost equally likely to be affected during road upgrading. Indirect, long-term impacts in the ROI are expected to be minor because of the abundance of recreational opportunities in the area and the anticipated dispersed nature of recreational activities. Because of the small amount of area expected to be disturbed and the minor loss of biological productivity and habitat expected, the overall short and long-term impacts to vegetation will be low.

The vegetation type expected to be disturbed is abundant in the region. Although past conversions to agricultural uses have been considerable, the minor impacts expected to result from the proposed project, in conjunction with losses that may result from future projects, are not considered substantial. These minor losses are not likely to be of concern to natural resource management agencies. Therefore, the overall short and long-term impacts to vegetation will not be significant.

Wildlife. The area of wildlife habitat that will be temporarily and permanently disturbed by construction is the same as described for vegetation. Construction of support facilities at the base, as well as upgrading existing roads and bridges, will create direct, long-term disturbances to big game species such as mule deer, pronghorn, and white-tailed deer. Nongame species will be similarly affected. Aquatic wildlife and riparian habitats may also be affected by upgrading bridges in the deployment area. Direct, long-term impacts can also be experienced during the operations phase. However, these impacts will be minimal because of the infrequent disturbance anticipated. Direct, short-term impacts will occur from construction-related activities at the launch facilities in the form of temporary disturbance to species in adjacent areas.

Other big game species (i.e., elk and bighorn sheep) occurring in the ROI are likely to receive relatively minor, indirect, long-term disturbance from project-induced population growth during the life of the proposed project. These effects will be minor due to the small growth expected (0.5-1.3%). The major vegetation type found in the direct impact area is short-grass prairie, where nongame diversity is low compared to other vegetative types in the general area such as coniferous forest (moderate diversity), meadow communities (moderate diversity), and riparian communities (high diversity).

Short and long-term impacts are expected to be low because of the small amount of habitat and small number of wildlife species that will be eliminated or disturbed. Only minimal impacts to wildlife communities will occur during construction, with even less disruption taking place during operations. Based on these minimal impacts, it is not likely that natural resource management agencies will view the expected impacts with concern, nor is it likely the project will add to the cumulative effects for wildlife that are already of concern in the area. Therefore, regional-level, short and long-term impacts will not be significant.

Aquatic Habitats. One of the launch facilities is within 1 mile of a major wetland habitat, the HML transit routes cross two lakes, and wetlands and several water bodies occur on F.E. Warren AFB. Short-term disturbance and sedimentation will occur in aquatic habitats from upgrading of bridges and culverts at stream crossings and construction along the HML transit routes, and possibly onbase and at the launch facilities. These disturbances may temporarily affect fisheries (primarily nongame species) and other wetland organisms; however, recovery is expected to occur rapidly after the disturbance ends (generally within 1 or 2 years). Landfill from construction (e.g., at roads and bridges) may result in minor, long-term encroachment of these and smaller wetlands. The project-induced population growth of 0.5 to 1.3 percent is expected to produce minor, indirect impacts to aquatic habitats in the remaining ROI. The majority of the recreational resources occur near the boundary of the ROI and are approximately equidistant from the MOB. Increased use of the habitats from the proposed project will be small and evenly distributed among them.

Short-term impacts will be moderate, primarily because of the large number of disturbances that will occur from upgrades at stream crossings (bridges and culverts). The environmental consequences for aquatic habitats in the long term will be minor as a result of the small number of habitats potentially affected and the minor disturbance expected. Therefore, the overall long-term impacts to aquatic habitats will be low. The regional-level, short-term impacts will be significant, because taken together they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems in the region, which will be of special concern to natural resource management agencies. Regional-level, long-term impacts will not be significant because of the low level of long-duration impacts and the lack of cumulative impacts to aquatic resources.

Unique and Sensitive Habitats. No unique or sensitive habitat occur on launch facilities or HML transit routes, though one is located within 2 miles of a launch facility. Because of the nature of construction land operations, it is unlikely that direct impacts to unique habitats will occur. Over 70 unique and sensitive habitats are found in the ROI. Most of these areas are regulated by government agencies and the potential for large, indirect impacts

from overuse is small. Several areas are in private ownership. Although public access to these sites is restricted, the habitat could be developed. It is not likely that project-induced growth will lead to development-related indirect impacts to these privately owned unique habitats because they are located at the boundary of the ROI.

Because of the absence of adverse effects on unique habitats, the overall short and long-term impacts will be negligible. These negligible impacts will not cause concern among natural resource management agencies nor add to cumulative impacts in the ROI.

Threatened and Endangered Species. Three bird species that are federally listed as endangered, the bald eagle, peregrine falcon, and whooping crane, occur in the base region as occasional migrants and may occur onbase for short periods. Because of their occasional migrant status, the likelihood of impacts to these species is low. Potential impacts will be minor and include loss of habitat and food sources, and general disturbance of daily/seasonal movements or activities.

Four animal species that are candidates for federal listing, the Colorado butterfly plant (a federal candidate), and four animal species that are listed as rare by the State of Wyoming, occur or are thought to occur onbase. These species may be adversely affected during construction. One state-listed plant, *Astragalus mollissimus*, is known to occur near an existing road edge in the Wyoming silo area and may be disturbed by road upgrading. Short and long-term impacts include direct mortality and loss of habitat. In addition, the animals may experience loss of food sources and disruption of daily/seasonal movements or activities. However, alternative siting of facilities can substantially reduce potential impacts to all federal and state-listed species. Upgrading of bridges in the deployment area may cause some localized impacts to riparian habitats and protected species associated with aquatic habitats (long-billed curlew, white-faced ibis, osprey, and greenback cutthroat trout).

Three federally listed animal species (black-footed ferret, piping plover, and greenback cutthroat trout) and one endangered plant species (Northpark phacelia) occur in the ROI. Additionally, 4 federal-candidate animal species, 10 federal-candidate plant species, 10 state-listed (Wyoming, Colorado, and Nebraska) animal species, and over 70 state-listed plant species occur in the ROI. These species have the remote possibility of being indirectly affected because of the rarity of the species and the minor urban growth and associated recreational pressures expected.

Because of the limited possibility of affecting candidate and state-listed species, including the Colorado butterfly plant, and the small area expected to be disturbed, the short and long-term impacts to threatened and endangered species will be low. The low level of impacts to threatened and endangered species is not expected to be of concern to natural resource management agencies. The minor impacts expected from the proposed project are not likely to add substantially to cumulative impacts in the region. The project is not likely to jeopardize the continued existence of any protected species. Therefore, overall short and long-term impacts are considered not significant.

4.6.4.3 Grand Forks Air Force Base

Potential project-related short and long-term impacts to threatened and endangered species will be low and are expected to not be significant on a regional level. Short and long-term impacts will be low for vegetation and wildlife and negligible for unique and sensitive habitats. Short-term impacts to aquatic habitats will be moderate and long-term impacts will be low. These regional-level, short-term impacts will be significant for aquatic habitats and not significant for other elements.

Vegetation. Construction of new facilities on Grand Forks AFB will disturb a minor amount of vegetation (1,140 acres temporarily and 390 acres permanently). Most of the vegetation disturbed onbase will likely be tall-grass prairie, but small amounts of wetland and riparian types also occur onbase and may be disturbed. An additional 1,480 acres of vegetation will be permanently disturbed during road and bridge upgrading in the deployment area. Based on the relative abundance in the region, approximately 91 percent of this area is used for agricultural production, and approximately 6 percent remains as grassland; the remaining area is wetlands, forested lands, urban, or currently disturbed. Indirect, long-term impacts from the minor population growth and associated recreational activities expected are likely to be low. Because of the relatively small amount of area expected to be disturbed, and the minor loss of biological productivity and habitat expected, the overall short and long-term impacts for vegetation will be low.

Native grassland has been extensively converted to agricultural production in the ROI. However, the small amount of area expected to be disturbed is not likely to be of concern to natural resource management agencies. The minor disturbance associated with the proposed project, in conjunction with potential disturbance from future projects, is not considered substantial. Therefore, the overall short and long-term impacts to vegetation in the region are considered not significant.

Wildlife. The area of wildlife habitat that will be temporarily or permanently disturbed by construction is the same as described for vegetation. Big game species occurring in the potential direct impact area include moose and white-tailed deer. These species, as well as nongame wildlife in the area, will receive direct disturbances from construction activities. Direct, long-term disturbances will also occur during the operations phase; however, these are anticipated to be minimal. Construction-related activities will also generate direct, short-term impacts to wildlife species in areas adjacent to the silos and the MOB. In addition, upgrading of bridges in the deployment area may cause localized impacts to aquatic wildlife species and riparian habitats.

Nongame diversity for the grassland vegetation type, which is the main type found in the direct impact area, is low. This rating is based on comparisons with other vegetation types in the area including coniferous/deciduous forests, which usually have moderate wildlife diversity, and wetlands, with a high diversity. One additional big game species, the pronghorn, occurs in the ROI and is likely to receive relatively minor, indirect, long-term effects from project-induced population growth. The expected increase will range from 0.9 to 2.4 percent over the existing population level. Nongame species within the ROI will also receive minor, indirect impacts.

During the construction and operations phases, no activities are expected to cause major disruptions to wildlife species or habitat. Most of the areas have been previously disturbed, so that only a minimal amount of additional habitat will be lost. Consequently, both short and long-term impacts will be low. It is not likely that natural resource management agencies will view the minimal impacts with concern. In addition, the proposed project will add only slightly to cumulative impacts to wildlife from other projects in the region. Therefore, regional-level, short and long-term impacts are expected to not be significant.

Aquatic Habitats. Numerous prairie potholes and other wetlands occur near Grand Forks AFB and the launch facilities (81 of the launch facilities are within 1 mi of a major wetland). The HML transit routes intersect 58 streams and wetlands, some of which support substantial fisheries. Upgrading stream crossings (bridges and culverts), in addition to construction along the HML transit routes (and possibly at the base and launch facilities), will result in direct disturbance and increased sedimentation, which could lower fisheries and wetland productivity in the short term. Recovery from this type of disturbance will begin when the disturbance ends (and should be complete within 1 or 2 years). Some minor expansion of roads, bridges, and other surfaces may result in small wetlands being encroached upon because of land-fill. This type of activity will remove the affected area in the long term. Other activities associated with operations, such as training exercises, may temporarily increase erosion. The potential operations impacts will be small and short term. In general, operations will be confined to developed areas and will not affect wetlands. There are many aquatic recreation opportunities available within the region, and many aquatic habitats are regulated by government agencies. Therefore, it is unlikely that the 0.9 to 2.4-percent project-induced population growth will produce large, indirect impacts from increased fishing activity or housing development.

Overall short-term impacts will be moderate, primarily because of the large number of wetlands that will be affected by upgrading of bridges and culverts at stream crossings. Long-term impacts will be minor and are rated low. The regional-level, short-term impacts will be significant, because taken together they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems in the region, which will be of special concern to natural resource management agencies. Regional-level, long-term impacts will not be significant because they represent a small LOI and are unlikely to be of concern to natural resource management agencies.

Unique and Sensitive Habitats. Launch facilities and HML transit routes occur near ten unique and sensitive habitats (of the more than 75 unique areas in the ROI). Construction and operations will not affect these habitats because none occur in the direct impact area. The 0.9 to 2.4-percent project-induced growth will increase use of these habitats. This increase should be small per area because there are many areas available. Access to a large number of these areas is controlled by government agencies who manage the resource for its continued use. Therefore, indirect impacts to unique and sensitive habitats will be minor.

Because of the small number of potential impacts to, and lack of environmental consequences for, unique and sensitive habitats, the overall short and long-term impacts will be negligible. These disturbances are not likely to be of

concern to natural resource management agencies or contribute to cumulative impacts. Therefore, these regional-level impacts will not be significant.

Threatened and Endangered Species. Three species that are federally listed as endangered, the bald eagle, whooping crane, and peregrine falcon, are migratory in the area and may occasionally occur onbase for short periods. Their occasional presence in the direct impact area makes the probability of the birds being affected by the proposed project low. Impacts to these species may include minor disturbance of daily/seasonal movements or activities during construction, and to a lesser degree, during operations. Some habitat or potential habitat may be temporarily disturbed or permanently lost. No federal-candidate or state-protected wildlife species are known to occur onbase or in the deployment area.

One Category 2 federal-candidate plant species, Platanthera leucophaea, and 67 plant species listed as threatened or endangered by the North Dakota Chapter of the Wildlife Society, occur in counties in the deployment area. Road construction or upgrading may result in direct, short and long-term impacts; however, the likelihood of encountering these species is low. Bridge upgrading in the deployment area may cause some localized impacts to riparian habitats and protected species associated with aquatic habitats (bald eagle, whooping crane, and long-billed curlew).

Three endangered mammals, the gray wolf, black-footed ferret, and piping plover, may occur in the ROI, but are so rare that they are not likely to be affected by the minor urban growth and recreational pressures expected. In addition, 3 federal-candidate animal species (the ferruginous hawk, long-billed curlew, and northern swift fox), 12 state-protected (North Dakota and Minnesota) animal species, 34 additional plants considered threatened or endangered by the North Dakota Chapter of the Wildlife Society, and 19 plants listed as threatened or endangered and 40 plants considered to be of special concern by the State of Minnesota (including 3 plants that are also federal candidates) are reported to occur in the ROI. The potential for and degree of impacts to these species are considered low. The small urban growth and associated minor recreational pressure projected are not expected to cause substantial impacts to most threatened and endangered species in the ROI. Because of the low potential for impacts, the minor degree of impacts expected, and the good likelihood of avoiding impacts through siting of facilities and other mitigation practices, the overall short and long-term impacts to threatened and endangered species will be low.

Adverse impacts to threatened and endangered species are often a concern to natural resource management agencies and scientific authorities because of the species' sensitive status. However, the low level of impacts expected to result from this project are not likely to be a concern. Available native habitat has been greatly reduced in the region because of extensive land use changes. However, the minor impacts expected from this project will not add substantially to cumulative impacts to threatened and endangered species in the region. The proposed project is not likely to jeopardize the continued existence of any protected species. Based on these considerations, the overall short and long-term impacts to threatened and endangered species are considered not significant.

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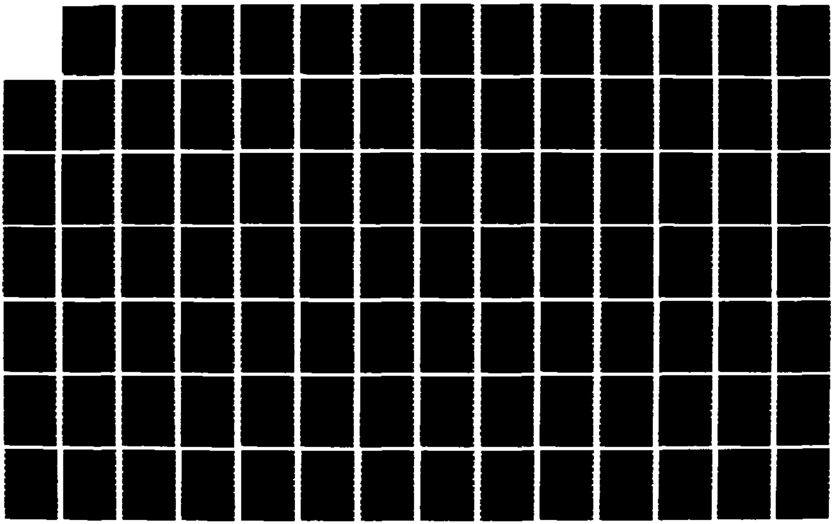

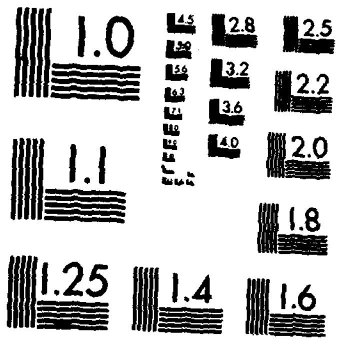

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4.6.4.4 Malmstrom Air Force Base

Short-term impacts to aquatic habitats will be moderate and long-term impacts will be low. Adverse, project-related, short and long-term impacts to vegetation, wildlife, and threatened and endangered species will be low. There will be short and long-term, negligible impacts to unique and sensitive habitats. These potential short-term impacts will be significant at the regional level for aquatic habitats and not significant for other elements.

Vegetation. Construction of new facilities on Malmstrom AFB will disturb a minor amount of vegetation (1,140 acres temporarily and 400 acres permanently). An additional 1,860 acres of vegetation will be permanently disturbed during road and bridge upgrading in the deployment area. Based on the relative abundance in the region, approximately 55 percent of the area that may be disturbed in the deployment area is used for agricultural production; the remaining area supports native grassland or a mixed grass-shrub type. Long-term, indirect impacts to vegetation are expected to be minor because of the relatively low population increase expected and the probable dispersed nature of the associated recreational activities. The small amount of area expected to be disturbed during construction and operations, the anticipated minor loss of biological productivity and habitat, and the fact that much of this area has been previously disturbed indicates short and long-term, low impacts to vegetation.

The relatively small amount of vegetation disturbance expected from the proposed project is not likely to be a concern to natural resource management agencies or scientific authorities. Although considerable native vegetation has been previously lost in the region, the small amount of new area potentially disturbed by the project makes a cumulatively significant impact unlikely. The small amount of area expected to be disturbed, the relatively good recovery potential of many of the sites, and the minor concern expected indicate overall short and long-term impacts to vegetation that will not be significant.

Wildlife. The area of wildlife habitat that will be temporarily and permanently disturbed by construction is the same as described for vegetation. Major game species in the direct impact area that have the potential to receive short and long-term impacts include mule deer, white-tailed deer, pronghorn, black bear, and elk. Because the areas expected to be disturbed lie adjacent to roads, they provide only marginal big game habitat. Other impacts that will result from construction and operations include disruption of daily/seasonal movements, stress during critical periods, and mortality from animal-vehicle collisions. Because only minimal vehicle movement is expected, these impacts will be minor. Upgrading of bridges in the deployment area may cause localized impacts to riparian habitats and wildlife species associated with aquatic habitats. Therefore, short and long-term impacts to big game species are not likely to be substantial.

The areas of native vegetation that may be temporarily or permanently disturbed also provide habitat for a variety of other game and nongame species. Loss of habitat and mortality will reduce the numbers of these animals. The unsuitable nature of wetland and riparian sites for development as silo sites indicates a minor impact to aquatic furbearers, riparian species, and waterfowl. Short and long-term impacts to small game and nongame species are

expected to be low. Long-term, indirect impacts to wildlife elsewhere in the ROI are expected to be minor because of the small urban growth expected and the abundant recreational opportunities available. A low potential for, and degree of, impacts to wildlife are expected for Malmstrom AFB and the deployment area. The relatively small amount of habitat that will be temporarily or permanently lost, and the low numbers of animals displaced or lost, represent a short and long-term, low impact to wildlife.

The Malmstrom AFB ROI supports diverse and abundant wildlife, particularly game species. However, it is not likely that the anticipated minor impacts to wildlife will be of concern to natural resource management agencies. Although considerable wildlife habitat has been lost to past development, the small amount of disturbance expected as a result of the proposed project is not expected to cause a cumulatively significant impact to the resource. The anticipated minor impacts to wildlife and wildlife habitat, and the relatively good recovery potential of most of the sites, represent an overall, regional-level, not significant impact to wildlife.

Aquatic Habitats. Major aquatic habitats occur within 1 mile of 18 of the launch control facilities and launch facilities. The HML transit routes intersect four major aquatic resources (including some that support sport fisheries). Smaller stream or pothole wetlands are present onbase and occur near some of the access roads and silos. Potential short-term impacts to these aquatic habitats and fisheries will result from upgrades at stream crossings (bridges and culverts) and other construction, which will produce direct disturbance and increased sedimentation. Landfill and expansion of roads may remove portions of some aquatic habitats in the long term. These construction impacts will most likely occur at stream crossings of the HML transit routes and can be reduced through siting and the use of sound construction methods. Minor, short-term impacts related to training exercises will probably occur onbase (affecting small wetlands). Other operations impacts will be small. The expected project-induced population growth of 1.5 to 4.7 percent will cause increased demands on aquatic recreational resources. The Montana Department of Natural Resources and Conservation has provided for additional use of resources in the study area. Minor impacts will occur because of the lack of cumulative impacts.

Short-term impacts will be moderate, primarily because a large number of aquatic habitats will be affected by bridge and culvert upgrading at stream crossings. Because of the small number and temporary nature of potential impacts and the resulting minor environmental consequences, the overall long-term impacts will be low. The Montana Department of Natural Resources and Conservation, and the Fish, Wildlife, and Parks Department, will be concerned with construction activities along the HML transit routes (including bridge upgrades). The regional-level, short-term impacts will be significant, because taken together they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems in the region, which will be a special concern to natural resource management agencies. Regional-level, long-term impacts will not be significant because they represent minor levels, do not substantially contribute to cumulative impacts, and will be of little concern to natural resource management agencies.

Unique and Sensitive Habitats. Five unique and sensitive habitats occur within 2 miles of a launch facility (none contain a launch facility) and

13 additional unique habitats occur in the deployment area. It is unlikely that construction will produce impacts to these habitats because of the localized nature of potential impacts and the distance to the unique habitat. Operations will be excluded from these unique habitats and will not affect them. The increased population resulting from the proposed project will not result in large, indirect impacts to the biota or uniqueness of the many habitats in the remaining ROI, because public access is managed for the preservation of the habitats. Access is generally restricted to privately owned unique areas, which results in situations similar to managed public access areas.

This lack of sizable effects creates a short and long-term, negligible impact for this element. Potential impacts that may occur are not expected to be of substantial concern to natural resource management agencies or add greatly to cumulative impacts. Therefore, regional-level impacts will not be significant.

Threatened and Endangered Species. Construction and operations activities are likely to result in minor short and long-term disturbance of the bald eagle and American peregrine falcon (both federally listed), which may inhabit areas within the deployment area and MOB. Five additional federally listed wildlife species (gray wolf, grizzly bear, black-footed ferret, Arctic peregrine falcon, and whooping crane) occur in the ROI and have a low likelihood for experiencing indirect, long-term impacts. Seven federal-candidate wildlife species, as well as five state-protected species, are believed to inhabit the ROI. Direct or indirect, long-term impacts could occur depending upon the location of these species.

Upgrading of bridges in the deployment area may cause localized impacts to riparian habitats and wildlife species associated with aquatic habitats (bald eagle, whooping crane, pallid sturgeon, long-billed curlew, Meltwater lednian stonefly, and paddlefish). No federally listed plant species occur in Montana. Nine federal-candidate wildlife species, one federal-candidate plant species (Antennaria aromatica), and fourteen plants listed as imperiled or critically imperiled by the Montana Natural Heritage Program are likely to occur in the deployment area. These species have a small potential for experiencing adverse, short-term impacts during construction of support facilities. Additionally, there is a low likelihood that these species will be affected by day-to-day operations. Eight federal-candidate plants and 12 additional plants listed by the Montana Natural Heritage Program may occur in the ROI and could receive minimal long-term, indirect impacts from project-induced population growth over the life of the proposed project. Additionally, four state-listed animal species occur either in the deployment area or adjacent areas.

Short and long-term impacts are expected to be low because of the small amount of habitat that will be affected, the small number of listed and candidate threatened and endangered species within the MOB and deployment area, and the minor impacts expected for species occurring in the impact areas. Project impacts are not expected to add substantially to the cumulative impacts to threatened and endangered species in the region and are not likely to cause major concerns on the part of natural resource management agencies and scientific authorities. Substantial reduction or avoidance of impacts through sound construction techniques and care in siting facilities is likely. The

project is not likely to jeopardize the continued existence of any protected species. Therefore, short and long-term impacts are considered to not be significant.

4.6.4.5 Minot Air Force Base

Potential short and long-term impacts of the proposed project on threatened and endangered species will be low and not significant at the regional level. Short and long-term impacts will be low for vegetation, wildlife, and unique and sensitive habitats. Short-term impacts for aquatic habitats will be moderate and long-term impacts will be low. These regional-level, short-term impacts will be significant for aquatic habitats and not significant for other elements.

Vegetation. Construction of new facilities onbase will disturb a relatively small amount of vegetation (1,140 acres temporarily and 390 acres permanently). Because most of the base has been built on, reseeded, or generally disturbed, it is likely that only a small amount of native vegetation (grassland) will be affected. Based on the relative abundance in the region, the additional area (approximately 1,580 acres) expected to be disturbed during road and bridge upgrading in the deployment area is likely to be agricultural land (approximately 83%), prairie vegetation (approximately 12%), or wetland types (5%). Because of the small amount of project-related urban growth and recreational pressure anticipated, long-term, indirect impacts are expected to be minor. The overall short and long-term impacts to vegetation will be low because of the minor amount of vegetation that will be disturbed and the low potential for disturbing native vegetation.

The impacts are not expected to be of concern to natural resource management agencies or scientific authorities. Although considerable land use changes have occurred in the area, the minor disturbance likely to occur from the project, in combination with disturbance from future projects, is not expected to be substantial. Based on these considerations, the overall short and long-term impacts to vegetation will not be significant.

Wildlife. The area of wildlife habitat that will be temporarily and permanently disturbed by construction is the same as described for vegetation. Construction activities in the deployment area will also disturb approximately 1,297 acres. Direct, long-term disturbance will occur during construction and will affect major game species (i.e., white-tailed deer and pronghorn) in the direct impact areas or immediately adjacent areas. Nongame species in these areas will be similarly affected. Upgrading of bridges in the deployment area may cause some localized impacts to riparian habitats and wildlife associated with aquatic habitats. The operations phase will also generate direct, long-term impacts; however, the disturbances are expected to be minor. Construction of facilities at the support base and silos, as well as upgrading existing roads, will cause direct, short-term impacts to species in the immediate vicinity of construction activities. The two major vegetation types in the direct impact area, mixed-grass prairie and transition grassland, support a low nongame diversity as compared to other vegetation types in the region, such as northern floodplain forest (moderate diversity), oak savannah (moderate diversity), mountain juniper (moderate diversity), and hardwood draws (high diversity).

Several additional big game species occur in the ROI, including moose, mule deer, and bighorn sheep. These species will receive minor, indirect, long-term impacts, primarily as a result of increased population growth. The expected increase will be relatively substantial and will range from 2.3 to 6.2 percent.

The small amount of wildlife habitat expected to be lost or disturbed, and the small number of wildlife expected to be killed and/or displaced, are likely to result in only minor disruption of wildlife communities during either the construction or operations phases. Therefore, both short and long-term impacts will be low. The proposed project will not add appreciably to the overall cumulative impacts to wildlife in the area because of the minor effects expected. The minimal disturbance expected is not likely to generate concern among natural resource management agencies. Consequently, short and long-term, regional-level impacts will not be significant.

Aquatic Habitats. Major aquatic habitats (marshes and potholes) occur within 1 mile of 101 of the launch facilities, HML transit routes intersect 88 aquatic habitats (several supporting substantial fisheries), and several marshes and streams occur onbase. Because of the large number of stream intersections and wetlands nearby, bridge and culvert upgrading at stream crossings and construction along the HML transit routes will increase the amount of direct disturbance and sediments entering these resources in the short term. The fisheries and wetlands affected by these short-term impacts will recover shortly after the disturbance ends (generally within 1 or 2 years). Construction may result in the long-term encroachment upon some aquatic resources, but this is a relatively minor impact when compared to the large number of wetlands in the area. In addition, the impact could be reduced through siting and the use of sound construction methods. Training and other activities may increase erosion and affect wetlands onbase. These off-road, short-term impacts will be limited to the duration of the activity plus the recovery time. Other operations will be removed from aquatic habitats and will not affect these resources in the short or long term. Recreational aquatic habitats are abundant in the ROI, so that the expected 2.3 to 6.2-percent project-induced population growth will not produce large, indirect impacts to these resources.

Although many impacts to aquatic habitats are expected to be small, a large number of habitats will be affected in the short term by bridge and culvert upgrades. Therefore, the overall short-term impacts are rated moderate and long-term impacts are rated low. The regional-level, short-term impacts will be significant, because taken together they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems in the region, which will be of special concern to natural resource management agencies. Long-term, regional-level impacts will not be significant because they do not represent a substantial contribution to cumulative impacts and should not be of special concern to natural resource management agencies.

Unique and Sensitive Habitats. Launch facilities and HML transit routes occur near 17 of the more than 100 unique and sensitive habitats in the ROI. One launch facility occurs on Lostwood National Wildlife Refuge, near its outer boundary. Construction will be restricted to the launch facility and the area near the HML transit routes. This represents a small area of unique habitat that will be potentially affected. Minor short-term disturbance will occur

during construction from grading and fill. Smaller areas will be removed in the long term if road boundaries are expanded to accommodate the HMLs. Operations will take place in the developed area within the unique habitat and will produce short and long-term impacts. Many of the unique areas occur at the boundary of the ROI and will not receive large impacts because of their distance from the MOB. The majority of these areas are regulated by government agencies and will not be subject to extreme problems caused by overuse.

The overall short and long-term impacts to unique and sensitive habitats will be low because only one habitat will be directly affected (with few effects to its biological uniqueness) and indirect impacts are likely to be very small. The proposed project will not contribute largely to cumulative impacts in the ROI or produce impacts to unique habitats that are of substantial concern to natural resource management agencies. These regional impacts will not be significant.

Threatened and Endangered Species. The bald eagle and peregrine falcon are migratory in the region and may occur onbase for short periods. Impacts to these species are not likely to occur, but may include minor disturbance of daily/seasonal movements and activities during construction and, to a minor degree, during operations. The piping plover, which is federally listed, may occur in the direct impact area and will be similarly affected. The black-footed ferret may occur in the ROI. Ferrets have been sited in areas south and west of the Missouri River. However, the rarity of this species and small urban growth and recreational pressures expected indicate that indirect, long-term impacts are unlikely.

Two federal-candidate animal species (interior least tern and northern swift fox) and 16 state-listed wildlife species may also occur in the direct impact area. One federal-candidate plant species (Eriogonum visheri) and 62 additional species considered by the North Dakota Chapter of the Wildlife Society to be threatened or endangered occur in counties in the deployment area. Because the areas expected to be disturbed are small, lie adjacent to roads, and have been previously disturbed, substantial short and long-term impacts to these species from construction are not expected. Upgrading of bridges in the deployment area may cause localized short-term impacts to riparian habitats and wildlife species associated with aquatic habitats. Minor, long-term impacts to animal species, such as animal-vehicle collisions, disruption of daily/seasonal movements, and disturbance-related stress, may occur, but are not likely.

Two federal-candidate animal species (long-billed curlew and sicklefin chub), 25 additional state-listed animal species, and 52 additional Society-listed plant species occur in the ROI. Long-term impacts to these species are expected to be minor because of the small urban growth and the associated minimal dispersed recreation pressure expected.

No federally listed species occur as residents in the potential direct impact area and only a small number of federal-candidate and state-listed species may be directly affected; consequently, it is unlikely major adverse impacts will occur. If potential impacts to threatened and endangered species do become apparent, there is a good likelihood of avoiding these impacts through alternative siting of facilities and other mitigating measures. Therefore, the overall short and long-term impacts to threatened and endangered species will

be low because of the small potential for disturbance and the minor degree of disturbance expected. It is unlikely that the project impacts will add to cumulative impacts to threatened and endangered species, or that concern will be expressed by natural resource management agencies or scientific authorities. The proposed project is not likely to jeopardize the continued existence of any protected species. Therefore, short and long-term impacts will not be significant.

4.6.4.6 Whiteman Air Force Base

Potential project-related short and long-term impacts to threatened and endangered species will be low and not significant at the regional level. Short-term impacts to aquatic habitats will be moderate and long-term impacts will be low. Short and long-term impacts will be low for vegetation and wildlife. Short and long-term impacts to unique and sensitive habitats will be negligible. Short-term, regional-level impacts will be significant for aquatic habitats and not significant for other elements.

Vegetation. Construction activities on Whiteman AFB will disturb a relatively minor amount of vegetation (1,140 acres temporarily and 390 acres permanently). Most (80%) of the undeveloped area on Whiteman AFB is grassland, which comprises the majority of area potentially disturbed by the proposed project. The rest of the undeveloped area (20%) consists of dispersed wooded areas. Additional areas totaling nearly 1,480 acres will be permanently disturbed during road and bridge upgrading in the deployment area. Based on relative abundance in the area, the large majority (about 90%) of the area likely to be disturbed is used for agricultural production. Most of the remaining area supports forest vegetation. Long-term, indirect impacts in the ROI will likely be minor because of the small project-induced population growth and the expected dispersed nature of the attendant recreational activities. Based on the small amount of area to be disturbed and the minor loss of biological productivity and habitat expected, the short and long-term impacts to vegetation will be low. The native vegetation has been extensively converted to agricultural production. The minor additional disturbances expected as a result of the proposed project are not likely to be of concern to natural resources management agencies or scientific authorities. Disturbances that may result from the proposed project, in conjunction with disturbances that may result from future projects, are not expected to be cumulatively significant. The small amount of area to be disturbed, the good recovery potential of many of the sites, and the low level of concern expected indicate an overall short and long-term, not significant impact to vegetation.

Wildlife. The area of wildlife habitat that will be temporarily or permanently disturbed by construction is the same as described for vegetation. Construction of support facilities at the base and silos will cause direct, long-term disturbance to white-tailed deer, the major game species occurring within the direct impact area and ROI. The relatively diverse nongame species inhabiting the same areas will also receive similar disturbances. Both small and large game species will receive direct, long-term impacts during the proposed project's operation phase; however, these effects will be minor because of the infrequency of the disturbances. Upgrading of bridges in the deployment area may cause localized impacts to riparian habitats and wildlife species associated with aquatic habitats.

The two major vegetation types found onbase, blue stem prairie and oak-hickory woodland, support a nongame diversity of low and moderate, respectively, as compared to other vegetation types in the region (i.e., wetlands/riparian habitats which have high wildlife diversity). Minor, indirect impacts to wildlife in the ROI are likely to occur during the life of the proposed project because of increased human pressures brought on by population growth in the area. The population is projected to increase by only a minor amount (0.3-0.8%). The small amount of habitat expected to be lost or disturbed and the minor number of species that will be killed or displaced result in short and long-term, low impacts.

The impacts are not likely to generate concern among natural resource management agencies. The proposed project is also not likely to add substantially to other impacts to wildlife in the region. Based on these factors, regional-level, short and long-term impacts to wildlife will not be significant.

Aquatic Habitats. Major aquatic habitats occur within 1 mile of 19 launch facilities, HML transit routes intersect 17 aquatic resources, and several small streams and ponds occur on Whiteman AFB. Construction (bridge and culvert upgrades and road expansion along HML transit routes) will create short-term impacts to aquatic habitats. Direct disturbance, as well as sedimentation and landfill, will disturb fisheries and other biota in these habitats (including the drainages of the Blackwater and Osage rivers). Recovery potential will be high in most cases (completing in 1 or 2 years), and begin when the disturbance ends. Permanent landfill may create long-term impacts because of the removal of aquatic habitats. These long-term impacts are most likely to occur along the HML transit routes. Short and long-term impacts can be reduced through siting and the use of construction methods that minimize erosion and sedimentation. Operations onbase may increase erosion and produce short-term impacts to aquatic habitats. Other operations impacts will be minor. Aquatic recreational resources are abundant in the ROI, and project-induced population growth will be small (0.3-0.8%). Therefore, indirect impacts will be minor.

The level of short-term impacts is rated moderate, primarily because of the large number of bridge and culvert upgrades and other construction activities that will affect aquatic habitats. The overall long-term impacts will be low because disturbances are likely to be contained within small areas and can be reduced through siting and the use of sound construction methods. Therefore, there will be few adverse consequences for aquatic habitats. The short-term impacts are significant at the regional level, because taken together they represent a substantial disruption of ecologically and recreationally important aquatic habitats and systems, which will be of special concern to natural resource management agencies. Regional-level, long-term impacts will not be significant because they are unlikely to cause concern among natural resource management agencies and indirect impacts (including cumulative effects) will be small.

Unique and Sensitive Habitats. Five of the 21 unique and sensitive habitats that occur within the deployment area also occur within 2 miles of a launch facility. Most of these areas do not have major roads within their boundaries (including HML transit routes). Potential construction impacts will be mainly along the HML transit routes, at the MOB, and at the launch facilities. Therefore, there should be few construction-related short or long-term impacts

to unique habitats. Operations activities will not occur in natural or sensitive areas of the unique habitats, and will have no impact. Many of the unique habitats are privately owned and will not be at risk from project-induced development because they are located at some distance from the MOB. Public access to these areas is either regulated or restricted, and project-induced growth (0.3-0.8%) will not produce large impacts to these habitats.

Because of the lack of negative environmental effects on unique and sensitive habitats, the overall short and long-term impacts will be negligible. The contribution of these impacts to cumulative impacts to unique areas is minor and will not be a concern to natural resource management agencies. Therefore, these regional-level impacts will not be significant.

Threatened and Endangered Species. Although no species that are federally listed as threatened or endangered are known to occur on Whiteman AFB, the base is within the range of the endangered Indiana bat and three endangered migratory species (the bald eagle, American peregrine falcon, and Arctic peregrine falcon). The endangered gray bat also occurs within the deployment area. Construction impacts to all of these species are not likely because of the animals' limited occurrence in the direct impact area. The state-protected greater prairie chicken occurs onbase, and eight other state-protected wildlife species are thought to occur either onbase or within the deployment area. No federal-candidate wildlife species occur in the direct impact area. Two federal-candidate plant species (*Asclepias meadii* and *Platanthera leucophaea*), and one proposed species, *Geocarpon minimum*, may occur in the deployment area. Twenty-eight state special-status plants occur in counties in the deployment area. Species occurring onbase could experience direct impacts from construction and operations, but it should be possible to avoid impacts to these species through alternative siting of facilities and activities. Species occurring elsewhere in the deployment area have a low probability of being adversely affected. Upgrading of bridges in the deployment area may cause localized impacts to riparian habitat and wildlife species associated with aquatic habitats (bald eagle, whooping crane, and piping plover).

Four animal species federally listed as endangered (the whooping crane, gray bat, piping plover, and the Eskimo curlew), 9 federal-candidate wildlife species, 23 state-listed (Missouri and Kansas) animal species, 1 federally proposed plant (*Lesquerella filiformis*), 5 federal-candidate plants, and 120 state-listed (Missouri only) plant species occur in the deployment area or the ROI. Long-term, indirect impacts are not expected, and, if they do occur, will be minor because of the low population growth and associated minimal dispersed recreational activity expected.

Because of the low potential for affecting protected species, the small numbers of species potentially affected by the proposed project, and the small degree of disturbance expected for most species, short and long-term impacts to threatened and endangered species will be low. Adverse impacts to threatened and endangered species are generally a concern to natural resource management agencies and scientific authorities. However, the level of concern expected to result from the project impacts will be low because of the small number of species potentially affected and the minor degree of disturbance that will occur. Major land use conversions and loss of habitat have occurred in the region. However, the minor impacts expected will not add significantly

to cumulative impacts in the region. The proposed project is not likely to jeopardize the continued existence of any protected species. Based on these factors, short and long-term impacts to threatened and endangered species are not expected to be significant.

4.6.5 Impacts of Hard Silo in Patterned Array

4.6.5.1 Davis-Monthan Air Force Base

Potential project-related long-term impacts to vegetation and wildlife in the region are expected to be high and significant and short-term impacts to wildlife will be moderate and significant. Short and long-term impacts to aquatic habitats will be low and short-term impacts to vegetation will also be low. There will be short-term, low impacts and long-term, moderate impacts to threatened and endangered species. Short and long-term, moderate impacts to unique and sensitive habitats will occur. However, none of these latter impacts is expected to be significant at the regional level.

Vegetation. Implementation of this basing mode will directly affect approximately 31 sq mi (19,700 acres) of Davis-Monthan AFB and SDA. Construction of new facilities at the MOB will disturb 1,700 acres of the paloverde-cactus type. Construction in the SDA will result in slight to severe disturbance of a large area (28 sq mi). Minor but long-term disturbances during operations are also expected. Because of the low recovery potential characteristic of vegetation types common in the deployment area, most temporary disturbance will cause long-term effects. Based on the relative abundance of vegetation types in the SDA, these vegetation types have the following probabilities of being permanently affected: grama-tobosa shrub steppe, 41 percent; paloverde-cactus shrub, 36 percent; creosote bush-bursage, 8 percent; creosote bush-tarbush, 6 percent; agricultural land, 5 percent; and desert wash, 2 percent. The saltbush type and an oak-pine woodland type each comprise less than 1 percent of the SDA. Long-term, indirect impacts that may result from project-induced population growth and attendant increased recreational pressure are expected to be minor. The abundant recreational opportunities available indicate that recreation is likely to be dispersed, thereby causing less disturbance. The degree of impacts resulting from recreational activities (especially off-road vehicle use) in desert environments will vary depending on the frequency and intensity of use. Although the vegetation types that may be disturbed are relatively common in the region, the large areas expected to be directly disturbed or lost represent long-term, high impacts to the vegetation of the area. The consequences of major disturbances to vegetation represent losses of biological productivity and habitat, and are major disturbances to the balance of the biological community. Short-term impacts are considered to be low because few impacts will be transient.

Desert ecosystems are fragile with a poor recovery potential from disturbance. The potentially high degree of disturbance to vegetation and consequently, wildlife habitat, is likely to be of concern to natural resource management agencies and scientific authorities. Substantial loss of vegetation and wildlife habitat from agricultural and urban development has occurred. Project-induced disturbance will add considerably to the cumulative impacts of these and planned projects. Overall regional-level, long-term impacts to vegetation will be significant because of the major impacts expected to the native vegetation, the poor recovery potential and fragile nature of the desert

ecosystem, and the level of concern among natural resource management agencies that the impacts may generate. Short-term impacts are not considered significant.

Wildlife. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Large animal species that may be directly affected in the long term by construction of silos and support facilities include mule deer, mountain lion, javelina, and white-tailed deer; numerous small game species common to the area will also be affected. Short-term impacts may also occur during construction activities at the MOB and within the SDA; however, these impacts are expected to be minimal. Most direct, long-term impacts will result from construction; operations impacts are expected to be minor but may adversely affect these species in the long term.

Direct habitat loss is not likely to occur for mountain lions because this species occurs in mountainous regions where construction activities will not occur. This species may still be adversely affected because it occurs in areas adjacent to SDA and because of its high sensitivity to human disturbance and noise. Nongame species diversity in the directly affected vegetation types include grama-tobosa shrub steppe, which has a low nongame diversity, and paloverde-cactus shrub, creosote bush-bursage, and creosote-bush-tarbush, which have moderate diversities. The desert wash type has a high diversity. Indirect, long-term impacts to both small and large animals found in the ROI will also occur throughout the duration of the proposed project. These impacts will be the result of project-induced population growth (0.3-0.9%) with an associated increase in recreational and nonrecreational uses.

Long-term disruption to the wildlife communities in the region will result from the large area of habitat that will be lost or disturbed and the number of wildlife that will be killed or displaced during construction. Operations disturbances will occur over the life of the proposed project, but will be less severe than those from construction. Habitat loss and animal mortality will be long-term impacts, but considerable transient disturbances to wildlife will occur during construction. Therefore, short-term impacts will be moderate and long-term impacts will be high. These large, adverse impacts will [illegible] a concern of natural resource management agencies. In addition, the poor recovery potential and fragile nature of the desert ecosystem, and the proposed project's potential to add to the area's cumulative wildlife impacts, result in short and long-term impacts that will be significant at the regional level.

Aquatic Habitats. The SDA contains 6 miles of permanent stream habitat, a rare occurrence in this desert region. The SDA also covers 402 miles of regionally common desert wash habitat, 794 acres of common playa habitat, and 9 miles that support palustrine shrub-scrub vegetation. The permanent stream habitat and, to a lesser degree, washes, may receive short-term disturbances from erosion and sedimentation. These short-term impacts will be greatest along the San Pedro and Santa Cruz drainages. Groundwater removed for silo construction near the San Pedro River could substantially reduce flows and threaten aquatic species (including sensitive species). Encroachment on these habitats by construction landfill or clearing of riparian zones could create long-term impacts (habitat loss). Short or long-term impacts to permanent streams may not occur because there are few of these habitats within SDA, and

it should be possible to avoid conflicts during siting. Because of the number of desert wash and playa habitats in the SDA, it is probable that construction of launch facilities will occur near some of these habitats. Short and long-term impacts resulting from this construction will favor transition of desert playa habitat to upland vegetation because of landfill. These potential impacts could be reduced through the use of proper construction methods. Construction directly in these habitats is not likely because they are unsuitable for silo siting. Portions of the San Pedro River and several other small streams in the indirect impact area provide biologically important riparian habitat. These areas are threatened by disturbance from housing developments. The 0.3 to 0.9-percent project-related increase in population is small compared to the projected population growth for this area; therefore, the project will not contribute substantially to the cumulative impact. Recreational use of aquatic habitats will cause potential indirect impacts. The project-induced demand on these resources will be small compared to the current level of use.

Short and long-term impacts will be low because of the likelihood of avoiding direct impacts to rare aquatic resources and the expected small indirect impacts (resulting in only minor environmental consequences to aquatic habitats). Potential indirect impacts to permanent stream habitats are of interest to the Arizona Game and Fish Department and the USFWS; however, these potential impacts are not likely to cause substantial concern among natural resource management agencies because of the small contribution to cumulative impacts by the proposed project. Based on these factors and the low probability of affecting environmentally critical aquatic habitats, short and long-term impacts to aquatic resources will not be significant at the regional level.

<u>Unique and Sensitive Habitats</u>. Eleven designated unique habitats representing eight geographic areas occur in SDA (out of 172 in the ROI). Three of these unique areas are associated with stream riparian and marsh habitats, one with plains habitat, and three with mountain habitat. Construction near the riparian and marsh habitats could cause sedimentation and create short-term impacts. The Research Ranch is a pristine area of desert grassland. Construction of launch facilities in this habitat will result in long-term impacts such as loss of species, reduced value for future research, and general habitat devaluation. It is likely that these impacts could be reduced or avoided through the siting effort and the use of proper construction methods. The remaining unique habitats that overlap SDA are associated with mountainous areas, where siting will not occur. Additionally, the uniqueness of these habitats is generally associated with the higher elevations, and construction of launch facilities in the lower elevations of these habitats will probably have only minor, short-term impacts. Saguaro National Monument occurs within SDA, but will be excluded from proposed project use. Public access to most of the remaining unique habitats in the ROI is controlled by the agency or organization managing the habitat. Therefore, the 0.3 to 0.9-percent project-related population increase will not produce a noticeable impact to these areas. A few areas (e.g., the San Pedro River riparian zone) are privately owned and may be disturbed by development or increased recreational use.

Short and long-term impacts will be moderate because of the potential for adverse effects on the biological uniqueness of these sensitive habitats. Such effects are likely to occur because of the number of unique areas

occurring in SDAs, the need to avoid habitats during siting to reduce impacts, and the potential for indirect impacts. The potentially affected habitats are of interest to the State of Arizona, the BLM, the USFWS, the U.S. Forest Service, the Nature Conservancy, and the scientific community. Potential concern about these impacts from natural resource management agencies could be reduced through the siting effort. Indirect impacts are expected to be small with respect to cumulative impacts that may occur in the region. Therefore, regional-level, short and long-term impacts will not be significant because of the minor contribution to cumulative effects and the possibility of avoiding controversial impacts.

Threatened and Endangered Species. Four federally listed animal species (Yuma clapper rail, masked bobwhite, jaguarundi, and Gila topminnow) are likely to occur in or adjacent to SDA. Of these, the masked bobwhite is most likely to be affected because it prefers the desert grassland type suitable for launch facility construction. Construction activities could have direct, short and long-term impacts to this species. Eight federal-candidate wildlife species, one plant species federally listed as endangered (Tumamoca macdougalii), nine federal-candidate plant species, and ten species protected by the Arizona Plant Law that are not under consideration for federal listing, may occur onbase or in SDA and could be disturbed during construction or operations. Also, nine state-listed wildlife species could occur in SDA and be susceptible to direct impacts. The magnitude of these impacts will vary considerably, depending on the location of silo construction. Impacts to many of these species can be avoided or minimized by siting facilities and restricting activities away from these species habitats, therefore preventing adverse effects.

Nine federally listed wildlife species, 3 federally listed plant species (Echinocactus horizonthalonius var. nicholii, Cowania subintegra, and Echinocereus triglochidiatus var. arizonicus), 2 plant species proposed as threatened (Mammillaria thornberi and Coryphantha robbinsorum), 4 federal-candidate wildlife species, 27 federal-candidate plant species, and 17 plants protected by the State of Arizona occur elsewhere in the ROI, but will not be substantially affected by the anticipated dispersed recreational activities. Seven state-protected wildlife species are thought to occur in the ROI.

Short-term impacts to threatened and endangered species are rated as low because transitory disturbances will be a minor part of all expected impacts to these species. Long-term impacts are rated as moderate, based on the number of protected species occurring in the direct and indirect impact areas, the relatively large amount of habitat that will be disturbed, and the reasonable feasibility of avoiding impacts through siting.

Potential impacts to threatened and endangered species are generally a concern to natural resource management agencies and scientific authorities. Potential impacts to the endangered masked bobwhite quail are of particular concern because of recent efforts to preserve its habitat in southeastern Arizona. However, proposed project impacts will not be a great concern because the impacts will be relatively minor and will not add substantially to cumulative impacts to threatened and endangered species in the region. In addition, impacts can be mitigated (through avoidance and other measures) so that the continued existence of any protected species will not be jeopardized. Therefore, regional-level, short and long-term impacts are expected to not be significant.

4.6.5.2 Edwards Air Force Base

Potential project-related, long-term impacts to vegetation and wildlife in this region are expected to be high and significant and short-term impacts to wildlife will be moderate and significant. Short and long-term impacts to aquatic and unique and sensitive habitats will be low, as will short-term impacts to vegetation. There will be short-term, low and long-term, moderate impacts to threatened and endangered species. However, these latter impacts will not be significant at the regional level.

Vegetation. Deployment at Edwards AFB will potentially disturb approximately 31 sq mi (19,700 acres) of Mojave Desert vegetation. Construction of new facilities at the MOB will disturb 1,700 acres of vegetation. Construction of facilities and roads in the SDA will disturb a large area of desert vegetation (28 sq mi). Because of the poor recovery potential of the vegetation types common to the deployment area and the major disturbance that may result from construction activities, most construction-related impacts will be long term. Based on the relative abundance in the SDA, these vegetation types have the following probabilities of being affected: creosote bush, 45 percent; Joshua tree-creosote bush, 20 percent; juniper-pinyon, 10 percent; saltbush, 5 percent; and shadscale, 1 percent. Sixteen percent of the SDA is irrigated agricultural land and another 3 percent is classified as urban or otherwise disturbed. Minor, long-term impacts are expected during operations. Long-term, indirect impacts will be low to moderate because of increased recreational pressure and urban growth. Because of the limited recreational opportunities (e.g., campsites) in the area, a substantial amount of recreational pressure may be concentrated in several areas, thereby increasing the likelihood of impacts. Although the vegetation types that may be directly affected occur extensively in the region, the large area expected to be lost or disturbed represents long-term, high impacts to vegetation. Consequently, a large decrease in biological productivity and a major loss of habitat will occur in the region. Short-term impacts will be low because few impacts will be transitory.

The vegetation of the Mojave Desert, like other desert environments, has a poor recovery potential from disturbance. The anticipated large degree of disturbance to vegetation is likely to be of concern to natural resource management agencies and scientific authorities. Substantial loss of native vegetation from urban and agricultural development has occurred in the area. Proposed project disturbances will add substantially to cumulative impacts of the project and other projects in the region. Because of the substantial impacts that will occur to vegetation, the poor recovery potential and fragile nature of the Mojave Desert, and the level of concern among natural resources management agencies the impacts may generate, the overall long-term impacts to vegetation will be significant at a regional level. Short-term impacts are not considered significant.

Wildlife. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Mule deer, mountain lion, feral (wild) burro, and desert bighorn sheep may be directly affected in the long term by construction of silos and support facilities. Numerous nongame species common to the area will also be similarly affected. Direct, short-term impacts may also occur during construction activities at the MOB and within the SDA; however, these impacts are expected

to be minimal. Most direct impacts will occur during the construction phase; operations impacts are expected to be minor but long term.

Direct habitat loss from construction is not likely to occur for desert bighorn sheep and mountain lion, since these species occur in mountainous regions where construction will not occur. However, these species may still receive adverse impacts because they occur in habitats adjacent to the SDA and are highly sensitive to human disturbance and noise.

Indirect, long-term impacts to both big game and nongame wildlife in the ROI will not occur for the duration of the proposed project; however, any indirect impacts that do occur are expected to be minimal since the projected population growth will range from 0.0 to 0.1 percent. Nongame diversity in the major vegetation types of the direct impact area (i.e., creosote bush, Joshua tree-creosote bush, and saltbush) is moderate.

Large areas of wildlife habitat will be lost because of construction activities, with a corresponding increase in wildlife displacement or mortality. Less extensive operations-phase disruptions are expected; however, the combination of construction and operations effects will cause a major long-term disruption of wildlife communities in the region. Therefore, long-term impacts are expected to be high. Short-term impacts will be moderate because considerable transient disturbance of wildlife will occur during construction.

Adverse impacts to a large number of wildlife species and the large amount of wildlife habitat expected to be lost will be a concern of natural resource management agencies. Likewise, the proposed project's potential to add to the cumulative wildlife impacts for the area will be of major importance. Therefore, short and long-term impacts will be significant at the regional level.

Aquatic Habitats. The SDA contains 118 miles of desert wash habitat, 8 miles of canal, 4 miles of palustrine shrub-scrub habitat, and 2 miles of marsh in this otherwise arid region. The canal will not be disturbed by the proposed project because it is an excluded area. The palustrine shrub-scrub habitat is regionally common and represents a small portion of the SDA. Because of the nature of the habitat, it is not likely that structures or launch facilities will be placed in desert washes onbase or in the SDA. Short-term impacts to these wash communities may result from sedimentation and will result in the long-term removal of ephemeral aquatic habitat if it persists. These short and long-term impacts can be reduced through siting and by the use of sound construction methods. Increased demand on recreational fisheries in the ROI is expected to be proportional to the expected 0.0 to 0.1-percent project-related population increase. These resources already experience a high degree of use, and the small additional use resulting from the project is not likely to create large changes in the biota or require changes from current habitat management.

Few environmental consequences are expected because of the small amount of regionally common aquatic resources potentially affected, the likelihood of avoiding impacts to these resources, and the minor, indirect impacts that may occur. Short and long-term impacts to aquatic habitats will be low. In addition, short and long-term impacts will not be significant on a regional level because of the lack of substantial concern among natural resource

management agencies or cumulative impacts that will develop from these disturbances.

Unique and Sensitive Habitats. Two unique and sensitive habitats occur on Edwards AFB, 8 in the SDA, 8 near the SDA, and over 200 in the remaining ROI. The habitats onbase are Rosamond Dry Lake (including the Piute Ponds wildlife area) and several areas of relatively undisturbed vegetation (these are Los Angeles County Significant Ecological Areas). Construction and operations are likely to occur in the areas of the base that are already disturbed by existing structures and will not affect these two habitats. The eight areas on the SDA represent desert washes, Joshua tree woodland, and desert plains. The desert plains habitats include two research natural areas and a wilderness study area. The SDA generally overlaps small portions of these eight habitats, except for an area of desert tortoise habitat near Helendale and an area of Joshua tree woodland east of Lancaster. Construction could result in the direct disturbance of these areas in the short term. These disturbances are likely to be greater in habitats with larger areas of SDA that could support more missiles. Recovery of temporarily disturbed areas will begin when construction ends. Permanent construction impacts will occur from the loss of habitats to launch facilities, buildings, and access roads. The area lost will not be large enough to affect the biological uniqueness of the habitats. Operations are likely to be restricted to the roads, launch facilities, and base, and therefore will not affect these habitats. These impacts can be reduced by locating silos in less sensitive habitats and by the use of sound construction methods to minimize surface disturbance. Use of the majority of unique habitats in the remaining ROI is controlled by various agencies, limiting the potential impacts from population increases.

Short and long-term impacts to unique habitats will be low because of the small area potentially disturbed, the lack of effect on the uniqueness of the disturbed habitat, and the likelihood of reducing these impacts through siting. The potential impacts are of interest to the BLM, California Department of Fish and Game, Los Angeles County, and the scientific community, but are not likely to cause concern from natural resource management agencies on a regional scale. These impacts will not lead to large cumulative impacts; therefore, both short and long-term impacts are rated not significant at the regional level.

Threatened and Endangered Species. The endangered bald eagle and peregrine falcon occur in the SDA or are resident in nearby areas and may occur in SDA occasionally. Construction and associated human activity could cause these birds to avoid the construction area. The California condor, also reported from the ROI, is so rare that the chance of disturbing this endangered species is remote. Eight federal-candidate plant species and two federal-candidate animal species (desert tortoise and Mohave ground squirrel) may occur in the direct impact area. It is likely that major impacts to species in potential direct impact areas can be avoided through careful siting of facilities and activities. Impacts to plant species and ground-dwelling mammals or their habitats are possible as a result of short-term construction and long-term loss of habitat. No state-protected wildlife species that are not also listed as federal candidates are known to occur in the direct impact area. Six federally listed animal species, 22 federal-candidate animal species, 3 federally listed plant species (Centaurium namophilum var. namophilum, Sidalcea pedata, and Thelypodium stenopetalum), 87 federal-candidate plant species, and

1 state-protected animal species, occur or are thought to occur elsewhere in the ROI. Indirect, long-term impacts to these species from urban growth and recreational pressure will be small.

Short-term impacts to threatened and endangered species will be low because transitory disturbances will be a minor part of all expected impacts. Long-term impacts will be moderate, based on the number of protected species occurring in the direct and indirect impact area, the relatively large amount of habitat that will be disturbed, and the reasonable feasibility of avoiding impacts through siting.

Potential impacts to threatened and endangered species are generally a concern of natural resource management agencies and scientific authorities. However, proposed project impacts are not likely to be of great concern because the impacts will be relatively minor. In addition, the impacts will not add substantially to the cumulative impacts to threatened and endangered species in the region. Impacts to these species can be mitigated (through avoidance and other measures) so that the continued existence of any protected species will not be jeopardized. Therefore, both short and long-term impacts are expected to not be significant at the regional level.

4.6.5.3 F.E. Warren Air Force Base

Potential project-related, long-term impacts are expected to be high and significant for wildlife and moderate and significant for vegetation, while short-term impacts to wildlife will be moderate and significant. Short and long-term impacts to aquatic habitats will be low, as will short-term impacts to vegetation. There will be short and long-term, negligible impacts to unique and sensitive habitats, and short-term, low and long-term, moderate impacts to threatened and endangered species. None of these latter impacts will be significant at the regional level.

Vegetation. The vegetation of a large area (approximately 31 sq mi) of primarily short-grass prairie and agricultural land will be directly affected by construction and operations at F.E. Warren AFB. Based on the relative abundance, construction activities at the MOB will disturb approximately 1,700 acres of primarily short-grass prairie. Construction in the SDA will disturb roughly 28 sq mi of land and is almost equally likely to affect either prairie vegetation or agricultural land. Most of the area disturbed in the SDA will be permanently removed from biological production. Approximately 70 percent of the area disturbed at the MOB will be only temporarily affected and will be reseeded after construction ends. Indirect impacts will be long term and minor. The abundance of recreational opportunities available in the area indicates that recreational pressure will be small and dispersed. Although vegetation types potentially affected by the proposed project are relatively common in the region, the large areas expected to be directly and permanently disturbed represent a long-term, moderate impact to the vegetation and associated resources of the region. Major losses of biological productivity and habitat, as well as general disturbances to the overall biological community, can be expected as a consequence of large vegetation losses. The small amount of area temporarily disturbed represents a short-term, low impact. The potentially high degree of disturbance to vegetation, and consequently wildlife habitat, is likely to be of concern to natural resource management agencies and scientific authorities. Substantial vegetation and

habitat have been lost from agricultural development in the ROI. Cumulative losses from this project and other projects in the region are likely to be substantial. Because of the major impacts to the overall biological productivity and native vegetation of the area, and the level of concern among natural resource management agencies the expected impacts may generate, the overall long-term impacts to vegetation will be significant at the regional level. Because short-term impacts will be minor and can be reduced through reseeding, short-term impacts will not be significant.

Wildlife. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Permanent loss of wildlife habitat from construction will have a major long-term impact to the wildlife inhabiting the SDA or adjacent areas, including mule deer and pronghorn. Construction activities at the MOB, as well as within the SDA, will cause short and long-term impacts to wildlife and wildlife habitat. Operations impacts are also expected; however, these long-term impacts will be minor.

Direct impacts to nongame species within the SDA are expected to be long term, primarily because of habitat loss. The major habitat type that will be directly affected is primarily short-grass prairie, which has a low diversity of nongame species compared to other vegetation types in the ROI such as coniferous forest (moderate diversity) and meadow communities (high diversity). Big game species such as elk, white-tailed deer, and bighorn sheep occur in the ROI, and are likely to receive indirect, long-term impacts from population increases (0.6-1.8%) that are anticipated for the ROI. Nongame species will be similarly affected.

Construction activities will kill or displace a large number of wildlife and destroy or disturb a large area of wildlife habitat over a long period. This, combined with the minor operations impacts expected, will cause a major disruption of wildlife communities in the area. Consequently, long-term impacts will be high. Short-term impacts will be moderate because considerable transient disturbance of wildlife will occur during construction. The large area of wildlife habitat that will be affected is likely to generate concern among natural resource management agencies. In addition, the expected impact will add to the cumulative wildlife impacts for the area for the life of the proposed project. Therefore, short and long-term impacts will be significant.

Aquatic Habitats. Two lakes that are stocked with trout and several streams occur onbase. Minor, short-term impacts to these habitats could occur if sediments from construction activities were to enter the streams or lakes. Long-term impacts to aquatic resources could result from construction if large amounts of sediments enter and persist in the aquatic habitat, or if a habitat receives landfill. These short and long-term effects can be reduced through siting and the use of sound construction methods. The expected 0.6 to 1.8-percent proposed project population increase will proportionally increase recreational use (e.g., fishing pressure) of aquatic habitats, which occurs at the western and northern edges of the ROI. The habitats already receive a high use rate, and increased use will probably be evenly spread among these aquatic resources because of their distance from the MOB. Therefore, indirect impacts resulting from increased use will be minor.

Short and long-term impacts will be low because of the small amount of wetland habitat in the SDA, the likelihood of avoiding impacts to these habitats, and the minor expected level of indirect impacts. Population growth and increased tourist activity without the proposed project will produce cumulative impacts on aquatic resources in the long term. The additional pressure created by the project is small compared to these potential cumulative impacts, and the project will not alter the projected conditions for aquatic resources in this area. Therefore, short and long-term impacts will not be significant at the regional level.

Unique and Sensitive Habitats. No unique and sensitive habitats have been identified onbase or in the SDA. Habitat for several sensitive species is discussed in the threatened and endangered species element. Therefore, unique and sensitive habitats will not receive direct impacts in the short or long term from construction or operations. Many of the unique habitats in the greater ROI are managed public habitats and will not receive indirect impacts from the expected 0.6 to 1.8-percent project-induced population increase. Several areas exist on private lands at the boundary of the ROI, but are sufficiently removed from the major population center to preclude short or long-term, indirect impacts.

Because of the lack of potential for impact to, or other environmental consequences for, unique habitats in the ROI, short and long-term impacts will be negligible.

Threatened and Endangered Species. Three birds that are federally listed as endangered (bald eagle, peregrine falcon, and whooping crane) occur in the region as occasional migrants and may occur in SDA. Short and long-term impacts could include loss of habitat and food sources and general disturbance; however, the impacts to these federally listed bird species should be minimal. Four animal species and one plant species (the Colorado butterfly plant) that are candidates for federal listing, and four animal species that are classified as rare by the State of Wyoming, occur onbase and may receive some impacts during construction. One plant species listed as unique and seven species listed as rare in Wyoming, and one plant species listed as threatened in Nebraska, may occur elsewhere in the deployment area. Short and long-term impacts will occur and may include mortality and permanent loss of habitat. However, it is likely that major impacts to species in potential direct impact areas can be avoided through careful siting of facilities and activities.

The endangered black-footed ferret occurs in the ROI. Any long-term, indirect impacts to this very rare species will be of great concern; however, impacts to the species are not likely because of its absence from the direct impact area and extreme scarcity elsewhere in the ROI. Three other federally listed species (Northpark phacelia, piping plover, and the greenback cutthroat trout), 4 federal-candidate wildlife species, 10 state-listed (Wyoming, Colorado, and Nebraska) animal species, 10 federal-candidate plant species, and over 70 state special-status plant species occur in the ROI, but are only remotely likely to receive long-term effects from project-related urban growth and recreational pressures.

Short-term impacts to threatened and endangered species are rated low because transitory disturbances will be a minor part of all expected impacts to these

species. Long-term impacts are rated moderate, based on the number of protected species occurring in the direct and indirect areas, the relatively large amount of habitat that will be disturbed, and the reasonable feasibility of avoiding impacts through siting.

Potential impacts to threatened and endangered species are generally of concern to natural resource management agencies and scientific authorities. However, impacts from the proposed project are not likely to be of great concern because the impacts will be relatively minor and will not add substantially to cumulative impacts to threatened and endangered species in the region. In addition, impacts can be mitigated (through avoidance and other measures) so that the continued existence of any protected species will not be jeopardized. Therefore, both short and long-term impacts are expected to not be significant on a regional level.

4.6.5.4 Fort Bliss

Potential project-related, long-term impacts to vegetation and wildlife in this location are expected to be high and significant, while short-term impacts to wildlife will be moderate and significant. Short and long-term impacts to unique and sensitive habitats will be low, as will short-term impacts to vegetation. There will be short and long-term, negligible impacts to aquatic habitats, and short-term, low and long-term, moderate impacts to threatened and endangered species. It is not anticipated that any of these latter impacts will be significant at the regional level

Vegetation. The vegetation of approximately 31 sq mi (19,700 acres) of Fort Bliss and the SDA will be affected by Hard Silo construction and operations. Disturbance of approximately 1,700 acres of vegetation will occur onbase from construction of new facilities. Because of the poor recovery potential of most of the vegetation types that may be disturbed, and the moderate to severe degree of disturbance likely to occur during construction, most construction-related impacts will be long term. The majority of impacts will occur in the SDA during construction, when nearly 28 sq mi of vegetation will be moderately to severely disturbed. Minor but long-term disturbance is expected during operations. Based on the relative abundance of vegetation types in the SDA, these vegetation types have approximately the following probabilities of being affected: mesquite-sandsage, 50 percent; grama-tobosa shrub-steppe, 34 percent; creosote bush-tarbush, 14 percent; and saltbush-greasewood, 2 percent. Indirect impacts to vegetation are expected to be minor because of the limited population growth expected and the probable dispersed nature of the associated recreation. Although the vegetation types potentially disturbed are widespread in the region, the large areas of vegetation expected to be lost or disturbed represent a long-term, high impact to vegetation of the region. Major losses of biological productivity and habitat and substantial disturbances to the general biological communities can be expected as a consequence of large vegetation losses. The small amount of transient impacts expected represent a short-term, low impact.

The Chihuahuan Desert has more limited distribution in the United States than other deserts in North America. Most of the Chihuahuan Desert lies in Mexico. Like other arid environments, the Chihuahuan Desert is a fragile ecosystem with poor potential for recovering from disturbance. The potentially high degree of disturbance to vegetation and wildlife habitat is likely to be of

concern to natural resource management agencies and scientific authorities. Cumulative losses of vegetation and wildlife habitat from this project and other projects in the region are likely to be considerable. Because of the major impacts to the native vegetation and overall biological productivity of the area, the low recovery potential and fragile nature of the Chihuahuan Desert, and the level of concern the expected impacts may generate, the overall long-term impacts to vegetation will be significant at the regional level. Short-term impacts will not be significant.

Wildlife. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Chihuahuan Desert vegetation and wildlife habitat will be severely and permanently disturbed during construction. Major big game species that may be affected by the proposed project are pronghorn and mule deer. A small number of oryx in the central area of White Sands Missile Range are not likely to be affected.

Based on relative abundance in the SDA, approximately 10 sq mi of grama tobosa-shrub steppe, a preferred habitat of pronghorn, is likely to be severely disturbed. This type also supports moderately diverse nongame wildlife species. Approximately 14 sq mi of the mesquite-sandsage type may be disturbed. This type receives only slight use by mule deer and pronghorn and is rated low for overall animal species diversity. Approximately 4 sq mi of the creosote bush type may be affected. This habitat supports a moderate overall wildlife diversity and receives a low degree of use by big game species. Riparian and desert wash habitats, though not abundant, are particularly valuable to game and nongame species and may be disturbed during road construction and upgrading. Construction impacts will be both short and long term. Wildlife communities will receive short-term, moderate impacts as a result of temporary disturbance from construction activities. Long-term impacts will be high because of the permanent loss or disruption of large areas of wildlife habitat, long-term disruption of daily/seasonal movements or activities, mortality from vehicle movements, and stress caused by human presence and activity.

Long-term disruption to the wildlife communities in the region will result from the large area of habitat that will be lost or disturbed and the number of wildlife that will be killed or displaced during construction. Operations disturbances will occur over the life of the proposed project but will be less severe than those from construction. Habitat loss and animal mortality will be long-term impacts, but considerable transient disturbance of wildlife will occur during construction. Therefore, short-term impacts will be moderate and long-term impacts will be high.

The Chihuahuan Desert has limited distribution in the United States, and the large expected impacts will be of concern to natural resource management agencies. In addition, the poor recovery potential and fragile nature of the desert ecosystem and the proposed project's potential to add to the area's cumulative wildlife impacts will result in short and long-term impacts that are significant at the regional level.

Aquatic Habitats. Most of the SDA is seasonal habitat and only 22 miles of desert wash habitat (8 linear miles are associated with palustrine marsh and shrubs) occur in the SDA. Most of these desert washes and seven areas of

palustrine marsh and shrub habitat occur in small parcels of SDA near the San Andres, Organ, and Franklin mountains, and in the parcel of SDA southeast of El Paso (these aquatic habitats could be avoided through the siting effort prior to construction). Short-term construction impacts may occur in wetlands on SDA or in the Rio Grande River (if sediments from construction enter the river). These short-term impacts can be minimized by using proper construction methods. A reservoir complex on the Rio Grande River, north of Las Cruces, is the nearest aquatic recreational area to El Paso. This area can accommodate the moderate increase in use from the expected 0.4 to 1.3-percent increase in population growth from the proposed project. Other recreational aquatic resources occur at the boundaries of the ROI and will receive small increases in use.

Few environmental consequences are expected for aquatic habitats because of the small number of habitats that may be affected and the likelihood of avoiding these impacts. Therefore, the overall short and long-term impacts will be negligible. These regional-level impacts will also not be significant because of the lack of cumulative effects on aquatic habitats resulting from the proposed project.

Unique and Sensitive Habitats. Five of the 63 unique habitats in the ROI occur on SDA. Roderick Ecology Plot occurs in the center of a parcel of SDA, west of Las Cruces. The biological uniqueness of this site could be jeopardized by silo construction because of its small size. Silos placed on the parcel of SDA overlapping the Jornada Experimental Range could reduce the biological research value of that area in the short and long term. The SDA overlaps small portions of the Kilbourne Hole National Natural Landmark, and the Aden Lava Flow and West Potrillo Mountains wilderness study areas. Although silo placement in these areas may not disturb their habitat value to any large degree, it may conflict with other long-term aspects of these habitats such as their wilderness status. All of these conflicts could be avoided or reduced by siting silos in other areas. Use of the majority of unique habitats in the remaining ROI is controlled by various agencies, limiting the potential for indirect impacts from project-induced population increases.

The overall short and long-term impacts for this element will be low because the proposed project poses a low risk to the biological uniqueness of habitats in the region. This is because of the small number of habitats potentially affected and the likelihood of avoiding impacts through silo siting. The impacts to habitats on SDA should cause little concern to the Agricultural Research Service, the BLM, and the National Park Service because of the likelihood of avoiding impacts to these habitats. Cumulative impacts are expected to be minor. Based on the these considerations, the potential short and long-term impacts will not be significant at the regional level.

Threatened and Endangered Species. Sneed's pincushion cactus (*Coryphantha sneedii* var. *sneedii*), an endangered plant, may occur within the SDA and will be subject to potential long-term impacts from silo construction. The bald eagle (federally listed) is transient in the area and may experience minor, short and long-term disturbance. The eagle may also avoid some areas because of human activity and vehicle movement. The American peregrine falcon is a resident in the region and may be susceptible to direct and indirect impacts on nesting behavior, daily/seasonal movements, and feeding activities. The

wood stork and whooping crane may also occasionally occur onbase during migration. Two federal-candidate plant species (Cereus greggii and Opuntia arenaria) may occur within the SDA, and seven federal-candidate wildlife species (Swainson's hawk, ferruginous hawk, snowy plover, mountain plover, western yellow-billed cuckoo, Organ Mountain chipmunk, and interior least tern) occur within the SDA. Seven state-protected wildlife species and three state-protected plant species are likely to occur within the SDA and may receive direct, long-term impacts during the operations phase. Major impacts to species in the potential direct impact areas can be avoided through siting of facilities and activities.

Five federally listed plant species, 1 species proposed for federal listing (Cirsium vinaceum), 18 federal-candidate plant species, and 11 state-listed species occur in the ROI. Three federally listed wildlife species, 14 federal-candidate wildlife species,and 35 state-protected wildlife species occur in the ROI. These species may receive some indirect impacts from urban expansion and recreational activities; however, the impacts are expected to be minor. One state-protected species, the desert tortoise, inhabits areas adjacent to the SDA and is particularly sensitive to human disturbance. Therefore, this species is more likely to be affected than other species in the ROI.

Short-term impacts to threatened and endangered species are rated low because transitory disturbances will be a minor part of all expected impacts to these species. Long-term impacts are rated moderate, based on the number of protected species occurring in the direct and indirect impact areas, the relatively large amount of habitat that will be disturbed, and the feasibility of avoiding impacts through siting.

Potential impacts to threatened and endangered species are generally a concern to natural resource management agencies and scientific authorities. However, proposed project impacts are not likely to be a great concern because they will be relatively minor and will not add substantially to cumulative impacts to threatened and endangered species in the region. In addition, impacts can be mitigated (through avoidance and other measures) so that the continued existence of any protected species will not be jeopardized. Therefore, both short and long-term impacts are expected to not be significant at the regional level.

4.6.5.5 Gila Bend Air Force Auxiliary Field

Potential project-related, long-term impacts to vegetation, wildlife, and threatened and endangered species in this region are expected to be high and significant, while short-term impacts to wildlife and threatened and endangered species will be moderate and significant. Impacts to threatened and endangered species are also considered nationally significant because of the potential for disturbance of the Sonoran pronghorn. Short and long-term impacts to aquatic habitats will be low, as will short-term impacts to vegetation. There will be short and long-term, moderate impacts to unique and sensitive habitats. However, none of these latter impacts are expected to be significant at the regional level.

Vegetation. The vegetation of approximately 31 sq mi (19,700 acres) of Gila Bend Air Force Auxiliary Field (AFAF) and the SDA will be directly affected by

construction and operations of this basing mode. Construction at onbase facilities will result in the disturbance of approximately 1,700 acres of the creosote bush-bursage type. Because of the severity of construction-related impacts and the poor recovery potential of the vegetation types common to the deployment area, most construction-related impacts will have long-term effects. Major long-term disturbance of approximately 28 sq mi of vegetation will occur in the SDA. Minor but long-term disturbance during operations is also expected. Based on the relative abundance of vegetation types in the SDA, these vegetation types have the following probabilities of being permanently disturbed: creosote bush-bursage, 66 percent; paloverde-cactus shrub, 18 percent; and saltbush and desert wash communities, 2 percent. Approximately 14 percent of the SDA is agriculture and may also be affected. Indirect impacts that may occur are expected to be minor because of the small population growth expected and the probable dispersed nature of the associated recreational pressure. Long-term impacts from off-road vehicle use in desert areas will occur. Although the vegetation types potentially affected by the proposed project are relatively common in the region, the large areas expected to be directly disturbed or lost represent a long-term, high impact to the vegetation and associated resources in the region. The consequences of major losses of vegetation include decreased biological productivity and loss of habitat for many organisms. Short-term impacts will be low. The Sonoran Desert is a fragile ecosystem with poor potential for recovery from disturbance. The potentially high degree of disturbance to vegetation, and consequently wildlife habitat, is likely to be of concern to natural resource management agencies and scientific authorities. Substantial amounts of vegetation and wildlife habitat have been lost as a result of agricultural and urban development in the ROI. Cumulative losses from the proposed project and other projects in the region are likely to be substantial. Because of the major impact to the native vegetation and biological productivity of the area, the poor recovery potential and fragile nature of the Sonoran Desert ecosystem, and the level of concern the expected impacts may generate, the overall long-term impacts to vegetation will be significant at the regional level. Short-term impacts are not considered significant.

<u>Wildlife</u>. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Permanent loss of wildlife habitat from construction will have a major, long-term impact to the wildlife inhabiting the SDA or adjacent areas including white-tailed deer, mountain lion, black bear, and mule deer. Construction activities at the MOB, as well as within the SDA, will also cause short and long-term impacts to wildlife and its habitat.

Direct habitat loss is not likely for mountain lions because this species occurs in mountainous regions where construction activities will not occur. However, this species could still be adversely affected because of its high sensitivity to human disturbances and noise. Long-term disturbance of wildlife from operations is also expected; however, these impacts will be minor. Direct, long-term impacts to nongame species that occur within the SDA are expected, primarily because of habitat loss. Indirect but long-term impacts to all wildlife will also result from project-induced population increases within the ROI. Nongame diversity for the creosote bush-bursage vegetation type is moderate, while diversity in the paloverde-cactus shrub and desert wash communities is high.

Numerous big game and nongame species will be affected, primarily during construction, either by mortality, displacement, or loss of large areas of habitat. This will result in considerable disruption to wildlife communities of the area. Transient disturbances from both construction and operations activities will cause short-term, moderate impacts, while loss or disruption of large areas of wildlife habitat and its inhabitants will generate long-term, high impacts.

The loss of a large area of wildlife habitat and the potential for affecting various small and large wildlife species will be a concern to natural resource management agencies. Additionally, project impacts will add considerably to cumulative impacts to wildlife in the ROI. Regional-level, short and long-term impacts will be significant based on these factors.

Aquatic Habitats. The SDA occurs in arid areas and contains only 139 miles of regionally common desert wash and 12 miles of open water in canals. Canals will be excluded from construction and operations; therefore, impacts are not likely. Short-term impacts to wash and playa habitats from construction onbase and at the launch facilities could occur because of sedimentation. These habitats are not likely to be used for silo sites; however, fill from construction could remove wash and playa habitat in the long term. Short and long-term impacts could be reduced through siting and the use of proper construction techniques. Operations will be carried out within the boundaries of the launch facilities and onbase, and will have little impact to aquatic habitats. The nearest aquatic recreational facilities occur in Painted Rock Reservoir, which will probably receive a substantial increase in use because of its proximity to the MOB. The expected 0.1 to 0.3-percent population increase will result in minor increased demands on recreational lakes northeast of Phoenix, resulting in small, indirect impacts to these resources. Aquatic recreational resources near Tucson are sensitive to increased use; however, it is not likely that the proposed project will create substantial indirect impacts to these resources because of their distance from the MOB. The Colorado River will probably receive only a small increase in use because of its distance from the MOB.

Few adverse environmental effects are expected for aquatic habitats because of the small number of aquatic habitats in the direct impact area, the likelihood of avoiding impacts to these areas, and the minor, indirect impacts expected. Therefore, short and long-term impacts will be low. Any increased use of Painted Rock Reservoir will be of interest to the Arizona State Parks Board and Game and Fish Department because of its size; however, management of the reservoir will preclude the development of serious cumulative impacts. These short and long-term impacts are expected to not be significant at the regional level.

Unique and Sensitive Habitats. Twelve of the 137 designated unique and sensitive habitats in the ROI occur on or overlap SDA. The Gila River Wildlife Area is in the center of one parcel of SDA. The SDA covers large portions of the Northern Maricopa Mountains, Southern Maricopa Mountains, and Table Top Mountains wilderness study areas. The remaining eight areas overlap small areas of SDA. Short-term construction impacts will result from the direct disturbance of these habitats. This disturbance will be minor (and primarily short term) in eight of the unique habitats because the SDA overlaps small portions of each habitat near its boundary. The areas at the boundary

of most of the unique habitat are generally less sensitive than those in the central portions. Short and long-term construction disturbances to the Gila River Wildlife Area and the Northern Maricopa Mountains Wilderness Study Area could be great because the SDAs represent a large portion of each unique area. These impacts can be reduced by timing construction activities to reduce direct impacts to sensitive animal populations. The siting effort can reduce impacts by avoiding the formation of permanent barriers to sensitive species and disruption of large sensitive habitats. Many of the unique habitats on the remaining ROI have controlled public access, thereby reducing the potential for indirect impacts from increased use by project-related personnel.

The anticipated effects are expected to be of considerable environmental consequence because of the potential for large disturbances to two unique habitats, minor disturbances to all other unique habitats in the ROI, and the likelihood of reducing some of these impacts through siting and construction. Therefore, short and long-term impacts will be moderate. The habitats that may receive direct impacts from the proposed project are of special interest to the BLM and the Arizona Department of Game and Fish. Concern for impacts to two unique habitats from natural resource management agencies may be minor because several other similar habitats occur in the region and the siting effort may reduce these impacts to acceptable levels. Because of the minor potential for impacts to most unique habitats in the ROI, the potential of recovery from short-term disturbances, and the lack of cumulative effects in addition to the proposed project, short and long-term impacts to unique and sensitive habitats will not be significant at the regional level.

Threatened and Endangered Species. Two animal species that are federally listed as endangered may occur in the SDA. Based on present distribution and habitat preference, the Sonoran pronghorn is likely to occur in the deployment area and may experience long-term loss of habitat, loss of forage, disturbance of daily and seasonal habitats, interference with movements, and reduction in reproductive success from both construction and operations activities. The endangered peregrine falcon, observed in the area occasionally, may experience short and long-term loss of prey and habitat. Reduced nesting and foraging success by the peregrine, as well as general avoidance of the disturbed area, may also occur.

One federally listed plant species (*Echinocactus horizonthalonius* var. *nicholii*), one federally proposed species (*Mammillaria thornberi*), one federal-candidate plant (*Neolloydia erectocentra* var. *acunensis*), and ten state-protected (Arizona) plants may occur in the direct impact area. Five wildlife species that are candidates for federal listing and four wildlife species that are protected by the State of Arizona (but not by the USFWS) may also occur in the direct impact area. The plant species, the less mobile animal species, and habitat of many of these species are likely to receive large, adverse, short-term impacts as a result of construction activities. Long-term loss of habitat may also occur. Because of the large number of species occurring in various habitats and widespread locations in the SDA, it is not likely that silos and other facilities can be sited to completely avoid adverse impacts to these species.

Two federally listed animal species (jaguarundi and Yuma clapper rail), 2 federally listed plant species (Arizona agave and Tumamoc globeberry), the

desert pupfish (proposed for federal listing), 8 candidate animal species, 21 federal-candidate plant species, 9 state-protected wildlife species, and 14 state-protected plants occur or are thought to occur elsewhere in the ROI. The rarity and remote locations of several of the species and/or their habitats indicate that these sensitive species may be slightly to moderately affected from urban growth or recreational activities.

The overall short and long-term impacts will be moderate and high, respectively, based on the large potential for adverse impacts to the only United States population of the endangered Sonoran pronghorn and its habitat, as well as the number of other protected species occurring in the direct and indirect impact areas, the large area of habitat that will be disturbed, and the low likelihood of avoiding all adverse impacts.

Potential impacts to threatened and endangered species are a concern of natural resource management agencies and scientific authorities. It is not likely that impacts to threatened and endangered species at this location, particularly the Sonoran pronghorn, can be substantially reduced or avoided through siting of facilities or operations. Therefore, these impacts will add substantially to cumulative impacts to threatened and endangered species in the region, and may pose a threat to the continued existence of some species. Therefore, short and long-term impacts are expected to be significant at both the regional and national levels.

4.6.5.6 Yuma Proving Ground

Potential project-related, long-term impacts to vegetation and wildlife in this location are expected to be high and significant, while short-term impacts to wildlife will be moderate and significant. Short and long-term impacts to unique and sensitive habitats will be low, as will short-term impacts to vegetation. There will be short and long-term, negligible impacts to aquatic habitats, and short-term, low and long-term, moderate impacts to threatened and endangered species. None of these latter impacts are expected to be significant at the regional level.

Vegetation. The vegetation of approximately 31 sq mi of Yuma PG and the SDA will be affected by Hard Silo construction and operations. Approximately 1,700 acres will be disturbed onbase during construction of new facilities (most likely creosote bush-bursage type). Construction activities in the SDA will potentially disturb approximately 28 sq mi of vegetation. Because of the poor recovery potential of the vegetation types common to the deployment area and the large amount of disturbance expected to occur during construction, most construction-related impacts will have long-term effects. Minor but long-term disturbance during operations is also expected. Based on the relative abundance of vegetation types in the SDA, these vegetation types have the following probabilities of receiving long-term impacts: creosote bush-bursage, 90 percent; paloverde-ironwood-smoketree type, 2 percent; and paloverde-cactus shrub, 1 percent. Approximately 6 percent of the SDA, mostly sand dune types in the California portion of the SDA, has perennial vegetation so sparse as to be classified as "vegetation largely absent." Some 2,800 acres of desert wash habitat also occur in the SDA. Indirect impacts that may result from the proposed project are expected to be minor. Although much of the desert and off-road vehicle recreational use will be dispersed, concentrated use along the Colorado River may cause long-term impacts to

riparian vegetation. Although the vegetation types likely to be disturbed are relatively common in the region, the large areas expected to be directly disturbed or lost represent long-term, high impacts to the vegetation of the area. Loss of large amounts of vegetation in Sonoran Desert ecosystems will remove the major component of the overall biological productivity of the area, as well as a major component of habitat. Short-term impacts will be low.

The Sonoran Desert is a fragile ecosystem with poor potential for recovery from disturbance. The potential for a high degree of disturbance to vegetation, and consequently wildlife habitat, is likely to be of concern to natural resource management agencies and scientific authorities. Vegetation and wildlife habitat have been lost from agricultural and urban development in the ROI. Continued loss of native vegetation from agricultural conversion is expected. Cumulative losses from the proposed project and other projects in the region are likely to be substantial. Because of the major impacts to the native vegetation and biological productivity of the area, the poor recovery potential and fragile nature of the Sonoran Desert ecosystem, and the level of concern the expected impacts may generate, the overall long-term impacts to vegetation will be significant at the regional level. Because of the small amount and temporary nature of the impacts, short-term impacts will not be significant.

Wildlife. The areas of wildlife habitat that will be temporarily and permanently disturbed by construction are the same as those described for vegetation. Permanent loss of wildlife habitat from construction will have a major, long-term impact to the wildlife inhabiting the SDA or adjacent areas, including mountain lion, mule deer, Gambel's quail, and desert cottontail. Construction activities at the MOB, as well as within the SDA, will also cause short and long-term impacts to wildlife and its habitat. Direct habitat loss is not likely for mountain lions because this species occurs where construction activities will not occur. However, this species could still be adversely affected because of its high sensitivity to human disturbances and noise. Long-term disturbance of wildlife from operations is also expected; these impacts will be minor but long term.

Direct impacts to small game and nongame species occurring within the SDA are expected to be long term, primarily because of habitat loss. Nongame diversity for those habitats that will be directly affected ranges from moderate to high. The creosote bush-bursage type has moderate diversity, and diversity of the paloverde-ironwood-smoketree type is rated as high. A substantial population increase (0.9-4.8%) is expected for the ROI, which will generate indirect, long-term impacts to wildlife.

A large area of wildlife habitat will be lost or disturbed during construction, with a large number of wildlife displaced or killed. Operations impacts will be minor; however, the large construction impacts are likely to cause a major disruption of wildlife communities in the region. Therefore, long-term impacts will be high. Both construction and operations will generate transient disturbance to wildlife, which will cause short-term, moderate impacts. The loss of wildlife habitat and the potential for affecting various small and large wildlife species may be a concern to natural resource management agencies. Additionally, cumulative impacts to wildlife from this and future projects may occur. Therefore, short and long-term impacts are considered significant at the regional level.

Aquatic Habitats. The aquatic habitats in the SDA consist of 17 miles of desert wash that occur in two southern parcels of SDA. These wash habitats are regionally common, though not as abundant as washes in some other desert areas that receive more rainfall. Washes are generally unsuitable for construction; however, short-term construction impacts could result from increased sedimentation and long-term construction impacts will occur if landfill persists in the habitat. It is likely that short-term sedimentation can be reduced through proper construction techniques and that long-term impacts (e.g., as fill placed in washes) can be avoided entirely. Operations will take place within the boundaries of the launch facilities and should not result in any impacts to aquatic habitats. Wetland and aquatic recreational resources along the Colorado River (and to a lesser extent along the Gila River) will receive additional use from project-induced population increases. Access to many of these areas is controlled, and more accessible recreation areas are expected to be able to accommodate the increased use, resulting in only small impacts from the proposed project. Aquatic resources at the boundaries of the ROI, northeast of Phoenix and west to California, are close to large population centers and will not receive a perceptible increase in use because of project-related population growth.

The short and long-term impacts will be negligible because of the small amount of aquatic habitat that has the potential to be directly affected, the likelihood of avoiding impacts to these habitats, and the minor, indirect impacts expected for aquatic habitats (these impacts are of little environmental consequence). Because of the lack of major disturbance, impacts to aquatic habitats are not likely to generate additional concern among natural resource management agencies and will not be significant at the regional level.

Unique and Sensitive Habitats. Eleven designated unique habitats (9 actual localities) occur on SDA (295 unique habitats have been identified in the ROI). Portions of the Algodones Dunes (an area of special biological importance and a wilderness study area) and the dunes of the Mohawk Mountains (designated natural area) occur on SDA. The SDA overlaps a small portion of the lower elevations of the Chocolate Mountains (area of special biological importance), the Tinajas Altas Mountains (designated natural area), and the East Clanton Hills, Face Mountain, and Palo Verde Mountains (wilderness study areas) (considered biologically unique because they represent relatively undisturbed mountain habitat). Two BLM Areas of Critical Environmental Concern also occur in SDA. Short and long-term construction impacts are likely to be small in the mountain habitats because construction will not occur in the higher elevations. Potential impacts to the Algodones Dunes and the Mohawk Sand Dunes are likely to be greater because larger parcels of SDA overlap their boundaries. Construction activities could result in short-term destabilization of some dunes, which will displace part of the biota in these systems. It is not likely that launch facilities will be placed on or in the advancing path of nearby active dunes. However, other construction activities may affect their growth or stabilization in the long term. This will adversely affect the biota of the dunes through loss of habitat. These potential short and long-term impacts can be reduced through silo siting. The BLM Areas of Critical Environmental Concern are small areas that may be avoided during siting. Many of the unique and sensitive habitats in the remaining ROI experience controlled public access. Because of the large number of these habitats, the expected 0.9 to 4.8-percent increase in population resulting from the proposed project should not produce any large disturbance to these habitats.

Project-related disturbances are not expected to be of great consequence to the biological uniqueness of these habitats because of the small areas disturbed in some habitats and the likelihood of reducing or avoiding impacts in the remaining habitats. Therefore, the overall short and long-term impacts will be low. The habitats potentially affected are of special concern to the BLM and the California Department of Fish and Game. Based on the lack of cumulative impacts, the potential of recovery from short-term disturbances, and the small number of impacts to unique biological habitats, impacts to unique and sensitive habitats will not be significant at the regional level.

Threatened and Endangered Species. Deployment of this basing mode at Yuma PG may directly affect three federally endangered animal species. The Sonoran pronghorn may occur in the SDA and may experience short and long-term loss of its preferred lowland habitat or temporary disruption of daily activities. Overlap between SDA and pronghorn habitat is small enough that it is likely that pronghorn habitat can be avoided during silo siting. The wood stork and American peregrine falcon, which may occur as migrants in the SDA, will probably avoid the area during construction and operations. Six federal-candidate wildlife species, three state-listed (Arizona and California) animal species, six federal-candidate plant species, three state-protected plant species, and one plant (Croton wigginsii) protected by the State of California are thought to occur in the SDA. Short-term disturbance and long-term loss of habitat may occur for many of these species as a result of construction activities. However, major impacts to species occurring in the direct impact area can be avoided through careful siting of silos and other facilities.

The state-protected desert bighorn sheep, which occurs in the direct impact area, may be adversely affected during both construction and operations. While no substantial loss of the species' preferred mountain habitat is expected, general human presence, noise pollution, and vehicle movement may cause some stress, reduced reproductive success, and possibly block migration corridors.

The federally listed bald eagle and brown pelican (both migratory species) and the Yuma clapper rail are thought to occur in the ROI. Three federal-candidate animal species (spotted bat, Sonora green toad, and the flat-tailed horned lizard), 1 endangered plant (Tumamoc globeberry), 1 federally proposed plant (Thornber's fishhook cactus), 34 federal-candidate plant species, 5 state-listed animal species, and 4 additional state-listed plant species are thought to occur elsewhere in the ROI. Long-term impacts from urban growth and recreation will vary both in degree and likelihood of occurrence depending on such factors as their rarity, mobility, and location of the species in the ROI, and the type of habitat they occupy.

Short-term impacts to threatened and endangered species will be low because transitory disturbances will be a minor part of all expected impacts to these species. Long-term impacts will be moderate, based on the number of protected species occurring in the direct and indirect impact areas, the relatively large amount of habitat that will be disturbed, and the reasonable feasibility of avoiding impacts through siting.

Potential impacts to threatened and endangered species are generally of concern to natural resource management agencies and scientific authorities. However, impacts from the proposed project are not likely to be of great

concern because the impacts will be relatively minor and will not add substantially to cumulative impacts to threatened and endangered species in the region. In addition, impacts can be mitigated (through avoidance and other measures) so that the continued existence of any protected species will not be jeopardized. Therefore, both short and long-term impacts are expected to not be significant at the regional level.

4.6.6 Impacts of the No Action Alternative

If the proposed project is not implemented, present activities, policies, and trends will continue to have impacts to biological resources. New and continuing projects, missions, and associated construction at the various MOBs and federal government installations can be expected to disrupt biological habitat and disturb flora and fauna. Present and future projects at the defense installations under consideration for the Hard Mobile Launcher in Random Movement basing mode are, in particular, likely to cause adverse biological effects. Activities occurring and planned at these installations that destroy habitat and kill or disturb biota include off-road tests of military vehicles, troop training and maneuvers, impact of artillery fire and ballistic missiles, and air-to-ground firing and bombing. In addition, at Nellis AFR, Luke AFR, and China Lake NWC, low-altitude flying of military aircraft startle and disrupt daily activities of wildlife. Lands managed by the BLM make up much of the SDA for the Hard Silo in Patterned Array basing mode. Many of these lands will be used for grazing, mineral development, recreation, and other uses, which will result in adverse biological effects. However, present BLM policies favor sustainable, long-term multiple use, including natural habitat and wildlife use, so that major or extensive adverse biological impacts to these lands should not occur.

In all locations, regional recreational activities, such as off-road vehicle use, boating, hunting, and fishing, also adversely affect biota. In addition, most of the ROIs are experiencing growth and development at rates varying from modest to considerable. Construction will result in loss of biological habitat and disruption of ecological communities. Also, increasing population size will lead to increased recreation-related impacts. Increased development and recreation will degrade aquatic habitats and biologically unique habitats and add to cumulative impacts to threatened and endangered species.

4.6.7 Irreversible and Irretrievable Resource Commitments

The expected operational life of the proposed project is 20 years. Disturbed biological communities, given sufficient time, can usually recover to a state approximating predisturbance conditions once disturbance ends. Therefore, few of the biological impacts expected from the proposed project will be irreversible or irretrievable in the strict sense. However, some of the expected impacts are likely to be of such long duration that they will represent irreversible or irretrievable commitments of biological resources for all practical purposes. For example, much of the long-term disturbance of vegetation and wildlife habitat expected from construction will be severe, such as the removal of vegetation and habitat for construction of buildings, roads, silos, or other facilities, which may remain in place longer than 20 years, as well as scarification of areas during construction where no permanent structures are built. In the arid areas of the southwestern United States, where many of the proposed project locations occur, biological communities recover very

slowly from disturbances because of limited moisture and low growth rates. In these areas, complete recovery from severe disturbances could take more than 100 years. At the alternative locations for the Hard Mobile Launcher at Minuteman Facilities basing mode, such long-term commitments of biological resources are expected to be negligible for three reasons: (1) relatively little undisturbed biological habitat will be disturbed, (2) much of the habitat expected to be disturbed has already been severely disturbed by agriculture and ranching, and (3) higher rainfall and faster growth rates in these areas mean that biological communities can recover from disturbances or be replaced by successional communities faster than can desert communities.

In addition, some potential impacts of the proposed project could be literally irreversible or irretrievable. Removal of an aquatic habitat for construction of a project facility will represent irretrievable loss of the affected habitat. Restoration or replacement with another aquatic habitat could be infeasible, depending on the location, and the new habitat will be unlikely to have the ecological value of the lost habitat. Therefore, this will not completely mitigate the loss of the original habitat. If the proposed project resulted in loss or degradation of the biologically unique characteristics of a unique and sensitive habitat, it is not likely that the biological uniqueness of the habitat could redevelop or be restored, at least in the foreseeable future. Extinction of a threatened or endangered species will be irretrievable, but the proposed project will be implemented so as to not cause the extinction of any species.

4.6.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The proposed project represents local, short-term use of the environment. The loss and disturbance of biological habitat expected from some of the basing modes and in some of the deployment locations will result in long-term, significant reductions of biological productivity in the region. For example, construction and operations of the Hard Mobile Launcher in Random Movement basing mode are expected to result in long-term disturbance of large areas of biological habitat. In the arid areas of the western United States, where most of the alternative locations for this basing mode occur, biological communities recover very slowly from disturbance. Therefore, this basing mode could have an adverse effect on regional biological productivity for periods ranging from several decades up to more than 100 years. The possible exception is the Florida Complex, where faster growth rates result in a shorter time required for recovery of ecological systems from disturbances.

The Hard Mobile Launcher at Minuteman Facilities basing mode is not expected to have a long-term adverse effect on regional biological productivity. The principal reason for this is that this basing mode will disturb relatively small areas, much of which are already disturbed in one manner or another, so t little cumulative productive biological habitat will be lost. In addition, ecological recovery rates in the proposed locations for this basing mode are faster than in the arid southwestern United States.

The Hard Silo in Patterned Array basing mode will disturb large areas of biological habitat, and most of the locations proposed for this basing mode are also located in arid areas of the southwestern United States where ecological recovery is slow. Therefore, long-term, significant reductions in regional biological productivity could also result from this basing mode.

4.7 Air Quality and Noise

The proposed deployment of the Small Intercontinental Ballistic Missile (ICBM) system may affect regional air quality and noise levels. The following impact analysis includes consideration of regional project-related changes of these selected environmental characteristics. Regions cover county or multiple-county areas, and are defined by the airsheds or physical basins and their contiguous areas. Local impacts are confined to the immediate vicinity of the project-related activity.

4.7.1 Impact Analysis Methodology

Three phases of impact analysis for air quality and noise are discussed in this section: evaluation of potential project impacts, determination of levels of impact (LOIs), and determination of the significance of impacts.

4.7.1.1 Evaluation of Project Impacts

The evaluation of Small ICBM deployment impacts involved the examination of many different deployment-area activities including site preparation, construction of new operations facilities, or modification of existing facilities. In addition, systems and operations data were examined in order to evaluate the proposed project impacts to air quality and noise.

Primary sources of airborne pollutants are fuel combustion by construction equipment, and fugitive dust generated by mechanical activity and/or as a result of wind erosion from disturbed soil. Graders, bulldozers, trucks, and other equipment emit carbon monoxide (CO) and other pollutants. The amounts of these pollutants emitted depend on the number and types of vehicles used, the quantity of fuel consumed, and any pollution abatement equipment installed on the vehicles. Dust raised by the vehicles contributes to short-term ambient total suspended particulate (TSP) concentrations. The amount of fugitive dust generated depends on the surface area disturbed, the amount of mechanical activity, ambient wind conditions, characteristics of the soil (e.g., moisture content and particle size distribution), and any dust-suppression techniques that may be used (e.g., water or chemical sprays, revegetation, and use of gravel). Emissions of gaseous pollutants and particulates from the various transportation, construction, and operations activities cannot be explicitly determined because of the lack of detailed knowledge of daily project-related activities. In addition, concentrations of the various air pollutants depend on atmospheric dispersion characteristics, both near to, and far from, the sources, which are a function of specific atmospheric characteristics such as wind speed, stability, mixing height, and terrain features.

As details of the basing modes, construction-activity locations, and operations become available, localized emission data and site-specific meteorological data can be collected. The evaluation of these parameters, which may affect potential emissions, will then become a specific study to determine impacts at the second tier (environmental impact statement level) for the selected basing mode, region, and complex.

4.7.1.2 Determination of Levels of Impact

Air quality impacts for the present analysis were estimated on the basis of currently available systems data. To provide a framework for the analysis, air quality guidelines were developed for CO, dust-generating parameters, and descriptors of visibility:

- Negligible Impact -- Impacts to CO levels will not be discernible and expected amounts of generated dust will be small without causing any exceedances of the TSP standards. Visibility may intermittently decrease in isolated areas or dust plumes may be visible for only a few minutes.

- Low Impact -- The CO levels will be slightly elevated at specific locations and during certain time intervals. Dust generation will occasionally cause a light atmospheric haze but will still be within the limits of the TSP standards. Long-distance visibility will not be impaired.

- Moderate Impact -- Substantial increases in CO levels and occasional violations of standards may occur. Heavier dust levels will be generated regularly, increasing density and duration of atmospheric haze. The TSP standards will be occasionally violated. Long-distance visibility will be occasionally impaired.

- High Impact -- Substantial increases in CO levels are expected and frequent violations of standards will occur. Heavy dust levels will be generated almost continuously, contributing to a regular haze, TSP standards violations, and noticeable local redeposition. Regional visibility will be restricted and local dust levels may be occasionally hazardous.

These guidelines provide a means of describing the expected impacts at levels that are compatible with the available project information for each of the basing mode alternatives. When Prevention of Significant Deterioration (PSD) Class I areas and/or nonattainment areas occur near the proposed project areas, the likelihood or potential for the estimated impacts to occur in these areas is discussed. Locations of construction and operations activities, expected activity levels, and other regional parameters were used in making estimates of the LOI for the present basing modes.

Using the same kind of general evaluation approach used for air quality, the following guidelines were used to determine noise LOIs:

- Negligible Impact -- Noise will be barely discernible over general background levels.

- Low Impact -- Noise levels will not interfere with normal conversation. Noticeable peaks in noise levels will infrequently occur.

- Moderate Impact -- Noise levels will make conversation difficult at times. Average noise levels will be perceptibly higher in local areas than regional background.

- High Impact -- Noise levels will make conversation frequently difficult. Average noise levels will be noticeably higher over large areas.

Noise impacts are usually specific for a certain defined action. Since construction techniques have not yet been specified, it was assumed that construction-related equipment requirements for the Small ICBM system will be similar to those typical of other large facility construction projects. On this basis, an overview and general noise evaluation was determined for the proposed project construction phase. The operations phase was evaluated based upon reasonable expectations of activity location and possible noise parameters.

4.7.1.3 Determination of Significance

The significance of the identified air quality impacts was judged on the basis of whether or not the impacts will violate a standard or contribute in a meaningful way to an undesirable condition. Subjective evaluations of potential effects on sensitive (Class I) or special interest (nonattainment) areas, estimated distribution of effects, continuity of activity, and expected frequency of discernible events were included. No weighting was assigned to a particular variable, and significance has been stated in general terms for a region by subjectively integrating the applicable criteria. This general methodology was also applied to noise impacts.

4.7.2 Impacts Common to All Locations

Impacts common to all locations for each basing mode are discussed in the following sections.

4.7.2.1 Hard Mobile Launcher in Random Movement

Air Quality. Construction of the Main Operating Base (MOB) for this option will require approximately 400 acres within or close to existing facilities at each of the deployment locations. Construction of the various new facilities at the MOB to support the Hard Mobile Launcher (HML) operations and associated activities will generate dust. Most of this dust will be generated by ground-clearing operations, surface grading and leveling, construction-related vehicle traffic, and labor-force transportation. Fugitive dust generated by wind on disturbed areas (loose soil and storage piles) will also add to the construction-phase dust emissions and may cause local impacts. Short-term degradation of local air quality may also occur during the construction phase because of emissions and dust from support vehicles used to move personnel, material, and equipment. Table 4.7.2-1 provides estimates of the number of trucks required to haul aggregate. Short-term, moderate, and local impacts may result from CO emissions associated with the operation of construction vehicles and labor-force transportation. Table 4.7.2-2 provides peak-hour traffic estimates. Regional air quality impacts will be negligible.

Table 4.7.2-1

ESTIMATED NUMBER OF TRUCKS USED PER DAY
DURING PEAK-CONSTRUCTION YEARS*

Hard Mobile Launcher in Random Movement

50 Missiles	1990	1991	1992
Main Operating Base[1]	66	51	18
Deployment Area	258	239	149
200 Missiles			
Main Operating Base[1]	163	83	24
Deployment Area	644	731	522

Hard Mobile Launcher at Minuteman Facilities

170 Missiles	1990	1991	1992
Main Operating Base[1]	74	55	31
Deployment Area	47	20	4
200 Missiles			
Main Operating Base[1]	77	56	30
Deployment Area	64	30	26

Hard Silo in Patterned Array

250 Missiles	1991	1993	1994
Main Operating Base[1]	62	87	88
Deployment Area	11	30	39

Assumptions

1. Truck net load 25 tons.
2. Trucks make 4 trips per day at Minuteman missile bases and 2 trips per day at Random Movement bases.

Notes: *Peak-construction years for either MOB or deployment area and estimated number of trucks per day used to haul cement, coarse and fine aggregate, asphalt, concrete block and brick, structural steel, reinforced steel, metal siding, and miscellaneous metal.

[1]Includes trucks used by the contractor on the base.

Table 4.7.2-2

WORKER TRANSPORTATION
APPROXIMATE PEAK-HOUR VEHICLE MOVEMENTS*

Hard Mobile Launcher at Random Movement		
50 Missiles	1990	1991
Main Operating Base	1,050	715
Deployment Area	330	200
200 Missiles		
Main Operating Base	1,495	1,005
Deployment Area	750	560
Hard Mobile Launcher at Minuteman Facilities		
170 Missiles	1990	1991
Main Operating Base	1,565	925
Deployment Area	30	50
200 Missiles		
Main Operating Base	1,575	930
Deployment Area	55	65
Hard Silo in Patterned Array		
250 Missiles	1994	1995
Main Operating Base	895	1,105
Deployment Area	1,980	1,600

Note: *Commuter traffic to job sites, peak hour for either MOB or deployment area.

During the construction phase, the total population inmigration for 200-missile deployment will reach about 10,400 people, while the population inmigration for 50-missile deployment will be 4,400. The total operations-phase population inmigration will be about 9,800 people for 200 missiles and 3,900 for 50 missiles; these levels will remain constant throughout the life of the system. Local project-induced growth rates vary widely, and impacts are related to the trends in each area. (Section 3.1 discusses population projections.)

Since long-term pollutant emission levels are directly related to population, project-induced emissions are expected to grow in direct proportion to population growth. Whether or not this emission growth will result in subsequent air quality degradation depends on the location and density of emission sources and local meteorological and topographical characteristics. These population-related emission sources include fuel combustion (residential and commercial-institutional), solid waste disposal (residential and commercial-institutional), air/water transportation (civil and commercial), land vehicle use (gasoline and diesel), and miscellaneous factors such as unpaved roads and evaporation loss from gasoline stations and solvent tanks.

During the operations phase, dust and CO will be generated by HMLs operating in the Random Movement Area (RMA) and in association with maintenance support activities at and away from the deployment installation maintenance facilities.

Visibility will be only intermittently affected during the construction phase. However, potentially long-term, moderate impacts are likely in the operations phase as a result of dust generated from project-associated vehicle movement, particularly if HML repositioning is frequent. Wind erosion may also be increased when fine soils are disturbed in the RMA. Dust disturbed under strong wind conditions may cause visibility degradation. Soils subject to wind-erosion effects are discussed in Section 4.9. These two effects are expected to result in infrequent, moderate impacts to visibility. No detectable effects on regional CO levels are expected; however, fugitive-dust levels may cause violations of annual air quality standards and contribute to a low LOI at some locations in the RMA.

Noise. During the construction phase, worksites will be subject to increased noise levels from earthmovers such as bulldozers and scrapers. Effective muffler systems on heavy equipment could minimize local noise impacts. Noise levels of less than 50 decibels weighted on the A scale (dBA) (i.e., below normal background noise levels) are expected in built-up areas over 1,000 to 1,200 feet from such equipment, and levels of approximately 40 dBA are expected beyond 0.5 mile from a construction site in the outlying undeveloped areas. Major roads carrying additional aggregate-hauling truck traffic will show higher average noise levels close to the roadway. These are not expected to affect the few people living in rural areas. During the HML operations phase, sound pressure levels (i.e., noise) may reach 110 dBA at a distance of 50 feet from a vehicle, decreasing rapidly to around 60 dBA at 500 feet. Such levels are considered negligible because these areas are remote from the public. Long-term noise impacts to wildlife will be site specific and were not quantified at this level of analysis. However, low-level effects may occur on the most sensitive species. (These effects are discussed in Section 4.6.)

4.7.2.2 Hard Mobile Launcher at Minuteman Facilities

Air Quality. Construction of the MOB for this basing mode will occur within or near existing facilities at each of the deployment locations. Construction of the various new facilities at the MOB to support HML operations and associated activities will generate dust and cause vehicle emissions. Most of this dust will be generated by ground-clearing operations, surface grading and leveling, construction-related vehicle traffic, and labor-force transportation. Fugitive dust from wind effects on disturbed areas (loose soil and storage piles) may also contribute to construction-phase dust emissions and temporarily degrade local air quality, resulting in a low LOI. In addition, movement of personnel, material, and equipment over short distances will add to dust generation. Short-term, moderate, and local impacts will result from CO emissions associated with the vehicles hauling aggregate and labor-force transportation (Tables 4.7.2-1 and 4.7.2-2). Long-term regional air quality impacts that result from MOB construction will be negligible.

During the construction phase, the population inmigration will be either 7,800 or 8,800 people for either the 170 or 200-missile options, respectively. The total population increment (workers plus families) will be either 7,200 or 8,100 during the operations phase. Local growth rates are widely variable and long-term impacts are related to the trends in each area. (A discussion of the population projections is in Section 3.1.)

Since long-term pollutant emission levels are directly related to population, emissions are expected to increase in direct proportion to population growth. Whether or not these emissions will result in subsequent air quality degradation depends on the location and density of emission sources and the local meteorological and topographical characteristics. These population-related emission sources include fuel combustion (residential and commercial-institutional), solid waste disposal (residential and commercial-institutional), air/water transportation (civil and commercial), land vehicle operation (gasoline and diesel), and miscellaneous factors such as unpaved roads and evaporation losses from gasoline station and solvent tanks.

During the operations phase, minor levels of dust and CO may be generated by infrequent HML movement and in association with maintenance support activities at the deployment installation maintenance facilities. The HML will be located at existing Minuteman launch facilities, which, depending on the base location chosen, are scattered over approximately 7,500 to 23,000 square miles (sq mi) of deployment area. No detectable long-term effects on regional particulate or CO levels are expected.

Noise. During the construction phase, worksites are expected to be exposed to increased noise levels from construction equipment. Effective muffler systems on heavy equipment could minimize local noise impacts. Noise levels of less than 50 dBA (i.e., below normal background noise levels) are expected in built-up areas over 1,000 to 1,200 feet from the equipment, and levels of approximately 40 dBA are expected beyond 0.5 mile from the construction site in the outlying areas. Increased short-term aggregate-hauling truck traffic will result in higher noise levels on roads and at residences close to the roads. During the long-term operations phase, negligible noise impacts are expected from limited HML movements. Noise effects on wildlife will be site

specific and have not been quantified. In general, low-level noise effects may occur on the most sensitive species. (These effects are discussed in Section 4.6.)

4.7.2.3 Hard Silo in Patterned Array

Air Quality. Impacts from this mode are related to the construction of buildings at the MOB as well as silos for 250 missiles in a deployment area. Construction activities associated with the MOB may temporarily degrade air quality in a localized area around the construction sites. Negligible, short-term, regional impacts and low, local impacts will result from fugitive dust generated by ground-clearing operations, road dust entrainment from construction-related vehicles, and from temporary storage areas. Low, short-term impacts will also result from the increased local vehicular traffic and emissions associated with the construction-related vehicles and labor-force transportation (Tables 4.7.2-1 and 4.7.2-2). No modifications in present pollution control requirements are expected. A peak incoming labor force of about 5,400 personnel, with an average population increment of approximately 10,000 people, and an operations/construction area of about 29 sq mi (including 740 acres for the MOB), will be involved during the construction phase. Air quality in some urban locations may be affected by the influx of a maximum population increment of about 11,500 people, including workers and their families. This will occur during the build up in the workforce and the phased increase in operations personnel (military), which will be spread over several years.

Since long-term pollutant emission levels are directly related to population, emissions are expected to change in direct proportion to population changes. Whether or not these emissions will result in subsequent air quality degradation depends on the location and density of local emission sources as well as the local meteorological and topographical characteristics. These population-related emission sources include fuel combustion (residential and commercial-institutional), solid waste disposal (residential and commercial-institutional), air/water transportation (civil and commercial), land vehicle operations (gasoline and diesel), and miscellaneous factors such as unpaved roads, gasoline station evaporation loss, and solvent evaporation loss. The number of operations-phase personnel required is expected to be about 1,800 (4,400 including families); this is a small number compared to the regional populations of the deployment areas. This number is also small compared to the expected regional population growth, so that negligible population-related air quality impacts are expected over the system life.

Noise. During the construction phase at the MOB and at the Hard Silo locations, increased noise levels resulting from earthmoving equipment are expected; these could be mitigated through the use of effective muffler systems. Noise levels of less than 50 dBA are expected in the urban areas (i.e., below normal background noise levels) over 1,000 to 1,200 feet from the equipment, and levels of 40 dBA are expected beyond 0.5 mile from the construction site in the outlying areas. During the operations phase, noise impacts are expected to be negligible. Long-term noise effects on wildlife are site specific and have not been quantified. In general, low-level effects may occur on the most sensitive species (Section 4.6).

4.7.3 Impacts of Hard Mobile Launcher in Random Movement

4.7.3.1 Arizona Complex

Regardless of whether Gila Bend Air Force Auxiliary Field (AFAF) or Yuma Proving Ground (PG) is selected as the MOB for this complex, long-term impacts to regional air quality are expected to be low and not significant. Short-term impacts to urban air quality, primarily CO levels, will be moderate and not significant. Short and long-term impacts to regional noise levels are expected to be negligible.

Air Quality. Construction of the MOB at either Gila Bend AFAF or Yuma PG will not significantly affect regional air quality. The nonattainment status for TSP in the city of Ajo will not be affected by construction at the MOB. The short-term air quality in the cities of Yuma or Gila Bend may be affected. During the construction phase, increased CO emissions from trucks hauling aggregate may result in moderate, not significant impacts. Long-term air quality in Yuma and Gila Bend may also be affected at a low level by the expected project-related population increase of about 10,000 people, which will be approximately 10 percent of the general population level forecast and about five times the expected normal growth in 1 year. Enhanced control-measure enforcement to maintain good air quality may be required.

During the operations phase, dust generated by movement of the HMLs within the RMA and associated maintenance support, including activities at the deployment installation maintenance facilities, will affect air quality in the RMA. Visibility may be intermittently affected during construction and more extensively affected in the operations phase by dust generated from project-associated vehicle movement, particularly the HML off-road repositioning. Wind erosion may also be increased when fine soils are disturbed in the RMA. This dust disturbance could cause visibility degradation under strong wind conditions. The combination of vehicle movement and wind effects will result in low to moderate, regional impacts to visibility. Increased fugitive-dust levels could occasionally meet annual air quality standards in the RMA.

Short-term air quality impacts will be moderate but not significant within the region. Long-term impacts will be low and not significant.

Noise. Short-term, negligible noise impacts are expected at the regional level for the MOB and RMA. During MOB construction, local impacts will occur in the immediate vicinity of heavily traveled routes. Long-term impacts will be negligible.

4.7.3.2 Florida Complex

Impacts to regional air quality will be short-term, low, and not significant. Long-term impacts will be negligible. Short and long-term visibility and regional noise-level impacts are expected to be negligible.

Air Quality. Eglin Air Force Base (AFB) consists of 463,600 acres; about 400 acres will be used for facilities construction. The permanent disturbance will take place during a construction phase of several years, and the total land area disturbed each year will be considerably less than the final total of 400 acres. All areas in the Region of Influence (ROI) are in attainment

status for the criteria pollutants and good air quality exists throughout the region. Heavy trucks hauling aggregate will generate CO during the construction phase, which will cause low, not significant impacts to air quality in the region. The population increment (about 4,000) for the proposed project is less than 0.5 percent of the baseline population. It is not expected to contribute measurably to air pollution during construction or operations.

During the operations phase, dust and CO generated by HML movements in the RMA, combined with the small relative population increment and the project-associated maintenance and support activities, will be expected to cause long-term, negligible impacts to the regional air quality.

<u>Noise</u>. Long-term, negligible impacts are expected at the regional level for the MOB and RMA. Local impacts near heavily traveled truck routes may occur during construction; however, these short-term impacts will be negligible for the region.

4.7.3.3 <u>Nevada Complex</u>

Regardless of whether Indian Springs AFAF or Nellis AFB is selected as the MOB for this complex, long-term impacts to regional air quality and visibility are expected to be low and significant. Short-term impacts will be moderate, not significant, and related to construction activity. Short and long-term regional noise impacts are expected to be negligible.

<u>Air Quality</u>. Construction of the MOB at either Indian Springs AFAF or Nellis AFB is expected to affect short-term, local air quality. The air quality in the Las Vegas Valley Basin, west and south of Nellis AFB, may be marginally affected during the construction phase. Depending on source location, trucks hauling aggregate will cause short-term, moderate, and not significant impacts to CO in the basin. The project-related population increment (about 10,000) is 1 percent of the baseline population and represents 6 months' expected growth or just over 5 percent of the total population increase over the first 8 years of deployment. Long-term, negligible impacts are expected for this population increment.

During the operations phase, dust generated by HML movements within the RMA, and the associated maintenance support which includes activities at the deployment installation maintenance facilities, will cause air quality to be affected in the RMA. Visibility may be intermittently reduced during construction and frequently reduced in the operations phase by dust generated from project-associated vehicle movement, particularly the HML off-road repositioning. Wind erosion may also increase when fine soils are disturbed in the RMA. This wind-borne dust could cause moderate visibility degradation during periods of strong wind conditions. No detectable effects on regional CO levels are expected. Although fugitive-dust levels are expected to cause occasional violations of the 24-hour air quality standards in the RMA, it is not expected that annual TSP standards will be exceeded. The long-term overall impacts to regional air quality will be low and significant.

<u>Noise</u>. Overall, short and long-term impacts are expected to be negligible in the region. During construction, low, not significant, and local noise impacts will occur close to major highways.

4.7.3.4 New Mexico Complex

Regardless of whether Fort Bliss, Holloman AFB, or White Sands Missile Range Headquarters is selected as the MOB for this complex, long-term impacts to both regional air quality and visibility are expected to be moderate and significant. Short-term impacts to air quality, as indicated by CO levels, will be moderate and not significant. Short and long-term regional noise impacts are expected to be negligible.

Air Quality. Selection of Fort Bliss as the MOB will lead to placement of facilities near the El Paso TSP and CO nonattainment areas. Both TSP and CO standards have been exceeded in El Paso consistently for several years. The State Implementation Plan for Texas has identified various control measures to bring TSP and CO into attainment status. Fort Bliss is in attainment status for TSP and CO. Although urban air quality (for TSP) in the El Paso nonattainment area may be moderately affected during the construction phase, proposed changes to the State Implementation Plan to incorporate revised control procedures are not expected. Heavy trucks hauling aggregate will emit CO which will cause short-term, moderate, not significant, and local impacts to the urban levels of CO near Fort Bliss. The CO emissions associated with the influx of construction personnel and families will be negligible. After construction, the number of operations personnel (3,900) will remain less than 0.4 percent of the regional population. No air quality impacts are expected from this small population increment over the normal regional growth projections, which are incorporated in the current State Implementation Plan.

Construction of the MOB at either Holloman AFB or White Sands Missile Range Headquarters will place new facilities near or among existing facilities. The regional air quality will not be affected by construction activities. Local CO and dust levels may increase, and short-term, moderate, and not significant impacts may be generated by the number of trucks hauling aggregate to either MOB.

During the operations phase, dust and CO generated by HML movements in the RMA, and the associated maintenance support activities at the deployment installation maintenance facilities, will not affect the El Paso area. However, two PSD Class I areas, the Bosque del Apache National Wildlife Refuge and the White Mountain Wilderness, are close to the northern portion of the RMA. The visibility in both areas may be intermittently affected during construction and moderately affected in the operations phase by dust generated from project-associated vehicle movement, particularly the HML repositioning. Wind erosion may also increase when fine soils are disturbed in the RMA. This dust disturbance will cause visibility degradation during strong wind conditions. These two effects, ground disturbance and HML movement, are expected to result in infrequent moderate impacts to visibility. No detectable effects on regional CO levels are expected; however, fugitive-dust levels may cause violations of annual air quality standards in the RMA.

Short-term air quality impacts will be moderate and not significant in the region. Long-term impacts will be moderate and significant in the region.

Noise. Regionally, short and long-term impacts are expected to be negligible for the MOBs and the RMA. Slight, not significant noise increases may occur close to highways used by trucks hauling aggregate for construction.

4.7.3.5 South-Central California Complex

Regardless of whether Edwards AFB or Fort Irwin National Training Center (NTC) is selected as the MOB for this complex, long-term impacts to regional air quality are expected to be low and significant. Long-term impacts to regional visibility, though low, will be significant. Short-term, local impacts to air quality, as represented by CO, will be moderate but not significant. Short and long-term regional noise impacts are expected to be negligible.

Air Quality. Construction of the MOB at Edwards AFB or Fort Irwin NTC will place project facilities near or among existing facilities. Generally, the area is in attainment status or unclassified for TSP and CO. Only one community, Victorville, is in nonattainment status for the TSP standard. Impacts to CO levels from increased local traffic will be low in several communities in the area, since there is no single community into which the total labor force can migrate. Trucks hauling aggregate may cause short-term, moderate, and not significant impacts to CO levels on a regional basis. The incremental addition of personnel to operate the system overlaps the period when the construction force will be in place. The long-term regional effect is expected to be a low, significant impact to TSP and visibility regardless of the MOB selected. Although the regional population is close to 10 million, the bulk of this population is in southern Los Angeles and San Bernardino counties, beyond a range of mountains and somewhat removed from the ROI. As a result, only the local desert-area population will be affected by the long-term, significant impact. The proposed project population increment of just over 10,000 people is about 4 percent of the total desert-area population growth forecast in the first 8 years of deployment.

Long-term impacts from dust depend on the frequency of the HML vehicle movements. Victorville is the only nonattainment status area for TSP in this generally unclassified status region. The closest PSD Class I areas, Dome Land, San Gabriel, Cucamonga, and San Gorgonio wildernesses, are in the mountains west and south of the deployment area, with little, if any, impact expected in these areas. Regional visibility in the Mojave Desert has been decreasing with population build-up in the past few years, and the projected population figures show continuing growth. In a special study conducted at Edwards AFB, optical data from 150 tracking missions were analyzed with respect to visibility in order to define air quality essential to the mission. While there is a general relationship between reduced visibility and degraded optical-tracking capability, degraded photo data can also occur with good observed visibility conditions. This reflects specific mission-related data analysis requirements and also some differences between observed visibility and optical visibility. Long-term visibility will be significantly affected at low levels by the projected population growth and continue to affect the Edwards AFB mission. The Joshua Tree National Monument is close to the Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC) RMA, and the air quality may be significantly affected at a low level by dust raised as a result of HML repositioning.

Noise. Short and long-term, negligible impacts are expected at the regional level for the MOBs and the RMA. During the construction phase, potentially low and not significant local impacts may occur near highways heavily traveled by trucks hauling aggregate. These short-term impacts will be negligible at the regional level.

4.7.3.6 Washington Complex

Regional, long-term impacts to air quality and visibility are expected to be low and not significant. Local, short-term impacts to air quality will be moderate but not significant. Short and long-term noise impacts are expected to be negligible.

Air Quality. The Yakima Firing Center (FC) MOB will place facilities near the Yakima CO nonattainment area. The CO standards have been consistently exceeded in Yakima for several years. Washington has identified, in its State Implementation Plan, various control measures to bring CO into attainment status. Although short-term urban air quality in the Yakima CO nonattainment area may be moderately affected from heavy trucks hauling aggregate during the construction phase, no significant, regional-level impacts are expected. The project-related population increment of about 3,900 people is less than 1 percent of the baseline population in Yakima County. Therefore, the effects are low and not expected to cause long-term, significant impacts.

During the operations phase, dust and CO generated by HML movement in the RMA, and the associated maintenance support activities at the deployment installation maintenance facilities, will not affect the Yakima area. Visibility may be intermittently affected onbase during construction and more extensively affected in the operations phase by dust generated from project-associated vehicle movement, particularly the HML off-road repositioning. Wind erosion may also increase when fine soils are disturbed in the RMA. This dust disturbance could cause visibility degradation during strong wind conditions. These two effects, ground disturbance and HML movements, are expected to result in long-term, low impacts to visibility. No detectable effects on regional CO levels are expected, nor are fugitive-dust levels expected to cause significant, long-term violations of annual air quality standards in the RMA.

Noise. Short and long-term, negligible impacts are expected at the regional level for the MOB and RMA. Locally, short-term, low, and not significant impacts close to major highways used by aggregate trucks may occur.

4.7.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.7.4.1 Ellsworth Air Force Base

Impacts to long-term regional air quality, visibility, and noise levels are expected to be negligible for this base. For air quality (CO) levels and noise, some short-term, low, not significant impacts will occur in isolated local areas.

Air Quality. Ellsworth AFB consists of 4,858 acres; 400 acres will be used for MOB facilities. The only regional TSP nonattainment area is the Rapid City metropolitan area, which is 11 miles from the base. During the construction phase, the TSP and CO generated, in association with construction equipment, aggregate hauling, and increased vehicular traffic from the labor force, are not expected to significantly affect short-term air quality. This will not affect regional CO levels or add to the TSP nonattainment status in the Rapid City metropolitan area. The project-related population increment of 7,700 people is about 5 percent of the baseline population. Long-term,

negligible air quality impacts are expected because of this population increment. Some short term, low, not significant impacts will occur in isolated local areas.

The HMLs will be located at existing Minuteman launch facilities, which are scattered over an approximately 13,500-sq-mi deployment area in western South Dakota. The TSP and CO generated by activities at the launch facilities will be minimal and dispersed over such a large area that long-term, negligible impacts to regional air quality are expected. The visibility near Wind Cave National Park or the Badlands National Monument, both PSD Class I areas, will not be significantly affected by the new operations activities at Minuteman sites.

Noise. Long-term, negligible impacts are expected in the region. Short-term, low, and not significant impacts will occur close to the roadways along the specific highway segments used by trucks hauling aggregate.

4.7.4.2 F.E. Warren Air Force Base

Impacts to long-term regional air quality, visibility, and noise levels are expected to be negligible for this base. Short-term, low, and not significant impacts will occur in local areas for air quality and noise.

Air Quality. Construction of the MOB at F.E. Warren AFB (total area 5,866 acres) will require about 400 acres for new Small ICBM facilities in the vicinity of existing facilities that support the Minuteman and Peacekeeper forces. The base is presently in compliance with air quality criteria and the ROI has low levels of TSP and CO. No violations of federal air quality standards in the Cheyenne metropolitan area were reported in 1984 and no change in that condition is expected over the life of the proposed project. Long-term, negligible impacts are expected at the regional level. Short-term, low impacts resulting from ground clearing, road dust, and disturbance in temporary storage areas are likely. The CO emitted from trucks hauling aggregate may cause some low, local impacts during construction. Neither of these impacts will be significant in the region. The HMLs will be located at the existing Minuteman launch facility sites, which are scattered over approximately a 12,600-sq-mi deployment area in southeastern Wyoming. Short-term, negligible impacts are expected for the region during construction at these facilities. The general population increase in the Cheyenne area is expected to be about 13,000 people without the proposed project. Long-term, negligible air quality impacts are expected from the maximum project-related growth of about 8,800 people, which is just over 1 percent of the baseline population of the region.

There are no PSD Class I areas closer than 60 miles and no nonattainment status areas in the ROI, so location restrictions based on air quality impacts do not exist for placement of the HMLs at Minuteman sites. The small amounts of dust and CO generated by the various support activities will have long-term, negligible impacts to the urban and regional air quality, and on the Class I areas.

Noise. Long-term, negligible impacts are expected for the region. Short-term, low, and not significant impacts will occur close to the roadways along the heavily used highways.

4.7.4.3 Grand Forks Air Force Base

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible for this base. Local, short-term, low, and not significant impacts will occur for CO levels and noise.

Air Quality. Grand Forks AFB consists of 4,830 acres; 400 acres will be used for construction of the MOB facilities. The proposed project area is in attainment status for all criteria pollutants and there are no PSD Class I areas in, or near, the construction-related areas. Expected project emissions during construction will not significantly affect the regional air quality, but short-term, low, and local impacts to CO may occur from the number of heavy trucks hauling aggregate. Operations-phase impacts will be negligible and will not affect the long-term regional air quality. The project-related population increment of about 7,200 people is less than 3 percent of the regional baseline and will result in negligible impacts to long-term air quality.

The HMLs will be located at the existing Minuteman launch facility sites, which are scattered over approximately a 7,500-sq-mi deployment area in eastern North Dakota. Negligible air quality impacts are expected during construction at these facilities.

Noise. Long-term, negligible impacts are expected in the region. Short-term, low, and not significant impacts will occur close to heavily traveled highways.

4.7.4.4 Malmstrom Air Force Base

Long-term impacts to regional air quality and visibility levels are expected to be negligible for this base. Short-term, low, and not significant impacts will occur for air quality. Long-term noise impacts will be negligible. Short-term impacts will be local, low, and not significant.

Air Quality. Malmstrom AFB consists of 3,659 acres; 500 acres will be used for construction of the MOB facilities. Both TSP and CO secondary standards have been exceeded in Great Falls on several occasions during the past 6 years. Malmstrom AFB is in attainment status for TSP and CO. Short-term urban air quality in the Great Falls nonattainment area (TSP and CO) may be affected at a low, not significant level because of the number of heavy trucks hauling aggregate. Changes to the State Implementation Plan to incorporate revised control procedures are not expected. Long-term, negligible air quality impacts are expected from the project-related population increase of about 8,100 people over the normal regional growth projections, which are incorporated in the State Implementation Plan. In relation to the baseline population for the region, the expected project population increment is just over 4 percent for the operations phase.

The HMLs will be located at the existing Minuteman launch facility sites, which are scattered over a 23,000-sq-mi deployment area in central Montana. Short-term, negligible air quality impacts for the region are expected.

Three PSD Class I areas, Bob Marshall, Scapegoat, and Gates of the Mountains wildernesses, are about 30 miles from the nearest Minuteman launch facilities.

Short and long-term visibility and air quality of the region and the PSD Class I areas will not be significantly affected because of the wide scattering of the sites and the limited movement of the HMLs.

Noise. Long-term, negligible impacts are expected for the region. Short-term, low, and not significant impacts will occur close to heavily traveled highways.

4.7.4.5 Minot Air Force Base

Long-term impacts to regional air quality and visibility levels are expected to be negligible for this base. Short-term, moderate, not significant, and local impacts will occur for air quality. Short-term noise impacts will be low and not significant. Long-term impacts will be negligible.

Air Quality. Minot AFB consists of 5,381 acres; 400 acres will be used for facilities construction. All areas in the ROI are currently in attainment status for the criteria pollutants. During the construction phase, TSP and CO generated from equipment and increased vehicular traffic are not expected to affect the regional air quality. Short-term, moderate, and local impacts to CO levels, which are not significant at the regional level, will occur from heavy trucks hauling aggregate. The project-related population increment of 7,200 people is about 6 percent of the regional baseline and is slightly larger than the expected regional population growth over the first 8 years of deployment. Long-term, negligible air quality impacts are expected from this population increment.

The HMLs will be located at existing Minuteman facilities, which are scattered over approximately 8,000 sq mi in western North Dakota. The TSP and CO generated by construction activities at the existing Minuteman launch facilities will be minimal and dispersed over a large area. This will cause a short-term, negligible impact to the regional air quality. The air quality in Lostwood Wilderness (a PSD Class I area) could be temporarily affected depending upon road upgrading and construction activities associated with modifying nearby Minuteman launch facilities. At most, a short-term, moderate, and not significant impact is expected at the regional level.

During the operations phase, any dust and CO generated will be minimal, with long-term, negligible impacts because of limited HML movements.

Noise. Long-term, negligible impacts are expected in the region. Close to heavily used highways, short-term, low, and not significant impacts will occur because of aggregate hauling.

4.7.4.6 Whiteman Air Force Base

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible for this complex. Short-term, low, not significant, and local impacts will occur for CO and noise.

Air Quality. Whiteman AFB consists of 3,737 acres; 400 acres will be used for facilities construction. The proposed project area is in attainment status for all criteria pollutants and there are no PSD Class I areas in the vicinity. Proposed project construction-related emissions are not expected to

affect the area. The HMLs will be located at the existing Minuteman launch facility sites, which are scattered over a 10,000-sq-mi area in western Missouri. Dust generated during construction is expected to have a negligible effect on short-term regional air quality. The CO emissions from aggregate trucks may cause short-term, low, and not significant impacts in some local areas. Operations-phase emissions will be minimal and will have a long-term, negligible effect on the regional air quality. The project-related population increment of 7,200 people is about 1 percent of the regional baseline and represents a very small increase; this is expected to cause a long-term, negligible impact, even in a region with little population growth.

Noise. Long-term, negligible impacts are expected in the region. Near highways, aggregate trucks will cause short-term, low, local, and not significant impacts.

4.7.5 Impacts of Hard Silo in Patterned Array

4.7.5.1 Davis-Monthan Air Force Base

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible. Short-term, low, and significant impacts to the PSD Class I areas will occur. In Tucson, the short-term air quality impacts to the nonattainment area will be significant. Short-term, regional noise impacts will be negligible.

Air Quality. Construction of the MOB at Davis-Monthan AFB will place facilities in a nonattainment area where both TSP and CO standards are frequently violated. Negligible, regional impacts are expected because of the local and temporary nature of effects from the facilities construction process. Short-term, low, but significant impacts may result for Tucson from the increased vehicular traffic and CO emissions associated with the construction-related vehicles and labor-force transportation. No modifications in the present requirements of the State Implementation Plan for Tucson are expected. Long-term, negligible impacts are expected over the normal growth projections, since the long-term population increment of about 4,400 people for the proposed project is less than 1 percent of the regional baseline. Local impacts depend to a large extent on the final choice of location of the deployment area with respect to populated areas, the Tucson nonattainment area (with presently imposed Environmental Protection Agency [EPA] sanctions), and the PSD Class I areas. Since the Suitable Deployment Area (SDA), containing 2,243 sq mi, is adjacent to both the Tucson nonattainment area and three PSD Class I areas, there is a potential for low impacts from dust in each area. The lowest potential exists for the Galiuro Wilderness, which is a few miles from the SDA and has no direct contact. However, two segments of the Saguaro Wilderness are immediately adjacent to the SDA and may be affected at a higher level. Visibility may be most affected, though it is expected that any decreases from construction activities will be intermittent. Construction-phase effects in the silo area will result in short-term, negligible impacts in the designated nonattainment area around Tucson. During the operations phase, the small amounts of dust and CO generated by the various support activities will have negligible effects on the Tucson area and the regional air quality.

Noise. Short and long-term, negligible impacts are expected in the region.

4.7.5.2 Edwards Air Force Base

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible in the Edwards AFB area. Short-term, low, and local impacts may occur, but will not be significant. Short-term, negligible noise impacts are expected.

Air Quality. Generally, the Edwards AFB area is in attainment status for TSP and CO. Only one community, Victorville, is in nonattainment status for violation of the TSP standard. Short-term impacts from increased local traffic will be low in all communities in the area, since there is no single community into which the total labor force can migrate. Regional impacts from vehicle emissions will not be significant. During the peak-construction period, an additional labor force of about 5,400 workers and an MOB-construction area of about 500 acres will be involved. Short-term air quality in the various urban areas, including the nonattainment area for TSP at Victorville, may be affected at a low level that will not be significant. Since the population increment for the proposed project (4,400) is less than 0.1 percent of the regional baseline, long-term, negligible impacts will occur.

Local impacts from dust during construction in the 29-sq-mi silo area will vary depending on the final choice of location. Since there are 1,267 sq mi suitable for deployment in the Edwards AFB area, and only 29 sq mi are required, there is ample opportunity to select minimal impact locations. With Victorville the only nonattainment status area and the closest PSD Class I areas in the mountains south of the deployment area, little, if any, impact is expected in these areas. Regional visibility has been decreasing with population build-up, and projected population figures show no signs of decreasing growth. Visibility will continue to be affected, but the contribution from construction of the proposed project to the long-term regional visibility problems will be negligible. During the operations phase, the small amounts of dust and CO generated by the various support activities will not affect regional conditions.

Noise. Short and long-term, negligible impacts are expected.

4.7.5.3 F.E. Warren Air Force Base

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible. Short-term, low, and not significant air quality impacts are expected. Short-term noise impacts will be negligible.

Air Quality. Construction of the MOB at F.E. Warren AFB will involve placement of Small ICBM facilities in the vicinity of facilities that support the Minuteman and Peacekeeper forces. The base is in compliance with air quality criteria and the ROI currently has low levels of TSP and CO. No violations of federal air quality standards in the Cheyenne metropolitan area were reported in 1984, and no change in that condition is expected for the proposed project. Long-term, negligible, and regional impacts are expected. Short-term, low, and local impacts from ground-clearing, road dust, and disturbance in temporary storage areas are probable but will not be significant. The project-related population increment during the operations phase will be 4,400 people, which is less than 1 percent of the regional baseline population, and is not expected to cause other than long-term, negligible impacts.

During silo construction, emissions will be localized and will not cause any degradation of regional air quality. Since there are 215 sq mi of area suitable for deployment, and only 29 sq mi are required, a good opportunity for choosing minimal impact locations exists.

There are no PSD Class I areas closer than 60 miles and no nonattainment status areas in the ROI. During the operations phase, the small amounts of dust and CO generated by the various support activities will have a long-term, negligible effect on the regional air quality.

Noise. Short and long-term, negligible impacts are expected in the region.

4.7.5.4 Fort Bliss

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible. Short-term, low, and significant air quality impacts may occur in El Paso. Short-term noise impacts will be negligible.

Air Quality. Construction of the MOB at Fort Bliss will place facilities close to the El Paso nonattainment areas for TSP and CO. Both TSP and CO standards have been consistently exceeded for several years in El Paso, and the State of Texas, according to its current State Implementation Plan, has identified various control measures to bring TSP and CO into attainment status. Fort Bliss is in attainment status for TSP and CO. Short-term impacts in the El Paso area will be low but significant during construction at the Fort Bliss MOB. Long-term, negligible air quality impacts are expected, since the project-related population increment of 4,400 people in the operations phase is only 0.5 percent of the baseline population.

In the deployment area, construction-phase emissions are temporary and are not expected to cause long-term, significant air quality impacts. In addition, the surface disturbance will be limited to a relatively small area (29 sq mi) within the 2,020 sq mi of SDA available for the placement of silos. Short-term impacts depend to a large extent upon location of silo deployment with respect to population centers, nonattainment areas, and PSD Class I areas. Placing the deployment area in the parcel of SDA near White Sands Missile Range Headquarters; in the vicinity of Las Cruces, El Paso, and Fort Bliss; or near Holloman AFB and Alamogordo, will cause short-term, low, and not significant impacts. Some change in dust levels at Las Cruces, and at Holloman AFB or Alamogordo, may occur during the construction phase if the silo area is located nearby. Location of the deployment area in other parts of the SDA distant from populated areas will not cause any air quality impacts in metropolitan areas. During the operations phase, the small amount of dust and CO generated by the various support activities will not significantly affect the long-term regional air quality.

Noise. Short and long-term, negligible impacts are expected at the regional level.

4.7.5.5 Gila Bend Air Force Auxiliary Field

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible. Some areas will experience short-term, moderate, and not significant impacts from dust. Short-term noise impacts will be negligible.

Air Quality. Construction of the MOB in the Gila Bend area will considerably expand the facilities at Gila Bend AFAF. The region, except for isolated local air quality effects from copper smelting, is in attainment status for TSP and CO. Phoenix, north of Gila Bend, is not in attainment status, but because of its distance, will not be influenced by the activities in the Gila Bend area.

The influx of people into the Gila Bend area is expected to affect the local air quality to some extent, depending on population distribution and density. The short-term impacts will be moderate and not significant. Some intermittent visibility decrease may be evident during the construction phase. Since the operations-related population of 4,400 people is less than 0.5 percent of the regional baseline population, long-term, negligible effects on visibility and air quality are expected.

During silo construction, emissions will be localized and not expected to cause any significant degradation of short-term regional air quality, since there are 2,255 sq mi of SDA and only 29 sq mi are required for the Hard Silo area.

Short-term impacts from dust during silo construction will not be significant, but the levels will depend on the final choice of location. Since Ajo is in nonattainment status for TSP and is immediately adjacent to a large portion of SDA, constructing the silos in its vicinity will have moderate, temporary impacts to the local air quality. Similar concerns are also possible if the deployment area is located in the northeastern part of the SDA in the vicinity of the Phoenix nonattainment status area. No PSD areas exist within the ROI. The Organ Pipe Cactus National Monument (a potential PSD Class I area) is on the extreme southern edge of the SDA and is not expected to be affected by silo construction. During the operations phase, the small amounts of dust and CO generated by the various support activities will have a negligible effect on the long-term regional air quality.

Noise. Short and long-term, negligible impacts are expected in the region.

4.7.5.6 Yuma Proving Ground

Long-term impacts to regional air quality, visibility, and noise levels are expected to be negligible; however, short-term, low, and not significant dust impacts will occur. Short-term noise impacts will be negligible.

Air Quality. Construction of the MOB at Yuma PG will place additional buildings in an area where many similar facilities exist. This area is in attainment status for TSP and CO. The project-related population increment of 4,400 people is less than 2 percent of the baseline population in the operations phase. No local control plan changes will be initiated for such a population increment and long-term, negligible impacts are expected.

During construction in the deployment area, the magnitude of short-term impacts will depend on where the silos are located. Some of the SDA is relatively close to the city of Yuma and, if used, could result in low but not significant impacts to the urban area because of dust generated during construction. Since there are 1,512 sq mi available, and only 29 sq mi are required, it is likely that a location could be chosen that will not directly affect Yuma. There are no PSD Class I or nonattainment status areas within

the ROI. Long-term regional impacts will be negligible in the operations phase. The small amounts of dust and CO generated by the various support activities will not significantly affect either visibility or air quality.

Noise. Short and long-term, negl'gible impacts are expected in the region.

4.7.6 Impacts of the No Action Alternative

Air Quality. Increases in fugitive dust emissions are expected in the proposed project area from population growth and nonproject-related construction. The existing urban background concentrations and rural concentrations for fugitive dust (TSP) are conservatively assumed to remain constant in the future, though, during the past several years, ambient levels of urban TSP have been decreasing. Rural concentrations of TSP are primarily a result of natural sources and agricultural activities, and are expected to remain relatively constant.

In some populated areas, such as El Paso, Tucson, Great Falls, Rapid City, and Yakima, nonattainment areas have been identified for particular pollutants and long-term control measures have been instituted. Compliance dates have been established and state-level responsibilities defined to improve the air quality in these urban centers, taking into account planned population growth and general quality of life criteria. New or increased pollutant emissions sources are required to meet stringent conditions prior to starting operations.

The CO emission changes predicted for the proposed project areas will result from baseline population growth. With federal emission controls on automobiles and trucks and various transportation control measures adopted in the various state implementation plans, CO emissions will remain under control in rural areas. It is planned that attainment status in urban areas will be reached and maintained with the presently instituted controls.

Noise. The typical range of noise levels associated with general construction activities is not expected to differ from existing conditions. New federal regulations on permitted noise levels from heavy duty trucks and equipment may decrease these levels in the future.

4.7.7 Irreversible and Irretrievable Resource Commitments

Air Quality. Implementation of the proposed project will result in no irretrievable or irreversible resource commitments for air quality.

Noise. Implementation of the proposed project will result in no irreversible or irretrievable resource commitments for noise or noise-related impact areas.

4.7.8 Relationship Between the Local Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Air Quality. Implementation of the proposed project will result in short-term air quality impacts primarily associated with the construction phase. These impacts include increases in fugitive dust and CO from vehicular exhaust emissions. Because of visibility effects and suspended dust, some low and moderate, significant, long-term air quality impacts have been identified.

The maintenance and enhancement of long-term productivity, as it relates to military test missions in California and Nevada, may be affected by reduced regional visibility.

<u>Noise</u>. Implementation of the proposed project will result in short-duration, project-related noise impacts primarily associated with the construction phase. No long-term noise effects are anticipated; therefore, no effects on the maintenance and enhancement of long-term productivity will occur.

4.8 Water Resources

The deployment of the proposed Small Intercontinental Ballistic Missile (ICBM) system will have water requirements that will affect regional water resources characteristics. The analysis of water resources impacts includes consideration of surface water and groundwater hydrology and quality.

4.8.1 Impact Analysis Methodology

The methods used for impact analysis of the proposed project effects on each element of water resources include evaluation of potential project impacts, determination of levels of impact (LOI), and determination of impact significance.

4.8.1.1 Evaluation of Project Impacts

Total water use associated with the proposed project was evaluated for the construction phase (lasting from 1990 to 1996 or 1997, depending upon basing mode) and for the operations phase (from 1996 or 1997 onward). Construction-phase water use includes water used directly for project construction. It also includes indirect use, which is the domestic and related water needs of the project workers, their dependents, and other project-induced inmigrants to the region (Section 4.1.1.1). Operations-phase water use includes domestic and related water needs of the operations personnel, their dependents, and other operations-phase inmigrants to the region. Water required for the direct operation of the project is not known at this time and was not included in the analysis. However, it is expected to be a small portion of the domestic needs analyzed in this section and its omission should not seriously affect the analysis.

The direct water requirements for proposed project construction are shown in Table 4.8.1-1. All subsequent water use numbers in this section have been rounded to the nearest 10 acre-feet (acre-ft). Indirect, domestic water use by inmigrants to a Region of Influence (ROI), as a result of proposed project employment (see Section 4.1 for estimates of inmigrants), was calculated using per capita, area-specific, water use factors. Water use values for the entire construction phase are presented in Sections 4.8.3.1, 4.8.4.1, and 4.8.5.1. Operations-phase water use is evaluated on a constant, annual basis and compared to baseline conditions as represented by the year 2000, a year of full project operations. All Main Operating Base (MOB) construction water was assumed to be drawn from the base water supply. A maximum per capita water use figure of 200 gallons per day was used to estimate project-induced water use at the MOB, unless existing data indicated a lower per capita rate. Project-related water use at the support communities was also examined. Local per capita water use rates were adjusted to reflect the water demand of inmigrants moving to the community. A small fraction of the workforce will likely live in areas other than those specifically examined in this analysis. This estimated water use was identified and is minor in all cases. Therefore, it was not further evaluated.

Surface Water Hydrology and Quality. Surface water withdrawals resulting from project-induced population growth were calculated based upon baseline per capita consumption factors and the percentage of the total baseline water use that is supplied by surface water sources. Increases in water use at the MOB

Table 4.8.1-1

ESTIMATED ANNUAL WATER REQUIREMENTS FOR CONSTRUCTION BY CALENDAR YEAR
(in acre-feet)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL
Hard Mobile Launcher in Random Movement										
50 Missiles										
Main Operating Base	103	66	5	5	17	10	1	0	0	207
Deployment Area	385	280	175	70	5	0	0	0	0	915
50 Missiles, Total:	488	346	180	75	22	10	1	0	0	1,122
200 Missiles										
Main Operating Base	156	56	6	5	17	10	1	0	0	251
Deployment Area	1,628	1,041	581	325	30	0	0	0	0	3,605
200 Missiles, Total:	1,784	1,097	587	330	47	10	1	0	0	3,856
Hard Mobile Launcher at Minuteman Facilities										
170 Missiles										
Main Operating Base	72	42	28	8	8	5	0	0	0	163
Deployment Area	148	45	27	86	74	56	2	0	0	438
170 Missiles, Total:	220	87	55	94	82	61	2	0	0	601
200 Missiles										
Main Operating Base	75	41	28	8	8	5	0	0	0	165
Deployment Area	408	173	113	79	56	5	0	0	0	834
200 Missiles, Total:	483	214	141	87	64	10	0	0	0	999
Hard Silo in Patterned Array										
250 Missiles										
Main Operating Base	22	37	22	20	11	0	0	0	0	112
Deployment Area	44	75	157	250	269	137	30	3	0	965
250 Missiles, Total:	66	112	179	270	280	137	30	3	0	1,077

and support communities were identified, as were water diversions from surface water. Total project-induced surface water withdrawals, including construction water requirements, were compared with the baseline withdrawals and with the available supply of surface water resources. Water shortages attributable to the proposed project were identified along with alternate water sources/measures to relieve these shortages.

The potential water quality impacts resulting from land disturbance were qualitatively evaluated based upon the soil erosion characteristics provided by the geology and soils analysis. This information was used to identify critical erosion areas and their proximity to surface water features. For those alternatives where wastewater is discharged into surface water, wastewater discharges resulting from project-induced population growth were calculated using baseline per capita wastewater factors. The project-induced effluent flow was compared with the baseline wastewater discharges, and with the flow of the receiving stream. A qualitative estimate of the water quality impact downstream was made, taking into account the designated uses of the stream and its history in meeting state water quality standards.

Groundwater Hydrology and Quality. The project-related groundwater supply requirements of MOBs and support communities with known groundwater supply sources were calculated. The impacts of this incremental increase in groundwater withdrawal upon the affected groundwater system were evaluated. Impacts such as accelerated aquifer drawdown or the need to drill new wells were identified.

The specific locations of proposed project construction in the deployment area have not been selected; therefore, a regional groundwater analysis was carried out. Construction water requirements were compared to the groundwater basin information developed in Section 3.8. Groundwater depletions and water level decline attributable to the proposed project were estimated from recent aquifer trends. In addition, an evaluation was made if the data indicated that the potential exists for water quality degradation because of increased, project-induced aquifer withdrawals.

4.8.1.2 Determination of Levels of Impact

The proposed project impacts were compared to the future baseline conditions. The incremental impact attributable to the project was then compared to the LOI criteria and an LOI was assigned. The following criteria provide the basis for the determination of both short and long-term impacts to surface and groundwater resources and water use. The fulfillment of one or more criterion with the highest LOI results in the assignment of that LOI to the water resource element under consideration. The LOI definitions are expressed in qualitative terms. Specific conditions at the regional level determine LOI assignment. For instance, a given amount of proposed project water requirement will have a higher LOI in a basin where all existing water sources are fully committed as compared to a basin where only a small fraction of the available water was being used. Both primary and secondary impacts were considered in the application of LOI criteria.

Surface Water Hydrology and Quality. The following LOIs were assigned for surface water hydrology and quality:

- Negligible Impact -- Little or no surface water will be needed for the proposed project. No measurable effects will occur to surface water resources.

- Low Impact -- Measurable changes in flow or quality of surface water resources are likely. However, the quality and availability of the resource will not substantially change.

- Moderate Impact -- Substantial changes in the flow or quality of surface water resources will result from the proposed project. However, the availability or quality of the resource will not diminish to the point of affecting established water use patterns. The proposed project will require a substantial portion of the existing surface supply and additional supplies must be developed.

- High Impact -- Major changes in the flow or quality of surface water resources will result from the proposed project. As a result, resource availability or quality will diminish to the point where established water use patterns are likely to be substantially changed. The available surface water resource cannot meet project demand, forcing a shift in surface water use patterns.

Groundwater Hydrology and Quality. The following LOIs were assigned for groundwater hydrology and quality:

- Negligible Impact -- Little or no groundwater withdrawal will be needed for the proposed project.

- Low Impact -- The proposed project will use a minor portion of the groundwater resource. No change in groundwater quality is likely, and no major groundwater users will be affected. Limited groundwater declines may affect some individual well users.

- Moderate Impact -- The proposed project will require substantial additional development of available groundwater resources. Proposed project use will cause minor groundwater drawdown, which may reduce the well capacity of major groundwater users. Potential changes in groundwater quality will be minor and will not affect baseline uses of the resource.

- High Impact -- Proposed project use will cause substantial groundwater drawdown, which may severely affect major groundwater users by requiring the deepening or abandonment of existing wells. Existing patterns in groundwater use will shift. Potential changes in groundwater quality could be substantial, possibly eliminating one or more baseline uses of the resource.

4.8.1.3 Determination of Significance

Following the assignment of water resource impact levels for each alternative, separate determinations of significance were made. The emphasis was placed upon characterizing regionally significant impacts.

Surface Water Hydrology and Quality. The regional significance of potential impacts to surface water hydrology and quality was assessed through consideration of the following factors:

- Failure of stream water quality to meet state standards and/or interfere with designated water uses, or further degradation in the quality of water that currently fails to meet state standards;
- Serious depletion of perennial streamflow;
- A major change in flood characteristics or flood damage potential;
- Location of the proposed project in proximity to a designated wild and scenic river or other unique surface water feature;
- Potential curtailment or water shortages to existing surface water users, or a substantial change in water use patterns; or
- New regional importation of water.

Groundwater Hydrology and Quality. The regional significance of potential impacts to groundwater hydrology and quality was assessed through consideration of the following factors:

- A large reduction or cessation of major spring flows;
- Potentially large declines in groundwater levels affecting existing users;
- Groundwater withdrawal from a heavily overdrafted groundwater basin or aquifer where even proportionately small increases may contribute to its accelerated depletion;
- Groundwater quality impacts to a designated sole-source aquifer;
- Substantially diminished groundwater recharge; or
- Substantial change in groundwater use patterns.

4.8.2 Impacts Common to All Locations

Implementation of the proposed project will result in a number of types of water-related impacts: direct water requirements for proposed project construction and operations, indirect water demands to satisfy the domestic and related water needs of the inmigrating population relocating to the ROI because of proposed project jobs, and hydrological and water quality impacts associated with land disturbance and other proposed project activities. The indirect water demands of the inmigrating population will be responsible for about 70 to 90 percent of the total water requirements of the proposed project, depending upon the alternative. The projected specific requirements and distributions of the project-induced water demands are discussed for each alternative basing location in subsequent sections. This section focuses on common impacts arising primarily from activities in the deployment area. Certain practices are part of standard Air Force policy and construction

procedures. These practices, along with a number of assumptions, have been factored into the evaluation of the level and significance of the proposed project upon the water resource system and are the following:

- o State and local regulations and permit requirements for runoff control and wastewater disposal will be followed;
- o Water acquisition efforts will follow state and local law;
- o Site disturbance will be minimized, good erosion control practices will be followed, and revegetation of disturbed areas will be carried out, where appropriate, following completion of construction;
- o The existing per capita water use factors for the MOB and support communities evaluated in this section were assumed to remain constant throughout the evaluation period; and
- o Public and/or onbase wastewater utilities will be upgraded as necessary to satisfy both future baseline and project-induced wastewater treatment needs. The resulting impacts upon the utilities resource are discussed in Section 4.2.

Disposal of sanitary and other wastes, equipment wash water, runoff from construction stockpiles, and accidental spills all have the potential to degrade ground and surface water quality. Waste disposal activities will comply with all applicable state and federal regulations and will be conducted in such a manner as to minimize the potential for water quality impact. The risk of fuel or chemical spills entering streams, though remote, is a possibility, particularly during construction. If such an event occurs, immediate measures will be taken to notify the appropriate agencies, contain the spill to the extent possible, and begin cleanup activities as soon as is practical. For operations activities, the MOB will follow the existing policy of developing an emergency response plan that will include notification procedures and containment measures for spills or other emergencies that may threaten water quality.

Proposed project construction activities have the potential for reducing recharge to the groundwater system because of earth compaction, construction of impervious surfaces, and channeling of runoff out of the area. Such effects are expected to have a minor impact upon regional recharge rates because of their relatively small areal extent. Groundwater extraction at any single location in the deployment area is unlikely to be more than a few hundred acre-ft over a period of several years (equivalent to an agricultural irrigation well). Groundwater level declines attributable to construction activities are not likely to affect a radius of more than 1 or 2 miles and should generally recover over the long term. Unless other special circumstances occur, such as withdrawal from a heavily overdrafted or agency-designated groundwater basin, groundwater impacts from deployment-area construction activities will generally be of short duration.

Potential impacts common to any location for each proposed basing mode are discussed in the following sections.

4.8.2.1 Hard Mobile Launcher in Random Movement

Construction activities will disturb a total of either 10.9 square miles (sq mi) or 35.3 sq mi of land, depending on 50-missile or 200-missile deployment, respectively. These disturbed areas include about 3 sq mi at the MOB with the remainder in the Random Movement Area (RMA). Vegetation will be removed and the soil will be exposed to accelerated erosion, resulting in sedimentation in nearby streams following rainfall. Intermittent degradation of local water quality will likely occur because of increased levels of suspended sediment and associated pollutants with resulting changes in turbidity, sediment deposition, temperature, and dissolved oxygen. Construction practices to minimize soil erosion are expected to include stabilization or protection of exposed slopes or new fill, sedimentation basins to collect runoff from the larger disturbed areas prior to escape to the local stream system, and revegetation of disturbed areas.

Off-road activities associated with the long-term operation of the Hard Mobile Launchers (HMLs) will disturb from 2.5 to 17.5 sq mi of the RMA each year. There will be long-term impacts from sedimentation and associated degradation in water quality resulting from this activity. Avoiding movement through or within the immediate vicinity of perennial streams will reduce potential impacts. Construction activities, including road construction, are also likely to change the local surface drainage patterns. The construction of impervious surfaces such as buildings, parking lots, and roads will increase the intensity of local storm runoff. However, these impacts are not expected to appreciably increase regional flood potential.

4.8.2.2 Hard Mobile Launcher at Minuteman Facilities

Construction activities for this basing mode will disturb between 4.9 and 5.5 sq mi of land, including 2.4 sq mi at the MOB. The amount of disturbance at the MOB will be about the same as for the Hard Mobile Launcher in Random Movement basing mode, while deployment-area disturbance will be about one-tenth that of Random Movement disturbance and spread over a much larger area. However, the water impacts associated with land disturbance and surface alteration, while generally the same as that previously described, will generally be of a higher magnitude because of the higher density of perennial streams in these areas. Water quality degradation is particularly likely where project roads intersect streams and where bridges and culverts must be built or upgraded. Since there are no off-road activities associated with proposed project operations, these will be short-term impacts.

4.8.2.3 Hard Silo in Patterned Array

The amount of construction-disturbed land is the largest for this alternative (30.7 sq mi). About 90 percent (or 28.1 sq mi) of the disturbance will be concentrated in one or two contiguous areas, the Hard Silo module areas. Extensive land disturbance will occur in these areas. It is possible that the surface drainage pattern will be entirely altered. Land disturbance in the remainder of the ROI will be minimal. Siting of the Hard Silo module in an area remote from perennial streams or other permanent water bodies can reduce surface water impacts considerably. No additional land disturbance will occur during proposed project operations; therefore, the only long-term impact will

be the permanent alteration of surface drainage patterns (if this occurs) and increased sediment discharge to surface waters, should the Hard Silo module be sited near a stream (Section 4.8.5).

Other impacts common to this basing mode are similar to those previously discussed, except for groundwater withdrawal. Construction of the Hard Silo module will require about 900 acre-ft of water. If taken from wells, this will result in a somewhat more concentrated groundwater withdrawal than previously discussed, and short-duration declines in groundwater levels can be expected.

In areas with no nearby groundwater users, the resulting effects are expected to be minimal. Areas where major water users may be affected are identified in specific alternative impact analyses in Section 4.8.5.

4.8.3 Impacts of Hard Mobile Launcher in Random Movement

4.8.3.1 Arizona Complex

Some short and long-term, low, but not significant impacts to surface water are expected to occur if either Gila Bend Air Force Auxiliary Field (AFAF) or Yuma Proving Ground (PG) is selected as the MOB. The short and long-term impacts will be moderate and significant if Gila Bend AFAF is selected because of the overdrafted condition of the groundwater basin. Short and long-term groundwater impacts that are low and not significant will occur if Yuma PG is chosen as the MOB.

Summary of Project Water Use. Total project-related water use at Gila Bend AFAF or Yuma PG (including construction water needs) is presented in Table 4.8.3-1. Construction-phase water use at either MOB will increase steadily, rising to 1,850 acre-feet per year (acre-ft/yr) as the proposed project becomes fully operational. If the MOB is located at Gila Bend AFAF, the main support community will be the town of Gila Bend. Peak construction-phase water use will occur during the first year of construction (1990) at 1,630 acre-ft. If Yuma PG is selected as the MOB, the principal support community will be the city of Yuma. Construction-phase water use at Yuma also will peak in the first year of construction at a total of 1,560 acre-ft and then steadily decrease in succeeding years as the operations phase overtakes the construction phase. Total construction-phase water use at either Gila Bend or Yuma will be 5,810 or 5,540 acre-ft, respectively. Differences in the water use values between the two towns reflect varying per capita water use rates. Total construction-phase water use in other communities in the ROI is estimated at 90 to 230 acre-ft. Operations-phase water use is estimated to be about 2,300 acre-ft/yr. Eighty percent of this use will occur at the MOB.

Surface Water Hydrology and Quality. If the MOB is located at Gila Bend AFAF, the support community will be Gila Bend, which does not use surface water for its supply. As a result, it is expected that very little of the water requirements of the proposed project will be derived from surface water. The city of Yuma, the support community for Yuma PG, receives its water supply solely from a long-standing 50,000 acre-ft/yr entitlement of Colorado River water. Construction-phase water demand will entail a maximum increase of 9 percent over the baseline use at Yuma. Operations-phase water use will amount to a 2-percent increase over baseline. Operations-phase plus baseline water use will be 21,510 acre-ft in the year 2000. This amounts to just 43 percent of

Table 4.8.3-1

SUMMARY OF TOTAL WATER USE AND IMPACTS
FOR THE HARD MOBILE LAUNCHER IN RANDOM MOVEMENT ALTERNATIVES

	Total Construction[1] Phase (1990-1996) (acre-ft)	Operations Year[2] (2000) (acre-ft)
Arizona Complex		
Gila Bend AFAF (200 missiles)		
Total Project Water Use	15,950	2,300
Gila Bend AFAF Use	6,300	1,850
Gila Bend Use	5,810	430
Other Project Water Use	3,840	20
Key Impacts		
Induced Pumpage (Gila Bend Basin)	12,500	2,280
Yuma PG (200 missiles)		
Total Project Water Use	15,540	2,260
Yuma PG Use	6,300	1,850
Yuma Use	5,540	410
Other Project Water Use	3,700	0
Key Impacts		
% Water Supply Available to Yuma (Baseline + Induced Use)	40%	43%
Yuma-Induced Wastewater Discharge	2,000	180
% Annual Flow of Colorado River	<0.1%	<0.1%
Induced Pumpage (L. Colorado Basin)	6,930	1,850
Florida Complex (50 missiles)		
Total Project Water Use	5,810	730
Eglin AFB Use	2,700	520
Southern Okaloosa County Use	2,060	210
Other Project Water Use	1,050	0
Key Impacts		
Induced Pumpage (Floridan Aquifer)	5,810	730
Southern Okaloosa County-Induced Wastewater Discharge	1,760	180
Nevada Complex		
Indian Springs AFAF (200 missiles)		
Total Project Water Use	15,820	2,470
Indian Springs AFAF Use	4,520	1,310
Las Vegas Use	7,690	1,160
Other Project Water Use	3,610	0
Key Impacts		
Induced Pumpage (Indian Springs Valley)	4,520	1,310
Las Vegas-Induced Wastewater Discharge	4,160	620
% Annual Flow of Las Vegas Wash	0.6%	0.5%
Nellis AFB (200 missiles)		
Total Project Water Use	15,820	2,470
Nellis AFB Use	4,520	1,310
Las Vegas Use	7,690	1,160
Other Project Water Use	3,610	0
Key Impacts		
Induced Pumpage (Las Vegas Valley)	4,520	1,310
Las-Vegas Induced Wastewater Discharge	7,130	1,540
% Annual Flow of Las Vegas Wash	0.9%	1%

Table 4.8.3-1 Continued, Page 2 of 3 .

	Total Construction[1] Period (1990-1996) (acre-ft)	Operations Year[2] (2000) (acre-ft)
New Mexico Complex		
Fort Bliss (200 missiles)		
Total Project Water Use	13,520	2,070
Fort Bliss Use	5,990	1,760
El Paso Use	3,800	310
Other Project Water Use	3,730	0
Key Impacts		
Induced Pumpage (Tularosa Basin)	1,690	0
Induced Pumpage (Hueco Bolson)	10,140	2,070
El Paso-Induced Wastewater Discharge (Including MOB)	5,210	1,120
% Annual Flow of Rio Grande River	2%	2%
Holloman AFB (200 missiles)		
Total Project Water Use	12,990	2,020
Holloman AFB Use	4,520	1,310
Alamogordo Use	4,530	710
Other Project Water Use	3,940	0
Key Impacts		
Induced Pumpage (Tularosa Basin)	10,740	2,020
Induced Pumpage (Hueco Bolson)	350	0
White Sands Missile Range (200 missiles)		
Total Project Water Use	14,230	2,190
White Sands Missile Range Use	6,300	1,850
Las Cruces Use	3,920	340
Other Project Water Use	4,010	0
Key Impacts		
Induced Pumpage (Tularosa Basin)	7,990	1,850
Induced Pumpage (Hueco Bolson)	350	0
Las Cruces-Induced Wastewater Discharge	2,000	170
% Annual Flow of Rio Grande River	0.1%	0.1%
South-Central California Complex		
Fort Irwin NTC (200 missiles)		
Total Project Water Use	13,930	2,160
Fort Irwin NTC Use	5,990	1,760
Barstow Use	4,330	400
Other Project Water Use	3,610	0
Key Impacts		
Induced Pumpage (Bicycle/Langford/Coyote Lake Basins)	6,860	1,760
Induced Pumpage (Middle Mojave Basin)	4,330	400
Edwards AFB (200 missiles)		
Total Project Water Use	13,120	2,110
Edwards AFB Use	4,520	1,310
Lancaster Use	4,190	670
Palmdale Use	800	130
Other Project Water Use	3,610	0
Key Impacts		
Induced Pumpage (Antelope Basin)	5,030	1,310

Table 4.8.3-1 Continued, Page 3 of 3

	Total Construction[1] Period (1990-1996) (acre-ft)	Operations Year[2] (2000) (acre-ft)
Washington Complex (50 missiles)		
Total Project Water Use	5,780	690
Yakima FC Use	2,080	390
Yakima Use	2,770	300
Other Project Water Use	930	0
Key Impacts		
% Available Water Supply (Yakima) (Baseline + Induced Use)	42%	45%
Yakima Induced Wastewater Discharge	1,960	210
% Annual Flow of Yakima River	<0.1%	<0.1%

Notes: [1]Includes both direct project construction water (construction, dust control, and revegetation) and indirect water use resulting from project inmigrants to the region.

[2]Includes indirect water use resulting from operations personnel, their dependents, and other operations-phase inmigrants to the region.

Yuma's entitlement water. Project-induced wastewater discharge from the city of Yuma will peak in 1990 at 690 acre-ft. This represents less than 0.1 percent of the annual flow of the Colorado River and is not likely to have a measurable effect upon its water quality (Table 4.8.3-1). Therefore, the surface water impacts from the proposed project will be generally limited to construction and operations-related impacts from land disturbance in the RMA. However, the infrequent rainfall characteristic of the region, with the attendant low runoff yields, tends to minimize the potential for impacts to water quality resulting from land disturbance. Further, virtually none of the RMA is near any perennial water bodies. Therefore, the incremental water quality degradation in the Gila and Colorado rivers resulting from the proposed project will be minor.

In summary, the proposed project is not likely to use any surface water if Gila Bend AFAF is selected as the MOB. Impacts to surface water quality will result from land disturbance and will be relatively limited. As a result, the short and long-term impacts to surface water will be low and not significant at the regional level. If Yuma PG is selected, utilization by civilian inmigrants of a portion of the entitlement water from the city of Yuma will occur during the construction phase. The peak construction-phase use at Yuma will occur during the first year of construction, but will amount to 3 percent of Yuma's entitlement. Therefore, if the selected MOB is Yuma PG, the short and long-term impacts will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Total project-induced water use for the MOB at Gila Bend AFAF and the town of Gila Bend will amount to 0.5 to 0.8 percent, respectively, of the total groundwater pumpage for the Gila Bend groundwater basin during the construction phase. The town of Gila Bend will have the highest demand for water during the first year of construction with 1,630 acre-ft of project-induced demand. This represents an increase of about 200 percent over baseline. This demand will gradually decline to 430 acre-ft/yr during the operations phase and will increase baseline water use by 43 percent. Operations-phase water requirements at Gila Bend AFAF will be 1,850 acre-ft/yr, increasing long-term baseline use by about 640 percent. Therefore, the proposed project water demands will greatly exceed existing supply, requiring extensive additional groundwater development. The lack of good-quality groundwater in the Gila Bend Basin, combined with the basin's overdrafted condition and generally declining groundwater levels, will cause a substantial impact to the basin.

If Yuma PG is selected as the MOB, the construction-phase demand for water will steadily increase, reaching a peak of 1,850 acre-ft/yr during the operations phase. Project-induced pumpage from the Lower Colorado Basin will increase by 6 percent during the operations phase. While localized groundwater declines may result from the increased demands placed on the Lower Colorado Basin, this basin is not overdrafted and its overall groundwater supplies will not be greatly affected. Because of the low overall pumpage from the basin in the vicinity of Yuma PG and the relatively high local use of diverted Colorado River water, the impact to the groundwater system will be minor.

The greatest demand for construction water in the deployment area will also occur in the first year of construction and will most likely be derived from the local groundwater sources. The basins where the RMAs will be located

include the Lower Colorado Basin, the Lower and Middle Gila River basins, the Yuma Basin, and the Gila Bend Basin. Of the five, only the Middle Gila River and Gila Bend basins are in overdraft. The construction water used in the RMAs will be spread among these groundwater basins and will represent an average annual construction-phase pumpage of 0.1 to 0.3 percent. The impact to groundwater resources in the RMA should generally be minor.

In summary, the project-induced water demand at Gila Bend AFAF and the town of Gila Bend will be supplied by generally poor-quality groundwater from the overdrafted Gila Bend Basin and will require extensive additional groundwater development. This will result in short and long-term, moderate, and significant groundwater impacts. However, project-induced water demands for Yuma PG will be met by adequate groundwater supplies from the lower Colorado Basin and will result in short and long-term impacts that are low and not significant at the regional level.

4.8.3.2 Florida Complex

Short and long-term, moderate, and significant impacts to surface water may result if Eglin Air Force Base (AFB) is selected as the MOB; the impacts will result from the continuing land disturbances which could seriously degrade surface water quality within the RMA. Short-term, low, and significant impacts to groundwater will result at the regional level. Long-term groundwater impacts will be low and not significant.

Summary of Project Water Use. Total project-related water use at Eglin AFB, including construction water needs, is presented in Table 4.8.3-1. Onbase construction-phase water requirements will increase to a peak of 550 acre-ft in 1994 and then decline slightly during the operations phase. Project-induced water use in the southern Okaloosa County area (excluding use at Eglin AFB) will peak in the first year of construction at 500 acre-ft and then decrease steadily in succeeding years to about 210 acre-ft/yr in the operations phase. Total project-induced water use in southern Okaloosa County for the 7-year construction phase will be about 2,060 acre-ft. An additional 120 acre-ft will be used during the construction phase by civilian inmigrants living in other communities throughout the deployment area. The construction-phase water requirements by inmigrants will amount to about 4,690 acre-ft; contributing to a total construction-phase water requirement of 5,810 acre-ft. Operations-phase water use is estimated at 730 acre-ft/yr; 70 percent of this total will be used at Eglin AFB.

Surface Water Hydrology and Quality. About 11 million acre-ft/yr of good-quality surface water flows through the region; however, little use is made of this resource. The cost of establishing a surface water supply in the region is substantially higher than that for groundwater because of the slightly corrosive nature of the surface water. Therefore, it is not likely that large amounts of surface water will be used by the proposed project. However, a portion of the project construction demands, particularly in the RMA, could be met locally by using nearby streams. Increases in the amount of wastewater effluent will result from the project-induced population in the southern Okaloosa County (Fort Walton Beach) area. Effluent discharges to Santa Rosa Sound, which has generally good water quality, will increase by 2 percent during the construction phase as a result of the proposed project. The utilities analysis (Section 4.2) has shown that treatment system expansions

will be adequate to handle these increases. Assuming this, the increased discharge is not likely to result in more than a small decrease in the quality of the receiving water.

Land disturbance within the RMA may result in serious water quality problems during the construction phase. Because of the large amounts of rainfall in the region, there will probably be frequent periods where excessive sedimentation will occur that could degrade the high-quality water of the many local streams in the area, many flowing to Choctawhatchee Bay. Florida regulations define the latter as Class II waters (among the highest quality waters in the state), suitable for shellfish propagation and harvesting. It is possible that frequent exceedance of the stringent state water quality standards for phosphorus and turbidity could occur for this water body. Continued land disturbance due to HML movements during the operations phase in the RMA will further affect surface water quality. Therefore, the overall short and long-term surface water impacts will be moderate. State standards may be violated and a state-designated water use (shellfish harvesting) may be diminished. As a result, the short and long-term impacts will be significant at the regional level.

Groundwater Hydrology and Quality. The great majority of the water used in the MOB and RMA will be derived from groundwater supplies. Project-induced water use at Eglin AFB for the construction phase amounts to 2,700 acre-ft, a 7-percent increase over the baseline. The project-induced demand will have little effect on the water supply system at Eglin AFB. Many wells are located throughout the base and could be used for construction purposes. Construction-phase water use in southern Okaloosa County will amount to about 2 percent of baseline use and will also be derived from groundwater. Although there are abundant groundwater resources in the ROI, major declines in the potentiometric levels of the Floridan Aquifer are occurring in southern Okaloosa County, and they could be accelerated by the proposed project. This could intensify the problem of saltwater intrusion of the aquifer in the coastal area. Total proposed project construction-phase water demands, if derived solely from groundwater, will amount to a 0.3-percent increase in regional groundwater usage. Operations-phase demands will be 0.2 percent over the projected pumpage.

In summary, proposed project water requirements will be most likely derived from groundwater sources. As a result of the serious groundwater decline, which will be aggravated by the construction-phase demands in the coastal area, the short-term impacts of the proposed project will be low and significant at the regional level. Groundwater withdrawals in southern Okaloosa County resulting from project operations will amount to one-third of the peak annual project-induced pumpage during the construction phase. The lesser amount of groundwater used in the coastal area during the operations phase will result in long-term, low, and not significant impacts. There is an independent proposal currently under consideration by the Northwest Florida Water Management District to construct a pipeline to import additional water to the coastal area. If constructed, this would have the effect of lowering the short-term impacts to not significant.

4.8.3.3 Nevada Complex

Some short and long-term, low, and not significant impacts to surface water are expected to occur if either Indian Springs AFAF or Nellis AFB is selected as the MOB. If Indian Springs AFAF is selected, the short and long-term impacts to groundwater are expected to be moderate as a result of substantial groundwater level declines and possible reduction of the flow of an important nearby spring. If Nellis AFB is selected as the MOB, the short and long-term impacts to groundwater will be low. For either selection, these impacts will be significant at the regional level as the most heavily affected groundwater basins are projected to be in overdraft.

Summary of Project Water Use. Total project-related water use at Indian Springs AFAF and Nellis AFB, including construction water needs, is presented in Table 4.8.3-1. The onbase water requirements resulting from the proposed project will increase progressively through the construction phase, peaking during the operations phase at about 1,310 acre-ft/yr. Project-induced water use at the support community of Las Vegas will peak in the first year of construction at 1,400 acre-ft, decreasing to 1,160 acre-ft/yr in the operations phase. The construction-phase water requirement by inmigrants will be 11,960 acre-ft, contributing to a total construction-phase water requirement of 15,820 acre-ft. Water use associated with the operations phase is estimated to be 2,470 acre-ft/yr; 53 percent will be used at the selected MOB.

Surface Water Hydrology and Quality. No viable surface water sources are available to Indian Springs AFAF. A portion of the water used at Nellis AFB is met by the municipal water supply; most of which is diverted from nearby Lake Mead. All or a portion of the MOB construction water use at Nellis AFB may be met from this supply. If the municipal supply is used, the base will have to negotiate a higher contract water supply from the Las Vegas Valley Water District. The project-induced water requirements occurring in Las Vegas will be the same for either MOB: a total of 7,690 acre-ft during the construction phase and 1,160 acre-ft/yr during the operations phase. Peak annual water use will occur during the first year of construction and will be 1,400 acre-ft or 0.6 percent of total city water use. This increase is 20 percent of the baseline increase in city water use during this period and can be easily accommodated. Effluent discharges to Las Vegas Wash will increase from 0.4 to 1 percent over baseline. Adequate sewage treatment capacity exists to handle project-induced flows. The flow in the wash is about 90 percent effluent and the small induced increases in effluent discharge will not materially change its water quality. Land disturbance associated with construction and operations in the RMA should not result in serious water quality problems. Rainfall is infrequent within the ROI. In addition, none of the RMA lies within the watershed of any permanent stream or lake. Therefore, no receiving waters will be affected. The overall short and long-term impacts to surface water will be low and not significant.

Groundwater Hydrology and Quality. The project-induced water needs at Indian Springs AFAF will be met by groundwater. Nellis AFB may elect to supply all or a portion of the proposed project water needs from the local groundwater supply. The highest project-related water demand at either base will occur during the operations phase (1,310 acre-ft/yr). This represents an increased water use of 260 percent for Indian Springs AFAF and 30 percent for Nellis AFB. Groundwater pumpage in Indian Springs Valley is approaching the

natural recharge rate of 500 acre-ft/yr. Location of the MOB at Indian Springs AFAF will result in substantial overdraft of the basin and could affect well-water levels in the town of Indian Springs. Location of the MOB at Nellis AFB will increase pumpage in Las Vegas Valley by about 2 percent; however, baseline pumpage in the valley is already about 150 percent over the recharge rate of 25,000 acre-ft/yr. Both valleys are declared groundwater basins; that is, they are subject to special groundwater regulation, and application to the State Engineer's Office will have to be made to obtain additional groundwater. Local declines in groundwater levels are likely at either MOB. Extensive groundwater development at Indian Springs AFAF could affect other users in the town of Indian Springs and possibly reduce flow from an important nearby spring that supplies the town.

No viable surface water is available in the RMAs (located on Nellis Air Force Range [AFR] and the Nevada Test Site). Groundwater used for construction in the deployment area will result in a small (2%) increase in the amount of water now pumped from the area. Given the limited recharge to the region, local water level declines are likely. However, the impact will be of short duration and should not substantially affect other water users. The points of withdrawal are remote from the major springs toward which the regional groundwater is thought to move. Therefore, the proposed project will have no effect upon the regionally important Ash Meadows Springs. No substantial groundwater effects are anticipated during proposed project operations in the RMAs.

The selection of the MOB at Indian Springs AFAF will place the groundwater basin in substantial overdraft. The substantial relative increase in groundwater pumpage at Indian Springs AFAF will result in short and long-term, moderate groundwater impacts because of likely impacts to other groundwater users who have limited alternative supply options. The overall short and long-term groundwater impacts will be low if Nellis AFB is chosen as the MOB. The use of groundwater at Nellis AFB could boost pumpage in the overdrafted Las Vegas Valley groundwater basin by 2 percent. Groundwater pumped from this basin is an important component in the regional water supply for the metropolitan area of Las Vegas. The regional groundwater impacts for either MOB are likely to be significant.

4.8.3.4 New Mexico Complex

Some short and long-term, low, and not significant surface water impacts are expected to occur if either Fort Bliss or White Sands Missile Range Headquarters is selected as the MOB. If Holloman AFB is selected as the MOB, the short and long-term impacts to surface water are expected to be negligible. Regardless of the MOB selected, impacts to groundwater have the potential to be significant at the regional level: selection of Holloman AFB as the MOB will create both short and long-term, high impacts; selection of White Sands Missile Range Headquarters will create short and long-term, moderate impacts; and selection of Fort Bliss will create short and long-term, low impacts.

Summary of Project Water Use. Total project-related water use at Fort Bliss, Holloman AFB, and White Sands Missile Range Headquarters, including construction water needs, is presented in Table 4.8.3-1. The onbase water requirements resulting from the project will increase progressively through the construction phase, peaking during the operations phase at between 1,310 to 1,850 acre-ft/yr, depending upon the selected MOB. Project-induced water use

at two of the support communities, El Paso and Las Cruces, will peak in the first year of construction at about 1,000 acre-ft and steadily decrease in succeeding years to around 330 acre-ft/yr in the operations phase. A higher proportion of military inmigrants are projected to settle in the support community of Alamogordo, which will experience a project-induced peak in water use of about 800 acre-ft in both the first and last years of construction. During the construction phase, an additional 120 to 400 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. The project-induced water requirements by inmigrants will range from 9,130 to 10,370 acre-ft during the construction phase, contributing to a total construction-phase water requirement of 12,990 to 14,230 acre-ft. Water use associated with proposed project operations is estimated at between 2,000 and 2,200 acre-ft/yr.

Surface Water Hydrology and Quality. The surface water resources of the ROI are fully appropriated and most of the projected construction will be remote from streams or other surface water sources. As a result, it is expected that very little of the water requirements of the proposed project will be derived from surface water. Therefore, the surface water impacts from the proposed project will be largely limited to the increased effluent discharges to the Rio Grande River, should the project be located at Fort Bliss or White Sands Missile Range. If Fort Bliss is selected as the MOB, the peak effluent discharge from the El Paso area will increase by about 1,180 acre-ft/yr or about 2 percent over the current river flow through the area. The utilities analysis (Section 4.2) has shown that adequate treatment capacity will exist through the 1990s. If White Sands Missile Range Headquarters is selected as the MOB, the peak effluent discharge from project-induced population growth in the support community of Las Cruces will increase by about 520 acre-ft/yr, a 0.2-percent increase over the current river flow past the city. The Las Cruces wastewater treatment plants have adequate capacity to handle project-induced flows. In either case, the incremental water quality impacts of project-induced wastewater discharges upon the Rio Grande River should be minimal.

Land disturbance in the RMA should not result in serious water quality problems. Rainfall is infrequent and no substantial perennial streams will be adversely affected by runoff from the RMA. In summary, the proposed project is not likely to use substantial quantities of surface water. The surface water impacts will generally be limited to small changes in the flow and quality of the Rio Grande River, should Fort Bliss or White Sands Missile Range Headquarters be chosen as the MOB, and intermittent water quality degradation in the RMA from land disturbance associated with proposed project construction and operations. The latter will have minimal effects upon perennial streams. Some adverse impacts to surface water in the region may occur if either Fort Bliss or White Sands Missile Range Headquarters is selected as the MOB because of increases in wastewater discharge from their respective support communities to the Rio Grande River. Both short and long-term impacts are expected to be low and not significant at the regional level. If Holloman AFB is selected, the impacts to surface water will be essentially negligible.

Groundwater Hydrology and Quality. Given the shortage of available surface water in the region, the majority of the project-induced water requirements will be satisfied by extractions from the groundwater resources of the ROI. If Fort Bliss is selected as the MOB, groundwater withdrawn from the Tularosa

Basin during the construction phase will be about 1,690 acre-ft or 1 percent of baseline pumpage. No water from this basin will be needed for project operations. The 10,140 acre-ft of construction-phase groundwater that will be drawn from the Hueco Bolson represents less than 1 percent of total groundwater withdrawal from the bolson during the construction phase. The annual operations-phase water requirements (2,070 acre-ft/yr) are of the same magnitude. Although relatively small, these withdrawals will be occurring in a severely overdrafted groundwater basin which is undergoing widespread declines of 1 to 3 feet per year, and an associated gradual decline in groundwater quality. The peak construction-phase water demand on the El Paso water supply will be 0.8 percent, while the operations-phase demand will be about 0.2 percent. These increases are considerably less than the baseline growth rate of the city's water supply and can be readily accommodated. Project-induced demand on the Fort Bliss groundwater supply will increase to 1,760 acre-ft/yr during the operations phase. The operations water demand will be about 25 percent higher than baseline. This will require a substantial enlargement in the base's groundwater supply system. Such an enlargement could overlap a groundwater development program of a similar magnitude that is being considered by the base to replace the existing portion of its water supplied by El Paso. The Tularosa Basin and the New Mexico portions of the Mesilla and Hueco bolsons lie within declared groundwater basins, and new groundwater development in these areas will require groundwater permits from the New Mexico State Engineer.

Siting the MOB at either Holloman AFB or White Sands Missile Range Headquarters will draw water most heavily from the overdrafted Tularosa Basin. Groundwater withdrawal from this basin during the construction phase will be 10,470 or 7,990 acre-ft, which represents an 8 or 6-percent increase, respectively, over baseline. Operations-phase groundwater pumpage resulting from the selection of either of the bases will be 9 to 10 percent over baseline withdrawal in the basin and will be in locations experiencing groundwater declines. Further drawdowns could accelerate the intrusion of highly saline groundwater from the interior of the basin and shorten the useful lives of the existing onbase wellfields. Operations requirements of the proposed project will increase water use at Holloman AFB by over 40 percent and will nearly double the use at White Sands Missile Range. Either base will be forced to greatly accelerate its groundwater development program. Because of its proximity to the relatively untapped groundwater resources of the northern Hueco Bolson, White Sands Missile Range is probably in the more favorable position for the development of additional groundwater supplies. This supply could also be made available to Holloman AFB under a joint, long-range water development plan currently under consideration by both bases (Section 3.8.3.4). However, the City of El Paso is also seeking groundwater rights from the New Mexico State Engineer for the same general area.

Alamogordo's water supply will be most heavily affected if Holloman AFB is selected as the MOB. The project-induced demand at Alamogordo will peak at 17 percent over baseline in 1990. Use during the operations phase will be 13 percent over baseline. To meet this demand and its own baseline growth, Alamogordo will be competing for the same groundwater source as Holloman AFB. If White Sands Missile Range Headquarters is selected as the MOB, induced water demands on its support community of Las Cruces during the peak-construction and operations phases will be 6 and 1 percent, respectively. These relatively small increases can be accommodated with some expansion of

the city's existing wellfield in the Mesilla Bolson. An alternate source of water may be the purchase of Rio Grande water rights for agricultural irrigation, though the legal status of this measure has yet to be determined locally.

In summary, selection of Fort Bliss will place most of the project-induced water demand within the Hueco Bolson that, though overdrafted, can supply substantial additional amounts of groundwater. Only minor, short-duration groundwater pumpage will occur in the Tularosa Basin during the construction phase where groundwater availability is more limited. The short and long-term groundwater impacts will therefore be low. Selection of Holloman AFB as the MOB will result in short and long-term, high groundwater impacts because of greatly increased competition between the MOB and Alamogordo for a limited water supply for which there is no readily available supplement. Selection of White Sands Missile Range Headquarters will result in a generally similar groundwater impact except that increased base pumpage will not affect any other major water users and substantial additional groundwater supplies can be developed nearby. Short and long-term groundwater impacts will therefore be moderate. For either MOB, large amounts of groundwater will be withdrawn from heavily overdrafted basins that have existing or potential declines in groundwater quality. Therefore, all impacts will be significant at the regional level.

4.8.3.5 South-Central California Complex

Some short and long-term, low, and not significant impacts to surface water are expected to occur if either Edwards AFB or Fort Irwin National Training Center (NTC) is selected as the MOB. Significant impacts will occur to groundwater regardless of the base selected because of the existing conditions of groundwater overdraft. The short and long-term groundwater impacts at Edwards AFB will be low, while the short and long-term groundwater impacts at Fort Irwin NTC will be moderate because of the more limited availability of groundwater in the latter case.

Summary of Project Water Use. Total project-related water use at either Edwards AFB or Fort Irwin NTC (including construction water needs) is represented in Table 4.8.3-1. Project-induced water use at the Edwards AFB MOB will increase steadily to 1,320 acre-ft/yr as the proposed project enters the operations phase. Fort Irwin NTC project-related water use also will increase steadily to 1,780 acre-ft/yr over the same period. The difference in the values represents varying per capita water use figures for the two bases and a higher percentage of military immigrants living on Fort Irwin NTC. For Edwards AFB, the principal support communities are the cities of Lancaster and Palmdale. Combined construction-phase water use at the two communities will peak in 1996 at 910 acre-ft, declining to 800 acre-ft/yr in the operations phase. The principal support community for Fort Irwin NTC is the city of Barstow. Peak project-induced use will occur in the first year of construction (1990) at 1,040 acre-ft. Total project-induced water use during the construction phase at Lancaster and Palmdale will be about 4,990 acre-ft, while at Barstow it will be 4,330 acre-ft. Total project-induced use during the construction phase will be 13,120 acre-ft for the Edwards AFB alternative and 13,930 acre-ft for the Fort Irwin NTC alternative. Total water use associated with the operations phase is estimated to be between 2,100 and 2,200 acre-ft/yr for either MOB.

Surface Water Hydrology and Quality. No naturally occurring surface water sources are available to either of the MOBs or their support communities. However, the State Water Project (SWP) imports surface water from northern California into the region. A proposal to extend the SWP to the Twentynine Palms area is under study. No other bases are projected to have access to SWP water; therefore, neither Fort Irwin NTC nor its support community of Barstow will use imported water. The Antelope Valley-East Kern Water Agency, which serves much of the Antelope Valley area, will have an annual entitlement of 138,400 acre-ft/yr during the construction phase. However, construction of the facilities to deliver the complete entitlement to the area is not currently anticipated. Baseline deliveries of imported water to the region are expected to be 36,000 acre-ft during the first year of project construction (1990). These deliveries are expected to rise to 53,000 acre-ft by the year 2000. Lancaster and Palmdale, the support communities for Edwards AFB, are currently using imported water to supplement the existing groundwater supplies. It is probable that any new project-induced water demands at these communities will be served by imported water since increases in baseline water demands are also being met by this source. During the construction and operations phases, project-induced use at the support communities will constitute 2 percent of the projected baseline imported water supply. Adequate supplies of SWP water are available to meet project-induced demand in the support communities of Edwards AFB.

Land disturbance in the RMA should not result in serious water quality problems. Because of the scarcity of rainfall in the region and the general lack of perennial surface water bodies, there is little potential for degradation of surface water quality because of project-related land disturbance. As a result of the readily available imported water to the Edwards AFB support communities and the minor potential for surface water degradation in the RMAs, the short and long-term impacts to surface water attributable to either MOB will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Edwards AFB receives its existing water supply from locally derived groundwater from the overdrafted Antelope Valley Basin and will presumably use this source if selected as the MOB. Project-induced water use at Edwards AFB during the construction phase will increase use by 12 percent over baseline. Operations-phase water use will boost baseline use by 1,310 acre-ft/yr or 23 percent. The base currently experiences water shortages, and substantial additional groundwater development will be needed to avoid intensifying these shortages. This will exacerbate the overdraft conditions in the Antelope Basin, causing further groundwater level declines.

If Fort Irwin NTC is selected as the MOB, the water supply source will be Langford and Bicycle groundwater basins. Because of increasing baseline demands, the base has investigated the use of nearby Coyote Lake Basin as a potential new source of water supply. The project-induced demands will compound the problem of limited water supply available for the base. No imported water source exists for this area of the Mojave Desert. The limited ability of the basins to support the project-induced demand at Fort Irwin NTC of 5,990 acre-ft during the construction phase (a 33% increase over baseline demand) will result in further stress upon existing groundwater supplies. Operations-phase demand will amount to a 59-percent increase over baseline use. The latter demand will increase pumpage in the Bicycle-Langford-Coyote

basins by 44 percent. The support community of Barstow derives its water supply entirely from the overdrafted middle Mojave Basin. Total construction-phase water demand will result in a 6-percent increase over baseline city use, while operations demand will be a 4-percent increase over baseline. The project-induced pumpage from the Middle Mojave Basin will be 4,330 acre-ft during the construction phase. During the operations phase, project-induced requirements will increase baseline pumpage from the Middle Mojave Basin by 1 percent.

In summary, project-induced water demands for the Edwards AFB MOB will probably be met by increased groundwater pumpage. The short and long-term impacts will be low and significant at the regional level because of the increased withdrawal of groundwater from the overdrafted Antelope Basin. A pipeline supplying SWP water runs along the northern boundary of Edwards AFB. The SWP water is potentially available for use at Edwards AFB. If the base were to use imported water to meet project-induced needs, this would lower the short-term groundwater impacts to low and not significant. The long-term impacts would be negligible. The demands at Fort Irwin NTC will be entirely derived from already overtaxed groundwater resources in areas where there is limited potential for additional groundwater development. Fort Irwin NTC and its support community of Barstow are major regional water users. Therefore, the short and long-term impacts will be moderate and significant at the regional level if Fort Irwin NTC is selected as the MOB.

4.8.3.6 Washington Complex

Because of the likelihood of extensive sedimentation in a number of streams, some short and long-term, significant impacts to surface water at the regional level are expected to occur if Yakima Firing Center (FC) is selected as the MOB. The short-term impact will be low and the long-term impact will be moderate. Both the short and long-term impacts to groundwater are expected to be low and not significant at the regional level.

Summary of Project Water Use. Total project-related water use at the MOB, including construction water needs, is presented in Table 4.8.3-1. The water requirements resulting from the proposed project at Yakima FC will increase progressively through the construction phase, peaking during the operations phase at 390 acre-ft/yr. Project-induced water use at the support community of Yakima will peak in the first year of construction at 640 acre-ft/yr, decreasing in succeeding years to around 300 acre-ft/yr in the operations phase. The water requirements by inmigrants will be 4,660 acre-ft, contributing to a total water requirement of 5,780 acre-ft during the construction phase. Water use associated with proposed project operations is estimated to be 690 acre-ft/yr; 57 percent will be used at the MOB.

Surface Water Hydrology and Quality. The city of Yakima receives its water supply from several nearby streams, including the Naches River. The peak, project-induced water demand will occur in 1990 and will raise baseline water use by 5 percent. This is about three times the baseline rate of increase for the city but will decline in succeeding years and will pose no special water supply problems. The city has water rights to over 30,000 acre-ft/yr. The baseline plus project-related demands will be only about 45 percent of the city's water rights in the year 2000. Therefore, adequate water supplies are available to the city to meet project-related needs. The city discharges

treated effluent to the Yakima River. The proposed project will induce a 2-percent increase in effluent discharge in the peak year and less than 1 percent during proposed project operations. The utilities analysis (Section 4.2) has shown that the wastewater treatment system has adequate capacity to treat project-induced increases in sewage flows. The project-induced effluent represents less than 0.1 percent of the annual flow of the Yakima River and should not measurably degrade downstream water quality.

Construction in the RMA will disturb approximately 1.7 sq mi of land in areas immediately adjacent to a 50-mile stretch of the Columbia River and a 15-mile stretch of the Yakima River. Project operations will disturb an additional 1 sq mi of land each year within the same areas. Much of the RMA also contains highly erodible soils, which may contribute large quantities of silt when disturbed. It is likely that water quality standards for turbidity will be exceeded at least occasionally over the life of the proposed project, affecting the only free-flowing stretch of the Columbia River in the United States. Therefore, the overall regional-level, short and long-term surface water impacts will be significant. The short-term impact will be low and the long-term impact will be moderate because of substantial land disturbance during project operations.

Groundwater Hydrology and Quality. Yakima FC obtains its supply from groundwater and is assumed to continue this practice to meet proposed project requirements. Water use at the MOB will increase by about 135 percent during the construction phase and will be even higher during the operations phase. This will require a substantial increase in groundwater development at the base and groundwater levels may be lowered. Since the majority of water use near the base is agricultural irrigation supplied by surface water, no major offbase groundwater users are likely to be affected. Groundwater use for construction in the deployment area will be of a regionally low magnitude and will not substantially affect existing users. Groundwater levels in the central portion of the Department of Energy (DOE) Hanford Site have been rising and groundwater is generally readily available there, though there is a continuing concern over the quality of the groundwater because of industrial waste disposal and the storage of nuclear wastes. The overall short and long-term impacts to groundwater will be low. No special groundwater management areas will be affected. Since there is no regional groundwater overdraft occurring in the ROI, the groundwater impacts will not be significant.

4.8.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.8.4.1 Ellsworth Air Force Base

Some short-term, moderate impacts to surface water are expected to occur if Ellsworth AFB is selected as the MOB as a result of sediment transport and project-induced wastewater discharges. The long-term impacts to surface water and the short and long-term impacts to groundwater will be low. None of these impacts is expected to be significant at the regional level.

Summary of Project Water Use. Total project-related water use at Ellsworth AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements resulting from the proposed project will increase to a peak of 680 acre-ft in the last year of construction (1996), declining slightly during the operations phase. Project-induced water use for Rapid

Table 4.8.4-1

SUMMARY OF TOTAL WATER USE AND IMPACTS FOR THE HARD MOBILE LAUNCHER AT MINUTEMAN FACILITIES ALTERNATIVES

	Total[1] Construction Phase (1990-1996) (acre-ft)	Operations[2] Year (2000) (acre-ft)
Ellsworth AFB (170 missiles)		
Total Project Water Use	6,100	1,160
Ellsworth AFB Use	2,070	670
Rapid City Use	3,440	490
Other Project Water Use	590	0
Key Impacts		
% Supply Available to Rapid City (Baseline + Induced Use)	45%	49%
Ellsworth AFB-Induced Wastewater Discharge	1,090	390
% Annual Flow of Boxelder Creek	1%	4%
Rapid City-Induced Wastewater Discharge	2,040	290
% Annual Flow of Rapid Creek	1%	1%
F.E. Warren AFB (200 missiles)		
Total Project Water Use	8,270	1,760
F.E. Warren AFB Use	3,100	1,090
Cheyenne Use (Including MOB)	4,030	670
Other Project Water Use	1,140	0
Key Impacts		
% Supply Available to Cheyenne (Baseline + Induced Use)	78%	91%
Cheyenne-Induced Wastewater Discharge (Including MOB)	5,560	1,360
Grand Forks AFB (170 missiles)		
Total Project Water Use	6,440	1,380
Grand Forks AFB Use	3,640	1,220
Grand Forks Area Use	2,290	160
Other Project Water Use	510	0
Key Impacts		
% Available Supply to Grand Forks (Baseline + Induced Use)	24%	28%
Grand Forks AFB-Induced Wastewater Discharge	2,490	880
% Annual Flow of Turtle River	1%	2%
Grand Forks Area-Induced Wastewater Discharge	1,900	140
% Annual Flow of Red River	<0.1%	<0.1%

	Total[1] Construction Phase (1990-1996) (acre-ft)	Operations[2] Year (2000) (acre-ft)
Malmstrom AFB (200 missiles)		
Total Project Water Use	5,910	1,120
Malmstrom AFB Use	2,650	920
Great Falls Use	2,380	200
Other Project Water Use	880	0
Key Impacts		
% Available Flow of Missouri River (Baseline + Induced Use)	22%	24%
Great Falls-Induced Wastewater Discharge (Including MOB)	3,860	850
% Annual Flow of Missouri River	<0.1%	<0.1%
Minot AFB (170 missiles)		
Total Project Water Use	4,710	890
Minot AFB Use	1,660	530
Minot City Use	2,490	360
Other Project Water Use	560	0
Key Impacts		
Total-Induced Pumpage (Sundre and Minot Aquifers)	2,900	620
Minot AFB and Minot City Induced Wastewater Discharge	3,480	770
% Annual Flow of Souris River	0.4%	0.5%
Whiteman AFB (170 missiles)		
Total Project Water Use	4,040	800
Whiteman AFB Use	1,660	530
Sedalia Use	290	20
Warrensburg Use	1,500	250
Other Project Water Use	590	0
Key Impacts		
Total-Induced Pumpage	4,040	880
Whiteman AFB and Warrensburg-Induced Wastewater Discharge to Blackwater River System	2,670	700
Sedalia-Induced Wastewater Discharge to Lamine River System	270	20

Notes: [1]Includes both direct project construction water (construction, dust control, and revegetation) and indirect water use resulting from project inmigrants to the region.
[2]Includes indirect water use resulting from operations personnel, their dependents, and other operations-phase inmigrants to the region.

City, including use by the MOB, will also peak in 1996 at 1,250 acre-ft. An additional 140 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. The project-induced water requirements by inmigrants will amount to about 5,500 acre-ft, contributing to a total water requirement of 6,100 acre-ft during the construction phase. Water use associated with proposed project operations is estimated at 1,160 acre-ft/yr; 58 percent will be used at Ellsworth AFB.

Surface Water Hydrology and Quality. Rapid City, which supplies water to Ellsworth AFB, uses Rapid Creek as the source of 25 percent of its water supply and obtains the remaining 75 percent from groundwater sources. It was assumed that this split will continue over the projected period. Surface water diversions to meet project-induced water demand in the city will average 200 acre-ft/yr during the construction phase and 300 acre-ft/yr during the operations phase. The maximum annual baseline plus project-induced surface water use by the city will amount to 3,370 acre-ft/yr in the year 2000. The amount of surface water available to the city through the Bureau of Reclamation is 12,200 acre-ft/yr. Therefore, the proposed project water requirements are not expected to seriously affect the city's surface water supply. Rapid City discharges treated wastewater effluent to Rapid Creek. This discharge, plus those from livestock operations, considerably degrades the water quality of the creek. The proposed project will induce a maximum annual increase of 6 percent (or 440 acre-ft) over the baseline effluent discharge to the river, which may intensify this problem. Ellsworth AFB has its own wastewater treatment plant that discharges to Boxelder Creek. The proposed project will induce a maximum annual increase of 43 percent (or 390 acre-ft). Both creeks experience some water quality problems and the increases in effluent discharges may result in moderate declines in downstream water quality over that experienced under baseline conditions.

Part of the deployment-area construction water requirements may be supplied from surface sources. Construction water needs may be partially supplied by the Cheyenne River and by undependable streams, such as the Moreau and Bad rivers, which occasionally run dry. The flows of all of these streams are erratic; diverting water from them may require the purchase or lease of water rights from irrigators. A potential water quality problem may result from land disturbance associated with construction in the deployment area. Soil erosion and sediment transport, and resulting water quality degradation, will be most noticeable in the Bad and Moreau River basins because of poor cropland management and the erosive nature of the soil. A total of 0.2 sq mi of land will be disturbed within these watersheds during the construction phase. Minimal additional disturbance will occur in the operations phase. Therefore, this impact is expected to be of short duration, and recovery will occur within a few years of disturbance.

In summary, the surface water impacts will generally be limited to small changes in the flow of Rapid Creek, possible moderate declines in the quality of Rapid and Boxelder creeks, and localized water quality degradation in the deployment area because of land disturbance associated with construction. Therefore, the short-term impact to surface water will be moderate. The long-term impact to surface water will be low. No major existing water users will be affected and these impacts will not be significant at the regional level.

Groundwater Hydrology and Quality. Most of the water requirements of the proposed project will be derived from groundwater resources. The Minnelusa-Madison and Inyan Kara aquifers supply 75 percent of the water used by Rapid City, and it is assumed that they will supply the same percentage of the project-induced water use at Rapid City and Ellsworth AFB. The proposed project will induce a maximum annual increase of 11 percent over the baseline pumpage of the aquifer in the vicinity of Rapid City. The maximum project-induced water use also represents an increase of 11 percent over the total baseline water use of Rapid City. The maximum annual groundwater use by the city during the projected period, including proposed project water, will amount to 10,100 acre-ft/yr in the year 2000. Since the total amount of groundwater available to Rapid City amounts to 15,000 acre-ft/yr, the proposed project water demands are not expected to seriously affect the city's groundwater supply.

The baseline plus project water requirements for Ellsworth AFB will reach a peak of 2,130 acre-ft/yr in 1996. This represents an increase of 46 percent over the baseline water use of the base. The maximum contract delivery of Rapid City to Ellsworth AFB is 1,810 acre-ft. Prior to connection to the Rapid City Water Department, the base obtained its water supply from wells having a total pumping capacity of 1,500 acre-ft/yr. These wells could be repaired and placed in operation to supplement the water supply. Alternatively, a new pipeline from the city's water department could be built and a new water contract with the city negotiated in order to meet the project-induced water demand.

The majority of the construction water needs for the deployment area are likely to be supplied by groundwater sources. The amount of deployment-area construction water derived from groundwater resources will be, at most, about 450 acre-ft over the 7-year construction period. This represents an increase of 0.1 percent over the baseline groundwater use in the ROI. Since the deployment area is not forecast to experience any substantial groundwater overdraft, groundwater impacts will be minimal. The overall short and long-term impacts to the groundwater resources will be low. These impacts will not be significant at the regional level.

4.8.4.2 F.E. Warren Air Force Base

Some short and long-term, low impacts to surface water are expected to occur if F.E. Warren AFB is selected as the MOB. The short-term impact to groundwater will be low and the long-term impact will be negligible. None of these regional-level impacts is expected to be significant.

Summary of Project Water Use. Total project-related water use at F.E. Warren AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements as a result of the proposed project will increase to a peak of 1,100 acre-ft in the last year of construction (1996), declining slightly during the operations phase. Project-induced water use for Cheyenne will also peak in the last year of construction at 1,860 acre-ft. During the construction phase, an additional 300 acre-ft will be used by civilian immigrants living in other communities throughout the deployment area. The project-induced water requirements by immigrants will amount to about 7,270 acre-ft, contributing to a total water requirement of 8,270 acre-ft

during the construction phase. Water use associated with operation of the proposed project is estimated at 1,760 acre-ft/yr; 62 percent will be used at F.E. Warren AFB.

Surface Water Hydrology and Quality. F.E. Warren AFB is supplied water by the City of Cheyenne, which derives most of its water supply from surface sources. Project-induced water use at the MOB will rise steadily during the construction phase because of the influx of operations personnel. Water use at the base will almost double over baseline use during the operations phase of the proposed project. Total project-induced use of the Cheyenne water supply will peak in 1996 at 10 percent over baseline, boosting total city water demand in that year to 20,560 acre-ft. Project-induced demand will decline slightly to 9 percent over baseline during the operations phase. The rate of increase in water demand during the early construction phase will be two to three times that being experienced and might require substantial adjustments on the part of the city water utility to accommodate the increase. The City of Cheyenne has initiated a major expansion of its imported water system: the Cheyenne Water Project-Stage II. When fully constructed (by 1989), Cheyenne will have an available water supply of 24,000 acre-ft/yr. Baseline plus project-induced water use in the year 2000 will be 21,760 acre-ft, considerably less than the available supply.

Effluent discharge to Crow Creek will increase by a maximum of 12 percent as a result of the proposed project. Since the great majority of the flow of Crow Creek downstream of Cheyenne is currently treated effluent, this additional discharge will not materially affect downstream water quality, assuming adequate treatment capacity. Surface water in the deployment area is fully appropriated and will probably not be used extensively for proposed project construction. Minor water quality impacts will result from the land disturbance that will result from proposed project construction in the deployment area. Since there are few streams, these impacts will be largely localized and should be minor on a regional scale. No other surface water impacts are anticipated. The overall short and long-term impacts will be low to surface water. These regional-level impacts will not be significant.

Groundwater Hydrology and Quality. The City of Cheyenne supplies about 20 percent of its water use with groundwater from wells located to the west of the city. Groundwater levels in its wellfields have historically declined, though they have generally stabilized in recent years as a result of careful management. Additional groundwater development in support of the proposed project will probably result in moderate, local groundwater declines but is not expected to greatly affect existing groundwater users. It is likely that most of the deployment-area construction water will be obtained from groundwater. Much of the deployment area lies within two groundwater control areas and new appropriation requests are carefully reviewed by the State Engineer. Moderate groundwater declines are occurring throughout much of this area. Although the proposed project could aggravate this situation, project water requirements are relatively small (830 acre-ft) and will boost pumpage in the ROI by only 0.1 percent during the construction phase. Therefore, overall short-term groundwater impacts will be low and long-term impacts will be negligible. The impacts will not be significant at the regional level.

4.8.4.3 Grand Forks Air Force Base

Some short and long-term, low impacts to surface water are expected to occur if Grand Forks AFB is selected as the MOB. The short-term impacts to groundwater will be low and long-term impacts will be negligible. None of these regional-level impacts is expected to be significant.

Summary of Project Water Use. Total project-related water use at Grand Forks AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements resulting from the proposed project will increase to a peak of 1,250 acre-ft in 1996, declining slightly during the operations phase. Project-induced water use in the Grand Forks metropolitan area, including use by the MOB, will also peak in the last year of construction (1996) at 1,480 acre-ft. During the construction phase, an additional 60 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. The construction-phase water requirements by inmigrants will amount to about 5,480 acre-ft, contributing to a total water requirement of 6,400 acre-ft during this period. Water use associated with operations of the proposed project is estimated at 1,380 acre-ft/yr; 88 percent will be used at Grand Forks AFB.

Surface Water Hydrology and Quality. Most of the water requirements of the proposed project will be derived from surface water sources. The City of Grand Forks, which supplies water to Grand Forks AFB, has an ample supply of satisfactory-quality water and a dependable stream for waste assimilation in the Red River of the North. Grand Forks also obtains water from the Red Lake River, a tributary from Minnesota, to supplement its water supply. East Grand Forks, located directly across from the Red River in Minnesota, obtains all of its water from the Red Lake River. These rivers, which are the only water sources used by the Grand Forks metropolitan area, will supply most of the project-induced water use, including all of the MOB project-related water requirements. The proposed project will double the baseline water use at Grand Forks AFB. The total water requirements for Grand Forks AFB, including proposed project water use, will reach a peak of 2,500 acre-ft in 1996. Since the maximum contract delivery of Grand Forks to Grand Forks AFB is 2,900 acre-ft/yr, the contract delivery amount will not have to be increased. However, the existing water supply system may need to be upgraded in order to avoid water shortages onbase during periods of peak use. The maximum annual baseline plus project-induced water use by the Grand Forks area, including use by the MOB, will amount to 12,130 acre-ft in the year 2000. Grand Forks holds surface water rights amounting to 44,100 acre-ft/yr. Therefore, the proposed project water withdrawals will be easily met by the available surface water sources and the city's surface water supply will not be seriously affected.

The Grand Forks metropolitan area discharges treated wastewater effluent to the Red River. The proposed project will induce a maximum annual increase of 8 percent (or 550 acre-ft) over the baseline effluent discharge to the river. This increase represents less than 0.1 percent of the annual flow of the river. The utilities analysis (Section 4.2.4.3) has shown that adequate treatment capacity exists to handle project-induced increases. Therefore, the project-induced wastewater discharge should result in no more than a minor decline in receiving downstream water quality over that experienced during the baseline period. Grand Forks AFB discharges treated wastewater effluent to the Turtle River, a tributary to the Red River. Project-induced effluent

represents a maximum annual increase of 103 percent (or 890 acre-ft/yr) over the baseline conditions. This increase represents 2 percent of the annual flow of the river. In addition, the river is classified as suitable for municipal use. Therefore, the project-induced effluent is likely to result in a moderate decline in the quality of the river.

The 450 acre-ft of water required for construction in the deployment area represents a very small portion of the available regional surface water resources. Much of the construction-phase water requirements for the southern half of the deployment area are likely to be supplied by the Sheyenne River, which is the main tributary to the Red River. Water withdrawn from the river will be at most about 250 acre-ft. This represents a negligible effect on the flow of the river accounting for less than 0.1 percent of its average flow. In the northern half of the deployment area, construction water may be supplied by the upper reaches of smaller tributaries to the Red River, such as the Pembina, Park, and Forest rivers. Most of these streams are erratic and occasionally run dry. Deriving construction-phase water from these streams may require the purchase or lease of water rights from irrigators. Water quality in the deployment area is likely to be affected by land disturbance during the construction phase. Given the relative scarcity of perennial streams in the deployment area and the diffuse nature of the construction activities over a large area, water quality degradation will be largely localized and should have a minor regional effect.

In summary, the surface water impacts will generally be limited to small changes in the flow and quality of the Red River, short-duration water quality degradation in the deployment area from land disturbance associated with construction, and possibly long-term, moderate declines in the quality of the Turtle River. Since the Turtle River is a relatively minor stream in the ROI, the overall regional impact to surface water will be low. No major existing water users will be affected. Therefore, the short and long-term surface water impacts will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Groundwater can be considered an abundant resource in the ROI, though much of it is highly mineralized and of marginal quality for most users. Given the presence of an adequate source of surface water in the vicinity of Grand Forks, groundwater sources are likely to be used only for a portion of the deployment-area construction-phase water requirements when no dependable surface water sources are available. Groundwater use will be at most about 450 acre-ft. This represents an increase of 0.1 percent over the baseline groundwater use of the ROI. Since the ROI is not expected to experience any substantial groundwater overdraft, the proposed project short-term impacts to groundwater resources will be low and long-term impacts will be negligible. These impacts will not be significant at the regional level.

4.8.4.4 Malmstrom Air Force Base

Some short and long-term, low impacts to surface water are expected to occur if Malmstrom AFB is selected as the MOB. The short-term impact to groundwater will be low and the long-term impact will be negligible. None of these impacts is expected to be significant at the regional level.

Summary of Project Water Use. Total project-related water use at Malmstrom AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements resulting from the proposed project will increase to a peak of 930 acre-ft in the last year of construction (1996), declining slightly during the operations phase. This is a result of the large number of military personnel that will be required for proposed project operations. Project-induced water use at the major support community of Great Falls, including use by the MOB, will also peak in the last year of construction at 1,210 acre-ft. An additional 40 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area during the construction phase. Water requirements by inmigrants will amount to about 4,910 acre-ft, contributing to a total water requirement of 5,910 acre-ft during the construction phase. Water use associated with the operations phase is estimated at 1,120 acre-ft/yr; 82 percent will be used at Malmstrom AFB.

Surface Water Hydrology and Quality. Most of the water requirements of the proposed project will be derived from surface water sources. The City of Great Falls, which supplies water to Malmstrom AFB, has an ample supply of good-quality water and a dependable stream for waste assimilation in the Missouri River. The river, which is the only water source used by Great Falls, will supply most of the project-induced water use and all of Malmstrom AFB project-related water requirements. The maximum annual project-induced water use represents increases of 74 and 8 percent over the baseline water uses of Malmstrom AFB and Great Falls, respectively. The total water requirement for Malmstrom AFB, including proposed project water use, will reach a peak of 2,210 acre-ft/yr during the operations phase. Since the maximum contract delivery of Great Falls to Malmstrom AFB is 2,100 acre-ft/yr, the contract water amount will have to be increased. The existing water supply system connecting the city to the base is being upgraded by the city in order to overcome water shortages at the base during periods of peak use. The maximum annual baseline plus project-induced water use at Great Falls, including use by the MOB, will amount to 17,760 acre-ft in the year 2000. Great Falls holds surface water rights amounting to 73,120 acre-ft/yr. Therefore, adequate water is available to the city to meet project-induced needs. Great Falls and Malmstrom AFB (via the Great Falls system) discharge treated wastewater effluent to the Missouri River. The proposed project will induce a maximum annual increase of 7 percent (or 930 acre-ft) over the baseline effluent discharge to the river. This increase represents only 0.2 percent of the annual flow of the river. The utilities analysis (Section 4.2) has indicated that adequate wastewater treatment capacity exists to handle project-related flows. Therefore, it is not likely that the project-induced wastewater discharge will result in more than a minor decline in downstream water quality over that experienced under baseline conditions.

The 840 acre-ft of water required by the deployment area represents a very small portion of the available regional surface water resources. However, some of the deployment-area construction-phase water may be supplied by undependable streams, such as the Teton River which is overly appropriated and occasionally runs dry. Other streams that are occasionally depleted are the Sun and Musselshell rivers. Deriving construction-phase water from these three rivers to supplement the deployment-area construction requirements may require the purchase or lease of water rights from irrigators. A potential water quality impact will result from land disturbance associated with construction at Malmstrom AFB and in the deployment area. The segment of the Missouri

River that is classified as Wild and Scenic lies no closer than 6 miles from the deployment area; therefore, it will not be affected by construction activities. Soil erosion and sediment transport will be most critical in the Muddy Creek and the lower end of the Sun River, which currently receives 200,000 tons per year of sediment. A total of 0.3 sq mi of the land will be disturbed within these watersheds during the construction phase. Because of the relatively low rainfall in the region, degradation of water quality as a result of land disturbance and associated sediment transport will be minor. In addition, soil disturbance will be a short-term impact and recovery will occur within a few years of disturbance.

In summary, the surface water impacts will generally be limited to small changes in the flow and quality of the Missouri River, and short-term localized water quality degradation in the deployment area as a result of land disturbance associated with construction. No major existing water users will be affected. Therefore, the short and long-term surface water impacts will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Groundwater can be considered an abundant resource in the ROI, though much of it is highly mineralized and at considerable depth. Because of the relative abundance of good-quality surface waters in the vicinity of Malmstrom AFB, groundwater sources are likely to be used only for a portion of the deployment-area construction water requirements where no dependable surface water sources are available. Groundwater use will likely be, at most, about 840 acre-ft spread across the deployment area. This represents a 4-percent increase over the baseline groundwater use of the ROI. Since the ROI is not anticipated to experience any substantial groundwater overdraft problems, short-term impacts to groundwater resources will be low, and long-term impacts will be negligible. These regional-level impacts are not expected to be significant.

4.8.4.5 Minot Air Force Base

Some short and long-term, low impacts to surface water are expected to occur if Minot AFB is selected as the MOB. The short and long-term impacts to groundwater will also be low. None of these regional-level impacts is expected to be significant.

Summary of Project Water Use. Total project-related water use at Minot AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements resulting from the proposed project will increase to a peak of 540 acre-ft in the last year of construction, declining slightly during the operations phase (represented by the year 2000). Total project-induced water use for Minot, including use by the MOB, will also peak in the last year of construction at 960 acre-ft. An additional 110 acre-ft will be used by civilian immigrants living in other communities throughout the deployment area. The construction-phase water requirements by immigrants will amount to about 4,110 acre-ft, contributing to a total water requirement of 4,710 acre-ft during the construction phase. Water use associated with the operations phase is estimated at 890 acre-ft/yr; 60 percent will be used at Minot AFB.

Surface Water Hydrology and Quality. Approximately one-third of the water requirements of the proposed project will be derived from surface water sources. The City of Minot, which supplies water to Minot AFB, uses the

Souris River as the source of 30 percent of its water supply and obtains the remaining 70 percent from the Sundre and the Minot groundwater aquifers. It was assumed that this split will continue over the projected period. The maximum annual baseline plus project-induced surface water withdrawal by the City of Minot, including use by the MOB, will amount to 2,490 acre-ft in the year 2000. This diversion represents only 2 percent of the annual flow of the Souris River and is therefore not expected to seriously affect the city's surface water supply. The City of Minot discharges treated wastewater effluent to the Souris River. The proposed project will induce a maximum annual increase of 12 percent (or 500 acre-ft) over the baseline effluent discharge to the river. This increase represents only 0.4 percent of the annual flow of the river. The utilities analysis (Section 4.2) has shown that sufficient wastewater treatment capacity exists to handle project-induced increases. Therefore, the project-induced wastewater discharge is not likely to result in more than a minor decline in downstream water quality over that experienced under baseline conditions. Minot AFB discharges treated wastewater effluent to Egg Creek, a tributary to the Souris River. Since most of the flow of the creek is composed of wastewater effluent, the project-induced discharge is not likely to seriously affect the existing quality of the creek.

The 450 acre-ft of water required for deployment-area construction represents a small fraction of the available regional surface water resources. Much of the construction-phase water requirements for the southern part of the deployment area may be supplied by Lake Sakakawea, the largest reservoir on the Missouri River. Water withdrawals from the lake will be at most about 250 acre-ft over the 7-year construction phase. This represents a negligible portion of the amount of water stored at the lake (29.6 million acre-ft). The remainder of the deployment-area construction water needs may be partially supplied by the Souris and Des Lacs rivers, and by impoundments on these rivers such as Lake Darling and the Des Lacs Lake, respectively. The flows of these streams are erratic and diverting construction water from them may require the purchase or lease of water rights from irrigators. Water quality in the deployment area is likely to be affected by land disturbance during the construction phase. Because of the relative scarcity of perennial streams in the deployment area and the diffuse nature of the construction activities over a large area, water quality degradation will be largely localized and should have a minor regional effect.

In summary, the surface water impacts will generally be limited to small changes in the flow and quality of the Souris River and short-duration water quality degradation in the deployment area from land disturbance associated with construction. No major existing water users are likely to be affected. Therefore, the short and long-term surface water impacts will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Most of the water requirements of the proposed project will likely be derived from groundwater resources. The Sundre and the Minot aquifers supply 70 percent of the water used by Minot, and it was assumed that they will supply the same percentage of the project-induced water use at Minot and Minot AFB. Project-related withdrawals represent a maximum annual increase of 13 percent over the baseline use of the aquifers in the vicinity of Minot. However, since no long-term groundwater level declines have been reported in recent years, this increase in withdrawal is not expected to seriously affect the city's available groundwater supply.

The proposed project will result in a 34-percent increase over the baseline water use at Minot AFB. The total water requirements for Minot AFB, including proposed project water use, will reach a peak of 2,140 acre-ft in 1996. The maximum contract water delivery of Minot to Minot AFB is 2,800 acre-ft.

The amount of deployment-area construction water derived from groundwater resources will be, at most, about 450 acre-ft. This represents an increase of 0.3 percent over the baseline groundwater use in the ROI. Since the deployment area is not expected to experience any substantial groundwater overdraft, groundwater impacts will be minimal. The overall short and long-term impacts to groundwater resources will be low. These impacts will not be significant at the regional level. Minot AFB currently experiences water shortages during peak use periods. If Minot AFB is selected as the MOB, expansion of the water delivery system to the base and probable renegotiation of the contract water deliveries by the City of Minot will be necessary to avoid greatly intensifying these shortages.

4.8.4.6 Whiteman Air Force Base

If Whiteman AFB is selected as the MOB, short-term, moderate, significant, regional-level impacts to surface water will occur as a result of construction-induced water quality degradation in the numerous streams in the missile deployment area. Regional, long-term, low, and not significant impacts will occur. Short and long-term groundwater impacts will be low and are not expected to be significant at the regional level.

Summary of Project Water Use. Total project-related water use at Whiteman AFB, including construction water needs, is presented in Table 4.8.4-1. The onbase water requirements induced by the proposed project will increase to a peak of 540 acre-ft in the last year of construction, declining slightly during the operations phase. Induced water use by the cities of Sedalia and Warrensburg will peak in the first year of construction at 80 and 280 acre-ft, respectively, and generally decrease in succeeding years. Project-induced water use at Warrensburg and Sedalia for the construction phase will have a combined total of about 790 acre-ft. An additional 140 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. The project-induced water requirements by inmigrants will amount to about 3,440 acre-ft, contributing to a total water requirement of 4,040 acre-ft during the construction phase. Water use associated with the operations phase is estimated at 800 acre-ft/yr; 66 percent will be used by Whiteman AFB.

Surface Water Hydrology and Quality. Because of the construction costs of reservoirs and the unpredictability of sufficient surface flows, surface water is not expected to supply a substantial portion of the project-induced water needs of the proposed project. However, obtaining surface water from local systems in some instances may be feasible when water is available.

Total project-induced discharge of wastewater effluent from Whiteman AFB and Warrensburg to the Blackwater River system during the construction phase will be about 2,670 acre-ft, while project-induced operations-phase wastewater discharge will amount to 700 acre-ft/yr. Wastewater effluent discharge to the Lamine system from Sedalia will amount to about 270 acre-ft during the construction phase, while project-induced operations-phase wastewater discharge will amount to 20 acre-ft/yr. No serious effects to the water quality of

either river system are expected to occur. This is because, under baseline conditions, the water quality of both rivers is in compliance with applicable standards, even though a substantial part of their flow is currently made up of treated wastewater effluent.

Past channelization of streams in the region has resulted in continuing water quality problems and may be slightly aggravated by proposed project land disturbance. Continuing regional efforts to control preexisting stream sedimentation and erosion problems are underway. These activities may help to reduce construction-induced degradation of surface water quality. Nevertheless, the relatively high density of perennial streams within the deployment area and the abundance of rainfall in the ROI suggest a likelihood for extensive, short-term water-quality degradation during the construction phase. Short-term, moderate, and significant impacts at the regional level will occur primarily as a result of construction-induced water quality degradation and increases in wastewater discharges. Long-term, low, and not significant impacts at the regional level are expected to occur.

Groundwater Hydrology and Quality. The majority of the water requirements of the proposed project will be derived from abundant and readily available groundwater resources. Whiteman AFB and Warrensburg both obtain their water supplies from deep, regional aquifers. Whiteman AFB will sustain a 30-percent increase in water use during the construction phase. Operations-phase water use in the year 2000 will boost the baseline demands by 66 percent. Total construction-phase water demands for Warrensburg will be 1,500 acre-ft, which represent an 11-percent increase over baseline use. The highest use will occur in the first year of construction (1990) with 280 acre-ft of project-induced demand. Project-induced water use during the operations phase will be 220 acre-ft/yr, a 12-percent increase. The encroachment of poor quality groundwater from the north and west as a result of local pumpage has occurred, but the magnitude of this groundwater movement is small and of a very localized nature and will not be substantially accelerated by the proposed project. The City of Sedalia currently obtains approximately 75 percent of its water supply from a reservoir on a tributary of the Lamine River. The amount of available surface water to support additional population growth is small. The small, additional increase in water use at Sedalia during the construction phase will likely be supplied from groundwater. Total project-induced water use at Sedalia during the construction phase will be 290 acre-ft, with the peak demand occurring during the first year of construction (1990). Operations-induced water use will be 20 acre-ft/yr or 0.6 percent over the projected use. There will be adequate supplies of good-quality groundwater available for proposed project use.

In the deployment area, 450 acre-ft of construction water will be needed, which will be derived from groundwater sources. This represents less than a 0.1-percent increase over the baseline regional pumpage. The deployment area is not forecast to experience any substantial groundwater overdraft; therefore, the overall short and long-term impacts to groundwater resources will be low. The regional-level impact will not be significant.

4.8.5 Impacts of Hard Silo in Patterned Array

4.8.5.1 Davis-Monthan Air Force Base

The short and long-term impacts to surface water will be low and not significant if Davis-Monthan AFB is selected as the MOB. The overall short and long-term impacts to groundwater are also expected to be low. However, due to the severe overdraft condition of the groundwater basins, the groundwater impacts will probably be significant.

Summary of Project Water Use. Total project-related water use at Davis-Monthan AFB, including construction water needs, is presented in Table 4.8.5-1. The onbase water requirements induced by the proposed project will increase to 500 acre-ft in the last year of construction. Onbase water use during the operations phase will also be 500 acre-ft/yr. Project-induced water use for Tucson will peak in 1994 at 1,150 acre-ft and steadily decrease in succeeding years to 260 acre-ft/yr in the operations phase. An additional 300 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. The induced water requirements by inmigrants will amount to about 9,020 acre-ft, contributing to a total water requirement of 10,100 acre-ft during the 7-year construction phase. Water use associated with the operations phase is estimated at 760 acre-ft/yr; 66 percent will be used at Davis-Monthan AFB.

Surface Water Hydrology and Quality. No substantial amount of surface water is available for appropriation within the ROI. However, large amounts of imported water from the Colorado River will become available to the Tucson area after 1991 as a result of the completion of the Central Arizona Project. It is assumed that project-induced water use at Tucson will be satisfied from this source. Peak-year induced water use in Tucson will occur in 1994 and will be about 1 percent of baseline use or 38 percent of the annual growth being experienced. This should be easily accommodated by the Tucson water system. Similarly, the proposed project will result in a 1-percent increase in effluent discharge from the Tucson wastewater treatment plants to the Santa Cruz River. Effluent currently composes all of the base flow of the river downstream of the city and its quality is not projected to change as a result of the proposed project, assuming timely expansions in wastewater treatment capacity are made. The land disturbance associated with construction of the silo module will have a generally minor effect upon surface water quality because of the lack of perennial streams in the ROI. The overall short and long-term impacts to surface water will be low and not significant at the regional level.

A portion of Suitable Deployment Area (SDA) is in the vicinity of the San Pedro River for a total stretch of approximately 30 miles. Construction of the silo module near the river could cause substantial long-term degradation in the water quality of the perennial portions of this stream. Because of the close hydraulic connection between the San Pedro River and the groundwater system, depletion of river flow will also be likely during the construction phase. Construction of the silo module near the San Pedro River will change the short and long-term surface water impact ratings to moderate and significant at the regional level.

Table 4.8.5-1

SUMMARY OF TOTAL WATER USE AND IMPACTS FOR THE HARD SILO IN PATTERNED ARRAY ALTERNATIVES

	Total[1] Construction Phase (1990-1997) (acre-ft)	Operations[2] Year (2000) (acre-ft)
Davis-Monthan AFB (250 missiles)		
Total Project Water Use	10,100	760
Davis-Monthan AFB Use	2,520	500
Tucson Use	6,310	260
Other Project Water Use	1,270	0
Key Impacts		
Induced Pumpage (Upper Santa Cruz Basin)	4,470	500
Tucson-Induced Wastewater Discharge (Including MOB)	5,020	400
Edwards AFB (250 missiles)		
Total Project Water Use	10,900	940
Edwards AFB Use	2,950	580
Lancaster Use	5,860	300
Palmdale Use	1,120	60
Other Project Water Use	970	0
Key Impacts		
Induced Pumpage (Antelope Basin)	3,920	580
F.E. Warren AFB (250 missiles)		
Total Project Water Use	13,300	940
F.E. Warren AFB Use	2,950	580
Cheyenne Use	8,520	360
Other Project Water Use	1,830	0
Key Impacts		
% Available Water Supply (Baseline + Induced Use)	81%	87%
Cheyenne-Induced Wastewater Discharge (Including MOB)	8,940	721

	Total[1] Construction Phase (1990-1997) (acre-ft)	Operations[2] Year (2000) (acre-ft)
Fort Bliss (250 missiles)		
Total Project Water Use	13,760	930
Fort Bliss Use	3,950	790
El Paso Use	8,540	140
Other Project Water Use	1,270	0
Key Impacts		
Induced Pumpage (Hueco Bolson)	13,460	930
El Paso-Induced Wastewater Discharge (Including MOB)	6,870	500
% Annual Flow of Rio Grande River	2%	7%
Gila Bend AFAF (250 missiles)		
Total Project Water Use	16,200	1,040
Gila Bend AFAF Use	4,140	830
Gila Bend Use	10,670	200
Other Project Water Use	1,390	10
Key Impacts		
Induced Pumpage (Gila Bend Basin)	15,780	1,030
Yuma PG (250 missiles)		
Total Project Water Use	15,810	1,020
Yuma PG Use	4,140	830
Yuma Use	10,040	190
Other Project Water Use	1,630	0
Key Impacts		
% Available Water Supply (Baseline + Induced Use)	41%	43%
Induced Pumpage (L. Colorado Basin)	5,140	830
Yuma-Induced Wastewater Discharge	4,440	80
% Annual Flow of Colorado River	<0.1%	<0.1%

Notes: [1]Includes both direct project construction water (construction, dust control, and revegetation) and indirect water use resulting from project inmigrants to the region.

[2]Includes indirect water use resulting from operations personnel, their dependents, and other operations-phase inmigrants to the region.

Groundwater Hydrology and Quality. Davis-Monthan AFB obtains its water supply from the Upper Santa Cruz groundwater basin and can be expected to continue this practice to meet MOB project water needs. Tucson will also use the same water source to meet early project-induced water needs. After 1991, the city will be able to use imported water to meet needs as previously described. Peak water use at the MOB will occur in the operations phase and will increase water use at the base by 500 acre-ft/yr or 22 percent over baseline. Total pumpage from the Upper Santa Cruz Basin will be 4,470 acre-ft during the construction phase, assuming the silo module is also located in the basin. The increase in total pumpage as a result of the proposed project will be about 0.3 percent during both the construction and the operations phases. The MOB and 72 percent of the SDA are located in one of two Active (Groundwater) Management Areas (AMAs) (Tucson and Pinal), which are closely managed by the state because of serious, long-term overdraft. Offbase development of additional groundwater in these locations will require a state permit.

The limited need for groundwater for construction in the deployment area is expected to have only minor, short-term impacts to existing users. However, extraction of groundwater in the vicinity of the San Pedro River may affect the flow of the river as previously discussed. The overall short and long-term impacts to groundwater are expected to be low. Although the relative increase in pumpage is small, large additional quantities will be withdrawn from groundwater basin(s) which are heavily overdrawn and under special management. Even with the arrival of imported water, these basins will continue to supply about half of the baseline water use in the region. Therefore, the regional-level impacts will be significant. These impacts could be lowered to not significant if Davis-Monthan AFB acquired existing groundwater rights or used imported water to meet project-induced water demands.

4.8.5.2 Edwards Air Force Base

The short and long-term impacts to surface water will be low and not significant if Edwards AFB is selected as the MOB. However, short and long-term, low, and significant impacts to groundwater will occur because of withdrawal of water from an overdrafted groundwater basin.

Summary of Project Water Use. Total project-related water use at Edwards AFB, including construction water needs, is presented in Table 4.8.5-1. The onbase water requirements resulting from the proposed project will be highest during the operations phase (580 acre-ft/yr). The principal support communities for Edwards AFB are the cities of Lancaster and Palmdale, with Lancaster supporting the majority of the inmigrants. Project-induced water use at the support communities will peak during the fifth year of construction (1994) at a combined total of 1,260 acre-ft resulting from the inmigration of construction workers to the area. The operations-phase water use will equal about 360 acre-ft/yr. Project-induced water use for Lancaster during the construction phase will be 5,860 acre-ft, while for Palmdale the amount will be 1,120 acre-ft. Total project-related water use during the construction phase will be 10,900 acre-ft. Water use associated with the operations phase is estimated at 940 acre-ft/yr; 62 percent will be used at Edwards AFB.

Surface Water Hydrology and Quality. No naturally occurring surface water sources are available to the MOB or its support communities. However, the SWP imports surface water from northern California into the region. The Antelope

Valley-East Kern Water Agency, which serves much of the ROI, will have an annual entitlement of 138,400 acre-ft/yr during the construction phase. However, the construction of facilities to deliver the complete entitlement to the area is not anticipated. Currently, a pipeline transports imported water for use at many of the SDA locations. Baseline deliveries of imported water to the region are expected to be 35,900 acre-ft during the first year of construction (1990). These deliveries are expected to rise to 53,500 acre-ft by the year 2000. The support communities of Lancaster and Palmdale are using imported water to supplement the existing groundwater supplies. It is probable that any new project-induced water demands in the support communities will be served by imported water since increases in baseline water demands are also being met by that source. During the construction phase, project-induced use at the support communities will be an average of 3 percent over baseline use. This will constitute 2 percent of the projected baseline imported water supply, with a peak use of 3 percent occurring during the fifth year of construction (1994). Project-induced use at the support communities during the operation phase will amount to less than 1 percent of the imported water supply per year. Therefore, adequate supplies of SWP water are available to meet project-induced demand in the support communities.

Water quality in the deployment area is likely to be affected by land disturbance during the construction phase. Because of the lack of perennial streams in the deployment area and the diffuse nature of the construction activities over a large area, water quality degradation attributable to construction activities will have a minor regional effect. As a result of the readily available imported water to the support communities and the minor potential for surface water degradation, the short and long-term impacts to surface water in the ROI will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Edwards AFB receives its existing water supply from locally derived groundwater from the overdrafted Antelope Valley Basin and will presumably use this source to meet proposed project demands. Total construction-phase water use at Edwards AFB will increase 7 percent over baseline use. Operations-phase water use will boost baseline use by 10 percent. The base currently experiences water shortages during periods of peak use. The proposed project will require considerable additional groundwater development by the base in order to avoid greatly intensifying these shortages. Water used for the construction of the silo module will result in local groundwater declines. If the silo module site is located near irrigated areas, a potential for interference with existing groundwater users may occur. The project-induced groundwater use at Edwards AFB will constitute a 0.3-percent increase in pumpage in the Antelope Valley groundwater basin. However, the quantity of groundwater used for the proposed project will be substantial and will be withdrawn from a basin that is already seriously overdrafted. Therefore, the short and long-term impacts to groundwater will be low but significant at the regional level.

A pipeline supplying SWP water runs along the northern boundary of Edwards AFB. The SWP water is potentially available for use by the base. If Edwards AFB uses SWP water to meet proposed project needs, the effect will be to reduce short-term groundwater impacts to low and not significant and long-term groundwater impacts to negligible.

4.8.5.3 F.E. Warren Air Force Base

The short and long-term impacts to surface water are expected to be low if F.E. Warren AFB is selected as the MOB. The short-term impact to groundwater will be low and the long-term impact will be negligible. None of these impacts is expected to be significant at the regional level.

Summary of Project Water Use. Total project-related water use at F.E. Warren AFB, including construction water needs, is presented in Table 4.8.5-1. Onbase, project-induced water use during the operations phase will be 580 acre-ft/yr. Project-induced water use for the City of Cheyenne, which supplies the base, will peak in 1994 at 2,020 acre-ft and steadily decrease in succeeding years to 940 acre-ft/yr in the operations phase. During the construction phase, an additional 860 acre-ft will be used by civilian immigrants living in other communities throughout the deployment area. The induced water requirements by inmigrants will amount to about 12,220 acre-ft, contributing to a total water requirement of 13,300 acre-ft during the construction phase. Water use associated with the operations phase is estimated at 940 acre-ft/yr; 62 percent will be used at F.E. Warren AFB.

Surface Water Hydrology and Quality. F.E. Warren AFB is supplied water by the City of Cheyenne, which derives most of its water supply from surface sources. Project-induced water use at the MOB will rise steadily during the construction phase from the influx of operations personnel. Water use at the base will increase 50 percent over baseline use during the operations phase. Construction-phase use of the Cheyenne water supply will peak in 1994 at 11 percent over baseline, decreasing to 5 percent over baseline during the operations phase. The rate of increase in water demand during the early construction phase will be two to three times that being experienced and may require substantial adjustments on the part of the city water utility to accommodate demands. With the Cheyenne Stage II Water Project fully constructed by 1989, the City of Cheyenne will have an available water supply of 24,000 acre-ft/yr and should be able to supply project water needs.

Effluent discharge to Crow Creek will increase by a maximum of 13 percent as a result of the proposed project. The utilities analysis (Section 4.2) has shown that the wastewater treatment system will have generally adequate treatment capacity to handle project-induced increases in sewage flows only through 1991. It is assumed that sufficient treatment capacity will be added in a timely manner. Since the great majority of the flow of Crow Creek downstream of Cheyenne is currently treated effluent, this additional discharge will not materially affect downstream water quality. Surface water in the deployment area is fully appropriated and will probably not be used extensively for proposed project construction. Water quality degradation due to land disturbance resulting from construction of the silo module is a concern. However, most of the SDA is remote from perennial streams, and water quality degradation would be limited to short periods following infrequent rainfall. Construction of the silo module will likely have limited water quality effects. The overall surface water short and long-term impacts will be low. These impacts will not be significant at the regional level.

A portion of the SDA lies in proximity to a 12-mile stretch of Crow Creek downstream of Cheyenne and a 10-mile stretch of upper Lodgepole Creek. Locating the silo module in these areas could result in substantial declines

in water quality and quantity during the construction phase, affecting downstream users. If this occurs, the long-term impacts will be significant.

Groundwater Hydrology and Quality. The City of Cheyenne supplies about 20 percent of its water use with groundwater from wells located west of the city. Groundwater levels in its wellfields have historically declined, though they have generally stabilized in recent years as a result of careful management. Additional groundwater development in support of the proposed project will probably result in moderate, local groundwater declines, but will not be expected to greatly affect existing groundwater users. It is likely that most of the deployment-area construction water will be obtained from groundwater. Nearly all of the SDA within Wyoming lies within a controlled groundwater area, and new appropriation requests are carefully reviewed by the Wyoming State Engineer. Moderate groundwater declines are occurring throughout much of this area. Although the proposed project could aggravate this situation, project water requirements are not substantial (970 acre-ft) and will boost pumpage in the ROI by only 0.2 percent during the construction phase. Therefore, overall groundwater short-term impacts will be low and long-term impacts will be negligible. These impacts will not be significant at the regional level. If the silo module is located in the vicinity of either Crow or Lodgepole creeks, use of groundwater could reduce creek flow because of the close hydrologic connection between the flow of the creek and the area groundwater system. The resulting short-term impact was previously discussed. This impact could be mitigated by the lease or purchase of existing groundwater rights in the area.

4.8.5.4 Fort Bliss

The short and long-term impacts to surface water are expected to be low and not significant if Fort Bliss is selected as the MOB. The overall short and long-term impacts to groundwater are also expected to be low. However, because of the severe overdraft condition of the groundwater basins, the groundwater impacts will probably be significant.

Summary of Project Water Use. Total project-related water use at Fort Bliss, including construction water needs, is presented in Table 4.8.5-1. Onbase water use resulting from the proposed project during the operations phase will be 790 acre-ft/yr. Project-induced water use for the city of El Paso will peak in 1994 at 1,690 acre-ft and steadily decrease in succeeding years to 140 acre-ft/yr in the operations phase. An additional 300 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area during the construction phase. The project-induced water requirements by inmigrants will amount to about 12,680 acre-ft, contributing to a total water requirement of 13,760 acre-ft during the construction phase. Water use associated with the operations phase is estimated at 930 acre-ft/yr; 85 percent will be used at Fort Bliss.

Surface Water Hydrology and Quality. The only surface water present within the ROI is the Rio Grande River, which is already committed to other uses. Because this water is not available for use by the proposed project, the project will have a negligible effect on users of surface water. Proposed project impacts to the river will largely result from increased effluent discharges attributable to the project-induced population. Increased discharge to the Rio Grande River below El Paso is projected to be about

1,280 acre-ft in the peak year (1994) or a river flow increase of 3 percent. The utilities analysis (Section 4.2) has shown that El Paso will have sewage treatment capacity sufficient to handle this discharge. Since the flow along this stretch of the Rio Grande River (downstream of El Paso) during the nonirrigation season is mostly treated effluent, this additional effluent is expected to have little effect on baseline water quality conditions. Effluent discharges attributable to long-term operations will increase river flow by about 1 percent.

Most of the SDA lies remote from the Rio Grande River and other perennial streams. Therefore, water quality degradation resulting from land disturbance in the silo module area will be intermittent (following infrequent storms) and of limited extent. Given the limited effect that the proposed project will have upon the one perennial stream in the ROI and the intermittent nature of the impacts likely to result from storm runoff, the short and long-term impacts to surface water hydrology and quality will be low. The impacts will not be significant at the regional level.

A portion of the SDA in the Mesilla Valley, downstream of Las Cruces, lies in the vicinity of a 25-mile stretch of the Rio Grande River. Further downstream, near the El Paso-Hudspeth county line in Texas, the SDA lies in the vicinity of an additional 10-mile length of the river. Should the silo module be located in either of these areas, considerable sedimentation of the Rio Grande River could occur, raising long-term surface water impacts to moderate and significant.

Groundwater Hydrology and Quality. Nearly all construction-phase water use (13,460 acre-ft) will be drawn from the Hueco Bolson, which is the primary water source for both Fort Bliss and its support community of El Paso. This represents an increase over baseline of nearly 1 percent. This groundwater basin is severely overdrafted and has undergone widespread water level declines of 1 to 3 feet per year. Project-induced withdrawal will be about 1 percent of baseline pumpage. Pumpage associated with the operations phase will be about 930 acre-ft/yr, which is a 0.4-percent increase over the baseline water pumpage from the bolson in the year 2000. This additional groundwater withdrawal from the Hueco Bolson will exac rbate the current trend of declining groundwater levels and quality.

Two major groundwater users directly affected by proposed project water use are Fort Bliss and El Paso. During the operations phase, peak annual project-induced water use at Fort Bliss will be about 11 percent of baseline use. The peak-year, project-induced water requirement from the El Paso supply will be 1,690 acre-ft in 1994. This is less than the average annual increase in water use currently experienced, and in 1994, will represent about 1 percent of total city use. Because of the large and highly developed groundwater resource available to the El Paso/Fort Bliss area, the project-induced growth in groundwater use will be readily accommodated. The proposed project construction phase may overlap possible plans by the base to develop an additional 2,000 to 3,000 acre-ft/yr of supply to replace that portion of its supply currently obtained from El Paso. Accommodation of the proposed project could require the acceleration of the groundwater development plans by the base.

Construction in the deployment area will require 970 acre-ft of water, most probably from groundwater sources. The great majority of the SDA is remote

from major groundwater use in the ROI and the likelihood for direct conflict with other groundwater users is generally low. Virtually all of the SDA within New Mexico is within one or more declared groundwater basins. Therefore, placement of the module in the New Mexico portion of the ROI will require a permit application and special review by the State Engineer.

The overall short and long-term impacts to groundwater resources will be low. The majority of the groundwater used for the proposed project will be drawn from a severely overdrafted groundwater basin. Although the proportional increase in pumpage will be small, the absolute quantity withdrawn from the regional aquifer will be large; therefore, the impact will be significant. There are several locations within the SDA where the proposed project might affect existing users. If a silo module is sited in the northern portion of the Hueco Bolson or in the vicinity of Las Cruces, water will be drawn from groundwater sources currently supplying El Paso and Las Cruces, respectively, and could lower water levels in some of their supply wells during the construction phase.

4.8.5.5 Gila Bend Air Force Auxiliary Field

Some short-term, low, and not significant impacts to surface water will occur at Gila Bend AFAF if it is selected as the MOB. The corresponding long-term impact will be negligible. The short-term groundwater impacts will be moderate and significant because water availability depends on a very limited groundwater supply in an overdrafted groundwater basin. The long-term impact will be low and significant.

Summary of Project Water Use. Total project-related water use at Gila Bend AFAF, including construction water needs, is presented in Table 4.8.5-1. The onbase water use resulting from the proposed project will be highest during the operations phase at 830 acre-ft/yr. The principal support community for Gila Bend AFAF is the town of Gila Bend. Project-induced water use at Gila Bend will peak during the fifth year of construction (1994) at 1,970 acre-ft because of the inmigration of construction workers to the area. Total induced water use for the town of Gila Bend during the entire construction phase will be 10,670 acre-ft. An additional 420 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. Total construction-phase water will be 16,200 acre-ft. Water use associated with the operations phase is estimated at 1,040 acre-ft/yr; 80 percent will be used at Gila Bend AFAF.

Surface Water Hydrology and Quality. No viable surface water sources are available to the MOB or its support community. Most of the SDA is located in areas that are remote from the Gila River (the only perennial water feature), and the impact to surface water quality will be minor. Therefore, the short-term surface water impacts are expected to be low and not significant at the regional level. The long-term impacts are expected to be negligible. A small portion of the SDA lies near the Gila River in the vicinity of Gillespie Dam, upstream of Gila Bend. In addition, nearly 20 percent of the SDA overlies highly erodible soils located primarily in the Gila Bend, Centennial Wash, and Ten Mile Wash basins. These basins are closely linked to the Gila River and the erosive nature of the soils would likely result in greatly increased sediment delivery to the river. Should any of these areas be selected for the silo module, the long-term surface water impact will change to low and significant.

Groundwater Hydrology and Quality. Most of the water requirements of the proposed project will be derived from groundwater sources of marginal quality. Gila Bend and Gila Bend AFAF both obtain their water supplies from the overdrafted Gila Bend groundwater basin. The groundwater requires extensive treatment before delivery because of high total dissolved solids content. Gila Bend AFAF will sustain a 170-percent increase over baseline water use during the construction phase. Operations-phase water use at the base will be nearly 280 percent greater than baseline demands. Project-induced, construction-phase water demands for the town of Gila Bend will total 10,670 acre-ft, which represent a 150-percent increase over the baseline demand. Operations-phase water use will be 200 acre-ft/yr, an increase of just 20 percent. If the silo module is sited in areas remote from irrigated areas, then no groundwater users are likely to be affected. However, if the sites are selected near such areas, the potential for conflicting groundwater uses may occur. The availability of groundwater for proposed project needs is deemed adequate in all areas of the ROI despite overdraft conditions. Thirty-nine percent of the SDA is located within one of two AMAs (Phoenix and Pinal) that are closely managed by the state because of serious, long-term overdraft. Development of additional groundwater in these locations will require a state permit.

In summary, project-induced water demands will be derived from groundwater basins that are in overdraft and contain marginal-quality groundwater. This induced use represents a 0.7-percent increase in projected groundwater pumpage in the Gila Bend Basin during the construction phase. The quantity of groundwater needed for the proposed project will be large and the project will heavily affect the groundwater supply systems serving Gila Bend and Gila Bend AFAF, particularly during the construction phase. Alternative water supplies available to the area are very limited. The proposed project will therefore have a short-term, moderate impact and long-term, low impact to groundwater; both will be significant at the regional level.

4.8.5.6 Yuma Proving Ground

Some short and long-term, low impacts to surface water and groundwater will occur at Yuma PG if it is selected as the MOB. None of these impacts will be significant.

Summary of Project Water Use. Total project-related water use at Yuma PG, including construction water needs, is presented in Table 4.8.5-1. Onbase water use induced by the proposed project will peak during the operations phase at 840 acre-ft/yr. The principal support community for Yuma PG is the city of Yuma. Project-induced water use at Yuma will peak during the fifth year of construction (1994) at 2,120 acre-ft and then decrease to 190 acre-ft/yr during the operations phase. Total project-induced water use by the city of Yuma for the construction phase will be 10,040 acre-ft. During the construction phase, an additional 660 acre-ft will be used by civilian inmigrants living in other communities throughout the deployment area. Total water requirements for the construction phase will be 15,810 acre-ft. Water use associated with the operations phase is estimated at 1,020 acre-ft/yr; 81 percent will be used at Yuma PG.

Surface Water Hydrology and Quality. Yuma obtains its water supply solely from a long-standing entitlement of 50,000 acre-ft/yr of Colorado River water. Project-induced water demands will average about 7 percent over the projected

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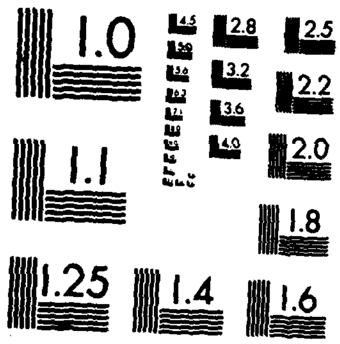

MICROCOPY RESOLUTION TEST CHART
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use during the construction phase. Total water use for Yuma during the construction phase will amount to only 41 percent of the 50,000 acre-ft/yr entitlement. Induced water use during the operations phase will be about 1 percent over the baseline, and will also be easily met by the supply available to Yuma. Project-induced wastewater discharge from Yuma to the Colorado River will peak at 940 acre-ft in 1994, 11 percent over baseline. The utilities analysis (Section 4.2.5.6) has indicated adequate treatment capacities to handle project-induced flows. The incremental increase in flow to the Colorado River from this discharge will be less than 0.1 percent and water quality impacts should be minimal.

Virtually all of the SDA is remote from perennial streams and construction of the silo module will probably have a minor effect on water quality. Therefore, the overall short and long-term impacts to surface water in the ROI will be low and not significant at the regional level.

Groundwater Hydrology and Quality. Yuma PG obtains its entire water supply from groundwater sources that are of marginal quality. The cantonment area derives its water from the Lower Colorado Basin. An increase of 56 percent in water use will occur at Yuma PG during the construction phase. Construction-phase groundwater pumpage from the Lower Colorado Basin will amount to 5,140 acre-ft, or about a 2-percent increase over projected demand. Operations-phase water use will be 830 acre-ft/yr, 83 percent over the baseline use of Yuma PG and a 3-percent increase in basin pumpage. The basin has adequate groundwater to supply the quantities of water needed for construction and operations of the proposed project. The lack of water users in the vicinity of the cantonment area and in the SDA reduces potential competition for groundwater. Increased pumpage at the cantonment area will likely lower local water levels but will not appreciably alter the groundwater conditions within the Lower Colorado Basin. This is a result, in part, of the existing recharge resulting from agricultural irrigation with water from the Colorado River.

Because of the generally abundant supplies of fair quality groundwater found throughout the ROI, the short and long-term impacts from project-induced pumpage will be low and not significant at the regional level.

4.8.6 Impacts of the No Action Alternative

This section contains a brief assessment, by ROI, of the long-term trends in regional water resources that can be expected to occur in the absence of the proposed project.

Baseline water demand in the Arizona Complex ROI is expected to increase by 26 percent by the year 2000. An increasingly larger portion of the water supply in the eastern portion of the ROI will be derived from imported Colorado River water delivered to the area by the Central Arizona Project. However, overdraft conditions will continue to occur in most groundwater basins in the ROI and groundwater levels will continue to decline, though at a lesser rate than recently experienced. An exception to this trend is the western portion of the ROI, where continued import of Colorado River water will meet most water needs and no regional groundwater declines are expected.

Baseline municipal water demand in the Florida Complex ROI is expected to increase substantially during the projected period, particularly in portions

of the coastal region where it will double by the year 2000. Groundwater currently supplies all of this demand. Substantial declines in pumping levels have resulted in the coastal areas of the ROI. These declines will likely continue, increasing the likelihood of saltwater intrusion and possible deterioration of a portion of the water supply for this region. Importation of groundwater from inland sources or utilization of the plentiful surface water resources may be initiated to alleviate this problem.

Water will continue to be very scarce in the northern three-quarters of the Nevada Complex ROI, though moderate development of available groundwater can be expected to continue. Local groundwater declines may occur but the strong state groundwater management policies should prevent the development of major, regional groundwater declines. In the southern portion of the ROI, specifically Las Vegas Valley, water from the Colorado River will continue to meet an increasing portion of the large municipal and industrial water needs. Groundwater levels in the basin will continue to fall, though at lesser rates than historically experienced.

In the New Mexico Complex ROI, the existing trends of declining groundwater will continue and may even accelerate, particularly in the fast-growing urban areas of Las Cruces, Alamogordo, and El Paso-Ciudad Juarez. Long-term declines in groundwater quality can be expected within the Hueco Bolson, and possibly the Tularosa Basin. Large-scale development of groundwater has begun in the Mesilla Bolson and may continue, ultimately resulting in widespread declines in groundwater levels in that basin. Major groundwater development in the Jornada del Muerto does not appear likely in the future. Although the Rio Grande River is fully appropriated, a portion of its use may shift from agricultural irrigation to municipal use as demand in the latter category increases.

Baseline municipal water demand in the South-Central California Complex ROI is expected to increase by about 50 percent by the year 2000. Expected declines in the agricultural demands are expected to more than offset the increasing municipal demands. The result will be a decrease in overall water use in the region. Also, a shift from groundwater to imported water will continue to occur because of the increasing costs of pumping local groundwater. However, overall use of groundwater supplies will still be in excess of natural recharge and overdraft conditions will continue.

In the Washington Complex ROI, planning efforts are underway by the Bureau of Reclamation that may result in additional water storage and irrigation projects within the Yakima River Basin. However, recognized fishery habitat needs guarantee that the current minimum flows maintained in the river will be maintained or even enhanced. In the Columbia River Basin, a major expansion of the Columbia Basin project in the 1990s will bring large tracts of land under irrigation. The impact of this additional diversion upon the Columbia River should be minor and no other major water development projects are likely to occur over the projected period. Adequate water supplies are expected to remain available for the larger municipal and industrial users. The availability of additional irrigation water from the Columbia Basin project should eliminate some of the moderate groundwater declines experienced in that basin. Limited groundwater declines are expected to continue in the Yakima Basin.

Rapid City, the largest town in the Ellsworth AFB ROI, will experience a baseline growth of 26 percent over the 1980 population in the year 2000. The city is undertaking a $3.2 million project to upgrade its wastewater treatment facility, and water quality in the receiving stream, Rapid Creek, should improve. Upgrading of the Belle Fourche irrigation project, the largest in the ROI, will reduce the water losses in that basin and may offset the projected increase in irrigation water demands. Although plans for the export of water from the region to the Powder River Basin in Wyoming have been shelved for the time being, a resurgence in the coal industry could change this.

Water resources are relatively abundant in the Malmstrom AFB ROI and the absence of the proposed project does not represent a significant change in their regional availability. Agricultural irrigators will continue to experience seasonal, localized water shortages. Conjunctive use of ground and surface waters may be implemented to meet water needs. This includes measures such as low flow augmentation with groundwater, and the transfer of subsurface water within river basins in order to increase minimum streamflows. The groundwater resources of the ROI are underdeveloped and substantial groundwater development is expected to occur in the future.

In the F.E. Warren AFB ROI, small to moderate water table declines are expected to continue as additional groundwater development occurs, primarily to support expanded agricultural irrigation. However, regional groundwater supplies should not become seriously depleted. The completion of Stage II of the Cheyenne Water Project by 1989 will result in additional imported water to the ROI's largest city. Adequate water should be available to meet the region's projected needs.

Water use will increase sharply in North Dakota following completion of the recently approved Garrison Diversion Unit, which will make additional water available for agricultural irrigation and for municipal supply. Groundwater development in the ROI is expected to level off. Groundwater levels may actually increase in certain areas of the ROI from the additional agricultural irrigation that will result from the Garrison project. However, in other areas, irrigation may cause a decline in the water quality of some of the shallow, glacial aquifers that underlie the newly irrigated areas.

Baseline municipal water demand is expected to grow very little in the Whiteman AFB ROI. The only growth projected is for the Kansas City area with an increase of 17 percent expected by the year 2000. The Harry S Truman Reservoir was recently completed, and no further major projects are likely within the ROI. Industrial water use is expected to increase somewhat in the southwestern portion of the ROI, though the exact amount is unclear at this time. There are adequate supplies of groundwater available to meet projected future needs in the region.

4.8.7 Irreversible and Irretrievable Resource Commitments

Project-associated water requirements will consume between 4,040 and 16,200 acre-ft of water during the construction phase, depending upon the chosen alternative. Operations-phase water requirements will vary from 640 to 2,470 acre-ft/yr for the duration of the proposed project. The potential water quality impacts resulting from land disturbance associated with project construction and operations are generally reversible with proper revegetation

and reclamation efforts upon cessation of the land disturbance activity. Water supplies developed to support the proposed project will in most cases be available to serve other uses once project needs cease, and will therefore not be irretrievably committed. However, in those groundwater basins with limited recharge and declining groundwater levels, water pumped to meet project needs can be considered to contribute to a shortening of the useful production life of the aquifer.

4.8.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

In a number of the more water-short or highly water-regulated areas, the water rights of existing users may be acquired in order to provide water for the proposed project. Local declines in groundwater levels resulting from project water use may interfere with existing groundwater users, making their supply more expensive or difficult to acquire. To the extent that these conditions occur, long-term regional productivity may decline slightly as a result of the proposed project.

4.9 Geology and Soils

Deployment of the Small Intercontinental Ballistic Missile (ICBM) system will have consequences that will affect the geology and soils environment. The analysis of impacts includes consideration of engineering geology, geologic resources, and soil resources.

4.9.1 Impact Analysis Methodology

The methods used for analyzing the effects of the proposed project on each of the geology and soils resource elements include evaluation of potential project impacts, determination of levels of impact (LOIs), and determination of significance of impacts.

4.9.1.1 Evaluation of Project Impacts

The interaction between proposed project demands and existing resources may cause impacts to the geology and soils environment. The proposed project impacts for each of the elements in the geology and soils resource were determined by comparing project effects to the resource base. Proposed project requirements will include both resource utilization (e.g., sand and gravel) and resource disturbance (e.g., road construction). The geology and soils resource was defined in Chapter 3.0 through identification and quantification of existing conditions, including projected future conditions without the proposed project.

Engineering Geology. Evaluation of impacts to engineering geology included considerations of geologic hazards and the engineering characteristics of geologic materials. The evaluation of proposed project requirements and their effect on geologic conditions in the Region of Influence (ROI) determined the potential for initiating or accelerating geologic hazards within the region. Interpretations of potential hazards relied on documented scientific methods and professional judgment. Geologic processes that have been considered include landslides and debris flows, and ground subsidence. These will vary for each basing mode and deployment area. Proposed project impacts to geologic materials are not expected to occur since the project will not change the characteristics of these materials. However, the characteristics of geologic materials will affect construction, and the consideration of such parameters will help in identifying and evaluating project effects on geologic hazards.

Geologic Resources. Impacts to energy, mineral, and aggregate resources, in addition to impacts to unique geologic features, were considered. Primary impacts to geologic resources are expected to be associated with development or increased production of existing resources in the deployment area (project demand associated with resource availability) and the effects associated with reduced exploration, development, and production of resources as a result of limited access related to the basing mode considered.

The impact analysis for aggregate resources was determined by evaluating the relationship between proposed project effects of short and long duration on the available resource supplies, and project-related increases in resource production relative to present production. The proposed project will affect aggregate resources more than other geologic resources because it will exert

pressure on existing supplies and production facilities during construction, and may conflict with other project needs in the region as a result of resource depletion.

Impacts to unique geologic features could be both direct (e.g., destruction of a recognized feature of geologic interest from project-related construction) and indirect (e.g., vandalism of a unique geologic feature by project-induced immigrant populations or restriction of access by the scientific community). Direct impacts tend to be spatially controlled; therefore, determination of proposed project impacts involves a comparison of the geographic locations with unique features and the types of construction activities expected. Indirect impacts have spatial (access to the feature) and population-induced (immigrant populations) components. Population-induced indirect impacts result primarily from population growth, increased recreational use of an area, project-induced changes in land use, and disturbance by construction crews. Impact magnitudes were based on how much a geologic feature will be modified by the proposed project and the scientific importance of the feature.

Soil Resources. Evaluations of project-related impacts to the agricultural properties of soils in the proposed project area were based on the quantity and condition of agricultural land potentially disturbed by the project. The impact rating was modified up or down depending on the relative agricultural value of the land (e.g., important farmland).

Project-induced impacts to wind and sheet erosion were based on a comparison of soil erosion sensitivity groups with conceptual facility configurations for each deployment area. If the conceptual configuration was not available, proposed project impacts were determined by assuming that project activities will be equally dispersed within the suitable area and that the relative amounts of soils sensitive to erosion are adequate measurements of potential impacts.

4.9.1.2 Determination of Levels of Impact

The LOI is the determination of the magnitude of an impact. At the regional level, only potential or probable impacts were identified and evaluated. The LOI was determined by comparing LOI definitive criteria to the amount of change to present or future baseline conditions attributable to project requirements. Values for several geology and soils elements were not numerically definable and were assessed through the use of professional judgment.

Engineering Geology. The LOI definitions for engineering geology are the following:

- o Negligible Impact -- The proposed project will not measurably affect the projected baseline rate of natural geologic processes.
- o Low Impact -- The proposed project will measurably affect the projected baseline rate of natural geologic processes (e.g., slightly increased frequency of landsliding or ground subsidence may be experienced). The associated effects or hazards will be slight.

- Moderate Impact -- The proposed project will measurably affect the projected baseline rate of natural geologic processes (e.g., increased frequency both in number and areal distribution of landslides or ground subsidence may occur). Geologic hazards that could require mitigation measures may be initiated.

- High Impact -- The proposed project will greatly accelerate the projected baseline rate of natural geologic processes (e.g., a substantial increase in the rate and amount of landsliding and ground subsidence may occur). Geologic hazards with lasting and possibly detrimental effects may occur, which could require extensive mitigation measures.

Geologic Resources. The LOI definitions for geologic resources that will be used by the proposed project are the following:

- Negligible Impact -- Minimal increases in the production of a resource when compared with the present rate of production, or the total proposed project demand represents a very small portion of the resource supply. Project demand is not expected to interfere with other consumers in the region and existing producers should be able to accommodate the project requirements without the acquisition of additional equipment or the identification of new sources.

- Low Impact -- Small increases in the production rate required to meet proposed project demand, or the total project demand represents a small portion of the available supply. Project demand is not expected to interfere with other consumers in the region and existing producers should be able to accommodate the project requirements without the acquisition of additional equipment, but may require the identification of new sources.

- Moderate Impact -- Substantial increases in the production rate to satisfy proposed project demand, or the total project demand may be a substantial portion of the available supply. Project demand may cause temporary shortages for other consumers. Existing producers may have to acquire additional equipment and identify new sources to meet the combined baseline and project demands.

- High Impact -- Critical increases in the production rate required to meet proposed project demand, or the total project demand represents a major part of the resource supply. Project demand may cause major disruption of supplies to other consumers. Existing aggregate producers will have to acquire additional equipment and identify new sources to meet the combined baseline and project demands. Project demand may require producers to use sources or processing techniques normally considered uneconomical.

The LOI definitions for geologic resources that will not be used by the proposed project, but which may be affected through restricted access, are the following:

- Negligible Impact -- No measurable changes in access, resource exploration, development, and production within the ROI, or no measurable changes in the condition of, or access by, the scientific community to the unique geologic feature.

- Low Impact -- Minor conflicts with access, resource exploration, development, and production of geologic resources. Affected resources are generally considered speculative or hypothetical. Minor restrictions in the access to the scientific community or degradation of the condition of unique geologic features by project construction activities.

- Moderate Impact -- Periodic interruptions in access, resource exploration, development, and production of geologic resources that will interfere with normal procedures of an active mining operation (e.g., restrictions to road access and water supply) or may potentially remove known resources from exploration and/or development. Project activities may eliminate scientific study of unique geologic features by restricting access to the feature, or may cause substantial degradation of the unique geologic feature by project construction.

- High Impact -- Major interruption or elimination of access, resource exploration, development, and production of geologic resources such as condemnation of mineral or energy resource lands or elimination of access to active mining operations. Major degradation of unique geologic features by road building or other construction activities, which will require mitigative action to prevent destruction.

<u>Soil Resources</u>. The LOI definitions for soil resources are the following:

- Negligible Impact -- No prime farmland or farmland of statewide importance occurs in the proposed project area, or the majority of soils in the project area are minimally susceptible to erosion. Project effects are expected to be minimal.

- Low Impact -- Small amounts of prime farmland or farmland of statewide importance occur in the proposed project area, or the amount of prime farmland or farmland of statewide importance is small compared to the total in the ROI, or small portions of the project area have soils whose erosion susceptibilities are moderate to high. Most of the area has soils with moderate susceptibilities to erosion. The disruption of soils by project activities, such as road construction, off-road Hard Mobile Launcher (HML) operations, and silo construction, may increase soil erosion to unacceptable levels in local areas. There is a high likelihood that important farmland could be avoided.

- Moderate Impact -- Substantial amounts of prime farmland or farmland of statewide importance occur in the proposed project area, or the

amount of prime farmland or farmland of statewide importance is substantial compared to the totals in the ROI, or substantial portions of the project area have soils whose erosion susceptibilities are moderate to high. Most of the area has soils with moderate susceptibilities to erosion. The disruption of soils by project activities such as road construction, off-road HML operations, and silo construction may increase erosion rates to unacceptable levels over much of the project area or cause changes in characteristics (e.g., soil compaction) of many soils.

- High Impact -- Large amounts of prime farmland or farmland of statewide importance occur in the proposed project area, or the amount of prime farmland or farmland of statewide importance is large compared to the totals in the ROI, or large portions of the project area have soils whose erosion susceptibilities are moderate to high. Most of the area has soils with high susceptibilities to erosion. The disruption of soils by project activities, such as road construction, off-road HML operations, and silo construction, are likely to dramatically increase erosion rates or cause important changes in the characteristics (e.g., soil compaction) of many soils.

4.9.1.3 Determination of Significance

The following factors were considered in the determination of significance:

- Increased risk to public health and safety (e.g., geologic hazards);
- Unique or unknown risks (e.g., liquefaction and ground rupture);
- Loss or destruction of important scientific resources (e.g., unique geologic features);
- Restrictions or elimination of access, exploration, development, or production of important reserves of strategic or critical materials or vital energy and mineral resources;
- Increases in production that threaten the resource system capacity or resource supply (e.g., aggregate supply);
- Alteration of physical (e.g., soil structure, bulk density, desert pavement) or chemical (e.g., organic matter and pH) characteristics of the soil in a manner causing long-lasting impairment of the soil's ability to support vegetation or to cause long-lasting effects that increase the soil erosion rate to an unacceptable level.
- Long-lasting detrimental effects to the agricultural characteristics of the soil; and
- Cumulative effects of projects competing for the same resources (e.g., aggregate) or effects that individually are small but combined may be considered large (e.g. off-road disturbances).

4.9.2 Impacts Common to All Locations

Assumptions and impacts common to all locations within each of the basing modes are discussed in the following sections. Estimated project aggregate requirements are provided in Table 4.9.2-1.

4.9.2.1 Hard Mobile Launcher in Random Movement

For this basing mode, the proposed project will consume extensive quantities of aggregate resources for road fill and surfacing and will consequently affect the production rate within the region. Many of the alternatives may have suitable sources and supplies of aggregate within the installation boundaries that will be used wherever possible in road upgrading. Likewise, some bases will not have suitable materials for upgrading roads and will require the purchase or acquisition of materials outside of the installation boundaries. Detailed investigations needed to verify these sources will be conducted during siting studies. Offbase and onbase disturbances are also expected to occur if new aggregate sources are developed. Road and facility construction and off-road travel in the Random Movement Area (RMA), and rarely in the Command Dispersal Area, may cause alteration of the physical (e.g., soil structure, bulk density, and desert pavement) or chemical (e.g., organic matter and pH) characteristics of the soil for several decades, detrimentally affecting the soils ability to support vegetation and/or markedly increasing the soil erosion rates. Construction-phase activities at the Main Operating Base (MOB), RMA, and Command Dispersal Area may also cause sedimentation that can alter drainage patterns, cause water quality problems, and affect flooding; all of these could potentially cause public health and safety concerns.

Construction of offbase housing and ancillary facilities (e.g., schools, water treatment facilities, and landfills) will cause surface disturbance and aggregate demand within a region during the construction and operations phases and will be considered indirect impacts.

4.9.2.2 Hard Mobile Launcher at Minuteman Facilities

Impacts to aggregate resources at the alternative bases for the Hard Mobile Launcher at Minuteman Facilities basing mode are expected to be similar to those described for the Hard Mobile Launcher in Random Movement basing mode. Within the deployment area and installation boundaries, soil disturbances may occur as a result of construction of facilities and upgrading of roads and bridges in the deployment area.

Mitigation of impacts to important farmland consists of avoidance during construction and operations, elimination of additional requirements for expansion of launch facilities, or needs for additional restrictive easements or road improvements. At the current stage of proposed project development, it was assumed these measures will be followed as much as possible.

4.9.2.3 Hard Silo in Patterned Array

Impacts to aggregate resources at the alternative Hard Silo in Patterned Array bases and within Suitable Deployment Areas (SDAs) are expected to be less than those described for the Hard Mobile Launcher in Random Movement basing mode (Section 4.9.2.1). Potential mitigations are similar. Within the SDAs and MOBs, soil disturbances may occur as a result of the construction of new silos

Table 4.9.2-1

COARSE AND FINE-GRAINED AGGREGATE REQUIREMENTS BY CALENDAR YEAR
(in short tons)

Basing Mode	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL
Hard Mobile Launcher in Random Movement										
50 Missiles										
Main Operating Base	164,865	121,477	29,560	3,605	3,006	2,179	195	0	0	324,887
Deployment Area	3,910,835	2,410,837	1,274,107	888,657	80,873	0	0	0	0	8,565,309
50 Missiles, Total:	4,075,700	2,532,314	1,303,667	892,262	83,879	2,179	195	0	0	8,890,196
200 Missiles										
Main Operating Base	418,032	158,079	55,944	5,312	3,175	1,665	90	0	0	642,297
Deployment Area	12,011,607	7,883,365	4,485,121	3,467,561	396,788	0	0	0	0	28,244,442
200 Missiles, Total:	12,429,639	8,041,444	4,541,065	3,472,873	399,963	1,665	90	0	0	28,886,739
Hard Mobile Launcher at Minuteman Facilities										
170 Missiles										
Main Operating Base	248,429	132,528	83,768	15,014	5,533	6,705	62	0	0	492,039
Deployment Area	1,300,715	401,489	232,226	625,570	456,461	417,947	16,566	0	0	3,450,974
170 Missiles, Total:	1,549,144	534,017	315,994	640,584	461,994	424,652	16,628	0	0	3,943,013
200 Missiles										
Main Operating Base	262,548	119,619	83,129	14,741	5,451	6,499	51	0	0	492,038
Deployment Area	1,802,874	733,443	616,617	508,564	358,121	42,591	1,353	0	0	4,063,563
200 Missiles, Total:	2,065,422	853,062	699,746	523,305	363,572	49,090	1,404	0	0	4,555,601
Hard Silo in Patterned Array										
250 Missiles										
MOB	106,936	119,207	63,020	59,061	28,110	411	0	0	0	376,745
Deployment Area	201,219	279,812	494,575	638,929	712,716	504,994	217,966	30,067	0	3,080,278
250 Missiles, Total:	308,155	399,019	557,595	697,990	740,826	505,405	217,966	30,067	0	3,457,023

and facilities and expansion of present facilities at the MOB. Damage to or removal of important farmland from production may occur as a result of construction activities offbase. Withdrawal of lands that are valuable for geologic resources may also occur in SDAs.

Impacts to mineral resources can be mitigated primarily by avoiding areas with known occurrences or favorable environments. Mitigation is possible by avoiding highly erodible soils and important farmland, and by identifying areas where surface disturbances to highly erodible soils can be minimized. In the evaluation of potential impacts, such avoidance was not assumed.

4.9.3 Impacts of Hard Mobile Launcher in Random Movement

4.9.3.1 Arizona Complex

Potential impacts were identified for all three geology and soils elements. Short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be high and significant, while long-term impacts will be negligible. Short-term impacts to soils during construction will be moderate and not significant, while long-term impacts will be moderate and significant. Regional impacts to geology and soils are not expected to depend on the MOB selected because both MOBs occur in similar geologic environments.

Engineering Geology. Possible project-induced geologic hazards consist of ground subsidence and fracturing as a result of groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction and operations activities. Proposed project effects on engineering geology could cause short-term, low impacts, which are defined as noticeable increases in debris flows and flooding, in both the construction and operations phases. Flooding may occur as sheet floods associated with basin margins adjacent to the Gila Bend and Trigo mountains and other mountain ranges in the deployment area. Road construction in the deployment area may affect surface drainage and may alter on and off-base flooding patterns. However, it was assumed that necessary construction practices will be implemented that will minimize effects from debris flows and flooding, and therefore limit threats to public health and safety. Potential project-induced ground subsidence and fracturing may result from long-term water needs by the proposed project and associated inmigration to Yuma or Gila Bend, Arizona and surrounding areas. Groundwater overdraft conditions exist in the Gila Bend area and other surrounding basins in the deployment area. Slight increases in the rate of ground subsidence and fracturing in the region may occur in the operations phase. Long-term impacts resulting from ground subsidence and fracturing are expected to be negligible during the construction phase and low during the operations phase.

Short and long-term impacts to engineering geology are expected to be low as a result of project-associated surface disturbance in the RMA and at the MOB. However, these impacts are not expected to be significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 28,886,739 short tons. Project demand will be greatest in 1990 when 12,429,640 short tons will be required. Peak-year aggregate demand will be about 36 percent of the 1984 aggregate production in southeastern

California and southwestern Arizona. Most reported aggregate production in the ROI (approximately 50%) is located in Maricopa County, Arizona near Phoenix. Consequently, aggregate-haul distances may greatly exceed the generally accepted maximum economical haul distance of 30 miles if existing aggregate pits and facilities are used to meet project requirements. Short-term impacts to geologic resources are expected to be high as a result of the critical increase in the production rate needed to satisfy project demand for aggregate during the construction phase. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. Project-sponsored identification, development, and production from new aggregate sources near the deployment area and MOB may be a viable alternative to long-haul distances. Minor project demand for aggregate resources is expected in the operations phase resulting in a long-term, negligible impact. Other geologic resources identified on the installations are not unique and are not substantial portions of the regional resource base; consequently, short and long-term, project-induced impacts to geologic resources (other than aggregate) are expected to be negligible.

Project-induced, short-term impacts to geologic resources will be high and significant at the regional level because of project-induced effects on aggregate supply and production rate. Long-term impacts to geologic resources will be negligible.

Soil Resources. Large portions of the deployment area may be disturbed by road upgrading (20,480 acres or 32 square miles [sq mi]) and off-road HML vehicle operations (175-350 sq mi). Soil disturbance at the MOB as a result of facility construction is expected to be about 2,120 acres. Many soils in the RMA (30%) and on the installations (42%) are moderately susceptible to erosion, indicating the likelihood of a moderate impact to soil resources because of accelerated soil erosion during HML operations and associated construction activities. Wind and sheet erosion on the installations is not expected to affect offbase soil resources, but it may cause irreparable damage to the productive capacity of soils in the deployment area and MOB. There is no important farmland on the installations; therefore, no project-induced farmland impacts are anticipated.

For the soils element, both short and long-term impacts are expected to be moderate. Only long-term impacts will be significant at the regional level as a result of surface disturbance associated with construction and operations activities.

4.9.3.2 Florida Complex

Potential adverse impacts were identified for all three elements. Short-term impacts to engineering geology will be low and not significant, while long-term impacts will be negligible. For geologic resources, short-term impacts will be high and significant at the regional level, while long-term impacts will be negligible. For soil resources, short and long-term impacts will be high and long-term impacts will be significant at the regional level.

Engineering Geology. Possible project-induced geologic hazards consist of flooding associated with construction activities at the MOB and deployment area, and operation of the HML in the deployment area. Proposed project effects on engineering geology could cause short-term, low impacts, defined as

noticeable increases in flooding events, during both the construction and operations phases along major drainages such as the Yellow River, or as sheet flows in the relatively flat terrain along the Gulf of Mexico. However, it was assumed that necessary construction practices will be implemented to minimize adverse effects from flooding and therefore limit threats to public health and safety.

Project-associated surface disturbance in the deployment area and at the MOB may cause short-term, low impacts to engineering geology. However, these impacts are not expected to be significant. Long-term impacts are expected to be negligible.

Geologic Resources. Total project aggregate resource requirements are expected to be 8,890,196 short tons. Project demand will be greatest in 1990 when 4,075,700 short tons will be required. Peak-year aggregate demand will be about 439 percent of the 1984 aggregate production for the western portion of the Florida Panhandle, but demand will decline to less than 1 percent of production by 1995. Short-term impacts to geologic resources are expected to be high as a result of the critical increase in the production rate needed to satisfy project demand for aggregate during the construction phase. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. The proposed project will probably require identification, development, and production from new aggregate sources on and near the deployment area and MOB. Minor project demand for aggregate resources is expected in the operations phase and will result in long-term, negligible impacts. Other geologic resources identified on the installations are not unique and are not substantial portions of the regional resource base; consequently, short and long-term, project-induced impacts will be negligible.

Because of the project-induced effects on the aggregate supply and production rate, short-term, regional-level impacts to geologic resources will be high and significant. Long-term impacts to geologic resources will be negligible.

Soil Resources. A large part of the deployment area may be disturbed by road upgrading (5,150 acres or 8 sq mi) and off-road HML operations (50 to 100 sq mi). Additional soil disturbances of about 1,830 acres (2.9 sq mi) are expected at the MOB as a result of facility construction. Approximately 89 percent of the soils in the RMA and on the installation are highly susceptible to erosion. This indicates the likelihood of a high impact to soil resources from accelerated soil erosion during HML operations and associated construction activities. It is not expected that wind and sheet erosion within the installations will affect offbase soil resources, but it may cause irreparable damage to the productive capacity of soils in the deployment area and MOB. About 67 acres of important farmland occur on the installation; therefore, project-induced impacts to important farmland are expected to be low and not significant at the regional level.

Short and long-term soil resource impacts will be high, and because of the surface disturbance associated with construction and operations activities, only long-term impacts will be significant at the regional level.

4.9.3.3 Nevada Complex

Potential adverse impacts were identified for all three elements. For engineering geology, short and long-term impacts will be low and not significant. Short-term, regional-level impacts to geologic resources will be high and significant, but long-term impacts will be negligible. Short and long-term soil resources impacts will be moderate and long-term impacts will be significant at the regional level. Regional impacts to geology and soils are not expected to be dependent on the MOB selected because both MOBs occur in similar geologic environments.

Engineering Geology. Possible project-induced geologic hazards consist of ground subsidence and fracturing because of groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. Proposed project effects on engineering geology could cause short-term, low impacts, defined as noticeable increases in debris flows and flooding events, in both the construction and operations phases. Flooding may occur as sheet floods associated with basin margins adjacent to mountain ranges near the deployment area. Deployment-area road construction may affect surface drainage and may initiate or accelerate on and offbase flooding. Necessary construction practices will be used, therefore minimizing the adverse effects from debris flows and flooding, and the threats to public health and safety will be limited. Potential project-induced ground subsidence and fracturing may result from long-term water needs by the proposed project and associated immigrant populations in Las Vegas, Nevada and other areas of groundwater overdraft. No change in the rate of ground subsidence and fracturing is expected during the construction phase but slight increases may occur during the operations phase. Long-term impacts as a result of ground subsidence and fracturing and are expected to be negligible during the construction phase and low during the operations phase.

For engineering geology, short and long-term, low impacts may occur as a result of project-associated surface disturbance in the deployment area and at the MOB. These impacts are not expected to be significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 28,886,739 short tons. Project demand will be greatest in 1990 when 12,429,640 short tons will be required. Peak-year aggregate demand will be about 297 percent of the 1984 aggregate production in southern Nevada, but demand will decline to less than 1 percent of production by 1995. Short-term impacts to geologic resources are expected to be high as a result of the critical increase in the production rate needed to satisfy proposed project aggregate demand during the construction phase. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. The proposed project will probably require identification, development, and production from new aggregate sources on and near the deployment area and MOB. Long-term impacts will be negligible because of minor project demand for aggregate during the operations phase. Other geologic resources identified on the installations are not unique and are not substantial portions of the regional resource base; consequently, short and long-term, project-induced impacts to these resources are expected to be negligible. Impacts to the Timber Mountain Caldera, a unique geologic feature, are expected to be negligible.

Project-induced, short-term impacts to geologic resources will be high and significant at the regional level because of project-induced effects on aggregate supply and production rate. Long-term impacts will be negligible.

Soil Resources. Road upgrading and off-road HML operations may disturb large portions (32 sq mi [20,480 acres] and 175 to 350 sq mi, respectively) of the deployment area. Soil disturbance at the MOB as a result of facility construction is estimated to be about 2,120 acres (3.3 sq mi). Soils in the deployment area and on the MOB are moderately (35%) to highly (5%) susceptible to erosion, indicating the likelihood of a moderate impact to soil resources because of accelerated soil erosion during HML operations and associated construction activities. Wind and sheet erosion within the installations is not expected to affect offbase soil resources. However, it may cause irreparable damage to the productive capacity of soils in the deployment area and MOB. No important farmland occurs on the installations; as a result, project-induced farmland impacts are expected to be negligible.

Short and long-term impacts to soil resources will be moderate and long-term impacts will be significant at the regional level because of surface disturbance associated with construction and operations activities.

4.9.3.4 New Mexico Complex

Potential impacts have been identified for all three elements. Short and long-term impacts to engineering geology will be low and not significant. Short-term, regional-level impacts to geologic resources will be high and significant, but long-term impacts will be negligible. Short and long-term soil resources impacts will be high and long-term impacts will be significant at the regional level. Regional impacts to geology and soils are not expected to be dependent on the MOB selected because the MOBs occur in similar geologic environments.

Engineering Geology. Possible project-induced geologic hazards consist of ground subsidence and fracturing caused by groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. Proposed project effects on engineering geology could cause short-term, low impacts, defined as noticeable increases in debris flows and flooding. Flooding may occur as sheet floods associated with basin margins adjacent to the San Andres and Sacramento mountains and surrounding mountain ranges in the deployment area. Road construction in the deployment area may affect surface drainage and may initiate or accelerate on and offbase flooding. However, it was assumed that necessary construction practices will be used that will minimize adverse effects from debris flows and flooding and therefore limit threats to public health and safety. Potential project-induced ground subsidence and fracturing may result from long-term water needs by the proposed project and associated inmigrant populations in the Tularosa and Hueco basins. No short-term change in the rate of ground subsidence and fracturing is expected and slight increases are expected during the operations phase. Long-term impacts as a result of ground subsidence and fracturing are expected to be negligible during the construction phase and low during the operations phase.

Project-associated surface disturbance in the deployment area and at the MOB may cause short and long-term, low impacts to engineering geology. These impacts are not expected to be significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 28,886,739 short tons. Project-induced demand will be greatest in 1990 when 12,429,640 short tons will be required. Peak-year aggregate demand will be about 398 percent of the 1984 aggregate production in south-central New Mexico and extreme western Texas, but demand will decline to less than 1 percent of production by 1995. Because of the critical increase in the production rate needed to satisfy project demand for aggregate, short-term, high impacts are expected. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. The proposed project will probably require identification, development, and production from new aggregate sources on and near the deployment area and MOB. Impacts will be negligible in the operations phase because of the reduced project demand for aggregate resources. A small portion of the deployment area on Fort Bliss is designated as a Known Geothermal Resource Field (KGRF). Deployment of the missile system in this area may restrict exploration and development of geothermal resources. However, this is expected to result in only a short-term, low impact. Since other geologic resources within the installations are not unique and are not substantial portions of the regional resource base, short and long-term, project-induced impacts are expected to be negligible.

For geologic resources, project-induced, short-term impacts will be high and significant at the regional level because of project-induced effects on aggregate supply and production rate. Long-term impacts to geologic resources will be negligible.

Soil Resources. Large portions of the deployment area may be disturbed by road upgrading (20,480 acres or 32 sq mi) and off-road HML operations (175 to 350 sq mi). Soil disturbance at the MOB as a result of facility construction is anticipated to be about 2,120 acres (3.3 sq mi). Approximately 57 percent of the soils on the installations are moderately to highly susceptible to erosion, indicating the probability of a high impact to soil resources from accelerated erosion during HML operations and associated construction activities. Offbase soil resources within the installations are not expected to be affected by wind and sheet erosion. However, erosion may cause irreparable damage to the productive capacity of soils in the deployment area and MOB.

For soil resources, short and long-term impacts will be high and long-term impacts will be significant at the regional level because of surface disturbance associated with construction and operations activities.

4.9.3.5 South-Central California Complex

Potential impacts were identified for all three elements. Both short and long-term impacts to engineering geology will be low and not significant. Short and long-term impacts to geologic resources will be high and significant at the regional level. For soil resources, short and long-term impacts will be high, but only long-term impacts will be significant. Regional impacts to geology and soils are not expected to be dependent on the MOB selected because both MOBs occur in similar geologic environments.

Engineering Geology. Possible project-induced geologic hazards consist of ground subsidence and fracturing caused by groundwater withdrawal (e.g., over-pumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. Proposed project effects on

engineering geology could cause short-term, low impacts, defined as noticeable increases in debris flows and flooding, in both the construction and operations phases. Flooding may occur as sheet floods associated with basin margins adjacent to the Slate and Granite mountains and other mountainous areas of the Mojave Desert. Road construction in the deployment area may affect surface drainage and may initiate or accelerate on and offbase flooding. However, necessary construction practices will be used that will lessen adverse effects from debris flows and flooding and limit threats to public health and safety. Potential project-induced ground subsidence and fracturing may result from long-term water needs by the proposed project and associated immigrant populations in Barstow, California and surrounding communities. No change in the rate of ground subsidence and fracturing is expected in the construction phase and slight increases in the region may occur during the operations phase. Long-term impacts as a result of ground subsidence and fracturing will be negligible during the construction phase and low during the operations phase.

Project-associated surface disturbance, subsidence, and fracturing in the deployment area and MOB may result in short and long-term, low impacts to engineering geology. These impacts are not expected to be significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 28,886,739 short tons. Project demand will be greatest in 1990 when 12,429,640 short tons will be required. Peak-year aggregate demand will be about 47 percent of the 1984 aggregate production in south-central California, but demand will decline to less than 1 percent of production by 1995. Most reported aggregate production in the ROI is located in the Los Angeles Basin. Consequently, if existing aggregate pits and facilities are used to meet project requirements, aggregate haul distances may greatly exceed the generally accepted maximum economical haul distance of 30 miles. Project-sponsored identification, development, and production from new aggregate sources near the deployment area and MOB may be a viable alternative to long-haul distances.

Short-term impacts to geologic resources are expected to be high because of the increase in the production rate needed to satisfy project demand for aggregate during the construction phase. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. The proposed project will probably require identification, development, and production from new aggregate sources on and near the deployment area and MOB. Impacts will be negligible in the operations phase because of the minor project demand for aggregate resources. A power generation facility is in development and an additional facility is being planned in the Coso Known Geothermal Resource Area (KGRA), which is located in the deployment area on China Lake Naval Weapons Center (NWC). Project-induced, long-term impacts to these geothermal facilities are expected to be high. Deployment of the missile system may inhibit future development of the geothermal resources in the Coso KGRA. Other geologic resources identified on the installations are not unique and are not substantial portions of the regional resource base; consequently, short and long-duration, project-induced impacts for these resources are expected to be negligible.

Project-induced effects on aggregate supply and production rate may result in short-term, high, and significant impacts at the regional level to geologic

resources. Long-term impacts are expected to be high and significant at the regional level because of potential deployment in an area with proven geothermal resources.

Soil Resources. Large portions of the RMA may be disturbed by road construction and upgrading (20,480 acres or 32 sq mi) and off-road HML operations (175 to 350 sq mi). Additional soil disturbance from facility construction (2,120 acres or 3.3 sq mi) may occur at the MOB. Approximately 60 percent of the soils in the RMA and 57 percent of the installation soils are moderately to highly susceptible to erosion. This indicates the likelihood of a high impact to soil resources because of accelerated soil erosion during HML operations and associated construction activities. Wind and sheet erosion within the installations is not expected to affect offbase soil resources, but it may cause irreparable damage to the productive capacity of soils in the deployment area and MOB. No important farmland occurs on the installations; therefore, project-induced farmland impacts are expected to be negligible.

Short and long-term impacts to soil resources will be high and long-term impacts will be significant at the regional level because of surface disturbance associated with operations activities.

4.9.3.6 Washington Complex

For all three elements, potential impacts were identified. For engineering geology, short-term impacts will be low and not significant and long-term impacts will be negligible. For geologic resources, short-term impacts will be high and significant at the regional level, but long-term impacts will be negligible. Both short and long-term soil resources impacts will be moderate and long-term impacts will be significant at the regional level.

Engineering Geology. Possible project-induced geologic hazards consist of flooding and mass movements (e.g., landslides and rock falls) associated with construction activities at the MOB and deployment area and the HML operations in the deployment area. Proposed project effects on engineering geology could cause short-term, low impacts, defined as noticeable increases in flooding and mass movements, in both the construction and operations phases. Flooding may occur as channelized flows along the tributaries of the Columbia River or as sheet flows on fluvial terraces, alluvial fans, or lakebeds. Areas susceptible to rock falls were identified on Yakima Firing Center (FC), and it is probable that additional construction or increased use of these areas during off-road operation of the HMLs will increase the frequency of rock falls. However, necessary construction practices will be used that will minimize adverse effects from floods and mass movements, therefore limiting threats to public health and safety.

Short-term, low impacts to engineering geology may occur because of the increased potential for flooding and mass movements in the deployment area and MOB. These impacts are expected to not be significant. Long-term impacts are expected to be negligible.

Geologic Resources. Total project aggregate resource requirements are expected to be 8,890,196 short tons. Project demand will be greatest in 1990 when 4,075,700 short tons will be required. Peak-year aggregate demand will be about 165 percent of the 1984 aggregate production in south-central

Washington, but demand will decline to less than 1 percent of production by 1995. Short-term impacts to geologic resources are expected to be high because of the critical increase in the production rate needed to satisfy project-induced demand for aggregate during the construction phase. These impacts will have a cumulative effect on the regional supply and production rate of aggregate resources. The proposed project may require identification, development, and production from new aggregate sources near the deployment area and MOB. Impacts will be negligible in the operations phase because of the reduced project demand for aggregate resources. Other geologic resources identified on the installations are not unique and are not substantial portions of the regional resource base; consequently, short and long-term, project-induced impacts are expected to be negligible.

Project-induced, short-term impacts to geologic resources will be high and significant at the regional level because of the project-induced effects on aggregate supply and production rate; long-term impacts will be negligible.

Soil Resources. Large portions of the RMA may be disturbed by road upgrading (5,150 acres or 8 sq mi) and off-road HML operations (50 to 100 sq mi), with additional soil disturbance occurring at the MOB (1,830 acres or 2.9 sq mi) as a result of facility construction. A majority of the soils in the RMA are moderately (36%) to highly (27%) susceptible to erosion, indicating the likelihood of a moderate impact to soil resources from accelerated soil erosion during HML operations and associated construction activities. Wind and sheet erosion within the installations is not expected to affect offbase soil resources, but it may cause irreparable damage to the productive capacity of soils in the deployment area and MOB. There is no important farmland on the installations; therefore, project-induced impacts to farmland will be negligible.

Short and long-term impacts to soil resources will be moderate and long-term impacts will be significant at the regional level because of surface disturbance associated with operations activities.

4.9.4 Impacts of Hard Mobile Launcher at Minuteman Facilities

4.9.4.1 Ellsworth Air Force Base

Potential impacts were identified for all three elements. Short and long-term impacts to engineering geology are expected to be moderate, but significant only for short-term impacts. Short-term impacts to geologic resources will be high and of regional and statewide significance. Long-term impacts will be low and not significant. Both short and long-term impacts to soil resources will be low and not significant.

Engineering Geology. Project-induced geologic hazards consist of mass movements, which are associated with both construction and operations activities, and flooding, which may be aggravated by proposed project construction. Landslides are common in cut slopes, fills, and excavations in the Pierre Shale, the bedrock unit underlying at least 50 percent of the launch facilities and almost all of the ROI. Mass movements may be initiated by increased erosion and soil loading during both construction and operations. Proposed project short and long-term impacts related to engineering geology will be moderate because of the potential for increases in mass movements caused by

construction and operations activities. These impacts represent essentially unknown and possibly unacceptable risks to public health and safety. Mitigation may be required to minimize the effects of mass movements and flooding during construction and to stabilize areas of high landslide susceptibility during the operations phase. Road upgrading that inhibits surface drainage may increase the soil's susceptibility to mass movements and accelerate on and offbase flooding. Short-term impacts resulting from flooding are expected to be low in both the construction and operations phases. Impacts to all other subelements are expected to be negligible.

In summary, short-term impacts to engineering geology will be moderate and significant at the regional level because of the potential for increases in the rate of mass movements. Long-term impacts will be moderate but are not considered significant because mitigation is expected to limit recurrent movement of existing landslides.

Geologic Resources. Total project aggregate resource requirements are expected to be 3,943,013 short tons. Project demand will be greatest in 1990 when 1,549,144 short tons will be required. Peak-year aggregate demand will be about 435 percent of the 1984 aggregate production in west-central South Dakota, but demand will decline to about 5 percent of production by 1996. Short-term impacts to geologic resources are expected to be high since the project will probably require the identification, development, and production of new aggregate sources in the region and will affect the statewide utilization of resources. This demand on geologic resources will have a cumulative effect on the supply and production of aggregate resources. Project demands will require a major portion of the regional resource supply, as well as production facilities, and may result in long-term, low impacts that are not considered significant. Short and long-duration impacts to other geologic resources are expected to be negligible because they are not unique and do not represent an important part of the resource base of the region.

Short-term impacts to geologic resources will be high and of regional and statewide significance. Long-term impacts will be low and not significant because of project-induced effects on aggregate supply and rate of production.

Soil Resources. Portions of the ROI may be disturbed by MOB construction (1,530 acres or 2.4 sq mi) and deployment/dispersal area road and bridge upgrading (1,580 acres or 2.5 sq mi). About 90 percent of the soils of the ROI are moderately to highly susceptible to sheet erosion and approximately 20 percent of the soils are moderately to highly susceptible to wind erosion. Construction activity may disrupt soil horizons, remove vegetative cover, and accelerate soil erosion. Approximately 40 percent of the ROI is important farmland and may be adversely affected by increased soil erosion as a result of project-related construction. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of the soils resulting in long-term, low impacts. Proposed project short and long-term impacts to important farmland are expected to be negligible because of the minor areal extent of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB. Impacts to all other soil resources are expected to be negligible.

In summary, short and long-term impacts to soil resources will be low as a result of project-related surface disturbance at the MOB and in the deployment area. Impacts to soil resources are not considered significant.

4.9.4.2 F.E. Warren Air Force Base

The potential for impacts was found for all three geologic resource elements. For engineering geology, short-term impacts are expected to be low and not significant; long-term impacts are expected to be negligible. For geologic resources, short-term impacts are expected to be moderate and of statewide significance, while long-term impacts will be low and not significant. For soil resources, short and long-term impacts are expected to be low and not significant.

Engineering Geology. Project-induced geologic hazards consist of flooding and mass movements associated with construction activities in the ROI and MOB and HML operations in the ROI. Approximately 50 percent of the soils in the ROI have severe limitations for shallow excavations because of the potential for caving or sloughing of excavation walls. Proposed project short-term impacts related to engineering geology are expected to be low because of the expected increases in the incidence of project-related excavation wall failures, but long-term impacts are considered negligible. Mitigation may be required to stabilize the walls of excavations during construction. Road and facility construction may affect surface drainage and initiate or accelerate on and offbase flooding by destroying vegetation and increasing the rate of surface runoff during precipitation events. However, necessary construction practices will be used that will lessen adverse effects of flooding and limit threats to public health and safety; therefore, impacts will be negligible.

Overall, short-term impacts related to engineering geology will be low and not significant because of the potential for excavation failure. Long-term impacts will be negligible.

Geologic Resources. Total project aggregate resource requirements are expected to be 4,555,601 short tons. Project demand will be greatest in 1990 when 2,065,422 short tons will be required. Peak-year aggregate demand will be about 35 percent of the 1984 aggregate production in the ROI counties, but demand will decline to about 1 percent of production by 1995. The proposed project will probably require identification, development, and production of new aggregate sources in the region and will affect the statewide utilization of resources. This demand for aggregate resources will have a cumulative effect on the supply and production of available resources. Project demands will require a major portion of the regional resource supply, as well as production facilities; however, because of the underutilized aggregate production facilities in the region, project-induced, short-term impacts are expected to be moderate during the construction phase. These impacts will be significant because the excess capacity is not adequate to satisfy the project demand. For other geologic resources, impacts are considered negligible because they are not unique and do not represent an important part of the resource base of the region.

Short-term impacts to geologic resources will be moderate and significant because of project-induced effects on aggregate supply and rate of production. Long-term impacts will be low and not significant.

Soil Resources. Portions of the ROI may be disturbed by road and bridge upgrading (1,960 acres or 3.1 sq mi), with additional soil disturbance occurring at the MOB as a result of facility construction (1,540 acres or 2.4 sq mi). Most of the soils in the ROI are moderately to highly susceptible to both wind and sheet erosion. In addition, over 50 percent of the ROI is important farmland and may be adversely affected by increased soil erosion. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of the soils resulting in long-term, low impacts. Proposed project short and long-term impacts to important farmland are expected to be negligible because of the minor areal extent of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB. Impacts to all other soil resources are expected to be negligible.

Because of project-related surface disturbance at the MOB and in the deployment area, short and long-term impacts to soil resources will be low and not significant.

4.9.4.3 Grand Forks Air Force Base

Potential impacts for two elements were identified. For engineering geology, negligible impacts are expected. For geologic resources, short-term impacts are expected to be high and of regional and statewide significance, while long-term impacts are expected to be low and not significant. Short and long-term impacts to soil resources will be low and not significant.

Engineering Geology. No project-induced geologic hazards are expected for this base. Proposed project effects to engineering geology are expected to produce negligible impacts. No initiation or acceleration in geologic processes is expected.

Geologic Resources. Total project aggregate resource requirements are expected to be 3,943,013 short tons. Project demand will be greatest in 1990 when 1,549,144 short tons will be required. Peak-year aggregate demand will be about 203 percent of the 1984 aggregate production in eastern North Dakota, but demand will decline to about 2 percent of production by 1996. Short-term impacts to geologic resources are expected to be high. Since the proposed project will probably require the identification, development, and production of new aggregate sources in the region and will affect the statewide utilization of resources, the effect of this demand for aggregate sources or the supply and production of available resources will be cumulative. Project demands will require a major portion of the regional resource supply, as well as production facilities, and may result in long-term, low impacts that are not considered significant. Impacts to other geologic resources are considered negligible because they are not unique and do not represent an important part of the resource base of the region.

Short-term impacts to geologic resources will be high and of regional and statewide significance; long-term impacts will be low and not significant because of project-induced effects on aggregate supply and rate of production.

Soil Resources. Portions of the ROI may be disturbed by the upgrading of roads and bridges in the ROI (1,580 acres or 2.5 sq mi) and facility construction at the MOB (1,530 acres or 2.4 sq mi). Construction activity will disrupt soil horizons, remove vegetative cover, and accelerate soil erosion. Moderate amounts of moderately erodible soil occur on floodplains, glacial till and lake plains, delta sands, and beaches. In the ROI, 35 to 85 percent of all soils are considered important farmland. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of soils resulting in long-term, low impacts. Because of the minor areal extent of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB, proposed project short and long-term impacts to important farmland are expected to be negligible. Impacts to all other soil resources are considered negligible.

In summary, short and long-term impacts to soil resources will be low and not significant as a result of project-related surface disturbance at the MOB and in the deployment area.

4.9.4.4 Malmstrom Air Force Base

Potential impacts have been identified for all three elements. Short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be high and of regional and statewide significance, while long-term impacts will be low and not significant. Short and long-term soil resources impacts will be low and not significant.

Engineering Geology. Project-induced geologic hazards consist of mass movements, which are associated with construction and operation activities, and flooding, which may be aggravated by proposed project construction. Landslides in the ROI are related, in part, to soil loading from roadway fill and are commonly found associated with Cretaceous shales that dominate the intermontane areas of central Montana. Proposed project short and long-term impacts that are related to engineering geology are expected to be low and of local extent because of the increased potential for mass movements and flooding. These impacts represent essentially unevaluated risks and possibly unacceptable risks to public health and safety. Mitigation may be required to minimize the effects of mass movements and flooding in the construction phase and to stabilize areas of high landslide susceptibility during the operations phase. Construction that inhibits surface drainage may result in greater subsurface water infiltration, increasing the soil's susceptibility to mass movements and accelerating on and offbase flooding. However, it was assumed that necessary construction practices will be used to minimize adverse effects from flooding, therefore limiting threats to public health and safety. Impacts to all other subelements of engineering geology are considered negligible.

In summary, both short and long-term impacts to engineering geology will be low and not significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 4,555,601 short tons. Project demand will be greatest in 1990 when 2,065,422 short tons will be required. Peak-year aggregate demand will

be about 198 percent of the 1984 aggregate production in west-central Montana, but demand will decline to less than 1 percent of production by 1996. Short-term impacts to geologic resources are expected to be high during the construction phase as the proposed project will probably require the identification, development, and production of new aggregate sources in the region and will affect the statewide utilization of resources. The demand for aggregate resources will have a cumulative effect on the supply and production of available resources. Project demands will require a major portion of the regional resource supply, as well as production facilities, and may result in long-term, low impacts that are not considered significant. Impacts to other geologic resources are expected to be negligible because they are not unique and are not an important part of the resource base of the region.

Short-term impacts to geologic resources will be high and of regional and statewide significance; long-term impacts will be low and not significant because of project-induced effects on aggregate supply and production rate.

Soil Resources. Portions of the ROI may be disturbed by MOB construction (1,540 acres or 2.4 sq mi) and upgrading of roads and bridges (1,960 acres or 3.1 sq mi). Soils in the ROI are moderately to highly susceptible to erosion, and susceptibility generally increases once the surface horizon (the top 4 to 10 inches) is disturbed and the underlying horizons are exposed. The ROI lies in a portion of the state that is predominantly farmland. Approximately 50 percent of the ROI is dry or irrigated cropland. Overall, only about 20 percent of the state is cultivated. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of soils resulting in long-term, low impacts. Proposed project short and long-term impacts to important farmland are expected to be negligible because of the minor amounts of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB.

In summary, short and long-term impacts to soil resources will be low and not significant because of project-related surface disturbance at the MOB and in the deployment area.

4.9.4.5 Minot Air Force Base

The potential for impacts was identified for all three elements. Short and long-term, low, and not significant impacts are expected for engineering geology. For geologic resources, short-term impacts are expected to be high and of statewide significance and long-term impacts are expected to be low and not significant. For soil resources, short and long-term impacts are expected to be low and not significant.

Engineering Geology. Project-induced geologic hazards consist of mass movements (e.g., landslides and slumps) caused by construction activities in potential slide areas. Construction associated with the MOB and for road upgrading may disturb unstable slopes and initiate or accelerate downslope movement. Slide-prone areas include stable and active landslide deposits in the Souris and Des Lacs River valleys. Proposed project short and long-term impacts are expected to be low and of local extent. Construction activities may initiate or slightly increase landslide activity. Project-induced geologic

hazards are not expected to produce excessive risks to public health and safety. Impacts to all other subelements of engineering geology are considered negligible.

Proposed project effects are expected to initiate or slightly increase mass movement in slide prone areas, creating short and long-term, low, and regional impacts that are not considered significant.

Geologic Resources. Total project aggregate resource requirements are expected to be 3,943,013 short tons. Project demand will be greatest in 1990 when 1,549,144 short tons will be required. Peak-year aggregate demand will be about 253 percent of the 1984 aggregate production in north-central North Dakota, but demand will decline to about 3 percent of production by 1996. Most aggregate in North Dakota has been found to be unsuitable for most military and highway construction. Proposed project short-term impacts to geologic resources are expected to be high. The proposed project will require the identification, development, and production of new aggregate sources in the region and will affect the statewide utilization of resources. The demand for aggregate resources will have a cumulative effect on the supply and production of available resources. Project demands will require a major portion of the regional resource supply, as well as production facilities, and may result in long-term, low impacts that are not considered significant. Impacts to other geologic resources are considered negligible because they are not unique and are not an important part of the resource reserves of the region.

For geologic resources, short-term impacts are expected to be high and of statewide significance, with long-term, low, and not significant impacts resulting from project-induced effects on aggregate supply and rate of production.

Soil Resources. Portions of the ROI may be disturbed by the upgrading of roads and bridges in the ROI (1,580 acres or 2.5 sq mi) and facility construction at the MOB (1,530 acres or 2.4 sq mi). Construction activities will disrupt soil horizons, remove vegetative cover, and accelerate soil erosion. Moderate amounts of important farmland occur throughout the ROI. Erodible soils occur on till plains which cover portions of the ROI. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of soils resulting in long-term, low impacts. Proposed project short and long-term impacts to important farmland are expected to be negligible because of the minor areal extent of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB. Impacts to all other soil resources are expected to be negligible.

In summary, short and long-term impacts to soil resources will be low and not significant as a result of project-related surface disturbance at the MOB and in the deployment area.

4.9.4.6 Whiteman Air Force Base

Proposed project short and long-term impacts to engineering geology are expected to be negligible. Short-term impacts to geologic resources will be high and of regional and statewide significance, while long-term impacts are expected to be low and not significant. Short and long-term impacts to soil resources are expected to be low and not significant.

Engineering Geology. No project-induced geologic hazards are expected for this base. Proposed project short and long-term impacts to engineering geology are expected to be negligible. No initiation or acceleration of the rates of geologic processes is likely.

Geologic Resources. Total project aggregate resource requirements are expected to be 3,943,013 short tons. Project demand will be greatest in 1990 when 1,549,144 short tons will be required. Peak-year aggregate demand will be about 592 percent of the 1984 aggregate production in west-central Missouri, but demand will decline to about 6 percent of production by 1996. Because the proposed project will probably require the identification, development, and production of new aggregate sources in the region and affect the statewide utilization of resources, proposed project short-term impacts to geologic resources are expected to be high. The demand for aggregate resources will have a cumulative effect on the supply and production of available resources. Project demands will require a major portion of the regional resource supply, as well as production facilities, and may result in long-term, low impacts that are not considered significant. Impacts to other geologic resources are considered negligible because they are not unique and are not an important part of the resource base of the region.

Because of project-induced effects on aggregate supply and rate of production, construction-phase, short-term impacts to geologic resources will be high and of regional and statewide significance, with long-term, low, and not significant impacts in the operations phase.

Soil Resources. Moderate amounts of soil may be affected by upgrading of roads and bridges in the ROI (1,580 acres or 2.5 sq mi) and facility construction at the MOB (1,530 acres or 2.4 sq mi). Construction activities will disrupt soil horizons, remove vegetative cover, and accelerate soil erosion. More than a third of the soils in the ROI are considered important farmland. Moderately to highly erodible soils occur on ridgetops, floodplains, terraces, and moderate to slight slopes in much of the ROI. Project-related construction in the MOB and the deployment area is expected to cause short-term, low impacts because of accelerated soil erosion. Construction and operations activities at the MOB may cause long-term degradation of the productive capacity of soils resulting in long-term, low impacts. Proposed project short and long-term impacts to important farmland are expected to be negligible because of the minor areal extent of ground-disturbing activities in the deployment area and the absence of important farmland on the MOB. Impacts to all other soil resources are considered negligible.

Short and long-term impacts to soil resources will be low and not significant as a result of project-related surface disturbance at the MOB and in the deployment area.

4.9.5 Impacts of Hard Silo in Patterned Array

4.9.5.1 Davis-Monthan Air Force Base

Potential impacts have been identified for all three elements. Both short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be low and not significant, while long-term impacts will be high and not significant. Short and long-term impacts to soil resources are expected to be moderate and long-term impacts will be significant at the regional level.

Engineering Geology. Project-induced geologic hazards consist of ground subsidence and fracturing from groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. The proposed project is expected to cause short-term, low impacts to engineering geology because of slight increases in debris flows and flooding in both the construction and operations phases. This may increase the risk to public health and safety to unacceptable limits. Flooding may occur as sheet floods associated with basin margins adjacent to the Santa Catalina, Tucson, and Santa Rita mountains and at other mountain ranges near the SDAs. Mass movements (e.g., landslides) are expected to occur periodically in deep excavations associated with deployment-area construction. The frequency of debris flows is expected to increase in response to the increased frequency of flooding resulting from construction. Road and deployment-area construction in the SDA and facility construction at the MOB will affect surface drainage and may initiate or accelerate on and offbase flooding. The proposed project will require mitigation to minimize adverse effects of debris flows and flooding in the Santa Cruz, San Pedro, and Avra valleys. Potential ground subsidence and fracturing impacts are the result of long-term water needs of the proposed project and associated inmigration to the Santa Cruz River Valley. No change in the rate of ground subsidence and fracturing is expected in the construction phase; therefore, the short-term impacts will be negligible for the region. However, the cumulative rate of subsidence may increase in the operations phase and result in long-term, low impacts.

For engineering geology, both short and long-term impacts are expected to be low and not significant.

Geologic Resources. Project-induced, long-term impacts to geologic resources are expected to be high because of the restriction of access, exploration, or development of mineral and energy resources in the SDAs. These resources, which include several strategic and critical minerals, are not unique in the region or do not represent a substantial part of the regional resource base. Specific conflicts may occur associated with areas identified as having low-temperature geothermal waters in the Avra Valley and along the Santa Cruz and San Pedro River valleys. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about 10 percent of the 1984 aggregate production in southeastern Arizona, but demand will decline to less than 1 percent of production by 1997. Short-term impacts to aggregate resources are expected to be low as the proposed project will probably require small increases in production from existing or new aggregate sources in the region. This demand for aggregate will have a cumulative effect on the supply and production rate of available resources.

Project-induced impacts will increase in intensity to a peak in 1994 and diminish thereafter, resulting in negligible impacts in the operations phase.

Long-term impacts to geologic resources will be high and not significant because of project-induced impacts to mineral and energy resources. Short-term, low, and not significant impacts are expected as a result of project demand for aggregate resources during the construction phase.

Soil Resources. Approximately 28.1 sq mi (18,000 acres) of the SDA may be disturbed by road and facility construction. Additionally, 1,700 acres (2.6 sq mi) of soil disturbance will occur on the MOB. Approximately 5 percent (110 sq mi) of the SDA is considered important farmland, with additional important farmland located near the SDA along the Santa Cruz River. About 65 percent of the soils in the SDA are moderately susceptible to wind or sheet erosion. Proposed project short and long-term impacts to soil resources will be moderate because project activities are expected to initiate or substantially increase soil erosion. Short and long-term impacts to important farmland will be negligible, but long-term impacts will be high because of possible degradation of the productive capacity of soils during construction and because project activities may eliminate a large portion of the important farmland in the region.

Short and long-term impacts to soil resources will be moderate as a result of surface disturbance and the potential for conflict with important farmland associated with construction and operations activities. Long-term impacts are expected to be significant at the regional level.

4.9.5.2 Edwards Air Force Base

Potential impacts have been identified for all three elements. Both short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be negligible and long-term impacts will be high and significant. Short and long-term impacts to soil resources will be high and long-term, regional-level impacts will be significant.

Engineering Geology. Project-induced geologic hazards consist of ground subsidence and fracturing caused by groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. The proposed project is expected to cause short-term, low impacts to engineering geology because of slight increases in debris flows and flooding in both the construction and operations phases. The proposed project may increase the risk to public health and safety to unacceptable limits, and mitigation may be required to minimize adverse effects by debris flows and flooding in the SDAs. Mass movements (e.g., landslides) are expected to occur periodically in deep excavations associated with deployment-area construction, and the frequency of debris flows is expected to increase in response to the increased flooding frequency caused by construction. Road and deployment-area construction in the SDA and facility construction at the MOB will affect surface drainage and may initiate or accelerate on and offbase flooding. This flooding may occur as sheet floods associated with basin margins such as those adjacent to the San Gabriel and Tehachapi mountains. Ground subsidence and fracturing were identified in and near Lancaster, and at Koehn, Rogers, and Rosamond lakes. The long-term water demands of the

pro[illegible] project and associated inmigrant populations may result in additional subs[illegible]ence and fracturing. No change in the rate of ground subsidence and fracturing is expected during construction; therefore, the short-term impacts will be negligible. Low impacts may occur because of a slight increase in the rate of ground subsidence and fracturing in the region and may present risks to public health and safety.

In summary, short and long-term impacts to engineering geology will be low and not significant because of surface disturbance, ground subsidence and fracturing, and public health and safety considerations in the SDAs.

Geologic Resources. Because of the restriction of access, exploration, or development of mineral and energy resources in the SDAs, project-induced, long-term impacts to geologic resources are expected to be high and significant at the regional level. The mineral and energy commodities in the SDAs are not unique and do not represent a substantial portion of the regional resource base. Active mining operations and occurrences of strategic and critical minerals are found in the SDAs. Several areas designated as favorable for the discovery of mineral resources exist in the region and on the installations. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about 3 percent of the 1984 aggregate production in south-central California, but demand will decline to less than 1 percent of production by 1997. Existing aggregate producers are expected to be capable of handling the 3-percent increase in production required to meet peak-year demand. However, most reported aggregate production in the ROI is located in the Los Angeles Basin. Consequently, if existing aggregate pits and facilities are used to meet project requirements, then aggregate haul distances may greatly exceed the generally accepted maximum economical haul distance of 30 miles. Short and long-term impacts to aggregate resources are expected to be negligible because the proposed project will probably require small increases in production from existing or new aggregate sources in the region.

Project-induced, long-term impacts to geologic resources will be high and significant at the regional level because of potential conflicts with mineral and energy resources. Short-term impacts are expected to be negligible because of project aggregate demand.

Soil Resources. Road, facility, and deployment-area construction may disturb about 28.1 sq mi (18,000 acres) of the SDA. Additionally, 1,700 acres (2.6 sq mi) may be disturbed at the MOB. Approximately 11 percent (138 sq mi) of the SDA is considered important farmland, with the majority of the important farmland in the region located west of Edwards AFB. Nearly 92 percent of the soils in the SDA are highly susceptible to wind erosion. Proposed project short and long-term impacts to soil resources will be high because the project is expected to initiate or substantially increase soil erosion. Short-term impacts to important farmland will be negligible, but long-term impacts will be high because project activities may eliminate or degrade the productive capacity of a large portion of the important farmland in the region.

Short and long-term impacts to soil resources will be high as a result of surface disturbance associated with construction and operations activities; only long-term impacts will be significant at the regional level.

4.9.5.3 F.E. Warren Air Force Base

For all three elements of geology and soils, potential impacts have been identified. Short-term impacts to engineering geology will be low and not significant, with long-term, negligible impacts. Long-term impacts to geologic resources will be low and not significant, while short-term impacts will be negligible. Short-term impacts to soil resources will be moderate and not significant. Long-term impacts will be high and significant at the regional level.

Engineering Geology. Project-induced geologic hazards consist of flooding and mass movements associated with construction activities. The proposed project is expected to cause short-term, low impacts because of slight increases in flooding and mass movements in both the construction and operations phases. Road and deployment-area construction in the SDA and facility construction at the MOB may affect surface drainage and may initiate or accelerate offbase flooding. This flooding may occur as sheet flows on upland areas or as increased runoff to the existing drainages in the region. Mitigation may be required to minimize adverse effects of flooding. Mass movements are expected to occur at excavations associated with deployment-area construction, and project-related construction is expected to increase the occurrence of slope instabilities, particularly in large excavations.

Short-term impacts to engineering geology will be low and not significant; long-term impacts will be negligible.

Geologic Resources. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about 13 percent of the 1984 aggregate production in southeast Wyoming and western Nebraska, but demand will decline to about 1 percent of production by 1997. Existing suppliers in the region will probably be able to supply project-required aggregate. This aggregate demand will have a cumulative effect on the supply and production rate of available resources. Because of the underutilized aggregate production facilities in the region, project-induced, short-term impacts are expected to be negligible during the construction and operations phases. Only a few other geologic resources occur in the SDA and none are actively being mined or otherwise exploited; therefore, long-term impacts are expected to be low and not significant for geologic resources.

Short-term impacts to geologic resources are expected to be negligible because of project aggregate demand, and long-term, low, and not significant impacts are expected because of project-induced effects on mineral and energy resources in the SDA.

Soil Resources. About 28.1 sq mi (18,000 acres) of the SDA may be disturbed by road, facility, and deployment-area construction. An additional 1,700 acres (2.6 sq mi) may be disturbed on the MOB. About 50 percent (108 sq mi) of the SDA is important farmland which may be eliminated or degraded by project-related construction. Soils in the SDA are moderately (32%) to highly (37%) susceptible to wind or sheet erosion. Proposed project short and long-term impacts resulting from soil erosion will be moderate because project construction may initiate or substantially increase soil erosion leading to the

degradation of productive capacity. Short-term impacts to important farmland will be negligible, but long-term impacts are considered high because construction and operations conditions may remove or restrict the use of important farmland.

Short-term impacts to soil resources will be moderate and not significant at the regional level. Long-term, regional-level impacts are expected to be high and significant because of surface disturbance and the removal or degradation of important farmland associated with construction and operations activities.

4.9.5.4 Fort Bliss

Potential impacts have been identified for all three elements. Short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be moderate and significant at the regional level, while long-term impacts will be high and significant. Short and long-term soil resources impacts will be high and long-term impacts will be significant at the regional level.

Engineering Geology. Project-induced geologic hazards consist of ground subsidence and fracturing caused by groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. The proposed project is expected to cause short and long-term, low impacts to engineering geology because of slight increases in debris flows and flooding. These impacts may increase the risk to public health and safety to unacceptable limits. Mitigation may be required to minimize adverse effects of debris flows and flooding in the Hueco and Tularosa basins and the basins west of the Rio Grande River. Road and deployment-area construction in the SDA and facility construction at the MOB may affect surface drainage and initiate or accelerate on and offbase flooding. This flooding may occur as sheet floods associated with basin margins adjacent to the San Andres, Hueco, and Sacramento mountains and in the basin areas west of the Rio Grande River. Mass movements (e.g., landslides) are expected to occur periodically in deep excavations associated with deployment-area construction. The frequency of debris flows is expected to increase in response to the increased flooding frequency. Potential ground subsidence and fracturing impacts are the result of long-term water needs of the proposed project and associated inmigrant populations in the Tularosa, Mesilla, and Hueco basins. No change in the rate of ground subsidence and fracturing is expected during construction; therefore, the short-term impact will be negligible. However, long-term impacts will be low because of a slight increase in the rate of ground subsidence and fracturing in the region during the operations phase.

Short and long-term impacts to engineering geology will be low and not significant.

Geologic Resources. Project-induced, long-term impacts to geologic resources are expected to be high and significant at the regional level because of the restriction of access, exploration, or development of mineral and energy resources in the SDAs. The mineral commodities in the SDAs are, however, not unique in the region and do not represent a substantial part of the regional resource base. Specific conflicts may occur associated with geothermal resources in the Radium Springs and Kilbourne Hole KGRAs and the KGRF in the Rio Grande Valley. Both are in or near portions of the SDAs in the Rio Grande

Valley. Several occurrences of strategic and critical minerals and other metallic and nonmetallic mineral commodities exist in SDAs. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about 24 percent of the 1984 aggregate production in south-central New Mexico and extreme western Texas, but demand will decline to about 1 percent of production by 1997. Because the project will probably require accelerated production from existing or new aggregate sources in the region, short-term impacts to aggregate resources are expected to be moderate. The demand for aggregate will have a cumulative effect on the supply and production rate of available resources. Project-induced impacts will increase in intensity to a peak in 1994 and decrease thereafter, resulting in negligible impacts in the operations phase.

Long-term impacts to geologic resources will be high and significant at the regional level as a result of project-induced impacts to mineral and energy resources in the SDAs, with short-term, moderate, and significant impacts resulting from project aggregate demand.

Soil Resources. About 28.1 sq mi (18,000 acres) of the SDA may be disturbed by road, facility, and deployment-area construction. An additional 1,700 acres (2.6 sq mi) are expected to be disturbed at the MOB. No important farmland exists within the SDA, but the majority of the important farmland in the region is located near the SDA along the Rio Grande River. About 76 percent of the soils in the SDA are highly susceptible to wind or sheet erosion. Proposed project short and long-term impacts to soil resources will be high because project activities are expected to initiate or substantially increase soil erosion and cause irreparable damage to the productive capacity of the soil.

Short and long-term impacts to soil resources will be high as a result of surface disturbance associated with construction and operations activities, and long-term impacts will be significant at the regional level because of potential conflicts with important farmland.

4.9.5.5 Gila Bend Air Force Auxiliary Field

Potential impacts for all three elements have been identified. Short and long-term impacts to engineering geology will be low and not significant. Short-term impacts to geologic resources will be negligible and long-term impacts will be high and not significant. Short-term impacts to soil resources will be moderate and not significant; long-term impacts will be high and significant at the regional level.

Engineering Geology. Project-induced geologic hazards consist of ground subsidence and fracturing resulting from groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. Mass movements (e.g., landslides) are expected to occur periodically in deep excavations associated with deployment-area construction. The frequency of debris flows is expected to increase in response to the increased frequency of flooding caused by construction. Proposed project effects to engineering geology are expected to cause short-term, low impacts duration because of slight increases in debris flows and flooding in both the construction and operations phases. This may

increase the risk to public health and safety to unacceptable limits. The proposed project will require mitigation to minimize adverse effects by debris flows and flooding in the SDAs along the Gila River and in other valleys designated as SDAs. Road and deployment-area construction in the SDA and facility construction at the MOB will affect surface drainage and may initiate or accelerate on and offbase flooding. This flooding may occur as sheet floods associated with basin margins adjacent to the Gila and Maricopa mountains, and near other mountain ranges adjacent to SDAs. Potential ground subsidence and fracturing impacts are the result of long-term water needs of the proposed project and associated inmigrant populations in the Gila River Valley. No change in the rate of ground subsidence and fracturing is expected during construction; therefore, the short-term impacts will be negligible. Long-term, low impacts may occur as a result of a slight increase in the rate of ground subsidence and fracturing in the region during the operations phase.

For engineering geology, short and long-term impacts resulting from surface disturbance in the SDA and MOB will be low and not significant.

Geologic Resources. Project-induced, long-term impacts to geologic resources are expected to be high and not significant as a result of the restriction of access, exploration, or development of mineral resources in the SDAs. The mineral commodities in the SDAs are not unique in the region and do not represent a substantial part of the regional resource base. Specific conflicts may occur associated with low-temperature geothermal resources located in many of the valleys in the SDA. Several occurrences of strategic and critical minerals and several metallic districts and nonmetallic mineral commodities exist in the SDAs. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about 3 percent of the 1984 aggregate production in the ROI, but demand will decline to less than 1 percent of production by 1997. Existing aggregate producers in the ROI are expected to be able to accommodate the 3-percent increase required during peak demand; therefore, short and long-term impacts to aggregate resources are expected to be negligible.

Long-term impacts to geologic resources will be high and not significant as a result of project-induced impacts to mineral and energy resources in the SDAs, with short-term, negligible impacts expected because of project aggregate demands.

Soil Resources. About 28.1 sq mi (18,000 acres) of the SDA may be disturbed by road, facility, and deployment-area construction. An additional 1,700 acres (2.6 sq mi) of disturbance is expected at the MOB. Approximately 14 percent (307 sq mi) of the SDA is considered important farmland, with additional important farmland located near the SDA along the Gila River. About 57 percent of the soils in the SDA are moderately susceptible to wind or sheet erosion. Proposed project activities are expected to initiate or substantially increase soil erosion and cause irreparable damage to the productive capacity of the soils during both the construction and operations phases. Proposed project short-term impacts to soil resources will be moderate and of regional extent because a large percentage of the SDA has soils with moderate susceptibilities to erosion. Project-related construction may eliminate a large portion of the important farmland in the region causing long-term, high impacts to soil resources.

Short-term impacts to soil resources are expected to be moderate and not significant as a result of surface disturbance associated with construction and operations activities. Long-term impacts are anticipated to be high and significant at the regional level because of potential impacts to important farmland.

4.9.5.6 Yuma Proving Ground

Potential impacts have been identified for all three elements. Short and long-term impacts to engineering geology are expected to be low and not significant. Short-term impacts to geologic resources are expected to be negligible, while long-term impacts are expected to be high and not significant. Short and long-term impacts to soil resources are expected to be moderate and long-term impacts will be significant at the regional level.

Engineering Geology. Project-induced geologic hazards consist of ground subsidence and fracturing caused by groundwater withdrawal (e.g., overpumping of aquifers) and mass movements (e.g., debris flows and flooding) associated with construction activities. Mass movements (e.g., landslides) are expected to occur locally in deep excavations associated with deployment-area construction. Debris flow frequency is expected to increase in response to the increased frequency of flooding caused by construction. Proposed project effects to engineering geology are expected to cause short and long-term, low impacts because of slight increases in debris flows and flooding in both the construction and operations phases, which may increase the risk to public health and safety to unacceptable limits. The proposed project will require mitigation to minimize adverse effects by debris flows and flooding in the SDAs along the Gila River and in other valleys designated as SDAs. Road and deployment-area construction in the SDA and facility construction at the MOB may affect surface drainage and may initiate or accelerate on and offbase flooding. This flooding may occur as sheet floods associated with basin margins adjacent to the Gila and Castle Dome mountains, as well as other mountain ranges near the SDAs. Potential ground subsidence and fracturing impacts are the result of long-term water needs of the proposed project and associated inmigrant populations in the Colorado and Gila River valleys. No change in the rate of ground subsidence and fracturing is expected during construction; therefore, the short-term impacts will be negligible. Long-term, low impacts may occur because of a slight increase in the rate of ground subsidence and fracturing in the region during the operations phase.

In summary, short and long-term impacts to engineering geology will be low and not significant as a result of surface disturbance in the SDA and MOB.

Geologic Resources. Project-induced, long-term impacts to geologic resources are expected to be high and not significant because of the restriction of access, exploration, or development of mineral resources in the SDAs. The mineral commodities in the SDAs are not unique and do not represent a substantial portion of the regional production. Specific conflicts associated with low-temperature geothermal resources located in many of the valleys in the SDA may occur. Several occurrences of strategic and critical minerals, and several metallic districts and nonmetallic mineral commodities, exist in the SDAs. Total project aggregate resource requirements are expected to be 3,457,023 short tons. Project demand will be greatest in 1994 when 740,826 short tons will be required. Peak-year aggregate demand will be about

4 percent of the 1984 aggregate production in southeastern California and southwestern Arizona, but demand will decline to less than 1 percent of production by 1997. Short-term impacts to aggregate resources are expected to be negligible because the project will probably require little or no increased production from existing or new aggregate sources in the region. The demand for aggregate will have a cumulative effect on the supply and production rate of available resources. Project-induced impacts will increase in intensity to a peak in 1994 and diminish thereafter, resulting in negligible impacts in the operations phase. Existing aggregate producers are expected to be capable of handling the 4-percent increase in production required to meet peak-year demand. However, most reported aggregate production in the ROI is located in Maricopa County, Arizona near Phoenix. Consequently, if existing aggregate pits and facilities are used to meet project requirements, then aggregate haul distances may greatly exceed the generally accepted maximum economical haul distance of 30 miles.

Long-term impacts to geologic resources will be high and not significant because of project-induced impacts on mineral and energy resources in the SDAs, with short-term, negligible impacts anticipated to result from project aggregate demand.

Soil Resources. About 28.1 sq mi (18,000 acres) of the SDA may be disturbed by road, facility, and deployment-area construction. An additional 1,700 acres (2.6 sq mi) of disturbance is expected at the MOB. No important farmland exists within the SDA, but important farmland is located near the SDA along the Gila and Colorado rivers. About 75 percent of the soils in the SDA are moderately susceptible to sheet erosion. Proposed project short-term impacts to soil resources will be moderate because project construction is expected to initiate or substantially increase soil erosion. Long-term impacts from soil erosion are considered moderate and may result in irreparable damage to the productive capacity of the soil.

Short and long-term impacts to soil resources will be moderate as a result of surface disturbance associated with construction and operations activities. Long-term impacts are expected to be significant at the regional level.

4.9.6 Impacts of the No Action Alternative

For the No Action Alternative, the conditions of engineering geology will, in general, not be materially different from historical geologic baseline conditions. Normal regional land development will initiate or accelerate some geologic processes that could potentially cause localized occurrences of geologic hazards. Within installation boundaries, the No Action Alternative is the same as baseline conditions, since the present restrictions to mineral development are not expected to change in the foreseeable future. Present restrictions are based on the incompatibility of existing base missions with mineral resource development. For aggregate resources and other geologic resources outside of installations, future trends without the project will reflect historic responses to market demands. For aggregate resources, normal regional expansion will create a steady, low demand in the region, with peak requirements needed in response to future large construction projects that could occur in the area. For soil resources on the installations, impacts of the No Action Alternative are expected to be similar to existing soil

resources impacts because of continued mission use of the areas. Impacts to soil resources offbase will be dependent upon offbase changes in land use patterns and other changes in the regional and local economy.

4.9.7 Irreversible and Irretrievable Resource Commitments

Geology and soils resource commitments to the proposed project consist of the consumptive use of nonrenewable aggregate resources within the project area for construction of facilities. Aggregate commitments range from about 3 to 22 million short tons depending upon the basing mode and configuration. Within parts of the ROI, soils will be permanently disturbed by construction of facilities (e.g., roads, buildings, and silos) or irreparably damaged during the life of the proposed project. Areas affected include RMAs, SDAs, and cantonment areas within the MOBs.

4.9.8 Relationship Between the Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Potential short and long-term effects may occur to geologic resources. Short-term geologic resources (aggregate) demands and engineering geology effects will be primarily related to construction. Short-term effects on soil resources will result from construction and long-term effects will occur during operations as a result of the permanent soil disturbances expected and the off-road use of the HML vehicle in the Random Movement mode.

Long-term productivity of the region for geology and soil resources may be affected in several ways. Potential restrictions to the development of mineral resources that will be important during the operations phase may occur. Changes in land use patterns may occur through the purchase and removal of important farmland from production. Finally, there may be a permanent and continuing disturbance of soils in the RMAs by off-road use of HMLs.

5.0 SAFETY CONSIDERATIONS

This chapter describes the System Safety Program used by the Air Force, which extends from concept development, to system design, through deployment and operations of the intercontinental ballistic missile (ICBM) system. The 25-year safe operating history of the Minuteman ICBM system, as well as technical advances to the components and operating procedures for the Small ICBM system, reasonably ensure that the probability of the accidents described in the following sections is remote.

For the purpose of analysis, conservative adverse risk assumptions were used. The most severe and environmentally threatening accident scenarios conceivably posed by Small ICBM operations were analyzed, though the probability of accidents of this magnitude during the operational life of the Small ICBM system is extremely small. Even with this conservative approach, the analysis demonstrates that the environmental impacts associated with these scenarios are not highly significant. Under all basing mode alternatives, air quality impacts from worst-case accidents would be confined to the immediate accident area. No significant water quality impacts are expected. Biological impacts would be restricted to the accident area. In the most severe accidents, there is the potential for adverse impacts to human health. This could arise from fire or toxic vapor release, but the impacts would be limited to personnel in close proximity to the accident. Finally, if an accident results in the release of aerosolized plutonium (the most improbable scenario analyzed), those in the immediate area could experience an increased health risk with the potential for increased early mortality as a result of radiation exposure.

5.1 System Safety Program Background

From conceptual development through operational deployment of military systems, safety is an uppermost Air Force consideration. All phases of the Small ICBM weapon system acquisition and operation are directed by formal safety programs. These safety programs include directives and regulations that establish policy, procedures, and requirements based upon a comprehensive set of proven procedures derived from both military and civilian experience. Department of Defense (DOD) Instruction 5000.36 (System Safety Engineering and Management) and Air Force Regulation 800-16 (Air Force System Safety Program) establish the requirement for the identification and elimination or control of hazards in the weapon system. Department of Defense MIL-STD-882B (System Safety Program Requirements) and MIL-STD-1574A (System Safety Program for Space and Missile Systems) provide specific requirements which are presently implemented in the Small ICBM Integrated System Safety Program. These requirements are included in a System Safety Program tailored to the specific characteristics of the Small ICBM. These system safety engineering and management controls are applied throughout the functional life of the weapon system.

The Small ICBM Integrated System Safety Program is an accident-risk management program designed to identify potential accident risks and define methods to eliminate or minimize these risks. System safety engineers have evaluated the system's design to identify and eliminate potential mishaps such as accidental ignition of the propellants or the warhead by external energy sources or other mechanisms. Proven design criteria, technology, and procedures are being incorporated into the system and its operation to eliminate or minimize the

potential hazards. Potential hazards are identified and tracked to ensure that appropriate corrective actions are incorporated into hardware, facilities, procedures, specifications, and drawings.

This comprehensive system safety engineering program complies with DOD and Air Force directives. The program encompasses the design, development, fabrication, checkout, modification, test, servicing, maintenance, transportation, handling, training, and deployment of the system, as well as normal and contingency operations during peacetime operation of the system.

Lessons learned from Minuteman and Peacekeeper programs have been incorporated into the design of the Small ICBM weapon system. Where possible, design decisions have been made to enhance the overall safety of the system. Three examples follow:

1. Insensitive High Explosives (IHE) have been incorporated into the warhead. These explosives are relatively stable and insensitive to shock and thermal stimuli.

2. A unique software control device prevents unintended missile launch by blocking access to the missile firing circuits. The missile can only be launched if a unique coded signal is generated and verified.

3. Air Force experience gained during many years of safe management of hydrazine has been incorporated into design and handling procedures to enhance the safety of the system.

Prior to test, deployment, and operations, the Small ICBM must receive explosives and range safety approvals and nuclear safety certification. To meet these requirements, the following certifications and approvals will be accomplished: (1) nuclear safety certification based on nuclear weapon system safety standards and applicable design safety standards in accordance with Air Force Regulation 122 series regulations (Nuclear Surety); (2) explosives safety classification and siting approval from the DOD Explosive Safety Board in accordance with Air Force Regulation 127-100, Explosive Safety Standards; and (3) range safety approval to ensure the safe conduct of the flight test program.

5.1.1 Nuclear Safety

Nuclear safety certification for the Small ICBM ensures that nuclear safety objectives are met through control of critical functions such as authorization, launching, prearming, arming, and target data change. This includes strict control of information that permits these functions to occur. Critical functions (except target data change) are also interlocked with one another so that each function can be accomplished only in a specific order, and only after the preceding function is accomplished in a prescribed manner.

Air Force Regulation 122-3 describes the process for the nuclear certification of a weapon system. This regulation outlines policies, responsibilities, and the evaluation process for safety certification of equipment and procedures used with nuclear weapons. The weapon system, support and transportation equipment, test equipment, and procedures must all be "certified." This process is discussed in the following sections.

5.1.1.1 Design Certification

Design certification requires the evaluation of the entire weapon system design for compliance with DOD Nuclear Weapon System Safety Standards (DOD Directive 3150.2) using the process defined in Air Force Regulation 122-2 and Air Force Regulation 122-3. The Nuclear Weapons System Safety Group (NWSSG) evaluates the entire weapon system to determine if it meets the appropriate regulations/standards. The NWSSG is an Air Force group with a Department of Energy (DOE) member that conducts independent evaluations of nuclear weapon systems. In addition, the Air Force Weapons Laboratory must evaluate and the Air Force Directorate of Nuclear Surety must certify noncombat vehicles (e.g., reentry system transporter and forklift), support equipment, and associated software to ensure compliance with the criteria in Air Force Regulation 122-10. Software certification is accomplished (as part of the design certification) in accordance with the evaluation criteria in Air Force Regulation 122-9 and Air Force Regulation 122-10. Air Force Regulation 122-9 requires a Nuclear Safety Cross Check Analysis (NSCCA) for any software that controls or is required in the prearming, arming, firing, launching, or targeting functions of the nuclear weapon system. This analysis is an independent cross-check that ensures that the software does not initiate any unauthorized functions.

5.1.1.2 Operational Certification

A functional checkout of a weapon system is required before the nuclear weapon is connected to the system. Additionally, after a nuclear weapon system has received design certification, it must successfully pass an initial nuclear surety inspection. Strategic Air Command personnel, assisted by other Air Force inspectors, will conduct the inspection of the weapon system. They will review the procedures for receipt of the warhead, assembly of the reentry vehicle (RV), transportation of the RV, assembly of the missile, checkout of the RV and missile, and placement of the missile on alert. Facilities and physical security procedures and activities are also reviewed during this inspection. Once this certification has been obtained, the weapon system is approved for deployment and peacetime operation.

5.1.1.3 Decertification and Recertification

A nuclear weapon system or component must be decertified as a result of certain preventive maintenance actions, failure to pass periodic inspections, or implementation of design modifications. Decertified components may not be returned to operational use with a nuclear weapon until they are recertified. The recertification of a system or component is functionally the same as that for the deployment/operational certification process and follows Directorate of Nuclear Surety approved procedures.

5.1.2 Explosive Safety Requirements

Air Force explosive safety requirements are established to prevent or minimize accidents and associated damage. Implementation of these requirements demands compliance with all directives that control the design, development, testing, production, transportation, handling, storage, and use of explosives. Before accepting an explosive component into the Air Force or federal inventory, it is necessary to establish its hazard classification. Contractors who manufac-

ture Small ICBM explosive components will provide the Air Force with explosives hazard classification data that will be the basis for the explosives class determinations. These data will be used to establish procedures to assure safe handling, packaging, storage, and use of the item.

Although the probability of an accidental deflagration or explosion of missile propellants is low, DOD Standard 5154.45 and Air Force Regulation 127-100 prescribe a safety zone called Quantity-Distance (Q-D) be maintained for operational and storage locations containing explosives, including missile propellants. Locations containing explosives are required to be at specified minimum distances away from facilities such as other explosive storage areas, inhabited buildings, public traffic routes, recreational areas, and utility systems. These Q-D zones vary depending on the combination, quantity, and hazard classification of propellants or explosives involved. Based on these factors, preliminary safe distances to other facilities will be determined for the assembled Small ICBM. For example, the Q-D criteria for a fully assembled missile containing 26,000 to 33,000 pounds of propellant (which has an equivalent explosive weight of 40,000-45,000 pounds of TNT) is approximately 1,400 feet from an inhabited building, 900 feet from a public traffic route, and 10,800 feet from airfield approach/departure zones. This is the currently planned configuration for the Small ICBM and its associated Q-D.

All three Small ICBM stages will contain a high performance solid propellant rocket motor. Propellant weights are expected to be approximately 23,000 pounds for Stage I; 6,400 pounds for Stage II; and 3,000 pounds for Stage III. This is based on a 37,000-pound missile. The solid propellant in the Small ICBM is expected to have properties similar to that used in the Peacekeeper third stage.

The Post Boost Vehicle (PBV) is powered by approximately 35 to 40 pounds (5 gal) of liquid propellant (composed primarily of hydrazine) in a stainless steel container. The container is filled and sealed at the factory; it is never opened, repaired, or maintained in the field. The PBV contains the missile guidance control system, shroud and shroud separation motor, and miscellaneous ordnance items all similar in function to those used for the Minuteman system.

The Small ICBM warhead is the same as that used on the Peacekeeper. This warhead uses an IHE which is very stable. This warhead improvement is an enhancement over the previously certified Minuteman design. This type of explosive is even safer to handle and its use ensures that ignition will occur only upon direct command. The IHE used in the Small ICBM reentry system has been rigorously tested to verify its insensitivity to shock and high temperatures.

5.1.3 Range Safety

The Small ICBM will undergo a series of missile flight tests. The first five flight tests will be conducted from a fixed launch facility at Vandenberg Air Force Base (AFB), California. The number and configuration of follow-on flight tests will depend upon the basing mode selected. While flight testing of the Small ICBM will be conducted primarily at the Western Test Range headquartered at Vandenberg AFB, some flight tests may occur at the Eastern Test Range headquartered at Patrick AFB, Florida. The basic objective of both ranges is to ensure that all programs are within acceptable risk limits and

are consistent with mission requirements. The range regulations provide specific requirements, criteria, and guidance to protect personnel from inordinate risks, injury, illness, and to protect property from loss or damage. Potential safety problems are identified, evaluated, and either eliminated or controlled as early as possible in the system acquisition process and throughout the life of the system. A rigorous series of mandatory approvals is required before flight tests can proceed. These approvals result from thorough evaluation of the design, flight plans, and ground and flight safety procedures.

5.1.4 Maintenance, Training, and Quality Control

Safety will be a critical aspect of all Small ICBM maintenance activities. All work on the missile system will be accomplished by highly trained and qualified maintenance technicians. A special Training Control Division will schedule, monitor, and control all aspects of training (e.g., job qualification, upgrade training, special technical training programs, recurring training, and management training).

This comprehensive training program will ensure that only the most highly trained and qualified personnel are permitted to perform work on the weapon system. Teams that handle nuclear weapons will receive special task certifications. All work will be performed in compliance with certified Technical Orders. In addition, a comprehensive quality control program will provide for periodic reviews of maintenance operations, which include evaluation and inspection of personnel, procedures, equipment, facilities, and technical data. The division carrying out this program will work directly for senior management and will be made up of personnel (usually commissioned officers and senior noncommissioned officers) selected on the basis of their sound judgment and technical knowledge. The inspection and evaluation teams will perform periodic and unannounced maintenance and technical inspections. A staff of safety professionals and specialists, complemented by senior staff members and field supervisors, will ensure that safety is foremost in all maintenance operations. All applicable Occupational Safety and Health Administration (OSHA) standards and specially developed Air Force Occupational Safety and Health standards will be strictly enforced.

Safe operation of an ICBM weapon system requires continuing review and evaluation of system modifications, technical manuals, and training programs for technicians that maintain and operate the systems. The NWSSG will conduct a study of the nuclear safety of the weapon system and develop Weapon System Safety Rules for approval by the Secretary of Defense before the system is allowed to become operational. At subsequent 5-year intervals, or more frequently if major modifications are planned, the NWSSG will again review the operations and maintenance concepts for the system to ensure continued nuclear safety of the system. A System Safety Group (SSG) is formed at the inception of the design phase of a new system to monitor all design and engineering activities. This group ensures that all serious hazards are minimized and the system is safe to operate. The SSG will continue to review and monitor the system throughout its functional life.

5.1.5 Personnel Reliability Program

To assist in protecting against acts which could lead to unauthorized launch, tampering with the system, or theft of the nuclear weapon, all personnel assigned to nuclear weapons activities and operations are evaluated under the criteria specified in Air Force Regulation 35-99, Personnel Reliability Program. This program is designed to ensure that personnel who perform critical nuclear weapon duties have no medical or psychological traits that might result in behavior that could ultimately threaten the national security of the United States. The Personnel Reliability Program is designed to ensure very high standards of individual reliability for those whose duties are associated with nuclear weapons and nuclear components. Candidates must meet all requirements of the Personnel Reliability Program before they may perform duties associated with nuclear weapons. These requirements include position designation, security clearance, and screening. In addition, personnel are continuously evaluated throughout the entire period of their assignment to nuclear weapons-related work. The program is designed to promptly identify and eliminate unreliable personnel from such positions.

5.1.6 Air Force Contingency Plans

Although accidents involving the Small ICBM weapon system that could affect the public are highly unlikely, the Air Force has contingency plans for response. Strategic Air Command Regulation 355-3, "ICBM Potential Hazard System" (PHS) contains procedures for responding to potential hazards involving an ICBM. This regulation is implemented when situations exist that are not covered by Air Force Technical Orders. The ICBM PHS provides a communications network to be used during emergency actions. The PHS is designed to resolve hazardous situations occurring at the local unit level by rapidly establishing centralized control at Strategic Air Command Headquarters. A recovery plan will be developed by appropriate technical experts. Experts from Air Force Logistics Command, Air Force Systems Command, other governmental agencies, and aerospace contractors will participate as required. The PHS will be implemented whenever the local unit exhausts technical data or the situation is beyond the unit's ability to control. These procedures exist for Minuteman and Peacekeeper and will be applicable to the Small ICBM when it becomes operational.

Air Force Regulation 355-1, The U.S. Air Force Disaster Preparedness Program, requires that each installation commander ensure that operations orders, plans, directives, and similar documents contain proper disaster preparedness instructions and guidance. At each ICBM base, response plans exist that will be implemented in the event of an accident involving the missile system. If an accident occurs offbase, designated individuals will be dispatched to the scene of the accident to coordinate with the local civil authorities. If it occurs onbase, they will take charge of the accident scene. Planning efforts for coordination with civil authorities include training sessions, joint exercises, and establishment of mutual aid agreements. The Air Force will publish a plan to cover highway accidents of the Small ICBM similar to those currently in effect for Minuteman and Peacekeeper missiles.

5.2 Alternative Basing Modes

The possibility of an accident involving the Small ICBM is extremely remote. However, each of the three alternative basing modes presents slightly different safety issues. These differences result from day-to-day operations, the location(s) selected for deployment, the proximity of the public to the missile, and the frequency of transportation between the deployment area and the Main Operating Base (MOB).

5.2.1 Hard Mobile Launcher in Random Movement

Under the Hard Mobile Launcher in Random Movement basing concept, the missile and the warhead unit will be assembled and installed into the Hard Mobile Launcher (HML) at the MOB. The fully assembled HML will travel to and from the Random Movement Area (RMA) for activities such as initial deployment, major maintenance, and redeployment. Travel between the MOB and RMA may involve movement over public highways, depending on the deployment complex selected. While traveling on public highways, the HML vehicle will be under constant surveillance and will follow required convoy procedures.

The fully assembled HML vehicle will also be moved periodically within the RMA on existing DOD/DOE installations. Although extremely remote, the principal risks associated with HML operations in the RMA are the potential for a vehicle collision or accident, and hazards associated with other missions on the deployment installation. While the movements will be on DOD/DOE land, infrequent travel over short distances of public roads may be required, depending on the deployment installation selected. However, use of public roads will be restricted to an absolute minimum. The HML is a very sturdy and heavy vehicle (approximately 200,000 lb). The HML vehicle, the missile interface, and the missile itself are all designed to resist the effects of transportation, explosive shocks, and vibration. Therefore, the possibility of propellant ignition or explosion because of shocks received in either a collision or rollover of the HML vehicle is extremely remote.

5.2.2 Hard Mobile Launcher at Minuteman Facilities

Under the Hard Mobile Launcher at Minuteman Facilities basing concept, the missile and warhead will also be assembled and installed in the HML at the MOB. The fully assembled HML will travel to and from the Minuteman facility for activities such as initial deployment and major maintenance and redeployment. Travel between the MOB and the Minuteman facility will include movement over public highways, where the HML vehicle will be under constant surveillance and will follow required convoy procedures. While the HML is at the Minuteman facility, it will remain parked in a shelter and will move to the MOB only for major maintenance. The stationary position of the operational HML, the screening provided by the shelter, and the fence all provide a more protective environment than that of the Hard Mobile Launcher in Random Movement basing mode.

5.2.3 Hard Silo in Patterned Array

Under the Hard Silo in Patterned Array basing concept, the warhead will be transported from the MOB separately from the missile stages. This movement will require travel over public highways and convoy procedures will be

followed similar to those used in Minuteman movements. The warhead and the missile will be assembled at the area support center adjoining the patterned array. Unlike either HML basing mode, the Small ICBM will be deployed in an underground silo, where it will be isolated from shock, temperature extremes, or other external influences.

5.3 Abnormal Environments

The Small ICBM weapon system will be designed to operate safely and securely under all normal operating conditions through strict adherence to the safety and security design practices and operations/maintenance procedures.

Based upon 30 years of experience operating ICBMs, and given the weapons system design and operating concept, the probability of an accident occurring is extremely remote. There has never been a fire or detonation of an operational solid propellant ICBM stage, nor has there ever been a release of nuclear material from an ICBM. However, for purposes of this Legislative Environmental Impact Statement (LEIS), it was assumed that the following worst-case abnormal events could occur:

> Case 1: An operational HML, while traveling, collides with another vehicle or stationary object, or hits unexploded ordnance.
>
> Case 2: A HML vehicle is hit by ordnance from an aircraft operating in an adjacent test range, or the aircraft crashes into the HML.
>
> Case 3: A truck transporting the warhead is involved in a collision with another vehicle.
>
> Case 4: A plane carrying the warhead is involved in a crash.

Given the structure of the HML, the missile stages, and the RV, these cases realistically represent the worst events the system may encounter.

5.4 Environmental Consequences

The following discussion addresses the environmental consequences of the four abnormal event cases previously outlined. This analysis indicates the major environmental impacts that could be expected from those events but does not describe the impacts at any specific location. The discussion treats (a) solid-propellant releases, (b) liquid-propellant releases, (c) a combined release, and (d) nuclear material releases.

5.4.1 Incidents Involving Propellants

Air Force experience has shown that these release scenarios are highly improbable. For analysis purposes, it was assumed that abnormal event Cases 1 and 2 may result in the release of solid or liquid propellant, either individually or simultaneously. Depending upon the severity of the accident, the existing physical and meteorological conditions, and the rate of release, the liquid propellant spill could vary from a small amount to total evacuation of the tank (approximately 5 gal). Depending upon the actual configuration of the system and circumstances of the accident, the physical structure of the system could enhance or retard the dispersal of the propellants and therefore affect the ultimate environmental impacts.

5.4.1.1 Solid Propellants

Propellant Properties. The Small ICBM will carry approximately 26,000 to 33,000 pounds of solid propellant. The solid propellant used in the missile is a proprietary mixture containing the following compounds (and their approximate proportions): HMX (cyclotetramethylenetetranitramine) (48%); aluminum (elemental) (18%); proprietary plasticisers (12%); ammonium perchlorate (9%); and TMEN (or BTTN) (6%). After mixing, the propellant is cast into the desired shape for the rocket motor system. After curing, the solid propellant has a physical consistency resembling that of a hard pencil eraser. Although the propellant will not spontaneously ignite, it will catch fire when exposed to temperatures exceeding 500°F.

Release Scenarios. The following sections examine the environmental impacts to air quality, water quality, biological resources, and human health that could result from the release of solid propellant and its combustion products into the environment. Both Case 1 and 2 accident events could result in a fire involving only the solid propellant. Some or all of the propellant will burn rapidly (within a few minutes). If an explosion results from the fire, burning propellant dispersal is likely. In this scenario, some quantity of unburned propellant can be expected.

Air Quality Impacts. The principal toxic constituents of the cloud resulting from a propellant fire are hydrochloric acid (HCl) and carbon monoxide (CO). Other components include water (H_2O), nitrogen (N_2), carbon dioxide (CO_2), hydrogen (H_2), and aluminum oxide (Al_2O_3), which are essentially harmless.

The downwind movement of an exhaust cloud is dependent upon the following parameters: temperature of the exhaust cloud, amount of material burned, mixing height (distance between the ground and the elevation that vertical mixing approaches zero), insolation, humidity, air temperature which changes with height, wind speed and direction, and local topography.

The HCl gas from burning propellent may collide with and coat Al_2O_3 nuclei, which are also formed when propellants burn. These nuclei would be transported downwind and gradually settle from the downwind cloud causing vegetative spotting and minor acidification of surface water supplies. Rain could scavenge residual HCl from the cloud, producing mildly acidic precipitation.

Water Quality Impacts. Minor surface water quality impacts may occur from the settling of Al_2O_3 particles coated with HCl into water bodies and the fallout of HCl vapors from the exhaust cloud. Surface water quality impacts from the exposed solid propellant are not expected since it is essentially insoluble in water. Potential minor impacts could result from the runoff of motor fuels, lubricants, and fire-extinguishing materials from the accident site into surface water.

Potential impacts to groundwater resulting from the accident scenarios are highly dependent upon local surface, subsurface, and deep groundwater system characteristics. Minor impacts could result from the movement of motor fuel, lubricants, and fire-extinguishing chemicals from the ground surface into shallow aquifers.

Biological Impacts. Minor adverse impacts to natural vegetation and animals could occur. Localized impacts to biota resulting from fire, fire-extinguishing chemicals, and mechanical cleanup are anticipated. Local biota may be adversely affected by deposition of HCl aerosol droplets on vegetation. Some animals could experience burning of eyes, throat, and skin.

Depending upon the geographical location, chemical constituency, and extent of surface water systems, aquatic biological systems in the local area may be negatively affected as a result of dilution and neutralization of the HCl. Runoff of fire-extinguishing chemicals, spilled fuels, or cleanup chemicals into surface water could affect biota.

Human Health Impacts. Under most combinations of wind speed, atmospheric stability, and expected propellant burn times, downwind concentrations of HCl would never exceed 2 parts per million (ppm) (the 30-minute, Short-Term Public Exposure Limit). Only when worst-case wind and atmospheric stability conditions are combined with an unlikely 2-minute propellant burn time, downwind peak concentrations might reach approximately 2 ppm. This peak concentration would occur about 3,300 to 4,500 feet downwind from the accident site. People exposed to 2 ppm of HCl might experience some slight irritation of the eyes, nose, throat, or lungs. As a comparison, a level of 100 ppm is considered the maximum concentration that one could escape from within 30 minutes without any irreversible health effects.

Cleanup Methods. The amount of cleanup activities at an accident site is dependent upon the nature of the accident. The use of fire-retardant chemicals, removal of contaminated soil and debris, and the areal extent of debris dispersal will determine the impact resulting from the cleanup procedures. In a severe case, significant quantities of soil could be contaminated with solid propellant and its residue, requiring removal after an accident. The severity of this impact will be dependent upon the environmental conditions at the accident site. Secondary impacts from cleanup activities are also possible.

5.4.1.2 Liquid Propellant

Propellant Properties. From 35 to 40 pounds (approximately 5 gal) of hydrazine are carried in the PBV. Hydrazine is a colorless, oily liquid that fumes upon exposure to air at atmospheric pressure and is water soluble. Its vapors can ignite at 126°F (flash point). For comparison purposes, the flash-point of gasoline is minus 50°F. Liquid hydrazine ignites at various temperatures depending upon the surface; for example, it can ignite at 435°F on a surface containing rust and at 587°F on glass. When hydrazine vapors come in contact (at high temperatures) with the metal oxides of copper, lead, and manganese, they may also ignite spontaneously. Hydrazine will form explosive mixtures with air and can explode at 212°F in concentrations between 4.7 and 100 percent. Hydrazine vapors are slightly heavier than air and, depending upon meteorological conditions, they may flow along the ground and fill depressions. Hydrazine vapors will not ignite spontaneously at normal atmospheric temperatures in open air.

Release Scenarios. For the abnormal event Cases 1 or 2 outlined in Section 5.3, the hydrazine tank could crack, allowing the release of liquid hydrazine and hydrazine vapors. If an ignition source (e.g., a diesel fuel fire) is present, the hydrazine could burn or explode. If an ignition source

is not present, a small pool of hydrazine could form. Vapor release from the pool could continue until remedial action is completed or total evaporation of the propellant has occurred.

Air Quality Impacts. Adverse environmental impacts to local air quality in the immediate area are likely to occur after an accident. Depending upon the conditions of the system after the accident, hydrazine spilled from the tank may vaporize or catch fire.

Hydrazine evaporates under certain environmental conditions. The evaporation is governed primarily by temperature. However, hydrazine tends to absorb both water and carbon dioxide from the surrounding air. With the continued absorption of water, the evaporation rate is substantially reduced. This is important since initial dilution of a spill could reduce the potential exposure of personnel located downwind of the release.

A hydrazine fire would produce nitrogen oxides, carbon dioxide, water, and some unburned hydrazine would remain. Since it is likely that an accident fire would involve more than hydrazine, the rising hot exhaust cloud would contain other chemicals, particulates, and dust from the crash site. Any unburned hydrazine would mix with all of the other components and be dispersed.

Water Quality Impacts. Hydrazine could be released into surface water resources near an accident site. This could occur directly as spilled/pooled hydrazine flows into a surface water resource, or indirectly as firefighting chemicals and/or water, which would be used to douse fires, could transport diluted hydrazine into receiving waters.

Although hydrazine when dissolved in water has been shown to be toxic to fish, crabs, and mussels, the small amount that could be spilled in an accident is not likely to result in concentrations high enough to affect aquatic animals. For example, all of the hydrazine in one Small ICBM would have to be spilled into a very small pond (8,000 gal or less) to reach toxic levels. This is approximately one-third to one-half the size of the average backyard swimming pool.

Percolation of hydrazine fuel into the soil following a spill would be limited because of the small quantity (5 gal) of hydrazine present in the system. Using soil leachate tests, one study showed that the hydrazine family interacts strongly with all natural soils. This study observed the adsorption of hydrazine onto various types of soil, including clean sand and soil samples from Vandenberg AFB. Because hydrazine readily adsorbs onto soil components, spilled hydrazine would be held in surface soil and would thus be unlikely to reach and contaminate local groundwater. In addition, cleanup following a spill would be relatively simple.

Biological Impacts. The downwind movement of hydrazine vapor could have impacts upon local biotic systems. Local areas adjacent to the accident and within the plume may have hydrazine concentrations exceeding those specified by the Short-Term Public Exposure Limit. The concentration and areal extent of the hydrazine vapor are dependent on the size of the leak and physical condition of the hydrazine at the accident site, the wind speed and direction, relative humidity, the difference between the hydrazine pool temperature and ambient temperature, and the vertical mixing height.

A spill of hydrazine can be expected to kill or seriously damage vegetation in the limited area of the spill proper. Any resulting fire would kill grasses, herbs, shrubs, and small trees, and burn the trunks and lower branches of large trees. Impacts to vegetation outside the immediate spill or fire area are unlikely because of the small quantity of hydrazine involved and the soil adsorptive characteristics of this chemical.

Few, if any animals are likely to be contacted directly by a hydrazine spill because of the small size of the spill. Animals exposed to sufficiently high concentrations of hydrazine vapor could experience burning of eyes, skin, and the respiratory tract, and possibly systemic effects, as described for humans in the following section. These concentrations will be limited to a small area because of the small quantity of hydrazine involved, so that very few individual animals are likely to be affected. Mortality of animals is unlikely.

Human Health Impacts. Hydrazine is a strong irritant and may cause eye damage and respiratory tract irritation. The 30-minute, Short-Term Public Exposure Limit for hydrazine is 20 ppm. Under certain wind and atmospheric stability conditions, combined with a rapid hydrazine evaporation rate (1 lb per minute), the 20-ppm level might be experienced as far downwind as 1,500 feet. People exposed to 20 ppm of hydrazine might experience irritation of eyes, nose, throat, or lungs, as well as dizziness and nausea. A concentration of 20 ppm is considered the level that a person could escape from within 30 minutes without any escape-impairing symptoms or irreversible health effects. As a comparison, a level of about 1,000 ppm is considered immediately hazardous to life.

If hydrazine contacts the skin or eyes, it can cause severe local burns and dermatitis. In addition, it can penetrate skin to cause systemic effects similar to those produced when hydrazine is inhaled. If inhaled, the vapor causes local irritation of the respiratory tract, followed by systemic effects. Upon short exposure, systemic effects involve the central nervous system; resultant symptoms include tremors. Upon exposure to higher concentrations, convulsions and possibly death may follow.

Cleanup Methods. The mechanisms used to detect, cleanup, and dispose of spilled hydrazine will depend upon the volume of hydrazine spilled, the surface on which it is spilled, and the extent and nature of debris from the accident which may prevent safe access to the hydrazine spill. Pooled hydrazine can be almost completely removed from a site using proven methods. Methods for decreasing the hazards from a pool of hydrazine range from careful collection of the liquid to dilution and chemical neutralization. Hypochlorite compounds (e.g., household bleach) are commonly utilized to neutralize hydrazine. Special care in the application of neutralizing agents would be necessary if cleanup was being carried out in the vicinity of a stream. Proven cleanup methods are already used in other Air Force systems and will be included in contingency plans for the Small ICBM.

5.4.1.3 Combined Propellant Releases

There is a possibility that both the liquid and solid propellants could be released or burned simultaneously in an accident. It is assumed that fire and/or explosion would accompany the accident and result in complete involvement of the missile. Debris and fire could then be spread over the area immediately surrounding the accident site.

The environmental impacts likely to result from explosion or fire will be equivalent to the impacts previously described for the solid propellant, except that the contribution of the hydrazine would moderately increase the toxicity of the burning propellant cloud. There is no potential for additional environmental impacts resulting from the combined propellants, their reaction products, or combustion products.

5.4.2 Incidents Involving Nuclear Materials

In the context of this discussion, "release" refers to dispersal of fissionable radioactive material (plutonium or uranium), not an accidental nuclear detonation, as a result of an accident in which the warhead is engulfed in flames from burning missile propellants. Since the Small ICBM warhead contains a special IHE that is significantly less sensitive than explosives used in previous warheads, it is unlikely to explode and disperse plutonium. As stated above, no realistic possibility of an accidental nuclear detonation exists. There has never been an inadvertent total or partial nuclear detonation.

5.4.2.1 Plutonium Properties

General Characteristics. Plutonium is a manmade radioactive element, the second in the transuranium series of elements. Its atomic number is 94, and its atomic weights range from 232 to 246. Plutonium is a heavy metal which has a shiny appearance (similar to stainless steel) when freshly machined. After being exposed to the atmosphere for a short period of time, it will oxidize to dark brown or black.

Radiological Characteristics. Plutonium-239 is the most abundant isotope in a nuclear weapon and is referred to as Weapons Grade Plutonium (WGP). Other isotopes of plutonium are also present, as is Americium, but these do not occur in sufficient quantities to merit detailed analysis.

The types of radiation emitted by the plutonium isotopes and Americium-241 are alpha particles, beta particles, x-rays, and gamma photons. The alpha particle is made up of two neutrons and two protons, bound together, and therefore is identical with the nucleus of a helium atom. The alpha particle is the least penetrating of the four common types of radiation (alpha, beta, x-ray, and gamma). Alpha radiation is completely stopped by the outer layer of the skin. As a result, the potential hazard from radioactive materials that emit alpha radiation is due to the possibility of inhalation or ingestion of fine dust-like particles which cause an internal radiation dose. Beta radiation consists of electrons which are emitted from the nucleus of an unstable atom. It is more penetrating than alpha radiation, passes through 1 or 2 centimeters of water or human flesh, and can present both an internal and external radiation hazard. Gamma photons are high energy, short-

wavelength electromagnetic radiation. They frequently accompany alpha and beta emissions. Gamma photons are usually more penetrating than x-rays. They also create an external radiation hazard to man. Of the types of radiation previously mentioned, alpha is the most abundant from WGP.

Hazards and Health Considerations. As an alpha emitter, the primary hazard arises from WGP being taken into the body. Because it is a heavy metal, WGP presents a toxic hazard similar to that associated with lead. The toxic heavy metal effects are not considered in the discussions of the hazards associated with WGP because of the magnitude of the radiation hazard and the fact that existing or proposed protection measures against the hazards of radiation will also guard against the heavy metal effect.

5.4.2.2 Uranium-235 Properties

General Characteristics. Uranium, element number 92, occurs only in radioactive form. Like WGP, it is a very heavy element and emits alpha radiation. Unlike WGP, it occurs in nature in small quantities. When first machined, it has an appearance much like stainless steel. When exposed to the atmosphere for a short period of time, it will oxidize to a golden-yellow color and then to black. Its oxidation is much slower than that of WGP.

Radiological Characteristics. There are 14 isotopes of uranium with half-lives of from 1.3 minutes to 45 million years. Uranium-235 (enriched uranium), often called Oralloy, primarily emits alpha radiation and is less hazardous than WGP. As with WGP, inhalation is the primary means of entry of Oralloy into the body. However, because Oralloy does not oxidize as rapidly or as easily as WGP, it is difficult, even in a fire or an explosion, to significantly oxidize or pulverize solid uranium. The spread of contamination in an accident involving Oralloy is therefore small, though significant levels of respirable particles might be found over a limited area around the accident site. In a fire, it will melt and form a slag, with only a small portion being oxidized. On a mass basis, WGP (Plutonium-239) is 29,000 times more hazardous than Uranium-235 because of its greater radioactivity per unit of mass. For that reason, WGP is used in the case study in the following section.

5.4.2.3 Release Scenarios

In Section 5.3, several accident events which could cause a release of nuclear materials are discussed. Case 3 postulated the collision of a truck (while transporting the warheads) with another vehicle. Case 4 postulated an airplane crash involving a nuclear warhead.

Recent testing indicates complete plutonium containment when the warhead is crushed or exposed to fire (Cases 3 and 4). Combined conditions testing is not feasible; however, it appears that there is a high probability of complete plutonium containment in Cases 3 and 4.

Cases 1 and 2 postulate accidents involving the operational HML. These cases assume the burning missile propellant remains in proximity to the RV, though this is unlikely to occur. While these cases are unlikely events, they could result in loss of containment of plutonium and aerosolization in a high-temperature propellant fire. For purposes of this study, the worst case would be a fire in which 2 to 20 percent of the material is dispersed as particulate

plutonium dioxide in aerosol form. Test data for the Small ICBM warhead do not support an aerosolization figure beyond 2 percent. However, the 20 percent figure was used as an outer limit. The data supporting the 2 percent figure were generated under conditions which were very severe, though not precisely similar to those postulated in Cases 1 and 2. The analysis also assumes that the Small ICBM propellant will burn for 5 to 10 minutes and the plutonium would be released from within the RV and subsequently be exposed to a high-temperature fire.

The following design features would minimize the potential for aerosolization of plutonium:

- Both the RV and warhead are sturdy and designed to withstand high temperatures and shock;

- The warhead is fire resistant and uses IHE, which may burn if continually exposed to flame, but will not explode if exposed to high temperature and shock;

- The RV is located within a protective structure on the HML that is specifically designed to withstand penetration and shock; and

- The PBV and missile structure, both located between the RV and the third stage propellant, would provide additional insulation and therefore delay the heating of the RV to a critical temperature.

5.4.2.4 Environmental Impacts

Soil/Water Contamination. Some soil contamination from plutonium could occur over a considerable area. Several factors affect the dispersal of WGP following an accident. The most important are (1) the quantity of WGP involved, (2) the height of the cloud from which the WGP is dispersed, (3) atmospheric stability characteristics, (4) wind velocity and direction, (5) terrain features, and (6) wind shear. Freshly deposited WGP could be resuspended in the air and could create hazards to personnel downwind from the accident site. As WGP migrates into the soil, the resuspension becomes less of a concern. Laboratory studies characterizing the behavior of plutonium in the soil show that most of the plutonium is tightly bound to the soil.

Because plutonium migrates so slowly through the soil matrix, it is unlikely that contamination of the water table will occur. However, surface water runoff from soil after an accident and the settlement of airborne plutonium particles on surface waters may pose a limited health risk to local aquatic biota, depending upon the amount and concentration of plutonium reaching the surface water.

Food Chain Contamination. The deposition of particulate plutonium oxides on vegetation may lead to some intake by humans. This may occur through direct consumption of fruits or vegetables that have particles on the surface or through consumption of plants or animals that have assimilated plutonium. However, the large majority of deposited plutonium (>99%) remains associated with soil, and plants cannot extract plutonium effectively from the soil.

Impacts to Man. Current Small ICBM plans call for the use of the same warhead as used on the Peacekeeper. Anyone working on or handling the warhead will

receive some minor exposure to radiation; therefore, a minimal hazard to personnel exists. Measurements of the intrinsic radiation from warheads using similar design technology have been made and were found to be well within established federal standards. Radiobiological research concerning the effects of plutonium on animals has been extensive. As a result, the uptake or absorption of plutonium and the resultant human health effects have been extrapolated from laboratory studies. The entry point of plutonium into the body is the chief determinant of the course of the subsequent contamination and determines appropriate therapeutic efforts. Unbroken skin offers high resistance to plutonium penetration. Experiments on the unbroken skin of animals and man with various solutions of plutonium applied for 1 day indicated that 0.002 to 0.25 percent of the applied plutonium is absorbed. Plutonium contamination of intact skin is easily removed by washing with water and detergents. Ingestion of plutonium results in only about 0.003 percent absorption into the bloodstream. This is a negligible amount and would not represent a serious hazard to man. Inhalation is the important route of plutonium intake, in contrast to the external radiation exposure to man from a cloud of WGP which is negligible.

Inhalation and Retention. The three organs identified as "critical" for WGP are the lungs, bone, and liver. These are "critical" because they receive a higher radiation dose than other organs or are the most significant in terms of biologic effect. The primary hazard of plutonium results from inhalation. The actual amount of plutonium or plutonium oxide that is absorbed into the bloodstream through the lungs is important; however, it is extremely difficult to determine the fraction of inhaled plutonium that is absorbed into the bloodstream. The particle size is important since smaller particles are more easily retained in the lungs and eventually absorbed.

The solubility of the radioactive material involved will affect its absorption characteristics. The particle density and the breathing rate of the individual involved are also very important. Although it is not always practical to determine and properly use all of these factors, some broad generalizations can be made as a result of animal experimentation. If 100 particles of WGP of optimum size for retention in the lungs were inhaled, about 25 would be immediately exhaled and 50 would be redeposited in bronchial passages and removed within a few hours or a few days by ciliary action (cilia are hairlike growths which, by a waving motion, move particles) and by swallowing. Of the 25 particles remaining in the lungs, 10 or less would be absorbed into the bloodstream. The remaining 15 particles might by ingested by cells, deposited in the lymph nodes, or pushed up the bronchial passages and then swallowed. It would take 150 to 200 days for these last 15 particles to be removed from the body.

Of the small amount of plutonium that enters the bloodstream following exposure, most is deposited in bone and liver tissue. A few months after exposure, 80 to 90 percent of the absorbed plutonium will be found in the skeleton. This deposition may produce bone diseases (including cancer) years later.

Once inside the body, WGP is eliminated extremely slowly. It takes approximately 100 years for half of the amount initially retained in the bone to be eliminated and 40 years for removal from the liver. Therefore, the absorbed WGP is effectively held wherever it is in the body. During the period that plutonium remains in the lungs, the lungs are irradiated and damage occurs.

5.4.3 Case Study

The release of aerosolized plutonium is not expected even for abnormal event Cases 1 and 2 (Section 5.3); however, to evaluate the possible consequences of a release of aerosolized plutonium, a very conservative analysis was conducted. The following assumptions were used in the analysis:

- Two to 20 percent of the plutonium is aerosolized in a missile propellant fire;
- The fire lasts for 1 hour and involves the missile propellant, vehicle structure, and fuel;
- Wind speeds of 5, 15, and 25 miles per hour (mph) with small to extreme cross-wind diffusion occurs during the fire;
- The wind direction remains constant during the fire;
- A standard atmospheric diffusion model is used to predict the dispersal;
- Precipitation is negligible during the fire;
- The average human breathing rate is 0.012 cubic foot per second for a 1-hour exposure to the plutonium cloud; and
- The lungs retain 20 percent of the initial aerosolized plutonium inhaled.

Based upon these conditions with a 5-mph wind and 2.0 percent aerosolization, a person up to 500 feet downwind of the accident site could inhale enough plutonium to retain 0.65 microgram, which is the permissible body level for occupational radiation workers. Based upon the same wind condition and 20 percent aerosolization of plutonium, a person up to 1,100 feet downwind of an accident could inhale enough plutonium to retain 0.65 micrograms. The 15 and 25 mph wind speeds would cause faster dispersion and dilution of the plutonium aerosol; therefore, the plutonium concentration in the cloud would be lower in this case than in the 5 mph one. Higher levels could be inhaled at closer ranges. However, other accident-related conditions (e.g., fire and exposures) would not permit a person to remain in the vicinity of the accident for any length of time and so human exposure at close range is unlikely to be a real concern.

The principal health effect of exposure to aerosolized plutonium is an increased risk of lung, liver, or bone cancer. Some rough estimate of the risk at low dose levels was made based upon a linear extrapolation of the data from human and animal exposure at high levels. This approach may well over-estimate the risks. Based upon this extrapolation, if 1 million people retained 0.65 microgram of plutonium (the permissible lifetime level for radiation workers), 1,900 additional early deaths from lung cancer might occur over the next 50 years. As a comparison, the expected early fatalities per million which could occur as a result of various activities are the following:

- Normal cancer deaths - 170,000;
- Smoking in excess of one pack of cigarettes a day - 150,000;
- Working for 10 years in a coal mine - 19,000; and
- Dwelling in a large eastern United States city - 3,600.

5.4.4 Cleanup Methods

In the event of a nuclear weapons accident involving the release of airborne radioactive material, many agencies would be involved with planning and executing a site restoration plan. This may involve removing the contaminated material, "fixing" it in place, or a combination of the two. The Environmental Protection Agency has proposed that accident sites should be cleaned up so that residual plutonium will not cause people to receive a dose greater than 1 millirad per year (mrad/yr) to the lungs and greater than 3 mrad/yr to bone. The specifics of the site restoration plan would depend upon the circumstances of the release and the character of the local area.

5.5 Conclusion

Three conservative assumptions were made in this analysis: (1) an accident occurs, (2) the total amount of propellant is burned, and (3) up to 20 percent of the nuclear material is released in an aerosol form. Given these conservative assumptions, the predicted environmental impact would only be significant within the immediate accident area. No significant impact to water quality can be expected. Air quality impacts could occur but would be restricted to the immediate accident vicinity. Biological impacts would be similarly restricted to the nearby accident area. Finally, human health impacts could be severe but only within the immediate accident vicinity.

6.0 AUTHORIZING ACTIONS

Federal, state, and local agencies may require permits or other authorizing actions for any phase of the proposed project, though few will be required prior to construction of the system. Table 6.0-1 provides a list of federal authorizing actions that may be required for the Small Intercontinental Ballistic Missile (ICBM) program. Authorizing actions required for construction, including those state and local enactments required under federal statute, regulation, or Executive Order, will be identified when the site-specific environmental impact analysis is performed.

Table 6.0-1

FEDERAL AUTHORIZING ACTIONS

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Water			
Section 404 (Dredge and Fill) Permit, Consultation	Discharge of dredged or fill material into waters of the United Sates at specified disposal sites, especially for impoundments, bridge crossing improvements, or where cable or pipe corridors traverse streams and wetlands.	Army Corps of Engineers, in consultation with Environmental Protection Agency and U.S. Fish and Wildlife Service	Federal Water Pollution Control Act of 1972, as amended (FWPCA), §404; 33 USC 1344; 33 CFR 320-330; 40 CFR 230. Executive Orders 11988 and 11990. Fish and Wildlife Coordination Act, 16 USC 661-666c.
Floodplain Consultation	Construction activities in floodplains.	Water Resource Council	Executive Order 11988, 29 May 1977.
Section 10 Permit	Construction of structures such as impoundments, bridge improvements, and cable components in or over any navigable water, the excavation from or depositing of material in such waters or any other work affecting the course, location, condition, or capacity of such waters.	Army Corps of Engineers, in consultation with Environmental Protection Agency and U.S. Fish and Wildlife Service	Rivers and Harbors Act of 1899, §10; 33 USC 403; 33 CFR 320-330; 40 CFR 230. Fish and Wildlife Coordination Act, 16 USC 661-666c.
National Pollutant and Discharge Elimination System Permit	Most point wastewater discharges require a discharge permit if discharged to any surface water body.	Environmental Protection Agency, or federally designated state agency	Clean Water Act of 1977, §402; 33 USC 466 et seq.

Table 6.0-1 Continued, Page 2 of 6

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Approval of Spill Prevention Control and Counter-Measure Plan	Storage or transportation of oil (i.e., in the form of gasoline and diesel fuel or in any other form) at construction sites.	Environmental Protection Agency	Federal Water Pollution Control Act, 33 USC 1251, et seq. at §1321(j)(1)(c); 40 CFR 112.
Air/Noise			
Review of Prevention of Significant Deterioration and Nonattainment Area Impacts	Movement of Hard Mobile Launcher vehicles (emissions and fugitive dust generation); Main Operating Base development activities with emissions to the atmosphere. Ensure compliance with state and local air quality implementation plans.	Environmental Protection Agency	Clean Air Act, Prevention of Significant Deterioration and other air quality approvals, 42 USC 7401 et seq.
Consultation	*Federal activities resulting in noise that* may jeopardize health or safety. Equipment must meet federal noise emission standards.	Environmental Protection Agency	Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978, 42 USC §4901 et seq., particularly 42 USC §4903.
Stationary Source Construction and Operation Permits	Concrete plant, rock crusher, incinerator boiler, generator.	Environmental Protection Agency	Clean Air Act, 42 USC §1701 et seq.
Solid and Hazardous Waste			
Authority for Short-Term Storage of Small Quantities of Hazardous Waste, Hazardous Waste I.D. Number	Generation during construction and temporary storage of small quantities of hazardous waste *including* expended or unusable oils and lubricants, machining fluids, cleaning agents, and adhesives.	Environmental Protection Agency	Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq., at §6921; 40 CFR 261.5, 262.34.

Table 6.0-1 Continued, Page 3 of 6

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Registration, Packaging, and Manifest Requirements	Transportation of hazardous waste generated during construction from generation site to temporary storage site; transportation of propellants.	Federal Highway Administration, Department of Transportation	Hazardous Materials Transportation Act, 49 USC 1801 et seq.; Resource Conservation and Recovery Act of 1976, §3003; 42 USC 6901 et seq.; 49 CFR 170-179; 40 CFR 262.30-262.33; 45 Fed. Reg. 51645.
Approval of General Safety Plan and Facility-Specific Safety Plans	Storage and processing of explosives and propellants in facilities that are near inhabited buildings, public traffic routes, recreational facilities, utilities, petroleum storage facilities, or processing facilities for other explosives.	Explosive Safety Board, Department of Defense	Department of Defense Ammunition and Explosive Safety Standards Directive, 5154.45; Air Force Regulation 127-100.
Biological Resources Protection			
Section 7 Consultation on Threatened and Endangered Species	Activities and facilities that may affect, threatened or endangered species or their critical habitat.	U.S. Fish and Wildlife Service, Department of Interior	Endangered Species Act, §7; 16 USC 1531 et seq., §1536; 50 CFR 402; Proposed Rules in 48 Fed. Reg. 29990.
Consultation on Effects on Fish and Wildlife	Modification, control, or impoundment of a surface water body over 4 hectares. Must consult with federal and state wildlife agencies.	U.S. Fish and Wildlife Service, Department of Interior	Fish and Wildlife Coordination Act, 16 USC 661-666.
Wetlands Assessment	Construction in, modification of, or impacts to wetlands is not allowed unless there is no practicable alternative. Must notify federal, state, and local agencies of expected impacts, alternatives considered, and mitigations.	U.S. Fish and Wildlife Service, Department of Interior, and/or Army Corps of Engineers	Executive Order 11990.
Conservation Program	Military Reservation.	DOD in cooperation with DOI and appropriate state agencies.	Sikes Act, 16 USC, §670a, et seq.

Table 6.0-1 Continued, Page 4 of 6

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Migratory Bird Treaty Act-Permits or Approvals for Movement of Migratory Birds	In the event that the mitigation plan for birds protected under the Migratory Bird Treaty Act involves movement of birds, approval of the Secretary of the Interior may be required.	U.S. Fish and Wildlife Service, Department of Interior	Migratory Bird and Treaty Act, 16 USC 703-711 et seq.; 50 CFR 21.
Cultural Resource Protection			
Section 106 Consultation and Comment	Project activities that affect property with historic, architectural, or cultural value which is listed or eligible fc listing in the National Register of Historic Places.	Advisory Council on Historic Preservation	National Historic Preservation Act of 1966, as amended, 16 USC 470 et seq.; Advisory Council on Historic Preservation, 36 CFR 800; National Register of Historic Places, 36 CFR 60; Executive Order 11593 "Protection and Enhancement of the Cultural Environment."
Consultation	Project activities that affect Native American religious practices and sites.	Native American religious leaders	American Indian Religious Freedom Act, 42 USC 1996 et seq.
Permit to Survey, Excavate, Analyze, and Curate Archaeological Resources	Project activities that affect cultural resources.	Interagency Archaeological Services, National Park Service, Department of Interior	Archeological Resources Protection Act, PL 96-95.
Cooperative Agreement for Construction and Operation on Historic Trails	Project actions that affect historic trails.	National Park Service, Department of Interior	National Trails System Act, 16 USC 1241 et seq.

Table 6.0-1 Continued, Page 5 of 6

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Transportation			
Highway Access Control Approval	Any construction involving new highway access improvements must be approved by the Secretary of Transportation.	Federal Highway Administration, Department of Transportation	23 USC 111 Federal Air for Highways.
Notice of Intent	Airfield construction (civil or joint use: not required for exclusive military).	Federal Aviation Administration, Department of Transportation	Federal Aviation Act, 49 USC 1347 et seq.
Air Space Permit	Construction of buildings, towers, or other structures greater than 200 ft in height.	Federal Aviation Administration, Department of Transportation	Federal Aviation Act, 49 USC 1347 et seq.
Land Use			
Rights-of-Way Consultation	Need to occupy, use, or traverse land for roads or railroads, power and communication distribution systems, and pipelines over wildlife refuges.	U.S. Fish and Wildlife Service, Department of Interior	Fish and Wildlife Coordination Act, §4CF, 16 USC 661 et seq.; Department of Transportation Act of 1966, 80 Stat 931, PL 89-670; National Wildlife Refuge System Administration Act, PL 89-669; Coastal Barrier Resources Act, 16 USC 3501-3510.
Consistency Determination for Coastal Zone Management	Projects that require use of land within the coastal zone.	Implementaion through state coastal management programs	Coastal Zone Management Act of 1972, 15 CFR 930, Subpart C.
Right-of-Way Grant (Bureau of Land Management or Forest Service Managed Lands)	Need to occupy, use, or traverse land for roads, railroads, powerlines, storage yards, etc.	Bureau of Land Management, Department of Interior, U.S. Forest Service, U.S. Department of Agriculture	Federal Land Policy and Management Act, 43 USC 1701-1782.

Table 6.0-1 Continued, Page 6 of 6

Authorizing Action	Typical Activity or Facility That May Require the Action	Authorizing Agency	Authority
Withdrawal Land Order	Need to obtain jurisdiction over or occupation of land for system uses other than rights-of-way under certain conditions.	Bureau of Land Management, Department of Interior/U.S. Forest Service, U.S. Department of Agriculture	Federal Land Policy and Management Act (supra); Engle Act, 43 USC 135-158.
Consultation	Federal project which requires the use of wilderness study areas.	U.S. Fish and Wildlife Service, U.S. Department of Agriculture	Wilderness Act, 16 USC 1131-1136; Federal Land Policy and Management Act, 43 USC 1782.
Right-of-Way Grant (Forest Service Managed Lands)	Federal project which requires the use/withdrawal of national forest land.	U.S. Forest Service, U.S. Department of Agriculture	National Forest Organic Legislation, 16 USC 475, *Multiple-Use Sustained-Yield* Act, 16 USC 528-531, Forest and Rangeland Renewable Resources Planning and Research Acts, National Forest Management Act, and Renewable Resource Extension Act, 16 USC 1600-1676; 36 CFR 261.
Consultation	Federal project which affects (directly or indirectly) wild, free-roaming horses or burros on public lands.	Bureau of Land Management, Department of Interior	Wild Free-Roaming Horses and Burros Act, 16 USC 113-1340; 43 CFR 7400.
Relocation Benefits Plan	In the event property owners are relocated as a result of the proposed project, a plan for relocation assistance will be developed.	U.S. Air Force	Uniform Relocation Assistance and Real Property Acquisition Act, 42 USC 4601 et seq.
Free-Use Permit	Quarries or borrow pits on public lands.	Department of the Interior, Bureau of Land Management	Materials Act of 1947, 30 USC 601-604.

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Years of Experience: 10

Raj Mathur, Principal Social Scientist, Tetra Tech, Inc.
B.A., 1957, Geography, Punjab University, India
M.A., 1960, Economics, Punjab University, India
Ph.D., 1972, Geography, University of Minnesota, Minneapolis
Years of Experience: 26

David A. McPhee, Chief, Environmental Protection Management Branch, U.S. Air Force, AFRCE-BMS/DEVE
B.S., 1970, Aeronautical Engineering, San Jose State College, California
Years of Experience: 15

David C. Merdinger, Staff Land Use Planner, Tetra Tech, Inc.
B.A., 1978, Environmental Design, State University of New York, Buffalo
M.R.P. 1980, Regional Land Use Planning, University of North Carolina, Chapel Hill
Years of Experience: 6

Thomas Meyer, Transportation Engineer, Tetra Tech, Inc.
B.S., 1972, Civil Engineering, University of Notre Dame, South Bend, Indiana
M.S., 1973, Traffic/Transportation Engineering, Northwestern University, Illinois
Years of Experience: 13

Leo Montroy, Principal Environmental Engineer, Tetra Tech, Inc.
B.S., 1969, Biology/Chemistry, University of Windsor, Ontario, Canada
Ph.D., 1973, Ecology, University of Notre Dame, South Bend, Indiana
Years of Experience: 15

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B.S., 1979, Geology, Indiana University, Indianapolis
M.A., 1984, Geology, Indiana University, Bloomington
Years of Experience: 7

Michael Morton, Staff Engineer, Tetra Tech, Inc.
B.S., 1976, Civil Engineering, Pennsylvania State University, University Park
M.S., 1981, Civil Engineering, Pennsylvania State University, University Park
Years of Experience: 8

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B.A., 1984, Environmental Studies, University of California, Santa Barbara
Years of Experience: 1

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B.A., 1976, Psychology, University of Central Florida, Orlando
M.A., 1981, Experimental Psychology, University of South Florida, Tampa
A.A.S., 1983, Information Processing, Riverside City College, Riverside, California
Years of Experience: 10

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B.A., 1972, Government, Oberlin College, Ohio
Ph.D., 1979, Economics, University of Maryland, College Park
Years of Experience: 14

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B.A., 1965, Business Commerce and Administration, North Central College, Naperville, Illinois
M.A., 1967, Economics, Roosevelt University, Chicago, Illinois
Ph.D., 1972, Economics, University of Arizona, Tucson
Years of Experience: 18

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B.S., 1961, Geology, Physics, and Chemistry, Government Arts College, Rajahmundry, India
M.S., 1963, Geology, Andhra University, Waltair, India
M.S., 1972, Geology, State University of New York, Albany
M.S., 1979, Urban Environmental Studies, Rensselaer Polytechnic Institute, Troy, New York
Years of Experience: 14

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B.A., 1972, Classics, University of Iowa, Iowa City
M.A., 1979, Anthropology, University of California, Riverside
Years of Experience: 11

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B.S., 1951, Physics, Loyola University, New Orleans, Louisiana
M.S., 1952, Physics, Vanderbilt University, Nashville, Tennessee
Years of Experience: 23

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B.S., 1979, Resource Management, Cornell University, Ithaca, New York
M.S., 1982, Environmental Health, Tufts University, New York, New York
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Years of Experience: 25

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Graduated, 1982, Air War College, Air Force University, Maxwell Air Force Base, Alabama
Years of Experience: 33

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B.S., 1982, Geology, California State University, Bakersfield
M.S., 1986, Geophysics, University of California, Riverside
Years of Experience: 1

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B.S., 1964, Mechanical Engineering, University of Miami, Coral Gables
Years of Experience: 22

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B.S., 1971, Biology, University of California, San Diego
M.S., 1974, Aquatic Ecology, University of Washington, Seattle
Years of Experience: 12

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M.A., 1947, Economics, University of Nevada, Reno
Sc.D., 1953, Economics, University of Paris, France
Years of Experience: 30

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B.S., 1950, Business and Engineering, University of Colorado, Denver
M.BA, 1953, Corporate Finance, Syracuse University, New York
Ph.D. 1963, Economics, Stanford University, Palo Alto, California
Years of Experience: 25

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B.S., 1955, Electrical Engineering, University of Massachusetts, Amherst
B.S., 1956, Meteorology, St. Louis University, Missouri
M.S., 1962, Meteorology, University of Wisconsin, Madison
M.S., 1976, Systems Management, University of Southern California, Los Angeles
Years of Experience: 29

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Years of Experience: 10

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A.A., 1974, Business Administration, Orange County Community College, Middletown, New York
Years of Experience: 12

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B.S., 1971, Distributed Studies, Iowa State University, Ames
J.D., 1974, University of Iowa School of Law, Iowa City
LL.M., 1984, Law and Marine Affairs, University of Washington School of Law, Seattle
Years of Experience: 12

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Years of Experience: 8

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B.S., 1967, Engineering, San Diego State University, California
M.S., 1968, Civil Engineering, Texas A&M University, College Station
M.BA, 1981, Auburn University, Montgomery, Alabama
Years of Experience: 18

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B.Ed., 1960, Science Education, Chicago State University, Illinois
M.A., 1967, Physical Geography (Climatology), Chicago State University, Illinois
Ph.D., 1975, Biogeography and Remote Sensing, University of Oklahoma, Norman
Years of Experience: 18

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B.E., 1976, Hydraulics, Tamkang University, Taipei, Taiwan
M.S., 1981, Civil Engineering, California State University, Long Beach
Years of Experience: 6

8.0 LIST OF RECIPIENTS

The environmental issues addressed in this Legislative Environmental Impact Statement were initially identified by Air Force and contractor personnel who have had experience with programs of similar scope. These issues were then presented at state and federal agency coordination meetings held between April 11, 1986 and May 13, 1986 in Washington, DC; Dallas, Texas; Denver, Colorado; Kansas City, Missouri; Atlanta, Georgia; San Francisco, California; Seattle, Washington; and Carson City, Nevada. Issues and comments identified through this coordination process have been included in the evaluation of environmental consequences of the proposed project. The list of recipients includes those agencies that participated in the issue identification process, interested organizations or agencies within the Department of Defense, and others who have expressed an interest in receiving the document. The list also includes governors, United States senators, congressional representatives in affected districts, and state libraries for all states that have potential deployment areas for the Small Intercontinental Ballistic Missile. Single points of contact were established in all states where data collection efforts were required; these have been included in the list of recipients.

8.1 Federal Agencies

Department of Agriculture
Alburquerque, NM
Davis, CA
Phoenix, AZ
Reno, NV

Forest Service
Albuquerque, NM
Milwaukee, WI
Tallahassee, FL
Washington, DC

Office of Finance and Management
Washington, DC

Soil Conservation Service
Washington, DC

Department of Commerce
Economic Development Administration
Atlanta, GA

National Oceanic and Atmospheric Administration
Terminal Island, CA

National Technical Information Service
Springfield, VA

Department of Defense
Army Corps of Engineers
Dallas, TX
Washington, DC
Planning
Dallas, TX

AFEN-FDE
Facilities Division
Fort McPherson, GA

China Lake Naval Weapons Center
China Lake, CA

Commandant of the Marine Corps
Code LFL
Washington, DC

Commander I Corps and Fort Lewis
AFZH-EHQ
Fort Lewis, WA

Headquarters National Training Center and Fort Irwin
Fort Irwin, CA

Marine Corps Air-Ground Combat Center
Twentynine Palms, CA

Department of Defense
Office of Economic Adjustment
Arlington, VA
Washington, DC

U.S. Army
Military Traffic Management Command
Falls Church, VA

U.S. Army Air Defense Artillery Center and Fort Bliss
Fort Bliss, TX

U.S. Army Engineering District
Fort Worth, TX

U.S. Army Engineering District, Southwestern
SWDED-MM
Dallas, TX

U.S. Army Engineering Division
SADAN-TA
Atlanta, GA

U.S. Army Environmental Office
Washington, DC

U.S. Army Headquarters
Washington, DC

U.S. Army Headquarters Forces Command
AFEN-FDE
Fort McPherson, GA
U.S. Army Material Command
Alexandria, VA

U.S. Navy
Southern Division, Naval Facilities Engineering Command
Charleston, SC

Washington Army National Guard
Camp Murray
Tacoma, WA

White Sands Missile Range, NM

Yakima Firing Center
Yakima, WA

Department of Defense
Yuma Proving Ground
Yuma, AZ

Department of Energy
Las Vegas, NV
Richland, WA
Washington, DC

Bonneville Power Administration
Hanford Site
Portland, OR
Richland, WA

Office of Environmental Guidance
Washington, DC

Office of Intergovernmental Affairs
Washington, DC

Department of Health and Human Services
Division of Assistance Policy
Washington, DC

Public Health Services, Center for Disease Control
Atlanta, GA

Department of Housing and Urban Development
Atlanta, GA
Dallas, TX
Denver, CO
Kansas City, MO
San Francisco, CA
Seattle, WA

Office of Environment and Energy
Washington, DC

Office of Intergovernmental Relations
Washington, DC

Department of the Interior
Headquarters
Washington, DC

Bureau of Indian Affairs
Aberdeen, SD
Albuquerque, NM
Washington, DC

Department of the Interior

Bureau of Land Management
Jackson, MS

Minerals Management Service
Reston, VA

Bureau of Mines
Spokane, WA

Bureau of Reclamation
Office of Environmental Affairs
Washington, DC
Boulder City, NV

Division of Environmental Coordination
Washington, DC

Fish and Wildlife Service
Albuquerque, NM
Denver, CO
Panama City, FL

Division of Endangered Species
Atlanta, GA

Division of Environmental Coordination
Washington, DC

National Park Service
Washington, DC
San Francisco, CA

Office of Environmental Project Review
Washington, DC

Regional Environmental Office
Atlanta, GA
Denver, CO

U.S. Geological Survey
Denver, CO
Reston, VA

Department of Labor

Intergovernmental Affairs
Washington, DC

Department of Transportation

Environmental Division
Washington, DC

Office of Planning and Environmental Coordination
Washington, DC

Kansas City, MO
Phoenix, AZ

Environmental Protection Agency

Atlanta, GA
Dallas, TX
Denver, CO
Kansas City, MO
San Francisco, CA
Seattle, WA
Washington, DC

Air Management Division
San Francisco, CA

Federal Activities Branch
San Francisco, CA

Federal Agency Liaison Division
Washington, DC

Grants, Policy, and Procedures Branch
Washington, DC

Office of Federal Activities
Washington, DC

Office of Groundwater
San Francisco, CA

Water Division
San Francisco, CA

Federal Aviation Administration

Headquarters
Washington, DC
Aurora, CO

Airports Division
Kansas City, MO

Office of Environment and Energy
Washington, DC

Federal Emergency Management Agency
Atlanta, GA

Federal Highway Administration
Grants Policy and Procedures
Branch
Washington, DC

Office of Environmental Policy
Washington, DC

General Services Administration
Washington, DC

Small Business Administration
Washington, DC

8.2 State and Local Agencies

8.2.1 State of Alabama

Honorable George C. Wallace, Governor, Montgomery

Honorable Jeremiah A. Denton, Jr., United States Senate

Honorable Howell T. Heflin, United States Senate

Honorable William L. Dickinson, House of Representatives

Alabama Department of Economic and Community Affairs, Montgomery

Alabama Public Library Service, Montgomery

8.2.2 State of Arizona

Honorable Bruce Babbitt, Governor, Phoenix

Honorable Dennis DeConcini, United States Senate

Honorable Barry M. Goldwater, United States Senate

Honorable Jim Kolbe, House of Representatives

Honorable Eldon Rudd, House of Representatives

Honorable Bob Stump, House of Representatives

Honorable Morris K. Udall, House of Representatives

Adjutant General, Phoenix

Arizona Agriculture and Horticulture Department, Phoenix

Arizona Department of Commerce, Phoenix

Arizona Department of Environmental Health, Phoenix

Arizona National Guard, Phoenix

Arizona State Land Department, Phoenix

Center for Public Affairs, Tempe

City of Mesa Water Department

City of Phoenix

Department of Library, Archives, and Public Records, Phoenix

Indian Affairs Commission, Phoenix

Maricopa Association of Governments, Phoenix

Pima Association of Governments, Tucson

State Historic Protection Officer, Arizona State Parks Board, Phoenix

Western Arizona Council of Governments, Yuma

8.2.3 State of California

Honorable George Deukmejian, Governor, Sacramento

Honorable Alan Cranston, United States Senate

Honorable Pete Wilson, United States Senate

Honorable George E. Brown, House of Representatives

Honorable Duncan L. Hunter, House of Representatives

Honorable Jerry Lewis, House of Representatives

Honorable Alfred A. McCandless, House of Representatives

Honorable William M. Thomas, House of Representatives

Adjutant General, Sacramento

California Indian Legal Services, Oakland

California Regional Water Quality Control Board, Palm Desert

Office of Planning and Research, Sacramento

State Library, Sacramento

The Resources Agency of California, Sacramento

8.2.4 State of Colorado

Honorable Richard D. Lamm, Governor, Denver

Honorable William L. Armstrong, United States Senate

Honorable Gary Hart, United States Senate

Honorable Hank Brown, House of Representatives

Adjutant General, Denver

Office of Library Services, Denver

State Clearinghouse, Denver

8.2.5 State of Florida

Honorable Bob Graham, Governor, Tallahassee

Honorable Lawton Chiles, United States Senate

Honorable Paula Hawkins, United States Senate

Honorable Don Fuqua, House of Representatives

Honorable Earl Hutto, House of Representatives

Adjutant General, St. Augustine

Division of Library Services, Tallahassee

Office of the Governor, Office of Planning and Budgeting, Tallahassee

8.2.6 State of Georgia

Georgia State Clearinghouse, Atlanta

8.2.7 State of Iowa

Office of Planning and Programming, Des Moines

8.2.8 State of Kansas

Intergovernmental Liaison, Topeka

8.2.9 State of Minnesota

Honorable Rudy Perpich, Governor, St. Paul

Honorable Rudy Boschwitz, United States Senate

Honorable David F. Durenberger, United States Senate

Honorable Arlan Strangeland, House of Representatives

Adjutant General, St. Paul

Minnesota State Planning Agency, St. Paul

Office of Library Development and Services, St. Paul

Renville County Commissioner, Hector

8.2.10 State of Missouri

Honorable John D. Ashcroft, Governor, Jefferson City

Honorable John C. Danforth, United States Senate

Honorable Thomas F. Eagleton, United States Senate

Honorable E. Thomas Coleman, House of Representatives

Honorable Ike Skelton, House of Representatives

Honorable Gene Taylor, House of Representatives

Honorable Alan D. Wheat, House of Representatives

Adjutant General, Jefferson City

Intergovernmental Relations, Missouri Federal Assistance, Office of Administration, Division of Budget and Planning, Jefferson City

Mid-America Regional Council, Kansas City

Office of Administration, Jefferson City

State Library, Jefferson City

8.2.11 State of Montana

Honorable Ted Schwinden, Governor, Helena

Honorable Max Baucus, United States Senate

Honorable John Melcher, United States Senate

Honorable Ronald C. Marlenee, House of Representatives

Honorable Pat Williams, House of Representatives

Adjutant General, Helena

Great Falls City/County Planning Board

Intergovernmental Review Clearinghouse, Office of the Lieutenant Governor, Helena

State Library, Helena

8.2.12 State of Nebraska

Honorable Robert Kerrey, Governor, Lincoln

Honorable J. James Exon, United States Senate

Honorable Edward Zorinsky, United States Senate

Honorable Virgina Smith, House of Representatives

Adjutant General, Lincoln

Library Commission, Lincoln

Policy Research Office, Lincoln

8.2.13 State of Nevada

Honorable Richard H. Bryan, Governor, Carson City

Honorable Chic Hecht, United States Senate

Honorable Paul Laxalt, United States Senate

Honorable Harry Reid, House of Representatives

Honorable Barbara F. Vucanovich, House of Representatives

Adjutant General, Carson City

Clark County A-95 Clearinghouse Council, Las Vegas

Governor's Office of Community Service, Carson City

Office of Community Services, Carson City

Nevada Bureau of Mines and Geology, Reno

Nevada Department of Transportation, Carson City

Nevada Department of Wildlife, Reno

Nevada Division of Historic Preservation and Archaeology, Carson City

Nevada Division of State Lands, Carson City

Nevada Division of Water Resources, Carson City

Nuclear Waste Project Officer, Carson City

State Library, Carson City

8.2.14 State of New Mexico

Honorable Toney Anaya, Governor, Santa Fe

Honorable Jeff Bingaman, United States Senate

Honorable Pete V. Domenici, United States Senate

Honorable William B. Richardson, House of Representatives

Honorable Joseph R. Skeen, House of Representatives

Adjutant General, Santa Fe

Department of Finance and Administration, Santa Fe

New Mexico Environmental Improvement Division, Santa Fe

New Mexico Natural Resources Department, Santa Fe

New Mexico Office of Cultural Affairs, Santa Fe

Southern Rio Grande Council of Governments, Las Cruces

Southeastern New Mexico Economic Development District, Roswell

State Library, Santa Fe

8.2.15 State of North Dakota

Honorable George A. Sinner, Governor, Bismarck

Honorable Mark Andrews, United States Senate

Honorable Quentin N. Burdick, United States Senate

Honorable Bryon L. Dorgan, House of Representatives

Adjutant General, Bismarck

Office of Intergovernmental Assistance, Office of Management and Budget, Bismarck

State Library, Bismarck

8.2.16 State of Oregon

Intergovernmental Relations Division, Executive Department, Salem

8.2.17 State of South Dakota

Honorable William J. Janklow, Governor, Pierre

Honorable James Abdnor, United States Senate

Honorable Larry Pressler, United States Senate

Honorable Thomas A. Daschle, House of Representatives

Adjutant General, Rapid City

Black Hills Council of Local Governments, Rapid City

South Dakota Department of Game, Fish, and Parks, Pierre

South Dakota Historical Society Board of Trustees, State Historical Preservation Center, Vermillion

State Government Operations, Pierre

State Library and Archives, Pierre

8.2.18 State of Texas

Honorable Mark White, Governor, Austin

Honorable Lloyd Bentsen, United States Senate

Honorable William Philip Gramm, United States Senate

Honorable Ronald D. Coleman, House of Representatives

Adjutant General, Austin

General Land Office, Austin

Office of the Governor, Natural Resources Division, Austin

Railroad Commission of Texas, Austin

State Department of Highways and Public Transportation, Austin

State Library, Austin

State Planning, Office of the Governor, Austin

Texas Air Control Board, Austin

Texas Department of Agriculture, Austin

Texas Department of Health, Arlington

Texas Historical Commission, Austin

Texas State Soil and Water Conservation Board, Austin

Texas Water Commission, Austin

Texas Water Development Board, Austin

West Texas Council of Governments, El Paso

8.2.19 State of Utah

Office of the Governor, Salt Lake City

8.2.20 State of Washington

Honorable Booth Gardner, Governor, Olympia

Honorable Daniel J. Evans, United States Senate

Honorable Slade Gorton, United States Senate

Honorable Thomas S. Foley, House of Representatives

Honorable Sid W. Morrison, House of Representatives

Adjutant General, Tacoma

Department of Community Development, Olympia

State Library, Olympia

Washington Department of Community Development, Olympia

8.2.21 State of Wyoming

Honorable Ed Herschler, Governor, Cheyenne

Honorable Alan K. Simpson, United States Senate

Honorable Malcolm Wallop, United States Senate

Honorable Richard Cheney, House of Representatives

Adjutant General, Cheyenne

Cheyenne-Laramie County Regional Planning Office, Cheyenne

Laramie County School District No. 1, Cheyenne

Office of the Governor, State Planning Coordinator, Cheyenne

State Library, Cheyenne

State Planning Coordinator's Office, Cheyenne

Wyoming Office of Industrial Siting Administration, Cheyenne

8.3 Others

Chairman, Tohono O'Odham Nation, Sells, AZ

Dolby, Jeanelle L., Aspen, CO

Klein Walker Association, Inc., Cambridge, MA

McGill, John, Urbana, IL

Naslund, David, Edgewater, CO

Sierra Club, El Paso Regional Group, El Paso, TX

TAMS, New York, NY

Taylor, Elaine, Boulder, CO

The Harris Group, Reston, VA

Western Solidarity, Denver, CO

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1976 Leasable Mineral and Waterpower Land Classification Map of the Lewistown 1° x 2° Quadrangle, Montana. U.S. Geological Survey, Map I-1017.

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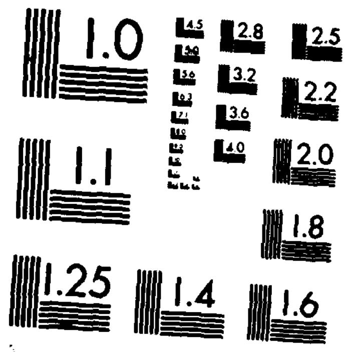

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10.0 GLOSSARY OF TERMS AND ACRONYMS

10.1 Terms

Acre-Foot. The volume of water that covers 1 acre to a depth of 1 foot.

Active Fault. A fault on which movement has occurred during the past 10,000 years and which may be subject to recurring movement, usually indicated by small, periodic displacements or seismic activity.

Active Management Area. Groundwater basin(s) within Arizona defined by specific state legislation and subject to restrictions of groundwater withdrawals.

Advisory Council on Historic Preservation. A 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (P.L. 89-655; 16 U.S.C. 470).

Aerosolize. To form minute solid particles or liquid droplets of a substance by mechanical or chemical means (e.g., smoke, fire, or mist).

Aggregate. Any of several hard, inert materials (e.g., sand, gravel, or crushed stone) used for mixing with a cementing material to form concrete, mortar, or plaster, or used alone, as in railroad ballast or graded fill.

Air Installation Compatible Use Zone. A concept developed by the Air Force to promote land use development near its airfields in a manner that protects adjacent communities from noise and safety hazards associated with aircraft operations, and to preserve the operational integrity of the air fields.

Air Quality Region. An area based on jurisdictional boundaries, urban-industrial concentrations, and other factors, including atmospheric areas, necessary to provide adequate implementation of air quality standards.

Alluvial Fan. The surface of a body of stream deposits that approximates a segment of a cone that spreads out downslope from the point where the stream leaves a mountainous area.

Alluvial/Colluvial Fan. A fan-shaped sedimentary deposit composed of materials eroded from a mountain range and deposited by a drainage issuing from a canyon mouth.

Alluvium. Sediments deposited by a stream or running water.

Alpha Particle. A product of the radioactive decay process which consists of a helium nucleus (two protons and two neutrons).

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated "criteria" pollutants (e.g., nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, lead, and hydrocarbons).

Ambient Noise. The existing noise characteristics of an area.

American Indians. Used in a collective sense to refer to all natives of North America, usually excludes Eskimos and Aleuts.

Ammonites. Flat, spiral fossil shells particularly abundant in the Mesozoic era.

Annual (plant). A plant that lives for only 1 year or season.

Anticline. A fold, convex upward, containing stratigraphically older rocks within its core.

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Arch. A broad, open anticlinal fold on a regional scale.

Archaeology. A scientific approach of the study of human ecology, cultural history, and cultural process, emphasizing systematic interpretation of material remains.

Archaic. A stage of prehistoric cultural development, recognized throughout North America, characterized by broad spectrum hunting and gathering economies and seasonal mobility. The material remains are recognized by the development of barbed and stemmed spear points, the extensive use of groundstone tools, and the lack of ceramics. The Archaic is also commonly used to designate a prehistoric period (generally 6000 B.C. to A.D. 500), but the dates vary from one region to another.

Argillaceous. Said of a rock or sediment composed of, or containing, clay-size particles or clay minerals.

Array. The physical layout of silos in a geometric configuration.

Arroyo. A water-carved gully or channel; dry wash.

Arterial. Signalized streets with signal spacings of 2 miles or less and turning movements at intersections that usually do not exceed 20 percent of total traffic. Urban arterials primarily serve through-traffic, and, as a secondary function, provide access to abutting properties (urban); roadways that provide large traffic volume capacity between major traffic generators, designed to facilitate traffic movement and discourage land access when feasible. Includes primary state roads (functional).

Artifact. Anything that owes its shape, form, or placement to human activity. In archaeological studies, the term is applied to portable objects (e.g., tools and the byproducts of their manufacture).

Aseismic. An area or region not subject to earthquakes.

Assembly and Checkout. The process of final assembly and verification of a weapon system.

Assessed Valuation. A certain percentage of the value of real property set by local government and used for tax purposes.

Atomic Number. The number of protons in the nucleus of a given chemical element equal to the positive charge of the nucleus.

Atomic Weight. The relative mass of the nucleus of a given chemical element in proportion to the mass of a hydrogen atom (one proton).

Attainment Area. An area that has been designated by the Environmental Protection Agency and the appropriate state air quality agency as having ambient air quality levels below the ceiling levels defined under the National Ambient Air Quality Standards.

Available Vacancy. A vacant housing unit that is either for sale or for rent.

Average Annual Daily Traffic. For a 1-year period, the total volume passing a point or segment of a highway facility in both directions, divided by the number of days in the year.

Baculites. An extinct form of ammonites with a rod-like shell.

Badlands. Intricately stream-dissected topography that is characterized by a very fine drainage network.

Bajada. A broad alluvial slope extending from the base of a mountain range out into a basin and formed by the merging of separate alluvial fans.

Ball Court. Prehistoric, open, oval or rectangular structure used to play ceremonial ball games; their use was adapted from pre-Hispanic Mexican populations.

Bannerstones. Stone weights for atlatl (dart-thrower) shafts.

Base Metal. Any of the more common and more chemically active metals (e.g., lead and copper).

Baseline. The existing and future-growth characterization of an area without the proposed project.

Basin. A drainage or catchment area of a stream or lake.

Bayou. A term used in the southeastern United States for a marshy, sluggish body of water that is tributary to a lake or river.

Beachstrand Lines. Linear areas of low topographic relief that correspond to decreasing water levels around former glacial lakes.

Bentonite. A soft, plastic, porous, light-colored rock composed essentially of clay minerals of the montmorillonite group and commonly able to absorb large quantities of water accompanied by an increase in volume.

Beta Particle. A product of the radioactive decay process that is physically identical to a high-velocity electron.

Biota. All of the organisms of an area; the flora and fauna of a region.

Body Wave. An earthquake wave that travels the interior of the earth.

Brachiopods. A phylum of invertebrates that has persisted from the Lower Cambrian to the present and consists of a marine animal with a calcareous bivalve shell with unequal valves.

Breaks. Terrain characterized by abrupt changes in surface slope (e.g., a line of cliffs and associated spurs and small ravines).

Bryozoans. A small phylum of aquatic animals that reproduce by budding, usually forming branching, mosslike colonies that are enclosed by a calcareous or ridged shell.

Cairn. A distinctly artificial pile of rocks that may mark or enclose burials, vision quests, caches, or geodetic locales.

Cambrian. A period of the Paleozoic era extending from about 570 to 505 million years ago.

Campsite (Cultural Resources). A short-term habitation site containing evidence of daily living activities, as opposed to specialized activities (e.g., quarry site). Campsites are generally open-air occupations of perhaps weeks to months duration.

Campsite-Night. The use of a campsite by a camping party for 1 night.

Capacity (Transportation). The traffic-carrying ability of a facility while maintaining prescribed operational qualities (e.g., a specific level of service); the maximum amount of traffic that can be accommodated by a given facility. (Note: Traffic facilities generally operate poorly at or near capacity, and facilities are rarely designed or planned to operate within this range.)

Capacity (Utilities). The maximum load a system is capable of carrying under existing service conditions.

Capacity Analysis (Transportation). A set of procedures used to estimate the traffic-carrying ability of facilities within a defined range of operating conditions.

Capacity Margin (Utilities). The difference between peak demand and total demonstrated capacity.

Carnivore. A flesh-eating animal.

Cenozoic. An era in geological history extending from the beginning of the Tertiary period, about 66 million years ago, to the present time, characterized by the rapid evolution of mammals, birds, grasses, shrubs, and higher flowering plants.

Ceramic Scatter. A spatially limited distribution of pot sherds on the ground's surface.

Chronology. The science of arranging time in periods and ascertaining the dates and historical order of past events.

Climate. The prevalent or characteristic meteorological conditions of any given location or region and their extremes.

Clovis. The earliest well-documented period of man's occupation in the New World; generally dated at 11,000 B.C. and represented by large, well-made, fluted points.

Collector Streets. Surface streets that provide land access and traffic circulation service within residential, commercial, and industrial areas (urban); secondary roads that provide access to higher-type roads and connect small communities and nearby areas and serve adjacent property (functional).

Command Dispersal Area. An area, located on existing Department of Defense or Department of Energy installations, where Hard Mobile Launcher vehicles may move during heightened international tension.

Complex. For the Small Intercontinental Ballistic Missile project, a complex has been defined as a grouping of Department of Defense or Department of Energy installations.

Component. One location or element within a settlement/subsistence system. Archaeological sites may contain several components that reflect the use of the locality by different groups in different time periods.

Corridor. A strip of land of various widths described on both sides of a particular linear facility such as a highway or transmission line.

Cretaceous. The last period of the Mesozoic era, extending between 144 and 65 million years ago.

Crinoids. A large class of fossil echinoderms that have a cup-shaped body, feathery arms, and a long, jointed stalk fixed to the base of the body to anchor the animal to the sea bottom.

Crystalline Rock. A rock consisting completely of crystals or fragments of crystals.

Culture. In general, the system of behavior, beliefs, institutions, and objects human beings use to relate to each other and to the environment.

Curation. The processes used to care for and preserve historically important artifacts, features, or structures.

Decibel. A logarithmic unit of measure of sound pressure level used to describe the loudness of sound. When used to correspond to the human range of hearing, decibels are weighted on an A-scale and expressed as dBA.

Decommissioning. The process of removing a weapon system from service.

Deflagration. A very intense, rapidly burning fire accompanied by the ejection of burning particles.

Deformation. A general term for the process of folding, faulting, etc., of rocks, resulting from various earth forces.

Deployment. Strategic emplacement of a weapon system.

Deployment Area. Geographic region where missiles will be located.

Desert Pavement. A natural mosaic of closely packed pebbles and cobbles found where wind has removed smaller particles.

Design Life. The anticipated functional life of a facility.

Designated Natural Area. Title given to natural areas recognized as unique by the Arizona State Parks Board.

Designated Wilderness Area. A tract of land that has been granted congressional approval for incorporation into the National Wilderness Preservation System, as mandated by the Wilderness Act of 1964.

Developed. Said of land, a lot, a parcel, or an area that has been built upon, or where public services have been installed prior to residential or commercial construction.

Developed Recreation. Recreational use that occurs in areas where facilities are provided for concentrated public use (e.g., campgrounds, picnic areas, and swimming areas).

Dire Wolf. Extinct wolf from the Pleistocene epoch.

Direct Employment. Military and civilian personnel who are employed by the Department of Defense and its contractors, and who are working onsite on the project.

Dispersed Recreation. Recreational use that occurs outside of developed sites.

Displacement. A general term for the relative movement of the two sides of a fault, measured in any direction.

Dissected Topography. An area of land characterized by numerous valleys and gullys created by extensive surface erosion.

District. National Register of Historic Places designation of a geographically defined area (urban or rural) possessing a significant concentration, linkage, or continuity of sites, structures, or objects united by past events (theme) or aesthetically by plan or physical development.

Disturbed Area. Specific land that has had its surface altered by grading, digging, or other construction-related activities.

Divide. The ridge marking the boundary between two adjacent drainage basins or dividing surface waters that flow naturally in one direction from those that flow in the opposite direction.

Dolomite. A variety of limestone or marble rich in magnesium carbonate.

Earthquake. A sudden motion or trembling in the earth caused by the abrupt release of accumulated strain.

Ecotone. Transitional zone between two distinct ecological communities (e.g., grasslands to forest). Important because of the greater diversity provided by the presence of species from both communities.

Edentates. Mammals with few or no teeth including sloths, armadillos, and anteaters.

Effect. A change in an attribute. Effects can be caused by a variety of events, including those that result from project attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied (indirect effect); those that result from attributes of other projects or other attributes that change because of other projects (cumulative effects); and those that result from natural causes (e.g., seasonal change).

Effluent. Wastewater discharge from a wastewater treatment facility.

Electromagnetic Radiation. Radiation produced by atomic or electrical activity. Its range of wavelengths or frequencies extend from very short gamma rays to the longest radio waves and includes visible light.

Electron. A particle of very small mass, carrying a unit negative or positive charge. The term electron, where used alone, commonly refers to negative electrons.

Endangered Species. A species that is threatened with extinction throughout all or a significant portion of its range.

Energy. The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal, mechanical, electrical, and chemical; in customary units, measured in kilowatt hours or British thermal units.

Entrada. The period of the Spanish entrance into, and exploration of, the southwestern United States, generally beginning in the middle to late sixteenth century.

Environmental Impact Analysis Process. The process of conducting environmental studies employed by the U.S. Air Force.

Eocene. An epoch of the Tertiary period extending from about 58 to 36 million years ago.

Ephemeral Stream. A stream that flows briefly only in response to precipitation in the immediate vicinity and whose channel is above the water table at all times.

Epicenter. The point on the earth's surface directly above the focus of an earthquake.

Equivalent Sound Level. The level of a constant sound which, in a given situation and time period, has the same sound energy as does a time-varying sound. Technically, equivalent sound level is the level of the time-weighted, mean square, A-weighted sound pressure. The time interval that the measurement is taken should always be specified.

Escarpment. A long cliff or steep slope separating two comparatively level or more gently sloping surfaces; results from erosion or faulting.

Ethnography. The description of human groups and their behavior by direct observation and/or by transcription of statements by living persons.

Ethnohistory. History of nonliterate human groups consisting of oral, written, or ethnographic records.

Ethnology. A subdiscipline of anthropology that attempts to explain general patterns of human behavior by comparing ethnographic information on different living groups of people.

Expenditure. A disbursement of funds by a government entity.

Extrapolation. The process of using known data or trends to predict unknown data or trends.

Farmland of Statewide Importance. Farmland, other than prime farmland, that is of statewide importance for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate state or local government agency, and that the Secretary of Agriculture determines should be considered as farmland (Farmland Protection Policy Act, 7 CFR 658).

Fault. A fracture or zone of fractures along which there has been movement of the sides relative to one another and parallel to the fracture.

Fault Plane. A fault surface that is more or less planar.

Fault System. Two or more interrelated fault zones.

Fault Zone. A fault that is expressed as a zone of numerous small fractures.

Fauna. Animals; organisms of the animal kingdom of a given area taken collectively.

Feature. Nonportable portion of an archaeological site or structure (e.g., fire pit, wall, and area of artifact concentration).

Firm Power. The amount of electrical power (in kilowatts) that a wholesaler is contractually bound to supply to a retailer on demand.

Flake. A small stone fragment produced as a byproduct of stone tool manufacturing; may also be used unmodified as a tool itself.

Flashpoint. The lowest temperature at which a liquid will give off flammable vapor in sufficient quantity to ignite when mixed with air and exposed to spark or flame.

Floodplain. The surface of relatively smooth land adjacent to a river channel that is covered by water when the river overflows.

Flora. Plants; organisms of the plant kingdom taken collectively.

Fluvial (Fluviatile). Of, or pertaining to, a river or rivers.

Fold. A curve or bend in rock strata.

Formation. A sequence of similar rock layers that can be traced over a large area.

Freeway. A multilane, divided highway with a minimum of two lanes for exclusive use of traffic in each direction, allowing full control of access and egress.

Fugitive Dust Emissions. Emissions released directly into the atmosphere that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

Full-Scale Development. The stage of development of a weapon system when all components are built and tested at full scale.

Furbearers. Mammalian species that are trapped or hunted for their pelts.

Gamma Radiation. A product of the radioactive decay process which includes very high-frequency electromagnetic waves.

Gastropods. A type of mollusk with a univalve shell (e.g., snail).

Geologic Hazard. A naturally occurring or manmade geologic condition or phenomenon that presents a risk or is a potential danger to life and property.

Geomorphic. Pertaining to the form of the earth's surface.

Geomorphology. That branch of geology specializing in the origin, development, and characteristics of surface features of the earth.

Geothermal. Pertaining to heat in the earth's interior.

Grassland Biome. Major ecological community of plants and animals (e.g., grassland and tropical rain forest).

Groundstone Artifacts. Stone artifacts made by grinding rather than flaking (e.g., milling stones and mortar and pestle).

Group. Two or more associated formations.

Gypsum. A widely distributed mineral consisting of hydrous calcium sulfate; chiefly used as a retardant in portland cement and in making plaster of paris.

Half Life. The time required for disintegration or transformation of half of the atoms of a radioactive substance.

Hard Mobile Launcher. Special vehicles, hardened against nuclear attack; used to transport and launch the small intercontinental ballistic missiles.

Hard Silo. A buried structure that will be used to protect small intercontinental ballistic missiles; similar to existing missile silos but more resistant to damage.

Hazardous Waste. Any waste that poses a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature, because they can be biologically magnified, because they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects.

Hearth/Firepit. A feature used for the placement of fires; may be lined with clay or stones.

Heavy Vehicles. Any vehicles with more than four tires touching the pavement; includes trucks, recreational vehicles, and buses.

Herbaceous (plant). Plant without persistent woody stems.

Herpetofauna. Amphibians (e.g., frogs, salamanders, and turtles) and reptiles (e.g., lizards and snakes).

Historic. A period of time after the advent of written history. In the Regions of Influence, the historic period ranges from about A.D. 1800 to the present. It also refers to items primarily of Euroamerican manufacture.

Holocene. The time since the end of the Pleistocene epoch, characterized by the absence of large continental or Cordilleran ice sheets and the extinction of large mammalian life forms. Generally considered to be the last 10,000 years.

Impact. An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique.

Important Farmland. A general term used to indicate both prime farmland and farmland of statewide importance.

Impoundment. A manmade area for the purpose of detention or retention of surface water.

Incised. Said of a stream channel that has been downcut or entrenched into the land surface during, and because of, a stream's rejuvenation.

Indirect Employment. Employment resulting from the purchases of workers who are directly working on a specified project. Also includes any subsequent employment arising from the increase in purchases in the area.

Induced Seismic Activities. A seismic activity that is initiated or increased as a result of nontectonic processes (i.e., fluid injection or withdrawal, or reservoir loading).

Infiltration. The leakage of groundwater into a sewer from defective or deteriorating pipe joints.

Inflow. The entrance of stormwater runoff into a sanitary sewer through defective or deteriorating manhole structures or via the illicit connection of roof drains or street storm drains to sanitary sewers.

Infrastructure. The system of public utility lines, communication facility networks, and roadways that connect all the structures and facilities in a given locale.

Initial Operational Capability. The point when the first ten missiles of the Small Intercontinental Ballistic Missile system will be operational.

Immigrants. All persons relocating to a defined geographic area as a result of the proposed project, usually calculated on an annual basis.

Insectivores. Any order of mammals depending on insects for food (e.g., moles, shrews, and hedgehogs).

Intaglio. Figures created by clearing rocks from desert pavement, generally visible from an aerial perspective.

Intercontinental Ballistic Missile. A land-based missile capable of accurate delivery over intercontinental ranges, usually greater than 5,000 miles.

Intermittent Stream. A stream that does not flow continuously during all periods of the year.

Interstate. The designated National System of Interstate and Defense Highways that are located in rural and urban areas; they connect the East and West coasts and extend from Canadian border points to various points on the Mexican border.

Irradiation. Exposure to radiation.

Isolated Artifact. An artifact, or a small, disarticulated group of artifacts, that cannot be associated with, or is situated outside of, a cultural resource site.

Isotopes. Different forms of the same chemical element which have identical atomic number but different atomic weights.

Jurassic. A period of the Mesozoic era extending from about 208 to 144 million years ago.

Kame. A short ridge or mound of stratified drift deposited by glacial meltwater.

Kill Site. An archaeological site indicated by the presence or association of faunal remains, butchering tools, and hunting equipment (e.g., projectile points).

Kilowatt. A unit of power equivalent to 1,000 watts.

Known Geothermal Resource Area. In the opinion of the Secretary of the Interior, an area where the geology, nearby discoveries, competitive interests, or other indicators would provide reason to believe that the prospects for extraction of geothermal resources are good enough to warrant expenditures of money for that purpose (43 CFR 3200.0-5).

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes; growing in or inhabiting lakes. Characterized by lakes or lakebeds.

Land Use Plans and Policies. Guidelines adopted by governments to direct future land use within their jurisdictions.

Landslide. The downslope movement of soil and rock material (en masse) under gravitational influence.

L_{dn} Noise Level. The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 P.M. and 7:00 A.M.

Leachate. A solution containing material removed by a liquid, e.g., by water that percolates through soil or rock.

L_{eq} Noise Level. A constant amount of acoustic energy equivalent to the energy contained in the time-varying noise measured from a given source for a given time.

Level Terrain. Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars; this generally includes short grades of no more than 1 to 2 percent.

Level of Impact. The measure of the magnitude of an impact. For each environmental resource in this study, specific definitions have been given for negligible, low, moderate, and high impact levels.

Level of Service. A qualitative measure describing operational conditions within a traffic stream and how they are perceived by motorists and/or passengers.

Lignite. A brownish-black coal mediating between peat and sub-bituminous coal.

Limb. The sides of a fold.

Limestone. A sedimentary rock consisting chiefly of calcium carbonate.

Linear Energy Transfer. The rate that a charged particle deposits its energy per unit path length.

Liquefaction. The transformation from a solid to a liquid state resulting from increased pore pressure and reduced effective stress.

Lithic Scatter. An archaeological site consisting only of stone artifacts.

Lithology. The physical character of a rock (e.g., its color, hardness, mineral composition, and grain size).

Load. The amount of electric power or natural gas required on a system at a given point.

Loam. A rich permeable soil composed of equal amounts of clay, silt, and sand, usually containing organic matter.

Locus/Loci. A place or locality; used archaeologically to define a small area within a larger site.

Loess. A typically buff-colored, windblown silt directly attributable to glacial outwash.

Long Term. A long-duration effect.

m_b. Body wave magnitude. An earthquake magnitude determined at large distances by using the logarithm of the ratio of amplitude to period of body waves.

M_L. Local Richter earthquake magnitude. A measure of the strain of energy released by an earthquake within 100 kilometers of the epicenter.

Magnitude (earthquake). A measure of the strength of an earthquake or the strain energy it releases.

Mammoth/Mastodon. Extinct elephants from the Pleistocene epoch.

Mass Fraction. The relative proportion, by weight, of a specific isotope present in a particular element.

Maximum Credible Earthquake. The largest earthquake capable of being produced from a source, structure, or region under the currently known tectonic framework.

Mean. A value that is computed by dividing the sum of a set of terms by the number of terms (i.e., average).

Medicine Wheel. Large stone circle with rock alignments radiating from the center to the circle edge, most likely ceremonial features.

Megafauna. Various species of large mammals that became extinct in North America sometime before 6,000 years before present. These mammals include the mammoth, giant bison, camel, and giant sloth.

Megawatts. 1,000 kilowatts or 1 million watts.

Mesozoic. An era in geological history, ranging from about 245 to 66 million years ago, characterized by the development of reptiles.

Metamorphic Rock. A rock derived from preexisting rocks because of changes resulting from increased temperature and pressure and the chemical environment, generally deep in the earth's crust.

Meteorology. The scientific study of the atmosphere.

Microgram. One-millionth of a gram.

Midden. Soil horizon resulting from the accumulation of human living debris containing artifacts and cultural refuse (e.g., bone and shell fragments, fire-cracked rocks, charcoal, chipping detritus, stone tools, or organic residues).

Milligram. One-thousandth of a gram.

Milling Station. An area within an archaeological site used for milling seeds or corn; may consist of portable milling stones or may be nonportable milling places in naturally occurring bedrock.

Millirad. One one-thousandth of a rad (a unit of radiation, see Rad).

Miocene. An epoch of the Tertiary period, 24 to 5 million years ago; marked by the development of apes and the appearance of ancestral gibbons.

Mitigations. Methods to reduce or eliminate adverse project impacts (e.g., avoidance of sites, fencing, or excavation if no other alternative is possible).

Mobile Home. A housing unit designed as a permanent dwelling, usually connected to utilities, but designed without a permanent foundation.

Modified Mercalli Intensity. An arbitrary measure of an earthquake's intensity based on its effect on people and structures. Ranges from I (not felt by people) to XII (almost total damage).

Module. A grouping of adjacent silos.

Mollusca. A large phylum of invertebrate animals with soft bodies protected by a calcareous shell (e.g., snails, mussels, bivalves, and octopus).

Mountainous Terrain. Any combination of grades and horizontal and vertical alignments causing heavy vehicles to operate at crawl speeds for significant distances or at frequent intervals.

Multifamily Housing. Renter-occupied units; includes apartments, duplexes, and fourplexes.

Multiple Resource Area. All, or a defined portion of, the cultural resources identified within a specific geographic area that have been identified for inclusion in the National Register of Historic Places.

National Ambient Air Quality Standards. Federal standards set by the Environmental Protection Agency to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

National Landmark (Historic). A site, building, or object in private or public ownership, that possesses national significance in American history, archaeology, or culture. In order to achieve landmark status, a property must be, or have the clear potential to be recognized, understood, and appreciated publicly and professionally for the strength and clarity of its historical association, its architectural or design excellence, or its extraordinary information content on a national scale.

National Register of Historic Places. A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966.

National Wildlife Refuge. Lands set aside for their wildlife habitat values and managed by the U.S. Fish and Wildlife Service for the conservation or enhancement of waterfowl, big game, endangered species, and nongame species populations.

Net Equivalent Weight. The amount of TNT required to produce an explosive power equal to that of the component of interest.

Neutron. An electrically neutral atomic particle found in the nuclei of all elements except those of ordinary (light) hydrogen.

Noise Exposure. The cumulative acoustic stimulation reaching the ear over a specified period of time (e.g., a work shift, a day, a working life, or a lifetime).

Noise Sensitive Areas. Specific locations (or general areas) of types of land use activities that may be affected by traffic noise.

Nonattainment Area. An area that has been designated by the Environmental Protection Agency and the appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards.

Noncompliance. Action contradicting a specified procedure or causing results outside specified limits.

Nonfirm Power. Electric power supplied under a contract that makes seasonal excess power available (i.e., power in excess of contractually firm power) and is generally sold at a lower price than firm power. This type of contract may be offered by a generator with a large hydroelectric capacity that is subject to water shortages during periods of low precipitation.

Normal Fault. A fault where the overlying side of the fault appears to have moved downward relative to the underlying side of the fault.

Nuclei. Small particles around which a chemical substance may collect, e.g., a dust particle around which a raindrop forms.

Nucleus. The small positively charged central region of an atom, which comprises essentially all the mass of the atom.

Numic. A Shoshonean (Uto-Aztecan family) language-speaking group who occupied the Great Basin from approximately A.D. 1000 to 1200 to the present (e.g., Paiute and Shoshone).

Oligocene. An epoch of the Tertiary period extending from about 36 to 24 million years ago.

Operations Activities. Those activities required to maintain the Small Intercontinental Ballistic Missile System in a secure, survivable, launch-ready condition.

Orogeny. The process that forms mountains.

Overdraft. A condition in which groundwater withdrawals exceed the amount of recharge.

Overview. A report that summarizes and generalizes information, usually of a region.

Paleo-. Prefix meaning "old" or "ancient".

Paleontological Resources. Fossilized organic remains from past geological periods.

Paleozoic. An era in geological history occurring between 570 and 245 million years ago, marked by the culmination of almost all invertebrates except the insects; in its later periods, marked by the first appearance of land plants, amphibians, and reptiles.

Particle Density. The number of particles per unit volume.

Peak Demand. The highest instantaneous amount of electrical power (in kilowatts) that an electrical system is required to supply over a given time frame, usually 1 year.

Peak Hour. The hour of highest volume of traffic on a given section of a roadway between 7 and 9 A.M. or between 4 and 6 P.M.

Peak Year. The year when a particular project-related effect (e.g., total employment) is greatest.

Peak-Hour Factor. The ratio of total hourly volume to the maximum 15-minute rate of flow within the hour.

Pediment. A broad, gently sloping bedrock surface at the foot of a much steeper mountain slope in an arid or semiarid region, usually covered with a thin veneer of alluvial sand and gravel.

Pelecypods. A class of bivalve mollusks with bilaterally symmetrical shells.

Pennsylvanian. A period of the Paleozoic era extending from about 320 to 286 million years ago.

Per Capita Expenditures. Amount of expenditures in a given category calculated on a per person basis.

Per Capita Personal Income. Average annual income per person (in a specified aggregation).

Per Capita Revenues. Amount of revenues in a given category calculated on a per person basis.

Perennial (plant). A plant that lives for several years or more.

Perennial Stream. A stream that flows continuously throughout the year.

Permafrost. Any surficial deposit occurring in arctic, subarctic, and alpine regions where below freezing temperatures have existed continuously for a long time.

Permanent Housing. Units intended for year-round use.

Permanently Disturbed. Surfaces that will be covered by impervious materials or kept in a cleared condition to accommodate buildings, parking lots, roads, and security zones.

Permeability. The property or capacity of a porous rock, sediment, or soil for transmitting a fluid.

Permian. The most recent geologic period of the Paleozoic era dating to 230 million years ago.

Permian Basin. An area underlain by bedded salt deposits of the Permian age. Encompasses a five-state region extending from central Kansas and southwestern Colorado through the Oklahoma and Texas panhandles, including eastern New Mexico.

Personal Income. Current income received by persons from all sources; includes transfer payments from governments or businesses.

Petroglyph. Schematic or representational art incised or pecked into a rock surface.

Petroliferous. Said of a geologic rock unit containing oil and/or gas.

Phreatophytes. Plants whose roots reach down to the capillary fringe of the groundwater table; often found in riparian zones.

Physiographic Province. A region with similar parts in geologic structure and climate that have a unified geomorphic history.

Physiography. A description of the surface features of the earth.

Pictograph. Schematic or representational art painted or drawn onto a rock surface.

Plasticiser. A chemical agent that is added to make a material more flexible.

Plate Boundary. Zone of seismic and tectonic activity along the edges of lithospheric plates; presumed to indicate relative motion between plates.

Platform Mound. Platform features found on some large archaeological sites and constructed of layers of clay and/or trash, generally believed to have been used for ceremonial purposes. Platform mounds are prominent aspects of some village sites in southern Arizona.

Playa. The flat-floored bottom of an undrained desert basin that, at times, becomes a shallow lake; may leave a deposit of salt or gypsum after evaporation.

Pleistocene. The last 1.6 million years of geological history, marked by repeated glaciation and the first indication of social life in human beings.

Pliocene. An epoch of the Tertiary period extending from about 5 to 1.6 million years ago.

Plunge. The inclination of a fold axis or other linear structure, measured on the vertical plane.

Pluvial. A prolonged period of wet climate when the moisture of an area is profoundly altered (e.g., formation of lakes).

Porosity. The percentage of the bulk volume of a rock or soil occupied by pore spaces (interstices).

Post Boost Vehicle. The portion of the missile containing the reentry vehicle and the guidance and attitude control system.

Postulate. To propose an explanation for a given process or event.

Precambrian. All geologic time before the beginning of the Paleozoic era, equivalent to about 90 percent of geologic time.

Precious Metal. A general term for gold, silver, or any mineral in the platinum group.

Predictive Model. In archaeology, a statement of the relationships among known sites and between sites and the environment that is used to predict the location, density, and types of sites in areas not yet inventoried.

Prehistoric. The period of time prior to the written record, generally before A.D. 1800 in western North America.

Preliminary Treatment. The first processes at a wastewater treatment facility to remove coarse debris from the wastewater. Typically, the treatment involves bar or mechanical screening, grit removal, and sometimes comminution.

Prevention of Significant Deterioration Area. An area where air quality is regulated in order to maintain air quality standards. It also regulates the amount of allowable deterioration. Land areas are designated as:

- Class I - An air quality area where the annual total suspended particulate value may only increase by 5 milligrams per cubic meter;
- Class II - An air quality area where an annual increase in total suspended particulate value of 19 milligrams per cubic meter is allowed; and
- Class III - An air quality area where an annual increase in total suspended particulate value of 37 milligrams per cubic meter is allowed.

Primary. A consolidated system of connected main roads important to regional, interstate, and statewide travel; they consist of rural arterial routes and their extensions into and through urban areas of 5,000 or more population.

Prime Farmland. Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture (Farmland Protection Policy Act, 7 CFR 658).

Probability Analysis. An analysis conducted to evaluate the chance of a given event's occurrence.

Projectile Point. Implement that probably served as the tip of a dart, lance, spear, or arrow.

Proposed Wilderness Area. An area under consideration for designation as a wilderness area under the Wilderness Act of 1964 (P.L. 88-577).

Protohistory. The period when nonliterate American Indian cultures were affected by Euroamericans without direct contact. For instance, inland Indian tribes received trade goods and reports of European cultures from coastal tribes before the arrival of European explorers in the interior.

Proton. A positively charged atomic particle physically identical with the nucleus of the ordinary (light) hydrogen atom. All atomic nuclei contain protons.

Provenience. The place where something is produced or found; the location of a fossil or artifact.

Public Domain Land. Any land or interest in land owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management.

Public Finance. Finances of, or relating to, a government entity.

Pueblo. Relating to groups of American Indians occupying the Southwest, and named for their use of multiroom, apartment-like buildings in sedentary villages.

Quantity-Distance (Q-D) Zones. The required safe distance between locations where explosives are stored or processed and other locations, such as inhabited buildings.

Quarry (Cultural Resources). A locality where lithic material was extracted and initially prepared for the manufacture of stone implements. In the narrow sense, the term refers to places where raw materials were actually excavated, but its use is commonly extended to localities where materials are collected at the surface, (e.g., gravel deposits).

Quaternary. A geologic period including the Pleistocene and Holocene epochs, the last 1.6 million years.

Rad. A unit of absorbed dose of radiation that represents the absorption of 100 ergs of ionizing radiation per gram of absorbing material (e.g., body tissue).

Radioactivity. The spontaneous emission of energy from an unstable atomic nucleus in the form of alpha or beta particles and gamma radiation.

Radiobiological Research. The study of the effects of radiation on living organisms.

Radiocarbon Dating. A method of dating carbon-bearing samples by analysis of radioactive carbon (C-14) content.

Radiometric Dating. Calculating an age in years for geologic materials by measuring the presence of a short-life radioactive element.

Rancholabrean Fauna. Large mammal assemblage associated with the Pleistocene epoch (e.g., sabertooth tiger and mammoth).

Random Movement Area. An area available on existing Department of Defense or Department of Energy installations for day-to-day Hard Mobile Launcher operations.

Rangeland. Land devoted to the maintenance (grazing and keeping) of animals (e.g., cattle, sheep, and horses).

Raptors. Those species of birds (e.g., hawks, eagles, falcons, and owls) that are considered birds of prey.

Recharge. The process by which water is absorbed and is added to the zone of saturation either directly into a formation, or indirectly by way of another formation.

Reclamation. The process of restoration of an area that has been disturbed, or the treatment to restore continued utility of a waste substance.

Recreational Vehicle. A heavy vehicle operated by a private motorist and involved in the transport of recreational equipment or facilities.

Region of Influence. That area where project-induced effects of any magnitude may be expected to occur.

Relief. The vertical difference in elevation between the hilltops or mountain summits and the lowlands or valleys of a given region.

Research Natural Area. An area designated by its managing agency (usually a federal agency) to be maintained in its natural state for research.

Reserve Margin. The difference between the net system generating capability and maximum system load requirements.

Revegetation. Regrowth or replacement of a plant community on a disturbed site. Revegetation may be assisted by site preparation, planting, and treatment, or it may occur naturally (secondary succession).

Revenue. The yield of sources of income that a government entity collects or receives.

Reverse Fault. Opposite of a normal fault (i.e., the overlying side of the fault appears to have moved upward relative to its underlying side).

Right-of-Way. A strip of land that a powerline, pipeline, access road, or maintenance road passes through or over.

Riparian. An area (and associated habitat, vegetation, and species) near the edge of water bodies (e.g., streams and lakes).

Road. For the purpose of the Bureau of Land Management's wilderness inventory, the following definition has been adopted from the legislative history of the Federal Land Policy and Management Act:

> The word "roadless" refers to the absence of roads which have been improved and maintained by mechanical means to ensure relatively regular and continuous use. A trail maintained solely by the passage of vehicles does not constitute a road.
>
> To clarify this definition, the following subdefinitions also apply:
>
> "Improved and maintained" - Actions taken physically by man to keep a road open to vehicular traffic. "Improved" does not necessarily mean formal construction. "Maintained" does not necessarily mean annual maintenance.
>
> "Mechanical means" - Use of hand or power machinery or tools.
>
> "Relatively regular and continuous use" - Vehicular use which has occurred and will continue to occur on a relatively regular basis. Examples are: access roads for equipment to maintain a stock water tank or other established water sources, access roads to maintained recreation sites or facilities, or access roads to mining claims.

Rockshelter. A naturally formed sheltered overhang that is commonly inhabited by prehistoric groups; it is generally found on a vertical rock face and is not as deep as a cave.

Rolling Terrain. Any combination of grades and horizontal and vertical alignments causing heavy vehicles to reduce their speeds substantially below those of passenger cars, but not causing them to operate at crawl speeds for any significant length of time.

Rural Electric Association. Cooperative sponsored by the Rural Electrification Administration of the U.S. Department of Agriculture to supply electricity to a rural area.

Sampling. The selection of a portion of a study area or population, the analysis of which is intended to permit generalization about the entire population. In archaeology, samples are often used to reduce the amount of land area covered in a survey or the number of artifacts analyzed from a site. Statistical sampling is generally preferred since it is possible to specify the bias or probability of error in the results, but judgmental or intuitive samples are sometimes used.

Sandstone. A clastic sedimentary rock composed of sand-size particles in a fine-grained matrix and held firmly in place by a cementing material; the consolidated equivalent of sand.

Savannah. A grassland with scattered trees.

Scrub (Scrubland). Land dominated by *sclerophyll or microphyll* shrubs and/or multistemmed trees, generally not exceeding 10 meters.

Scenic Highways. Highways or sections of highways that have been identified and/or designated as scenic passageways by state and/or federal agencies or by commercial atlases.

Seasonality. Phenomena that show cyclic or repeated behavior according to the season.

Secondary. Rural major collector routes that carry extensive local traffic.

Secondary Treatment. The reduction of biochemical oxygen demand in wastewater by aerobic biological processes and sedimentation.

Section 7 Consultation. Under Section 7(a) of the Endangered Species Act, each agency must first consult with the affected state and then with the Secretary of the Interior to ascertain the impact of its proposed actions on any endangered or threatened species.

Security Zones. Designated protected areas around a facility or site.

Sediment. Solid fragmental material that originates from weather-beaten rocks and is transported or deposited by air, water, or ice.

Sedimentary Rock. A rock resulting from the consolidation of loose sediment that has accumulated in layers.

Seismic. Pertaining to an earthquake or to earth vibrations; includes those that are artificially induced.

Seismic Source Zone. A zone determined by tectonics, historic seismicity, or both; it is believed to be capable of generating earthquakes.

Seismotectonic Province. A region characterized by similar tectonic and seismic characteristics.

Shale. A fine-grained sedimentary rock formed by the consolidation of clay, silt, and mud.

Short Term. A short-duration effect.

Significance. The importance of an impact on a resource. Council on Environmental Quality regulations specify several tests to determine whether an action will significantly affect the quality of the human environment. While these tests apply to the entire action, they can also be used in an amended form to judge impact significance for individual resources. It is important to note that a high impact may not be significant, while a low impact may be significant. Significance is an either/or determination. The level of impact described is either significant or is not significant. Additionally, beneficial significance must be determined at the same level as adverse significance. As specified in the Council on Environmental Quality regulations, significance needs to be determined for each of the three geographic areas, local, regional, and national. This places the impact into context. Significance is also determined in terms of intensity.

Siltstone. A fine-grained sedimentary rock, primarily composed of silt-sized particles.

Single-Family Housing. A detached dwelling unit designed to provide living quarters for one family.

Site. Any location where humans have altered the terrain.

Site-Specific. A study of the geographic project area which is identified at the second tier of the Environmental Impact Analysis Process.

Slag. A rock-like residue that is created after iron or other material is subjected to an intense fire.

Sloughs. Depressions that collect water.

Sobaipuri. Riverine-oriented hunters/gatherers and horticulturalists dating from the Protohistoric and Historic periods (ca. A.D. 1500-1900) along the Santa Cruz and San Pedro rivers of southern Arizona.

Soil. A natural body consisting of layers or horizons of mineral and/or organic constituents of variable thickness and differing from the parent material in their morphological, physical, chemical, mineralogical properties, and biological characteristics.

Soil Profile. A vertical section of a soil that displays all its horizons including the original rock.

Sound Level. The quantity in decibels measured by a sound level meter satisfying the requirements of American National Standards Specification for Sound Level Meters S1.4-1971. Sound level is the frequency-weighted sound pressure level obtained with the standardized dynamic characteristic "fast" or "slow" and weighting A, B, or C; unless otherwise indicated, the A-weighted is understood. The unit of any sound level is the decibel, which has the unit symbol dB.

Special Status Lands. Onbase lands currently managed under co-use agreements between the Department of Defense or Department of Energy and other federal and state agencies, and offbase lands managed by other federal agencies for national purposes, with the exception of public domain lands not under consideration for wilderness designation. These lands include national wildlife refuges, state wildlife areas, ecological reserves, agricultural experimental ranges, and national forest lands.

Special Visual Quality Area. An area that consists of landforms and/or vegetation of unusual or interesting dramatic quality or variety.

State Historic Preservation Officer. The official within each state, authorized by the state, at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

Statistical Techniques. Analyses that produce estimates of a dependent variable given specific values of one or more independent variables.

Strategic and Critical Materials. Materials that would be needed to supply the military, industrial, and essential civilian needs of the United States during a national emergency; they are not found or produced in the United States in quantities sufficient enough to meet such needs (Strategic and Critical Materials Stockpiling Act, 93 Stat. 319,50 USC 98).

Stratified Site. An archaeological site exhibiting various strata or layers of occupation, usually implies a large site with a long occupation.

Stratigraphic Column. A composite diagram that shows the subdivisions of part or all of geologic time and the sequence of stratigraphic units of a given locality or region.

Stratigraphic Sequence. A chronologic succession of sedimentary rocks from older below to younger above, essentially without interruption.

Stratigraphic Unit. A stratum or body of adjacent strata recognized as a unit in the classification of a rock sequence; used for any purpose (e.g., description, mapping, and correlation).

Stratigraphy. The interpretation and analysis of geologic strata; concerned with the original succession and age relations of layered materials and their individual properties (i.e., cultural materials are dated relative to each other by their position in stratigraphic layers).

Structural Geology. The branch of geology that deals with the form, arrangement, and internal structure of rocks.

Subsidence. The sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion.

Subsistence/Settlement Pattern. The distributional patterns of site types in relation to the environment that reflect a particular adaptation. Aspects of land use include the function, duration, and seasonality of individual sites.

Successional Communities. A stage or recognizable condition of a plant community that occurs during its development from bare ground to climax.

Suitable Deployment Area. A geographic area identified as potentially suitable for missile silo placement as a result of preliminary geotechnical investigations.

Surface Collection. Systematic mapping and removal of artifacts from a site by means not involving excavation.

Survey. A systematic search for cultural resources; may include literature review and records search, but an on-ground field investigation is usually implied. Surveys may be conducted at different levels of intensity, ranging from a reconnaissance or spot check to an intensive inventory study.

Syncline. A fold, concave upward, containing stratigraphically younger rocks within its core.

Taxon (pl.) Taxa. A taxonomic entity (e.g., species, subspecies, or variety) or a group of such entities.

Technical Order. A document issued by the Air Force that defines the technical details of a system or parts of a system, and may include data on assembly, repair, maintenance, storage, operation, and disposal.

Tectonics. A branch of geology that deals with the regional assembling of structural or deformational features, and includes a study of their mutual relations, origin, and historical evolution.

Temporarily Disturbed. Surfaces disturbed during construction, but later regraded, revegetated; or those able to return to a natural state during the operational life of the project.

Terrace. A flat portion of land created when a stream or river cuts further into its channel and migrates laterally to a different location. In river valleys, they typically represent former levels of the valley floodplain.

Terrace Deposit. The alluvial materials comprising the topographic terrace.

Tertiary. The first period of the Cenozoic era extending between 66 and 1.6 million years ago.

Threatened Species. A species that is likely to become endangered in the foreseeable future.

Tiering. Technique of proceeding from general to specific analyses as a program evolves.

Tipi Ring/Stone Circle. A circle of stones generally measuring from 3.5 to 7 meters in diameter that is thought to represent the remains of various types of structures or to have served a religious or ceremonial function.

Total Dissolved Solids. The concentration of solid materials in a solution; determined as the weight of the residue of a water sample upon filtration and evaporation decided by the volume of the sample.

Trail. A two-wheel track created only by the passage of vehicles. A trail is not a road.

Transfer. To convey energy from one system to another via a transmission interconnection.

Transporter/Erector. A vehicle that transports a mobile launcher, conceals it during movement, and permits its undetected emplacement or removal at a protective structure.

Transporter/Erector Roads. Roads used for the movement of Minuteman transporter/erector vehicles.

Triassic. A period of the Mesozoic era extending from about 245 to 208 million years ago.

Transuranium Series. Elements with atomic numbers greater than 92, which are the products of artificial nuclear changes.

Trilobite. Extinct Paleozoic marine arthropod; an invertebrate animal (e.g., insects, arachnids, and crustaceans).

Trinchera. Prehistoric stone check dam used to slow the flow of water and hold back soil. Often built along arroyos and canyon sides in association with other water control devices.

Two-Lane Highway. A roadway having a two-lane cross section, with one lane for each direction of flow, and where passing maneuvers must be made in the opposing lane.

Unemployment Rate. The number of civilians, as a percentage of the total civilian labor force, without jobs but actively seeking employment.

Ungulates. Hoofed mammals such as horses, bison, and antelope.

Upland Game. Bird species such as grouse, quail, pheasant, and wild turkeys found in areas elevated above rivers and valleys.

Uplift. A structurally high area in the earth's crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch.

Use-to-Capacity Ratio. The ratio of campground use to the theoretical available capacity (e.g., number of campsites available).

Utility Corridor. A common route used by more than one utility for transportation of energy resources.

Valley Fill. Unconsolidated sediments deposited by any agent to fill or partially fill a valley.

Viewshed Areas. Proposed deployment areas that lie within 5 miles of state and federal highways.

Visibility Degradation. Any adverse change in visibility consisting of either a reduction of visual range from some reference value, or a reduction in contrast between an object and the horizon sky, or a shift in coloration or light intensity of the sky or distant objects compared to what is perceived on a "clear day."

Vision Quest Site. A sacred area used by American Plains Indians to seek supernatural guidance through fast and prayer, usually located on a prominence (e.g., butte, mesa, or ridgetop).

Volcanic Ash. Fine-grained material ejected from a volcano.

Volume. The total number of vehicles that pass over a given point or section of a roadway during a given time interval. Volumes may be expressed in terms of annual, daily, hourly, or subhourly periods.

Warlodges. Vertical pole conical lodges, usually located in wooded breaks and associated with eagle trapping pits.

Water Table. The upper surface of a zone of saturation except where the surface is formed by an impermeable body.

Watt. A unit of electrical power equal to 1/756th horsepower.

Way. A vehicle route that has not been improved and maintained by mechanical means to ensure relatively regular and continuous use.

Wetlands. Transitional lands between terrestrial and aquatic systems where the water table is usually at, or near, the surface, or the land is covered by shallow water. The soil or substrate is at least periodically saturated with water.

Wilderness Area. A tract of land that has been granted congressional approval for incorporation into the National Wilderness Preservation System as mandated by the Wilderness Act of 1964 (P.L. 88-57).

Wilderness Study Area. An area determined to have wilderness characteristics; subject to interdisciplinary analysis and public comment to determine wilderness suitability. Suitable areas are recommended to the President and Congress for wilderness designation.

Wind Shear. A stress on a body in a region in which winds of different velocities and directions are close together.

Withdrawn Lands. Federal lands where jurisdiction has been transferred from one department, bureau, or agency, to another.

Woodland. Communities dominated by trees with a usual mean height of less than 15 meters.

10.2 Acronyms

AADT	Average Annual Daily Traffic
AC	Alternating Current
AFAF	Air Force Auxiliary Field
AFB	Air Force Base
AFR	Air Force Range
AICUZ	Air Installation Compatible Use Zone
AQCR	Air Quality Control Region
AMA	Active Management Area
BLM	Bureau of Land Management
B.P.	Before Present
CEQ	Council on Environmental Quality
CERL	Construction Engineering Research Laboratory
CO	Carbon Monoxide
COE	Army Corps of Engineers
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EIAP	Environmental Impact Analysis Process
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FC	Firing Center
FHWA	Federal Highway Administration
FY	Fiscal Year
GIS	Geographic Information System
GMIS	Geographic Management Information System
HML	Hard Mobile Launcher
ICBM	Intercontinental Ballistic Missile
IHE	Insensitive High Explosives
KCRA	Known Coal Resource Area
KGRA	Known Geothermal Resource Area
KGRF	Known Geothermal Resource Field
LEIS	Legislative Environmental Impact Statement
LOI	Level of Impact
LOS	Level of Service
LPG	Liquid Petroleum Gas
MCAGCC	Marine Corps Air-Ground Combat Center
MCE	Maximum Credible Earthquake
MMI	Modified Mercalli Intensity
MOB	Main Operating Base
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act

NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
NSCCA	Nuclear Safety Cross Check Analysis
NTC	National Training Center
NWC	Naval Weapons Center
NWSSG	Nuclear Weapons System Safety Group
OEA	Office of Economic Adjustment
OSHA	Occupational Safety and Health Administration
PBV	Post Boost Vehicle
PCPH	Passenger Cars Per Hour
PG	Proving Ground
PHS	Potential Hazard System
PMOA	Programmatic Memorandum of Agreement
PSD	Prevention of Significant Deterioration
Q-D	Quantity-Distance
RMA	Random Movement Area
ROI	Region of Influence
RV	Reentry Vehicle
SAC	Strategic Air Command
SCS	Soil Conservation Service
SCAG	Southern California Association of Governments
SDA	Suitable Deployment Area
SSG	System Safety Group
SWP	State Water Project
T/E	Transporter/Erector
TAC	Tactical Air Command
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
USBM	U.S. Bureau of Mines
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WGP	Weapons Grade Plutonium

10.3 Units of Measurement

acre-ft	acre-feet
acre-ft/yr	acre-feet per year
Bcf	billion cubic feet
cy	cubic yard
cy/yr	cubic yard per year
dB	decibel
dBA	decibels on the A-weighted scale
gpd	gallons per day
in/yr	inch per year
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
L_{dn}	day/night equivalent noise level
L_{eq}	energy-equivalent continuous noise levels
Mcf	thousand cubic feet
MGD	million gallons per day
mg/l	milligrams per liter
mg/m^3	milligrams per cubic meter
MMcf	million cubic feet
mph	miles per hour
mrad	millirad
MW	megawatt
MWh	megawatt-hour
ppm	parts per million
sq mi	square mile
sq km	square kilometer
T/day	tons per day
$\mu g/m^3$	micrograms per cubic meter

11.0 INDEX

This index lists the states and installations discussed in this document. It provides the text sections (excluding the Summary) that refer to each state or installation.

END

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