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APPENDIX A

**ENVIRONMENTAL ATTRIBUTES, APPLICABLE LAWS AND
REGULATIONS, AND COMPLIANCE REQUIREMENTS**

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**ENVIRONMENTAL ATTRIBUTES, APPLICABLE LAWS
AND REGULATIONS, AND COMPLIANCE REQUIREMENTS**

AIR

AIR QUALITY ACT (1967) 42 USC 7401 et seq., Pub. L. 90-148 81 Stat. 485

Protects and enhances the quality of the nation's air.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD) REGULATIONS 39 Fed Reg 42510 (1974) Amended by 44 Fed Reg 51924 (1979)

Prevents degradation of air that is already cleaner than that required by the National Ambient Air Quality Standards (NAAQS).

CLEAN AIR ACT (1963) 42 USC 7401 et seq., Pub. L. 95-95 91 Stat. 685-796

Regulates air pollution by means of (1) air quality control, which sets a maximum allowable level of air pollution for the surrounding air and determines the emission levels for conformity to a maximum allowable ambient level, and (2) emission control of certain pollutants by national standards.

Clean Air Act (amendments) 1977, Section 111. Pub. L. 91-604, 84 Stat. 1676-1713, Title 42. New Source Performance Standards.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) Section 109 Clean Air Act

Public health and the public welfare are protected by national primary and secondary ambient air quality standards for "criteria" pollutants (ozone, carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, particulate matter, and hydrocarbons).

BIOLOGY

FISH AND WILDLIFE COORDINATION ACT (1965) 16 USC 662 Pub. L. 89-72 79 Stat. 216

This law requires that the U.S. Fish and Wildlife Service be consulted when water bodies, including wetlands, greater than 10 acres in area are to be modified, controlled, or impounded. It further requires action to be taken to prevent loss and damage to these resources and provision for their development and improvement.

THE BALD AND GOLDEN EAGLE ACT (1940) 16 USC 668-668(d), Chapter 278
54 Stat. 250

Under this Act, activities that have the potential to disturb these birds and/or their nests require prior consultation with the U.S. Fish and Wildlife Service regarding mitigation measures.

THE MIGRATORY BIRD TREATY ACT (1918) 16 USC 703-712, Chapter 128 40
Stat. 755

This Act prohibits the pursuit, hunting, taking, capture, possession, or killing of such species or their nests and eggs. Also potential impacts of a proposed action on migrating birds have to be discussed with the U.S. Fish and Wildlife Service.

ENDANGERED SPECIES ACT (1973) 16 USC 1531-1543, Pub. L. 93-205,
87 Stat. 884 (1973)

Section 7 requires every Federal agency to inquire of the U.S. Fish and Wildlife Service whether any threatened or endangered species may be present in the area of a proposed agency activity before that activity can be taken.

Amended by Pub. L. 95-632, 92 Stat. 3571 (1978) Amended by Pub. L. 97-304, 96
Stat. 1411 (1982)

Protects species of fish and wildlife that are either in danger of extinction or are likely to become an endangered species within the foreseeable future throughout all or a significant part of their range.

All Federal agencies are directed to carry out programs for the conservation of endangered and threatened species, and to take such actions as necessary to ensure that their actions will not jeopardize the continued existence of such species (16 USC 1532(2)).

Federal agencies must also see to it that their actions do not result in destruction or modification of the habitats of such species determined to be "critical."

CULTURAL RESOURCES

ANTIQUITY ACT (1906) Pub. L. 59-209, 34 Stat. 225, 16 USC 431-433

Provides for the protection of all historic and prehistoric ruins or monuments on Federal lands.

HISTORIC SITES ACT (1935) Pub. L. 74-292, 49 Stat. 666, 16 USC 461-467

Declares as national policy the preservation for public use of historic sites, buildings, and objects. Established the National Historic Landmarks program (the beginning of the National Register program).

NATIONAL HISTORIC PRESERVATION ACT (1966) 16 USC 470, Pub. L. 89-665, 80 Stat. 915-919 as amended.

Provides for an expanded National Register of Historic Places to register districts, sites, buildings, structures, and objects significant to American history, architecture, archaeology, and culture. Section 106 requires that the President's Advisory Council on Historic Preservation be afforded an opportunity to comment on any undertaking that adversely affects properties listed on the National Register.

EXECUTIVE ORDER 11593: PROTECTION AND ENHANCEMENT OF THE CULTURAL ENVIRONMENT (1971) 16 USC 470

Requires that Federal plans and programs contribute to the preservation and enhancement of sites of historic, architectural, and archaeological significance.

ARCHAEOLOGICAL AND HISTORIC PRESERVATION ACT (1974) 16 USC 469, Pub. L. 93-291 88 Stat.

Directs the preservation of historic and archaeological data that would otherwise be lost as a result of Federal construction or other Federally licensed or aided activities.

HAZARDOUS WASTES

RESOURCE CONSERVATION AND RECOVERY ACT (1976) 42 USC 6901-6987, Pub. L. 94-580, 90 Stat. 2795

Regulates the disposal of discarded materials and hazardous wastes. RCRA mandated the EPA to promulgate criteria for identifying hazardous waste (42 USC 6921), and establish standards to apply to waste generators (42 USC 6922) and transporters (42 USC 6923), as well as owners or operators of treatment, storage, or disposal facilities for hazardous wastes (42 USC 6924).

Regulates disposal with a Federal and state permit program.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA). OR "SUPERFUND ACT" (1980) 42 USC 9601-9615, 9631-9633, 9641, 9651-9657; 26 USC 4611-4612, 4661-4662, and 4681-4682; 33 USC 1364. Pub. L. 96-510 94 Stat. 2767.

Amended by Pub. L. 99-499, Title I, Para. 101, 114 (B), 127 (A).

Requires notification of any release into the environment of substances that may present substantial danger to public health or welfare or the environment (42 USC 96002 [a]). It is the primary mechanism for governmental response actions to spills, discharges, or release of any substance designated toxic or hazardous by other environmental statutes.

NOISE

NOISE CONTROL ACT (1972) 42 USC 4901-4918, Pub. L. 92-574, 86 Stat. 1234

Establishes noise emission performance standards for certain noise source products and subjects Federal facilities to state and local noise emission standards that apply to stationary sources.

WATER

CLEAN WATER ACT (1977) 33 USC 1251 et seq., 1311 et seq., Pub. L. 95-217, 91 Stat. 1566.

Restores and maintains the chemical, physical, and biological integrity of the nation's waters.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

Regulates discharges into the nation's waters with a Federal permit program designed to reduce the amount of pollutants in each discharge via control point discharge. The primary requirement is compliance with effluent limitations for each point discharge source. The Act contains provisions that (1) require that the best available technology (BAT) be utilized by discharge applicants to prevent water pollution, (2) encourage conservation of nutrients and other natural resources, and (3) establish maximum levels for pollutants.

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT (1972) 33 USC
Section 1401 et seq. Pub. L. 93-254, 86 Stat. 1052 Amended 1974

More commonly referred to as the "Ocean Dumping Act," this law regulates the dumping of dredging wastes, industrial chemicals, and sewage sludge into the ocean environment.

ENVIRONMENT (GENERAL)

NATIONAL ENVIRONMENTAL POLICY ACT (1969) 42 USC 4321, 4331-4335,
4341-4347, Pub. L. 91-190, 83 Stat. 852

Amended by Pub. L. 94-475, 90 Stat. 2071 (1976)

Requires Federal agencies to consider environmental issues under NEPA just as they consider other matters within their mandate. Environmental issues must be considered in the decision-making process.

**COUNCIL ON ENVIRONMENTAL QUALITY REGULATIONS ON IMPLEMENTING
NATIONAL ENVIRONMENTAL POLICY ACT PROCEDURES** (1978) 40 CFR
1500-1508; 43 FR 55990

Corrected by 44 FR 873 (1979) Amended by 51 FR 15625 (1986)

Regulations are binding on all Federal agencies, replacing earlier sets of agency regulations, and provide uniform standards applicable throughout the Federal Government for conducting environmental reviews. Regulations are designed to ensure that the action-forcing procedures of Section 102(2) of NEPA are used by agencies to fulfill the requirements of the policy set forth in Section 101 of the Act.

Section 101 states that "it is the continuing policy of the Federal Government, in cooperation with state and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

Section 102(2)(C) states that all agencies of the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

- (i) the environmental impact of the proposed action,**
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,**
- (iii) alternatives to the proposed action,**
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and**
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented**

APPENDIX B

**SELECTED ENVIRONMENTAL CHARACTERISTICS
AT PROPOSED HEDI TEST INSTALLATIONS**

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TABLE B-1
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SELECTED ENVIRONMENTAL CHARACTERISTICS
ARNOLD ENGINEERING DEVELOPMENT CENTER

		BASE SIZE	REFERENCES
PHYSICAL CHARACTERISTICS	FACILITIES	15,816 hectares (39,081 acres), main laboratory is a 1,214-hectare (3,000-acre) fenced compound	29, 33, 45
		1,214-hectare (3,000-acre) fenced main laboratory area, 1,829-meter (6,000-foot) airstrip, test and administration buildings, recreation areas, 1,619-hectare (4,000-acre) Wood's Reservoir	33, 45
		40 aerodynamic and propulsion wind tunnels, 11 rocket and turbine engine test cells, 4 ballistic and impact ranges, 2 arc heaters, and 4 space environment chambers	33, 45
	NATURAL RESOURCES	Wood cutting permits are sold to the general public for cutting firewood in designated areas. The Wildlife Management Program restocks fish in Wood's Reservoir. Recreational facilities for base personnel and the general public are available at the Reservoir. 567 hectares (1,400 acres) are under sharecropper permits with local farmers.	29, 33, 41
ENVIRONMENTAL CONDITIONS	PUBLIC HEALTH AND SAFETY	No public health and safety issues have been identified.	40
	SPECIAL STATUS	Federally listed endangered species are the gray bat, Indiana bat, and the red-cockaded woodpecker. There are two designated wetlands, but no designated historic or archaeological sites.	19, 29, 33, 40, 41, 47
	NOISE	Work at Arnold Engineering Development Center creates noise in excess of safety levels within the test areas. The noise problems are minimized by a 2,428-hectare (6,000-acre) dense pine plantation, the distance of the site from the nearest town, selective scheduling of operations, and mufflers for facility exhausts. Tests are of short duration and are conducted after duty hours.	29, 33, 34, 37, 40
	STAFFING	Civilian = 210, Military = 148, Contractor = 3,450 (June 1988)	44
SOCIO-ECONOMICS (BASE)	PAYROLL	Military = \$6,856,660; Civil Service = \$6,835,603; 3 operating contractors = \$106,664,210 (Sept 30, 1987)	44
	HOUSING	Officer = 24, NCO = 16, Transient = 47 (1986)	28, 44
	POPULATION/EMPLOYMENT	Coffee County has an estimated 1986 population of 41,300 persons, which is almost an 8% increase over 1980 population totals of 38,311 persons. Coffee County had a 1984 total civilian labor force of 21,163 persons and an 8.7% unemployment rate. Franklin County has an estimated 1986 population of 33,700 persons, which is almost a 5.5% increase over 1980 population totals of 31,983. Franklin County had a 1984 total civilian labor force of 12,965 persons and a 10.9% unemployment rate.	8
SOCIO-ECONOMICS (REGIONAL)	INCOME	Coffee County has a per capita income of \$9,171 (1985), which is a 49% increase over the 1981 figure of \$6,153, and presumably there is a similar increase over the 1979 median family income of \$16,516. Franklin County has a per capita income of \$8,113 (1985), which is a 46% increase over the 1981 figure of \$5,544, and presumably there is a similar increase over the 1979 median family income of \$15,576.	8
	HOUSING	Coffee County has a total of 14,967 year-round housing units. Franklin County has a total of 11,570 year-round housing units.	6

SELECTED ENVIRONMENTAL CHARACTERISTICS
ARNOLD ENGINEERING DEVELOPMENT CENTER

REFERENCES

OPERATIONAL CHARACTERISTICS (Cont.)	INFRASTRUCTURE	ELECTRICITY	43
		Demand: 463,806,720 kWh/year at a cost of \$21,238,000. Supplied by Tennessee Valley Authority; capacity is undetermined.	
		SOLID WASTE	43
		Construction debris is disposed of in an on-base landfill; other waste has been removed by a contractor to an off-base landfill in the City of Tullahoma. This landfill is now closed; a landfill site in the City of Winchester will be used in the future.	
		SEWAGE TREATMENT	35, 36
		Design capacity for main plant = 232,000 gallons/day Current use averages 200,000 gallons/day Pumping capacity is 1 million gallons/day	
		TRANS-PORTATION	29, 47
		Interstate 24 and other Federal and state highways provide a good network of roads and access points for the base. There is, however, the potential for traffic congestion during rush hour periods.	
		WATER SUPPLY	36
		Demand = 1.07 million gallons/day Capacity = 2.50 million gallons/day	
		AIR	29, 37, 40, 46
		There are currently 27 PSD permits; the base is in compliance with all air quality permits.	
		WASTE WATER	40, 46
		There are NPDES permits for cooling water, the sewage treatment plant, housing, the airfield, and the rocket preparation areas. Wastewater permits are in compliance.	
		HAZARDOUS WASTE	46, 48
		There is a temporary storage facility for hazardous waste. The base submitted an RCRA Part B in August 1985 and is awaiting public notification. It was recently inspected by the state Department of Health and Environment, July 19, 1988; they found no violations. Materials are stored on base, then transported and disposed of by the Defense Reutilization and Marketing Office.	
ADDITIONAL ENVIRONMENTAL INFORMATION	PERMIT STATUS	Environmental Compliance Plan still under development; Base Master Plan currently under revision; Existing EA; formal EA for AEDC Operations, revision of February 1977, currently undergoing another revision; EA for Elk Resource Recovery Facility, AEDC; 1984 Environmental Quality Program, Arnold AFB; Environmental Statement, National Guard Use of AEDC, April 1972; Environmental Impact of Noise from the Proposed AEDC High Reynolds Number Tunnel, March 1973.	29, 33, 34, 37, 40
COMMENTS		The Earth Technology Corporation recently conducted an audit of environmental compliance. All permits are in compliance.	46

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SELECTED ENVIRONMENTAL CHARACTERISTICS
HILL AIR FORCE BASE, UTAH

		REFERENCES
PHYSICAL CHARACTERISTICS	FACILITIES	53
	BASE SIZE	2,692 hectares (6,654 acres)
	BASE FACILITIES	Storage and maintenance facilities, work facilities to open and rework missiles. There is a single 4,115-meter (13,500 foot) class B runway. There are 1,284 buildings, including maintenance shops and hangars, administration, operations, warehouses, training, community, recreation, housing, testing and fuel storage, a 35-bed hospital, exchanges and shops. 70% of Hill AFB is reserved for munitions storage and flightline/airfield-related activities.
	TEST FACILITIES	2, 3, 52, 60
	NATURAL RESOURCES	3, 60
	PUBLIC HEALTH AND SAFETY	Test firing range is approximately 161 kilometers (100 miles) from the base. Ogdan Air Logistics Center, 2701st Explosive Ord. Disposal, 6514th test squadron
	ENVIRONMENTAL CONDITIONS	55, 70, 71
		No known minerals, oil or gas reserves, or forest land. Land use: grazing, agriculture, recreation.
		No significant public health and safety issues have been identified.
		52
OPERATIONAL CHARACTERISTICS	SPECIAL STATUS	55, 70, 71
	NOISE	No known cultural resources. There are four threatened or endangered species within a 20-kilometer (12-mile) radius of Hill AFB. Endangered: the peregrine falcon and the bald eagle. Threatened: the spotted bat and the steptoe dace. There are no noise problems.
	STAFFING	52, 55, 68
		Military: 5,100 Civilian: 15,300 (as of 1988)
	SOCIO-ECONOMICS (BASE)	2, 3
		Total payroll: \$586 million (1988)
		2
		Housing on base is available for military personnel: 263 officer, 882 NCO, 45 transient. Additional housing is also available in the Ogden area.
		2, 3
		7
SOCIO-ECONOMICS (REGIONAL)	POPULATION/EMPLOYMENT	Davis County has an estimated 1986 population of 180,100 persons, which is an almost 23% increase over 1980 population totals of 146,450 persons. Davis County had a 1982 total civilian labor force of 66,793 persons and a 5.9% unemployment rate. Weber County has an estimated 1986 population of 158,800 persons, which is almost a 10% increase over 1980 population totals of 144,616 persons. Weber County had a 1982 total civilian labor force of 67,860 persons and an 8.6% unemployment rate.
	INCOME	7
		Davis County has a per capita income of \$8,761 (1985), which is almost a 40% increase over the 1981 figure of \$6,275, and presumably there is a similar increase over the 1979 median family income of \$21,948. Weber County has a per capita income of \$9,250 (1985), which is almost a 41% increase over the 1981 figure of \$6,585, and presumably there is a similar increase over the 1979 median family income of \$19,748.
	HOUSING	Davis County has a total of 41,549 year-round housing units. Weber County has a total of 50,294 year-round housing units.
		6

SELECTED ENVIRONMENTAL CHARACTERISTICS
HILL AIR FORCE BASE

REFERENCES

	INFRASTRUCTURE	ELECTRICITY	REFERENCES
		Capacity: 192,928,000 kWh/month	66
		SOLID WASTE On the average 11,100 tons/year is removed to the North Davis County landfill off base.	54, 66
OPERATIONAL CHARACTERISTICS (Cont.)		SEWAGE TREATMENT The North Davis County Sewage District treats the 832,286,000 gallons/year of sewage generated by Hill AFB. Industrial waste is pretreated in an Industrial Waste Pretreatment Plant so that it is brought up to standards prior to being released into the municipal system.	52, 54, 66, 71
		TRANSPORTATION There are five gates; three are open 24 hours and two are open during shift hours. The main gate is accessed from Interstate 15. Most people travel by car, although the Utah Transit Authority does provide public transportation between the base and the Ogden/Salt Lake City area; car and van pools are popular.	66
		WATER SUPPLY Most water is pumped from wells on base. Some water is purchased.	54, 56, 66, 71
		AIR Hill AFB is in a nonattainment area for ozone and carbon monoxide. There are no PSD permits. The state has a monitoring system off base.	52, 61, 70, 71
PERMIT STATUS		WASTE WATER Base has NPDES permits. Water released into local sewage systems must meet water quality standards.	52, 71
ADDITIONAL ENVIRONMENTAL INFORMATION		HAZARDOUS WASTE Hill AFB was placed on the National Priorities List on October 1984. The listing currently cites ten areas of hazardous waste disposal which cover a total area of 22 hectares (54 acres). The base is participating in the Installation Restoration Program (IRP) which identifies, evaluates, and controls the migration of hazardous contaminants from hazardous waste sites.	63, 64, 65, 67, 70, 71
		No environmental compliance plan available. Base Master Plan (under contract for revision), Bed Down EIS for F16 at Hill AFB-78, EIS to establish Gandy supersonic air space at UTR- Oct. '84	55
COMMENTS			

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SELECTED ENVIRONMENTAL CHARACTERISTICS NATIONAL TEST FACILITY, FALCON AIR FORCE BASE		REFERENCES	
PHYSICAL CHARACTERISTICS	FACILITIES	259 hectares (640 acres)	2
		Administrative offices, communications network, medical aid station	2, 3, 78
		Advanced communications network capabilities	78
	NATURAL RESOURCES	There are no known minerals, ores, forests, or other natural resources on the National Test Facility. The facility does overlie the Laramie-Fox Hills aquifer.	78, 80
	PUBLIC HEALTH AND SAFETY	No significant public health and safety issues have been identified.	75
	ENVIRONMENTAL CONDITIONS	No threatened or endangered species have been reported at the National Test Facility. Although three pre-historic isolated finds were made at the National Test Facility, none were considered significant by the Colorado State Office of Historic Preservation. No other cultural resources have been identified.	78, 80, 82
		The current ambient noise level is within acceptable limits.	78, 79
		Military = 1,200 (active duty); Civilian = 2,088 (1988, at Falcon Air Force Base) Upon completion, the new National Test Facility will employ approximately 2,700 people.	1, 84
	SOCIO-ECONOMICS (BASE)	Available payroll figures are for the Peterson AFB complex as a whole (Peterson AFB, Falcon AFB, Cheyenne Mountain, and the Federal Building in downtown Colorado Springs). Payroll data for individual units are not kept.	84
	OPERATIONAL CHARACTERISTICS	HOUSING	There is no housing at Falcon Air Force Base. Nearby Peterson AFB has available on-base housing. Housing is also provided off base in the Colorado Springs area.
POPULATION/EMPLOYMENT		El Paso County has an estimated 1986 population of 380,400 persons, which is almost a 23% increase over 1980 population totals of 309,424 persons. El Paso County had a 1984 total civilian labor force of 163,883 persons and an unemployment rate of 5.4%.	7
INCOME		El Paso County has a per capita income of \$10,855 (1985), which is a 54% increase over the 1981 figure of \$7,027, and presumably there is a similar increase over the 1979 median family income of \$18,729.	7
HOUSING		El Paso County has a total of 116,770 year-round housing units.	6

SELECTED ENVIRONMENTAL CHARACTERISTICS
NATIONAL TEST FACILITY, FALCON AIR FORCE BASE

		REFERENCES
OPERATIONAL CHARACTERISTICS (Cont.)	ELECTRICITY	The peak daily demand of the Consolidated Space Operations Center and the National Test Facility is 13,110 kWh/day. The existing substation on Falcon AFB is capable of providing 15,000 kWh/day, with the capacity to expand to 25,000 kWh/day. The Colorado Springs area is more than capable of supplying additional demands expected by facility expansion.
	INFRASTRUCTURE	Solid waste is disposed off site at a licensed landfill by a private contractor. Additional solid waste generation is expected to be minor.
	SEWAGE TREATMENT	Design capacity = 0.069 million gallons/day; designed to support 2,300 base personnel. Modification of the sewage facility will be necessary for the increased staff. Current wastewater facilities need to be expanded by 0.124 million gallons/day to accommodate the additional waste generated by the new facility. Sewage treatment plant expansion will begin in the spring of 1989.
	TRANSPORTATION	Access to Falcon AFB provided by State Highway 94 and Enoch Road. Current traffic at SH94 = 3,500 vehicles/day, capacity = 16,000 vehicles/day (as of 1987). Current traffic at Enoch Road = 1,550 vehicles/day, capacity = 11,300 vehicles/day.
	WATER SUPPLY	The Cherokee Water District's contract with Falcon AFB limits the delivery of water to 0.479 million gallons per day. Existing peak water demands at the installation are estimated at 0.409 million gallons per day. Presently supporting approximately 2,500, the existing water supply could support 6,000.
	AIR	This area is in attainment by Colorado standards (Falcon AFB is outside the Colorado Springs nonattainment areas for carbon monoxide and total suspended particulates).
PERMIT STATUS	WASTE WATER	NPDES permit under revision; the present wastewater treatment plant is being modified.
	HAZARDOUS WASTE	Potential hazardous wastes: electrolytes, sodium hydroxide, sodium sulphide, dichlorodifluoromethane, sulfur dioxide, SSP-55, all in very small amounts; offsite disposal by the Defense Reutilization and Marketing Office.
ADDITIONAL ENVIRONMENTAL INFORMATION	Environmental Compliance Assessments and Management Program, 1988. The Base Comprehensive Plan is being developed and is expected to be completed in 1989. Current EA: National Test Bed Program, 1987; Final Environmental Impact Statement, Consolidated Space Operations Center, January 1981.	
COMMENTS	National Test Facility has a categorical exclusion for the interim National Test Facility as stated in document 813 (control #AFSPC 86-1) dated 8-12-86. Data are for Falcon Air Force Base, unless otherwise noted.	

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SELECTED ENVIRONMENTAL CHARACTERISTICS
NAVAL SURFACE WARFARE CENTER

		REFERENCES
PHYSICAL CHARACTERISTICS	BASE SIZE	NSWC=2,057 hectares (5,083 acres) (White Oak = 295 hectares [729 acres]) 88
	FACILITIES	149,040 square meters (1,604,302 square feet) of research, development, training, and education facilities; 28,125 square meters (302,745 square feet) of administrative buildings; and 108,343 square meters (1,166,234 square feet) of various other buildings. 88
	TEST FACILITIES	Four wind tunnels, explosive test facilities, a robotics research and development laboratory, various weapons evaluation facilities, biological and chemical laboratory facilities, explosive test facilities, acoustic and hydro-acoustic facilities. Tunnel 9 will be used for HEDI testing. 88
	NATURAL RESOURCES	There are no natural resources. 104
ENVIRONMENTAL CONDITIONS	PUBLIC HEALTH AND SAFETY	No public health and safety issues have been identified. 91
	SPECIAL STATUS	There are no known Federally listed endangered species. There are no recorded historical or archaeological sites. 104
	NOISE	Noise is not of concern because testing areas are scattered and sufficiently buffered by thick hardwood forest. There have been no recent public complaints. 104
	STAFFING	Total employees = 5,196 Military = 107; Civilian = 5,089 (Figures include White Oak and Dahlgren). White Oak alone employs approximately 1,900 staff. 98, 103
SOCIO-ECONOMICS (BASE)	PAYROLL	Payroll not available, but estimated total budget = FY 1988 - \$639.6 million FY 1989 - \$684.4 million 88
	HOUSING	There are only four on-base housing units for military personnel. No other on-base housing is available. Adequate housing provided for in the Silver Springs area within the greater Washington D.C. metropolitan area. 105
	POPULATION/EMPLOYMENT	Montgomery County has an estimated 1986 population of 665,200 persons, which is almost a 15% increase over 1980 population totals of 579,053 persons. Montgomery County had a 1982 total civilian labor force of 335,308 persons and a 3.9% unemployment rate. Prince Georges County has an estimated 1986 population of 681,400 persons, which is almost a 2.4% increase over 1980 population totals of 665,071 persons. Prince Georges County had a 1982 total civilian labor force of 392,677 persons and a 5.8% unemployment rate. 8
SOCIO-ECONOMICS (REGIONAL)	INCOME	Montgomery County has a per capita income of \$19,589 (1985), which is almost a 59% increase over the 1981 figure of \$12,335, and presumably there is a similar increase over the 1979 median family income of \$33,702. Prince Georges County has a per capita income of \$13,067 (1985), which is almost a 52% increase over the 1981 figure of \$8,616, and presumably there is a similar increase over the 1979 median family income of \$25,525. 8
	HOUSING	Montgomery County has a total of 216,052 year-round housing units. Prince Georges County has a total of 236,339 year-round housing units. 6

SELECTED ENVIRONMENTAL CHARACTERISTICS
NAVAL SURFACE WARFARE CENTER

REFERENCES

OPERATIONAL CHARACTERISTICS (Cont.)	INFRASTRUCTURE	ELECTRICITY	REFERENCES
		Electricity is supplied by Potomac Electric Power Company (PEPCO). Demand is well within the capacity established by PEPCO.	94, 96
		Solid waste is removed and disposed off base by Superior Services. In the past, on-base landfills were used but these are now closed and are being monitored for leakage.	92, 94
		The base at one time had its own sewage treatment plant, which has been closed within the last 10 years. Sewage is now treated off base by the Washington D.C. Suburban Sanitary Commission (WSSC). The WSSC will accept up to 150,000 gallons per day from NSWC, White Oak.	87, 94, 96
		There are a limited number of access points to the base. Traffic congestion is a problem, characteristic of the greater Washington D.C. metropolitan area.	94, 97
		The base is connected to the municipal system (WSSC), with no measurable limit on demand or capacity.	94, 96
PERMIT STATUS		There are no PSD permits. The state presently monitors emissions; there have been no violations. Emissions by NSWC are varied but in small quantities.	94, 99
		NPDES permits are in place for industrial discharges.	87, 94
ADDITIONAL ENVIRONMENTAL INFORMATION		The Center operates with an interim permit from EPA from the State of Maryland. Almost every type of hazardous waste is generated. A private contractor transports waste off base to sites in Emelle, Alabama or to the Chicago area for disposal, storage, or incineration.	87, 100
COMMENTS		No EAs or EISs have been performed. There is a Hazardous Waste Management Plan, which was updated in 1986. The base master plan is currently being updated; the last update was in 1970.	93, 100, 101

TABLE B-5 page 1 of 2		SELECTED ENVIRONMENTAL CHARACTERISTICS SANDIA NATIONAL LABORATORIES		REFERENCES
PHYSICAL CHARACTERISTICS	BASE SIZE		Within the Kirtland AFB boundaries, 20,168 hectares (49,835 acres) have been set aside for the five areas of Sandia National Laboratories.	3, 108
	BASE FACILITIES		Sandia consists of 5 technical areas and some remote environmental test areas. There are laboratories, administrative offices, libraries, shops, housing, plants and testing facilities, medical facilities, parks, museums, and recreational facilities.	107, 108, 110
	FACILITIES	TEST FACILITIES	There are five technical testing areas and several remote environmental labs with distinctive operations, including: I. Research and Development of weapons systems II. Explosive Testing III. Environmental Testing (Sled Tracks, Centrifuges, Radiant Heat Facility) IV. Inertial Confinement Fusion Research: Pulsed Power Research V. Electron Beam Accelerators, Hot Cell Facilities A Strategic Defense Facility under construction will provide laboratory space that will enable Sandia to conduct experimental research leading toward future U.S. Strategic Defense Systems.	107, 110
		NATURAL RESOURCES	Sandia, through the Department of Energy, has use permits for areas of the Cibola National Forest controlled by the U.S. Forest Service and the Air Force.	111
		PUBLIC HEALTH AND SAFETY	Safety risks include: fire, explosion, release of toxic and radiological materials, aircraft crashes, electrical failures, and high-power microwave emissions.	107
		SPECIAL STATUS	Although a number of threatened or endangered species are known to occur in Bernalillo County, habitat requirements make it unlikely that they exist within the area of the Sandia Labs. Species known to inhabit the area include: grama grass cactus, the bald eagle, the peregrine falcon, whooping crane, and meadow jumping mouse. Ground surveys have not encountered these species, but the birds may pass over the area while migrating. No cultural resources have been identified at Sandia Labs.	107, 108, 117
		NOISE	There are no reported noise problems.	107, 115
		STAFFING	Civilian = 7,268 employees (Oct. 1987)	112
		PAYROLL	Total payroll = \$296 million (Sept. 1987)	112
		HOUSING	Housing is provided off base within the City of Albuquerque.	112
OPERATIONAL CHARACTERISTICS	SOCIO-ECONOMICS (BASE)	POPULATION/EMPLOYMENT	Bernalillo County has an estimated 1986 population of 474,400 persons, which is almost a 13% increase over 1980 population totals of 420,262 persons. Bernalillo County had a 1982 total civilian labor force of 202,085 persons and an 8.3% unemployment rate.	7
		INCOME	Bernalillo County has a per capita income of \$10,637 (1985), which is almost a 49% increase over the 1981 figure of \$7,137, and presumably there is a similar increase over the 1979 median family income of \$19,294.	7
	SOCIO-ECONOMICS (REGIONAL)	HOUSING	Bernalillo County has a total of 161,787 year-round housing units.	6

SELECTED ENVIRONMENTAL CHARACTERISTICS
SANDIA NATIONAL LABORATORIES

REFERENCES

OPERATIONAL CHARACTERISTICS (Cont.)	INFRASTRUCTURE	ELECTRICITY	REFERENCES
		Electrical power is supplied by the Public Service Company of New Mexico through the 115 kV Eubank Switching Station and several substations. Peak daily capacity = 107 kW	108, 123
		Solid waste is disposed of at the Kirtland AFB sanitary landfill.	116
		SEWAGE TREATMENT Portions of the sewage treatment demand are handled by the Kirtland AFB and City of Albuquerque systems. The remaining sewage is treated by an on-base septic tank system.	108, 118
		TRANSPORTATION Access to the base is provided by Interstates 40 and 25 and a network of smaller roads. The road network is part of the greater Albuquerque metropolitan system and is capable of handling large volumes of traffic.	107
		WATER SUPPLY Sandia's principle source of water is the Santa Fe group aquifers. Daily demand = 1 million gallons Daily delivery capacity = 3 million gallons Several large storage tanks exist. Groundwater monitoring gives no indication of groundwater pollution.	107, 110, 123
		AIR Sandia Laboratories is located within a nonattainment area for carbon monoxide because of vehicle emissions.	121
PERMIT STATUS		WASTE WATER There are no NPDES permits. Sandia is covered by the State of New Mexico. Liquid sanitary waste from Area I is discharged into the Kirtland AFB sewage system.	108, 110, 115
ADDITIONAL ENVIRONMENTAL INFORMATION		HAZARDOUS WASTE Sandia has an RCRA Part A permit to operate a temporary storage facility. They have applied to the State of New Mexico for an RCRA Part B permit.	110, 116
COMMENTS		EIA - Sandia Labs, Albuquerque (1977) Environmental Monitoring Report 1988 EA Strategic Defense Facility 1987 Sandia submitted a wastewater discharge permit application to the City of Albuquerque liquid waste division in August 1986.	107, 108, 110 107

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SELECTED ENVIRONMENTAL CHARACTERISTICS
U.S. ARMY KWAJALEIN ATOLL - KWAJALEIN ISLAND*

REFERENCES

		BASE SIZE	REFERENCES
PHYSICAL CHARACTERISTICS	FACILITIES	Approximately 100 component islands in Kwajalein Atoll, total land area = 1,560 hectares (3,854 acres); USAKA (11 islands) = 529 hectares (1,306 acres); Kwajalein Island = 303 hectares (749 acres)	139
		Operational facilities (Communication/Navigation/Liquid Fueling/Helicopter Pad) airfield with 2,057x 60 meter (6,750 x 200 foot) runway; maintenance facilities; utilities and grounds improvements; supply facilities; medical facilities; housing - accompanied and unaccompanied; administrative facilities; marine terminal facilities; schools.	139, 144
		Research and Development and Test Facilities that include: tracking radar, optical instrumentation, telemetry facilities, multiple launch facilities, satellite communications.	139, 167
		Coconut harvesting and operation of fisheries. Mineral deposits of limited quantity exist on the Marshall Islands, but not on Kwajalein Island.	140
ENVIRONMENTAL CONDITIONS	PUBLIC HEALTH AND SAFETY	Radar and microwave installations are governed by Technical Bulletin: Medical 523 (July 1980), as amended by Technical Guide No. 153, U.S. Army Environmental Hygiene Agency (April 1987) and by USAKA Regulation 385-3. Aircraft landing sites have a clear zone that extends 152 meters (500 feet) from the runway centerline.	155
	SPECIAL STATUS	One endangered species, the hawksbill turtle, one threatened species, the green sea turtle, and one rare species, the giant clam. Turtles have been observed at the southwestern end of Kwajalein Island but they have not been seen nesting on Kwajalein Island. Existing parks and sanctuaries are either privately owned or operated by the local authorities. A marine survey now in draft form addresses the marine habitat. The original island of Kwajalein is on the National Register of Historic Places. Prehistoric sites on the island are up to 2,000 years old. Separate USAKA EIS studies will address the marine habitat and cultural resources in detail.	144, 155, 172, 174
	NOISE	The primary noise sources on USAKA are aircraft, power plants, and heavy equipment. The locations of facilities (i.e., the power plant) and their distance from possibly affected areas precludes most noise problems. Workers in noise-risk facilities are required to wear hearing protection.	155, 191
	STAFFING	Employees: 1,892 Dependents: 1,080 Total USAKA population: 2,972 (as of December 1988)	164
	SOCIO-ECONOMICS (BASE)	Total USAKA military and civilian payroll: \$4,501,000 annually. At a minimum, \$60 million were earned by USAKA contract employees in 1988 (based on RMI 5% income tax receipts of \$3.3 million from residents of USAKA recorded in 1988).	142, 144, 186
OPERATIONAL CHARACTERISTICS	HOUSING	There are 425 existing family housing units. There are 1,240 barracks/dormitory spaces, 150 transient units on base, and 254 trailers.	139, 191
	POPULATION/EMPLOYMENT	In 1985 Ebeye had a population of 7,875 persons and in 1982 had a full-time employment level of 996 persons.	7
	INCOME	Not available.	
	HOUSING	Ebeye has a total of 602 housing units. 1988 Ebeye housing data are presently being analyzed.	6, 144

*Data presented are for Kwajalein Island only, unless otherwise noted.

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SELECTED ENVIRONMENTAL CHARACTERISTICS
U.S. ARMY KWAJALEIN ATOLL - KWAJALEIN ISLAND

		REFERENCES
OPERATIONAL CHARACTERISTICS (Cont.)	ELECTRICITY	Electricity is supplied by diesel generators; Power plant #1 capacity = 13,500 kW, Power plant #2 capacity = 4,800 kW, peak demand on Kwajalein Island = 11,600 kW. A new power plant is being built (Power Plant 1-A) that will increase capacity by 10 megawatts by 1991.
	SOLID WASTE	Metal wastes were previously transported by barge to an authorized deep water dumping site 2.1 miles off shore. Wastes were dumped into 1,000 fathoms of water. The last deep water dump was in 1984. Other solid waste is incinerated and placed in sanitary landfills. Wet waste is taken to a landfill where it is carried out to sea at high tide. A Waste Disposal Plan is now being developed as a part of the forthcoming 1989 EIS.
OPERATIONAL CHARACTERISTICS (Cont.)	SEWAGE TREATMENT	The design capacity of the sewage treatment plant on Kwajalein Island is 450,000 gallons/day.
	TRANSPORTATION	The sea transportation network provides inter-island movement of cargo and passengers, and logistical support. On Kwajalein Island, there are 21 kilometers (13 miles) of paved road and 300 vehicles with no vehicular congestion. Workers from Ebeye are brought over by ferry. Air transportation is available on Kwajalein Island. Bicycles are the principal mode of personal transportation.
	WATER SUPPLY	Potable water systems on Kwajalein Island include two primary water sources, a rainwater catchment system, and a groundwater lens well system. Reverse osmosis units have been used in the past and a freshwater production facility is scheduled for completion in 1990. The average supply of catchment water is 8.8 million gallons per month (assuming 100% capture in the catchment areas) and the estimated monthly sustainable yield from the groundwater lens well system is 4.2 million gallons per month (when average rainfall [105 inches] occurs). Because the amount of rainfall can vary, droughts can occur; during these droughts, stringent water conservation measures are employed. Total water supply is approximately 433,000 gallons per day; average water consumption per day is 250,000 gallons. Most of the outer islands are too small to provide additional water, but Meck, Roi Namur, and Ennyabegan have small catchment systems that can provide water, if needed.
PERMIT STATUS	AIR	Air pollution is currently not a problem because of the constant tradewinds, the island's low profile, and lack of constraining factors. Air pollutants are generated from transportation, range operations, power plant generators, dust, and waste incineration. Power plant generators are the major source for particulates, sulfur oxides, and nitrogen oxides. Estimates of power plant emissions have shown emissions approaching the limits of EPA standards for nitrogen oxides. Six of the nine diesel engines of Power Plant 1 have been rebuilt to help decrease these levels.
	WASTE WATER	The wastewater treatment plant is currently operating near design capacity.
	HAZARDOUS WASTE	Known hazardous wastes on Kwajalein: PCB's, solvents, asbestos, hydrazine fuel. The base hazardous waste plan is in the draft stage. No storage facilities are currently available.
ADDITIONAL ENVIRONMENTAL INFORMATION	EIA, Kwajalein Missile Range Operations, 1980; EA, Family Housing Dwellings, 1986; Facility Requirements for HED1, Meck Island, 1987; Record of Environmental Consideration, Airborne Optical Adjunct, 1985; EA Power Plant Upgrade, Kwajalein Island, 1987. Draft Master Plan Report: Concept Plans, Future Development Plans and Utilities Analyses (Draft), May 1988. Analysis of Existing Facilities, 1988; Facilities Requirement Evaluation, May 1988.	130, 139, 187 130, 155, 187 139, 155 139, 144, 191 130, 139, 144, 155 130, 152, 155, 172, 185 142 130, 184, 185 133, 134, 139, 152, 154, 155, 172, 174
COMMENTS	U.S. operations on the Kwajalein Atoll must comply with all NEPA standards. It is the responsibility of the user agency to make sure standards are met. It is a local USAKA policy to recover all reentry vehicle debris that lands in the Kwajalein Lagoon.	166, 180, 184

TABLE B-6
Page 3 of 4

SELECTED ENVIRONMENTAL CHARACTERISTICS
U. S. ARMY KWAJALEIN ATOLL - MECK ISLAND*

REFERENCES

			22.3 hectares (55 acres)	155	
			Helipad; missile launch facilities; production and construction shops; mess hall; miscellaneous buildings that house fire protection equipment, power production, and water storage; a boat ramp and dock facilities.	155, 171	
		FACILITIES	Systems Technology Test Facility Missile Site Radar (MSR) Test Tower	139, 171	
		NATURAL RESOURCES	None	155	
		PUBLIC HEALTH AND SAFETY	Live-explosive storage facilities and fuels associated with launch facilities.	155	
PHYSICAL CHARACTERISTICS		SPECIAL STATUS	Cultural Resources: No evidence for any surface or subsurface cultural remains was found during archaeological survey and testing of the entire island in 1989. Threatened and Endangered Species: None	143, 155	
		ENVIRONMENTAL CONDITIONS			
		NOISE	Noise sources on Meck Island are associated with aircraft, power generation, and launch facility activities.	155	
		STAFFING	Staffing is dependent on current operations.	155	
OPERATIONAL CHARACTERISTICS		SOCIOECONOMICS	Total USAKA military and civilian payroll: \$4,501,000 annually. At a minimum, \$60 million were earned by USAKA contract employees in 1988 (based on RMI 5% income tax receipts of \$3.3 million from residents of USAKA recorded in 1988).	142, 144, 186	
		HOUSING	Contractor provided trailers for construction only.	132	

*Data presented are for Meck Island only, unless otherwise noted.

SELECTED ENVIRONMENTAL CHARACTERISTICS U.S. ARMY KWAJALEIN ATOLL - MECK ISLAND		REFERENCES
OPERATIONAL CHARACTERISTICS (Cont.)	ELECTRICITY	Five 565-kW diesel engines. 142
	SOLID WASTE	Construction debris, landscape waste, and miscellaneous trash is concentrated into piles in various locations around the island for future burning and/or in situ burial. 157
	INFRASTRUCTURE	Meck Island has one septic tank/leach field; current practice is to bury the tank pumpings on the island. 157
	SEWAGE TREATMENT	
	TRANSPORTATION	Access to Meck Island is by boat or helicopter only. Ground transportation is predominantly by bicycle. 155
	WATER SUPPLY	Meck Island has a potable water system and an abandoned nonpotable salt water system. Potable water is provided by a 50,990-square-foot rainwater catchment located adjacent to the runway. Water from the catchment is stored in two tanks (a third is being added) (251,000 gallons and 502,000 gallons) prior to treatment (filtration and chlorination) and distribution. During the dry season, fresh water consumption exceeds the amount of rainwater obtainable from catchments. In order not to deplete the stored supply, fresh water is drawn from the lens wells on Kwajalein Island. 155, 171
	AIR	Air pollution is not currently a problem because of the prevailing northeasterly winds, the island's low profile, and a lack of constraining factors. 171
PERMIT STATUS	WASTE WATER	Wastewater is handled through the septic tank/leach field system. 157
	HAZARDOUS WASTE	Hazardous wastes on Meck Island associated with launch facilities include hypergolic fuels and various solvents (trichloroethane, etc.). No storage facilities are currently available. 157
	ADDITIONAL ENVIRONMENTAL INFORMATION	Analysis of existing facilities U.S. Army Kwajalein Atoll, Marshall Islands, 1988; Master Plan Report: Concept Plans, Future Development Plans And Utilities Analyses. U.S. Army Kwajalein Atoll, May 1988; Economic Development in the Marshall Islands, 1984; Environmental Assessment, Homing Overlay Experiment Program, 1979. 139, 155, 167, 171
COMMENTS	Meck Island is a significant site with respect to the SDI missile defense program. On June 10, 1984, an interceptor missile was launched from Meck and successfully accomplished the first direct interception and nonnuclear destruction of an incoming warhead launched from Vandenberg AFB, thus initiating USAKA's role as the test site for the SDI missile defense program. 155	

TABLE B-7
page 1 of 2
SELECTED ENVIRONMENTAL CHARACTERISTICS
VANDENBERG AIR FORCE BASE

		REFERENCES
PHYSICAL CHARACTERISTICS	FACILITIES	39,822 hectares (98,400 acres)
	BASE FACILITIES	45-bed hospital, 6 on base electrical power plants, 2,428-hectare (6,000-acre) cantonment area, 35 missile launch sites, 4,572-meter (15,000-foot) runway
ENVIRONMENTAL CONDITIONS	TEST FACILITIES	Missile assembly buildings, missile launch pads, missile control building, tracking stations
	NATURAL RESOURCES	Proven on-base oil and gas reserves
	PUBLIC HEALTH AND SAFETY	Potential safety risks have been significantly reduced by setting up safety clear zones around storage and operations areas.
	SPECIAL STATUS	There are over 600 known cultural resources, mostly archaeological sites. One site is listed on the National Register of Historic Places and others may qualify. Federally listed endangered species include: the California brown pelican, California least tern, least Bell's vireo, American peregrine falcon, and the unarmored three-spine stickleback. The southern sea otter and the guadalupe fur seal are threatened species. There are no known threatened or endangered plant species on base. There are approximately 2,070 hectares (5,100 acres) of wetlands. The base also contains 56 kilometers (35 miles) of coastline, 267 kilometers (166 miles) of streams, 3,642 hectares (9,000 acres) of dune habitat, and 1,670 hectares (4,126 acres) of woodland.
SOCIO-ECONOMICS (BASE)	NOISE	The north part of the base is affected by missile launches, maintenance activities, and traffic. Noise levels in the cantonment area are typical of a residential area. The south part of the base is affected by launch facilities, traffic, and the Southern Pacific Railroad. There is a noise monitoring network on base. Noise reduction measures include rerouting project-related traffic and avoiding conducting flight tests during sleep hours.
	STAFFING	Military = 3,824 Civilian = 1,479 Contractor = 4,992 (1988)
	PAYROLL	Military and civilian \$121.1 million; contractors \$181.3 million (1988)
OPERATIONAL CHARACTERISTICS	HOUSING	On-base housing is provided for military personnel: Officer = 511 NCO = 1,567 Transient = 400 Mobile housing = 172 Off-base housing is available in the nearby communities of Lompoc and Santa Maria, and within surrounding Santa Barbara County.
	POPULATION/EMPLOYMENT	Santa Barbara County has an estimated 1986 population of 339,400 persons, which is almost a 14% increase over 1980 population totals of 298,694 persons. Santa Barbara County had a 1984 total civilian labor force of 167,921 persons and a 5.9% unemployment rate.
	INCOME	Santa Barbara County had a per capita income of \$12,611 (1985), which is an increase over the 1981 figure of \$8,400, and presumably there is a similar increase over the 1979 median family income of \$21,630.
	HOUSING	Santa Barbara County has a total of 123,476 year-round housing units.

TABLE B-7
page 2 of 2

SELECTED ENVIRONMENTAL CHARACTERISTICS VANDENBERG AIR FORCE BASE		REFERENCES	
OPERATIONAL CHARACTERISTICS (Cont.)	ELECTRICITY	Electricity is supplied by the PG&E Power Co. Peak demand is 550,000 kWh/day. Capacity is 580,000 kWh/day.	228, 236
	SOLID WASTE	Volume = 25,000 tons/year, capacity = 95,000 tons/year; disposed of at a class III landfill on base.	195, 227, 228
	INFRASTRUCTURE	SEWAGE TREATMENT The design capacity of the off-site facility (serving the City of Lompoc, unincorporated areas surrounding Lompoc, and Vandenberg AFB) is 5 million gallons/day. An on-site system with a capacity of 3 million gallons/day treats waste from the cantonment area. In 1986 approximately 1 million gallons of sewage/day was produced on base.	202, 206
	TRANSPORTATION	The road network on base has considerable excess capacity. The road network leading to the base is near or at capacity during peak traffic periods. Access to launch sites is restricted for several hours prior to launches.	206, 230
	WATER SUPPLY	Ten on-base wells supply all of Vandenberg's water needs. Demand = 6 million gallons per day. The highest quality potable water is drawn from San Antonio Creek, which is currently being overdrawn by 11,000 acre-feet/year. The base is currently pulling out 3,400 acre-feet/year of the overdraw. Current water usage rate will deplete this local source in 50 years.	195, 206
	AIR	Permits in place from the Air Pollution Control District authorize on-base construction and operations. The north portion of Santa Barbara County, which contains Vandenberg, is currently in nonattainment of air quality standards for ozone and particulates. There are two PSD monitoring stations on base.	195, 231, 233, 239
	PERMIT STATUS	NPDES permits are in place for 15 on-base sewage discharge locations.	235
	HAZARDOUS WASTE	Approximately 700 tons of hazardous waste are generated per year; all is disposed at an off-site facility by private contractor. Vandenberg has a short-term hazardous waste storage RCRA Part B permit issued by the California Department of Health Services.	195, 231, 232
	ADDITIONAL ENVIRONMENTAL INFORMATION	There is a recent (1987) Draft EIS on oil and gas exploration at Vandenberg and existing EIS documents (1983, 1978) for MX missile and space shuttle launches from Vandenberg. Various quantity-distance requirement zones are part of safety regulations that restrict land use development on base.	
	COMMENTS	Missile launches have relatively little impact on air quality. Further drawdown of the aquifer could have an impact on aquatic and biologically dependent species of Barka Slough and San Antonio Creek.	

TABLE B-8
page 1 of 3

SELECTED ENVIRONMENTAL CHARACTERISTICS WHITE SANDS MISSILE RANGE		REFERENCES
PHYSICAL CHARACTERISTICS	BASE SIZE	The main range area is 161 kilometers (100 miles) long and 64 kilometers (40 miles) wide. The main range and the leased co-use areas comprise over 1.69 million hectares (4.2 million acres). 257
	FACILITIES	Headquarters area, barracks, administrative office space, post offices, schools, medical clinic, recreational facilities, library, nursery, chapels, shops, maintenance shop, storage areas, laboratories, sewage treatment plant. Five airstrips, NASA site, Rhodes Canyon Range Center, Oscura Range Center, Stallion airfield, Oscura airfield with a 1,219 x 30 meter (4000 x 100 foot) airstrip, solid waste management area, hazardous waste storage, repair shops, technical buildings, and housing. There are thousands of structures on the range. 257
ENVIRONMENTAL CONDITIONS	TEST FACILITIES	Static test facilities, nuclear effects laboratory, south range launch facilities, small missile range, Air Force impact areas, artillery range, high energy laser facilities, up-range launch site, hazardous test area, test cell area, NASA test facility, RF radiation facility, vibration and temperature facilities, areas for testing Army missile systems, air defense fire distribution systems, and other material. Capable of testing tactical weapons systems, air defense systems, nonnuclear hazardous material. Test support includes launch support, telemetry, real-time and deferred time trajectory data, photo-optical coverage, and simplified recovery of test items. Also rain, humidity, and salt/fog test facilities. 257
	NATURAL RESOURCES	Most land is underdeveloped open range areas for grazing. There is an abundance of gypsum and dolomite. Numerous metal deposits and parts of two coal fields are within the installation boundaries. The resources are not economical to mine and market. The San Andres National Wildlife Refuge and a portion of the Jornada Experimental Range are within the installation boundaries. 257
SOCIOECONOMICS (BASE)	PUBLIC HEALTH AND SAFETY	Potential safety risks include: fires, biologically harmful noise levels, potential ionizing radiation, RF radiation, and exposure to radioactive materials from missile fragmentation. Missile impact sites are monitored and decontaminated. 257, 288
	SPECIAL STATUS	There are many endangered, threatened, candidate, and sensitive species (refer to Appendix E). There are many historic and prehistoric sites scattered throughout the range (see Figures 2-14 and 2-15). 257, 258
OPERATIONAL CHARACTERISTICS	NOISE	Sources generating noise at harmful levels are monitored through various programs. Some identified noises cannot be eliminated, but measures have been implemented to prevent health effects from excessive levels. These measures include: identifying and posting noise hazard areas, providing hearing protection to personnel, and periodic audiometric testing. Some supersonic flights have been rerouted as well. 268, 275
	STAFFING	Civilian : 4,487; Military : 1,209; Contractor : 3,759 Noontime population (on post): 10,908 268, 275
OPERATIONAL CHARACTERISTICS	PAYROLL	Civilian : \$66,289,000; Military : \$10,189,959; Contractor : No estimate available 268, 275
	HOUSING	Housing for military personnel available on base. Adequate off-base housing is available in the nearby communities of Las Cruces, El Paso, Alamogordo, and Socorro. 257

SELECTED ENVIRONMENTAL CHARACTERISTICS
WHITE SANDS MISSILE RANGE

REFERENCES

OPERATIONAL CHARACTERISTICS	SOCIO-ECONOMICS (REGIONAL)	POPULATION/EMPLOYMENT	<p>Dofia Ana County, New Mexico has an estimated 1986 population of 123,000 persons, which is almost a 28% increase over 1980 population totals of 96,340 persons. Dofia Ana County had a 1982 total civilian labor force of 37,623 persons and a 9.6% unemployment rate.</p> <p>Otero County, New Mexico has an estimated 1986 population of 50,200 persons which is almost a 13% increase over 1980 population totals of 44,665 persons. Otero County had a 1982 total civilian labor force of 14,410 persons and an 8.0% unemployment rate.</p> <p>El Paso County, Texas has an estimated 1986 population of 561,500 persons, which is a 17% increase over 1980 population totals of 479,899 persons. El Paso County had a 1982 total civilian labor force of 190,343 persons and an 11.1% unemployment rate.</p>	7
		INCOME	<p>Dofia Ana County has a per capita income of \$7,881 (1986), which is almost a 49% increase over the 1981 figure of \$5,284, and presumably there is a similar increase over the 1979 median family income of \$14,914.</p> <p>Otero County has a per capita income of \$7,967 (1985), which is almost a 48% increase over the 1981 figure of \$5,379, and presumably there is a similar increase over the 1979 median family income of \$14,711.</p> <p>El Paso County has a per capita income of \$7,427 (1985), which is almost a 1% increase over the 1981 figure of \$7,360, and presumably there is a similar increase over the 1979 median family income of \$15,366.</p>	7
		HOUSING	<p>Dofia Ana County has a total of 33,584 year-round housing units; Otero County has a total of 16,776 year-round housing units; and El Paso County has a total of 147,766 year-round housing units.</p>	6
		ELECTRICITY	<p>The El Paso Electric Company supplies 90% of the White Sands Missile Range's power. The remainder is supplied by the U.S. Bureau of Reclamation's Elephant Butte hydroelectric plant.</p>	257
	INFRASTRUCTURE	SOLID WASTE	<p>Landfills are registered with the State of New Mexico, Environmental Improvement Division. There are landfills in Stallion, Rhodes Canyon, and North Oscura Peak, and a base-operated sanitary landfill approximately 3 miles east of the Main Post. In 1987, there were approximately 99,000 cubic yards of waste disposed. The trench method is used in the operation of the landfill. The Defense Property Disposal Office, located off base, also sponsors a waste recycling program.</p>	257, 275
		SEWAGE TREATMENT	<p>Designated capacity : 2.5 million gallons/day Current use : 600,000 gallons/day</p>	275

TABLE B-8
Page 3 of 3

SELECTED ENVIRONMENTAL CHARACTERISTICS
WHITE SANDS MISSILE RANGE

REFERENCES

OPERATIONAL CHARACTERISTICS (Cont.)	INFRA-STRUCTURE	TRANSPORTATION	REFERENCES
		<p>The range has over 3,062 kilometers (1,903 miles) of roads, of which 1,252 kilometers (778 miles) are paved. U.S. Highway 70 (Las Cruces to Alamogordo) provides access to the range for most of the work force. Eight buses, operating 80-90%, go to the base from Las Cruces. On-range roads, including U.S. 70, may be blocked for up to 1 hour 20 minutes while certain tests are being conducted. Access to the headquarters area from El Paso is also provided along War Road to the south.</p>	257, 275
	<p>WATER SUPPLY</p>	<p>The main water supply is from 10 deep alluvial wells at the base headquarters area. The water table in the headquarters area is declining as a result of groundwater pumping. Additional groundwater sources near the headquarters area, in the Soledad Canyon reentrant, are being evaluated as a means to eliminate the current local overdraft situation. No groundwater contamination has been observed to date.</p> <p>Demand is 600,000 gallons/day</p> <p>Capacity is 1,000,000 gallons/day</p>	248, 257, 275
	<p>AIR</p>	<p>No PSD permits. Air quality is very good in comparison with ambient air quality standards. Particulates, primarily a result of blowing dust, are the only real air pollutants of concern. Temporary air pollution may result from airplanes, helicopters, and rockets. No air pollution problems are known to occur from these sources.</p>	257, 275
<p>PERMIT STATUS</p>	<p>WASTE WATER</p>	<p>No NPDES permits</p> <p>The range does have wastewater treatment systems.</p>	257, 275
	<p>HAZARDOUS WASTE</p>	<p>A cradle-to-grave management objective has been established for handling of hazardous waste materials for compliance with RCRA, TSCA, CERCLA, and Executive Order 12316. Responses to Environmental Damage. There are storage and transfer facilities on the range. Some hazardous or toxic wastes are: petroleum, oils, lubricants, liquid propellants, acids, PCB's, pesticides, and others. White Sands Missile Range has a spill prevention countermeasure and control plan, and a toxic and hazardous materials regulation is in effect. As of 1985, all toxic waste disposal was in compliance with EPA regulations.</p>	257
<p>COMMENTS</p>	<p>No survey has ever been done to record occurrence or populations of plants and animals.</p> <p>When firings are scheduled, residents and workers leave their homes and offices for a specified time.</p> <p>No overall compliance plan is available.</p>		257, 268, 275, 287

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APPENDIX C
CORRESPONDENCE

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Environmental Office

2 : OCT 1988

Mr. John Peterson
U.S. Fish and Wildlife Service
Ecological Services Division
3530 Pan American Highway, Suite D
Albuquerque, New Mexico 87101

Dear Mr. Peterson:

Enclosed for your review are two relevant sections of the draft Environmental Assessment (EA) for the High Endoatmospheric Defense Interceptor (HEDI) project. The Project Description section provides an overview of the HEDI activities planned for several installations; pages 12, 16, and 18-24 address White Sands Missile Range (WSMR) phases. The second enclosure addresses project habitat and endangered species concerns for WSMR.

Concurrent requests for review have been sent to the New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, and the New Mexico Department of Game and Fish.

If you have technical questions regarding this project, contact Mr. Dru Barrineau, Project Proponent, at (205) 895-3632. Resource related questions may be directed to Daisan Taylor, Wildlife Biologist, at (505) 678-2224.

Since this project is operating under short funding deadlines, please send us your comments within two weeks if possible. Mr. Robert J. Andreoli, Chief, Environmental Office, may be contacted at (505) 678-2224 regarding any questions or comments involving your findings.

Sincerely,

FILE NAME: 1-HEDIFWS\TAB\19 OCT 88

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EL-N READ FILE

EL READ FILE

ORIGINAL SIGNED BY

Milton L. Howell, Jr.
Colonel, U.S. Army
Director, Engineering
and Logistics C-1

CONCURRENCES		
DATE	SIGNATURE	OR
EL-N	<i>[Signature]</i>	ELC
EL-N	<i>[Signature]</i>	PIU
EL-N	<i>[Signature]</i>	ELC

Enclosures

Environmental Office

31 OCT 1988

Mr. Andres Sandoval
New Mexico Department of Game and Fish
408 Galisteo Street
Santa Fe, New Mexico 87503

Dear Mr. Sandoval:

Enclosed for your review are two relevant sections of the draft Environmental Assessment (EA) for the High Endoatmospheric Defense Interceptor (HEDI) project. The Project Description section provides an overview of the HEDI activities planned for several installations; pages 12, 16, and 18-24 address White Sands Missile Range (WSMR) phases. The second enclosure addresses project habitat and endangered species concerns for WSMR.

Concurrent requests for review have been sent to the New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, and the U.S. Fish & Wildlife Service.

If you have technical questions regarding this project, contact Mr. Dru Barrineau, Project Engineer, at (205)895-3632. Resource related questions may be directed to Daisan Taylor, Wildlife Biologist, at (505)678-2224.

Since this project is operating under short funding deadlines, please send us your comments within two weeks if possible. Mr. Robert J. Andreoli, Chief, Environmental Office, may be contacted at (505)678-2224 regarding any questions or comments involving your findings.

FILE NAME: 1 HEDI.DG.F Sincerely,
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ORIGINAL SIGNED BY

Milton L. Howell, Jr.
Colonel, U.S. Army
Director, Engineering
and Logistics

Enclosure

C-2

CONCURRENCES		
INITIALS	SIGNATURE	DATE
EL-N	<i>[Signature]</i>	31 Oct 88
EL-N	<i>[Signature]</i>	31 Oct 88
EL-N	<i>[Signature]</i>	31 Oct 88

21 OCT 1988

Environmental Office

Mr. Paul Knight
New Mexico Energy, Minerals, and
Natural Resources Department
Forestry Division, Resource Survey
408 Galisteo Street
Santa Fe, New Mexico 87503

Dear Mr. Knight:

Enclosed for your review are two relevant sections of the draft Environmental Assessment (EA) for the High Endoatmospheric Defense Interceptor (HEDI) project. The Project Description section provides an overview of the HEDI activities planned for several installations; pages 12, 16, and 18-24 address White Sands Missile Range (WSMR) phases. The second enclosure addresses project habitat and endangered species concerns for WSMR.

Concurrent requests for review have been sent to the New Mexico Game and Fish Department, and the U.S. Fish & Wildlife Service.

If you have technical questions regarding this project, contact Mr. Dru Barrineau, Project Proponent, at (205) 895-3632. Resource related questions may be directed to Daisan Taylor, Wildlife Biologist, at (505) 678-2224.

Since this project is operating under short funding deadlines, please send us your comments within two weeks if possible. Mr. Robert J. Andreoli, Chief, Environmental Office, may be contacted at (505) 678-2224 regarding any questions or comments involving your findings.

Sincerely,

FILE NAME: 1-HEDIDNR\TAB\19 OCT 88

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EL-N READ FILE

EL READ FILE

ORIGINAL SIGNED BY

Milton L. Howell, Jr.
Colonel, U.S. Army
Director, Engineering
and Logistics

C-3

Enclosures.

CONCURRENCES		
DATE	SIGNATURE	INITIALS
EL-N	<i>[Signature]</i>	<i>[Initials]</i>
EL-N	<i>[Signature]</i>	<i>[Initials]</i>
EL-N	<i>[Signature]</i>	<i>[Initials]</i>



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services

Cons. #2-22-88-I-005

Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

November 15, 1988

Colonel Milton L. Howell
Director, Engineering, Housing and Logistics
U.S. Army White Sands Missile Range
White Sands Missile Range, New Mexico 8800-5076

Dear Colonel Howell:

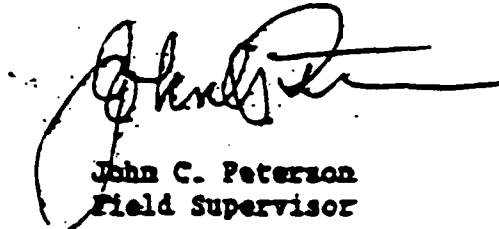
This responds to your letter dated October 24, 1988 regarding the effects of the High Endoatmospheric Defense Interceptor project at White Sands Missile Range on species Federally listed or proposed to be listed as threatened or endangered. We have also reviewed your Environmental Assessment for the project. The proposed action involves the flight testing of the Endoatmospheric Defense Interceptor at White Sands Missile Range. Your geographic area of interest is east and north of Range headquarters and traverses portions of Otero and Dona Ana Counties, New Mexico.

We have used the information in your request to identify those species occurring in the project area which may be affected by your proposed action. Our data indicate no listed species would be affected by the proposed action.

This project has a flight path that crosses the San Andres National Wildlife Refuge, a refuge designed to protect the desert bighorn sheep. The current herd size is approximately 31 animals. The projected flight and fallout path will cover approximately one-third of the eastern and northern portions of the refuge. The Environmental Assessment has covered those steps that will be taken should it be necessary to recover debris from the test which may land on the refuge. The mitigation measures are adequate under the prescribed conditions listed in the report. The report identifies the period from March through May as the critical time for the bighorn sheep and we would reemphasize the fact that during lambing time as little disturbance as possible occur with this herd. Although the potential impacts from this project are minimal we are concerned with the fact that the project is aimed to fly over and impact a target area immediately adjacent to the refuge. This is the first time this type of action has occurred. We do have some concern that future operations may have more impact than this project on the refuge and the species it is designed to protect. In any event, we expect this project to have minimal impact on the refuge if it goes according to the outline. However, we suggest future projects be planned to avoid any impacts due to falling debris, particularly during the critical lambing season.

If we can be of further assistance, please call Mike Donahoo or Gerry Roehn at (505) 883-7877 or FTS 474-7877.

Sincerely yours,



John C. Peterson
Field Supervisor

cc:

Refuge Manager, San Andres National Wildlife Refuge, Las Cruces,
New Mexico

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico

Director, New Mexico Energy, Minerals and Natural Resources, Forestry
Division, Santa Fe, New Mexico

Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife
Enhancement, Albuquerque, New Mexico

GOVERNOR
GARREY CARRUTHERS

State of New Mexico



DIRECTOR AND SECRETARY
TO THE COMMISSION
BILL MONTOYA

DEPARTMENT OF GAME AND FISH

VILLAGRA BUILDING
SANTA FE
87503

Mlt
EL-11
STATE GAME COMMISSION

GERALD MAESTAS CHAIRMAN
ESPAÑOLA

RICHARD A ALLGOOD
SILVER CITY

CHRISTINE DIGREGORIO
GALLUP

THOMAS P ARVAS, O.D
ALBUQUERQUE

BOB JONES
DELL CITY, TX

November 17, 1988

Colonel Milton L. Howell, Jr.
Director of Engineering, Housing and Logistics
Department of the Army
U.S. Army White Sands Missile Range
White Sands Missile Range, N. M. 88002-5076

Attn: STEWS-EL-N

Dear Colonel Howell:

The Department of Game and Fish has reviewed the draft environmental assessment (EA) for the High Endoatmospheric Defense Interceptor (HEDI) project. The proposed project will involve three (or possibly four) tests of the HEDI Kinetic Kill Vehicle Interceptor Technology Experiment (KITE 1-3) on White Sands Missile Range. Tests will begin in 1989, and are scheduled to occur annually during April-June.

The department concurs with the EA that detrimental impacts to most forms of wildlife and their habitat will be minimal. However, the department is concerned that the EA underestimates the potential negative impact that the tests may have on the state-endangered desert bighorn sheep located on the San Andres National Wildlife Refuge (SANWR) and adjacent areas.

The desert bighorn sheep population in the San Andres Mountains is delicately balanced between survival and extinction. Given this, our agencies must continue to take all prudent measures to protect and thus recover the bighorn sheep population to viable status. Within the scope of the current project, the means to best protect the sheep would be to alter the proposed trajectory of the HEDI KITE such that impact and debris fall-out would not occur on the SANWR. However, should this action not be possible, we recommend that

November 17, 1988

the Department of the Army employ flexibility in setting testing and debris recovery dates.

The proposed testing period (April-June) coincides with the peak of the lambing season for the desert bighorn sheep. The bulk of reproduction usually occurs from February through April, but may begin as early as December and end as late as June. Disturbance to the sheep during lambing could jeopardize lamb survival and therefore recruitment and the overall stability of the herd. Considering the sensitivity of this period for the sheep and the tenuous status of this particular population, the department recommends that testing be postponed until completion of the lambing season. Specific dates for testing should be established through coordination with the U.S. Fish and Wildlife Service who will be able to provide location and reproduction information on the desert bighorn sheep population. This procedure should also be followed for any debris retrieval efforts, and for all activities occurring within the range of the desert bighorn sheep.

We appreciate this opportunity to comment on the EA for the HEDI project. Please contact Andrew Sandoval (827-7952) of this department for any future coordination.

Sincerely,



Bill Montoya
Director

BM/csp

cc: Mike Spear (Regional Director, USFWS)
John Peterson (Ecological Services, USFWS)
Patricia Hoban (SANWR Manager, USFWS)
Craig Nordyke (SW Area Supervisor, NMGF)
Mike Robertson (SW Area Game Manager, NMGF)
Dick McCleskey (Assistant Director, NMGF)
Jim Vaught (Field Operations Chief, NMGF)
Wally Haussamen (Research & Modeling Section Chief, NMGF)
John Hubbard (Endangered Species Section Chief, NMGF)
Andrew Sandoval (Environmental Section Chief, NMGF)
Chris Pease (Environmental Section Biologist, NMGF)



United States Department of the Interior

**FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE**

P.O. BOX 50167
HONOLULU, HAWAII 96850

APR 24 1989

Mr. Dru Barrineau, P. E.
General Engineer
U. S. Army Strategic Defense Command
Attn: CSSD-H-SSP
P. O. Box 1500
Huntsville, Alabama 35807-3801

Dear Mr. Barrineau:

This follows up your visit to our office on April 24, 1989 and our subsequent discussion of the Army's proposed HEDI Construction Project on Meck Island, Kwajalein, Marshall Islands. Specifically, you requested our comments on any impacts the project may have on species within this Service's jurisdiction.

After our discussions and our review of the information you provided on the scope of the project and in consideration of the biological surveys of Meck and adjacent islands recently conducted by Mr. Bill Brewer, we concur with your determination that the HEDI Project will have no effect on plant and animal species within our area of jurisdiction or concern. More specifically, the project would not be expected to affect any endangered or threatened species of plant or animals.

Thank you for allowing us to review and comment on this project.

Sincerely yours,

William Kramer
Deputy Field Office Supervisor
Office of Environmental Services



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

May 18, 1989 F/SWR14:ETN

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Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

This responds to your letter of April 28, 1989 regarding preparation of an Environmental Impact Statement (EIS) for the U.S. Army Kwajalein Atoll (USAKA) and new activities proposed under the Strategic Defense Initiative (SDI). Your letter indicates that although sea turtles are known to rest and forage at Kwajalein Atoll they do not nest on any of the islands controlled by USAKA. We have reviewed survey reports produced by the U.S. Fish and Wildlife Service and the University of Hawaii Sea Grant Extension Service for the Corps of Engineers regarding the natural resources of Kwajalein Atoll, and previous documentation of sea turtle occurrence there. Based on our evaluation of the available information we concur with your determination that activities proposed for the USAKA islands will not likely to adversely affect threatened green turtles (Chelonia mydas) or endangered hawksbill turtles (Eretmochelys imbricata) at Kwajalein Atoll.

Although injury or mortality to green turtles or hawksbill turtles is unlikely, the following conditions should be included as part of the contract specifications for quarrying operations on the reef flats and the runway extension at Roi-Namur to minimize the potential for any adverse impacts.

1. The runway extension areas and quarry sites should be surveyed prior to each day's operations to ensure that no turtles are present.
2. Blasting in the quarries should be restricted to the smallest practical charge sizes. If turtles are detected within 100 m of the blast site, blasting should be postponed until the turtles have departed the area.
3. Should any turtle be injured or killed during construction, blasting or quarrying, the incident must



be documented and reported to the Pacific Area Office,
NOAA Fisheries, 2570 Dole Street, Honolulu, HI 96822
(Tel. 808/955-8831) within one working day of the
incident.

This concludes the Section 7 consultation process for this
action. Please provide a copy of the draft EIS for review to Mr.
Gene Nitta, Protected Species Management Branch, Pacific Area
Office, 2570 Dole Street, Honolulu, HI 96822.

Sincerely,

EC Fullerton
E.C. Fullerton
Regional Director

cc:
F/SWR14, Nitta

APPENDIX D
MARINE BIOLOGY SURVEY AT
MECK ISLAND, USAKA

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TABLE D-1. ALGAE FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

DIVISION/GENUS/SPECIES	Survey Sites*										
	1	2	3	4	5	6					
CYANOPHYTA (BLUE-GREEN ALGAE)											
<i>Hormothamnion</i> sp.	-	x	x	-	x	x					
<i>Schizothrix</i> sp.	-	x	-	-	x	x					
<i>Microcoleus</i> sp.	-	x	x	-	x	x					
unident. cyanophytes	-	-	-	x	-	-					
RHODOPHYTA (RED ALGAE)											
<i>Asparagopsis taxiformis</i>	-	x	-	-	-	-					
<i>Jania</i> sp.	x	x	-	-	-	x					
<i>Halyminia formosa</i>	-	x	-	-	-	-					
<i>Hydrolithon reinboldii</i>	x	x	-	-	x	x					
<i>Porolithon gardineri</i>	x	x	-	-	-	-					
<i>Porolithon onkodes</i>	-	x	-	-	x	x					
CHLOROPHYTA (GREEN ALGAE)											
<i>Halimeda opuntia</i>	x	x	x	x	-	-					
<i>Dictyosphaeria versluisii</i>	-	x	-	-	-	-					
<i>Enteromorpha</i> sp.	-	x	x	-	-	-					
<i>Neomeris</i> sp.	-	x	-	-	-	-					
PHAEOPHYTA (BROWN ALGAE)											
<i>Dictyota friabilis</i>	x	x	-	-	-	-					
<i>Dictyota divaricata</i>	-	x	-	-	-	-					
<i>Ralfsia</i> sp.	-	x	x	x	-	-					
<i>Padina</i> sp. (<i>tenuis?</i>)	-	x	-	-	-	-					
					No. Species	5	17	5	3	5	6

*Survey Sites

- 1 = Kwadack Lagoon Terrace
- 2 = Meck Quarries
- 3 = Meck Lagoon Terrace
- 4 = Meck Harbor Basin
- 5 = Missile Assembly Building
- 6 = Photography Tower

TABLE D-2. CORALS FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 1 of 3

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
SCLERACTINIA (HARD CORALS)						
PORITIDAE						
<i>Porites lutea</i>	x	x	x	x	-	-
<i>Porites lichen</i>	x	-	-	-	-	-
<i>Porites lobata</i>	x	x	x	-	-	-
<i>Porites (S.) hawaiiensis</i>	x	-	-	-	-	-
<i>Porites (S.) convexa</i>	x	-	-	-	-	-
<i>Porites</i> sp. 1 (massive, lobate)	x	-	-	-	-	-
<i>Porites</i> sp. 2 (massive, irregular)	x	-	-	-	-	-
<i>Alveopora</i> sp.	x	x	-	-	-	-
POCILLOPORIDAE						
<i>Pocillopora meandrina</i>	x	x	x	x	-	-
<i>Pocillopora damicornis</i>	x	x	x	x	-	-
<i>Pocillopora danae</i>	x	-	-	-	-	-
<i>Pocillopora elegans</i>	x	-	-	-	-	-
<i>Pocillopora eydouxi</i>	x	x	-	-	-	-
<i>Pocillopora verrucosa</i>	x	x	-	-	-	-
<i>Pocillopora</i> sp. 1	-	x	-	-	-	-
<i>Seriatopora hystrix</i>	x	-	-	-	-	-
<i>Stylophora</i> sp. 1	x	-	-	-	-	-
<i>Stylophora</i> sp. 2	x	-	-	-	-	-
ACROPORIDAE						
<i>Acropora cytherea</i>	x	-	-	-	-	-
<i>Acropora formosa</i>	x	-	-	-	-	-
<i>Acropora humilis</i>	x	x	x	-	-	-
<i>Acropora hyacinthus</i>	x	x	-	-	-	-
<i>Acropora acuminata</i>	x	-	-	-	-	-
<i>Acropora convexa</i>	x	-	-	-	-	-
<i>Acropora monticulosa</i>	x	x	-	-	-	-
<i>Acropora delicatula</i>	x	-	-	-	-	-
<i>Acropora palifera</i>	x	-	-	-	-	-
<i>Acropora ramiculosa</i>	x	-	-	-	-	-
<i>Acropora striata</i>	x	-	-	-	-	-
<i>Acropora verrilli</i>	x	-	x	-	-	-
<i>Acropora cymbicyathus</i>	x	-	x	-	-	-
<i>Acropora</i> sp. 1 (encrusting)	x	-	-	-	-	-
<i>Acropora</i> sp. 2	x	-	-	-	-	-
<i>Acropora</i> sp. 3 (encrusting)	-	x	-	-	-	-
<i>Acropora</i> sp. 4 (tables)	x	x	x	-	-	-

TABLE D-2. CORALS FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 2 of 3

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
ACROPORIDAE continued						
<i>Acropora</i> sp. 5 (foliose, tiny tips)	x	-	-	-	-	-
<i>Acropora</i> sp. 6 (low, bushy)	-	x	-	-	-	-
<i>Astreopora listeri</i>	x	-	-	-	-	-
<i>Astreopora</i> sp.	x	x	-	-	-	-
<i>Montipora digitata</i>	x	x	x	-	-	-
<i>Montipora composita</i>	x	-	-	-	-	-
<i>Montipora danai</i>	x	-	-	-	-	-
<i>Montipora foveolata</i>	x	-	-	-	-	-
<i>Montipora tuberculosa</i>	x	-	-	-	-	-
<i>Montipora verrilli</i>	x	-	-	-	-	-
<i>Montipora</i> sp. 1	x	-	-	-	-	-
<i>Montipora</i> sp. 2 (encrusting)	x	-	-	-	-	-
FAVIIDAE						
<i>Cyphastrea</i> sp.	x	x	-	-	-	-
<i>Favia stelligera</i>	x	-	-	-	-	-
<i>Favia pallida</i>	x	x	-	-	-	-
<i>Favia spectosa</i>	x	-	-	-	-	-
<i>Favia</i> sp.	x	x	-	-	-	-
<i>Leptastrea purpurea</i>	x	x	x	-	-	-
<i>Hydnophora</i> sp. 1	x	x	-	-	-	-
<i>Hydnophora</i> sp. 2	-	x	-	-	-	-
<i>Platygyra</i> sp.	-	x	-	-	-	-
MUSSIDAE						
<i>Lobophyllia</i> sp. 1	x	-	x	-	-	-
<i>Lobophyllia</i> sp. 2	x	-	-	-	-	-
<i>Symphyllia</i> sp.	x	-	-	-	-	-
DENDROPHYLLIIDAE						
<i>Tubastrea coccinea</i>	x	-	-	-	-	-
<i>Turbinaria</i>						
FUNGIIDAE						
<i>Fungia fungites</i>	x	x	x	-	-	-
<i>Fungia (Pleuractis) scutaria</i>	-	-	x	-	-	-
Unident. fungiid	x	-	-	-	-	-
AGARICIIDAE						
<i>Pavona varians</i>	x	x	-	x	-	-
<i>Pavona clavus</i>	x	-	-	-	-	-
<i>Pavona (P.) planulata</i>	x	-	-	-	-	-
<i>Pavona</i> sp.	-	x	-	-	-	-

TABLE D-2. CORALS FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 3 of 3

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
ANTHOZOANS (SOFT CORALS)						
ZOANTHIDEA						
<i>Palythoa tuberculosa</i>	x	x	-	-	-	-
Unident. zoanths (blue-green)	x	x	x	-	-	-
Unident. zoanths (green)	-	x	-	-	-	-
ALCYONIIDAE						
<i>Sarcophyton glaucum</i>	x	x	-	-	-	-
<i>Lobophytum</i> sp.	x	-	-	-	-	-
<i>Sinularia polydactyla</i>	x	x	x	-	-	-
<i>Sinularia rigida</i>	-	x	-	-	-	-
<i>Sinularia</i> sp. 1	-	x	-	-	-	-
<i>Sinularia</i> sp. 2	-	-	x	-	-	-
HELIOPORIDAE						
<i>Helopora coerulea</i>	x	x	x	-	-	-
(HYDROZOANS)						
MILLEPORIDAE						
<i>Millepora exaesa</i>	x	-	-	-	-	-
<i>Millepora platyphylla</i>	x	-	-	-	-	-
<i>Millepora dichotoma</i>	x	x	-	x	-	-
<hr/>						
Total Families	12	8	8	4	0	0
Total Species	68	35	17	5	0	0

*Survey Sites

- 1 = Kwadack Lagoon Terrace
- 2 = Meck Quarries
- 3 = Meck Lagoon Terrace
- 4 = Meck Harbor Basin
- 5 = Missile Assembly Building
- 6 = Photography Tower

TABLE D-3. FISHES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 1 of 5

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
CARCHARHINIDAE (REQUIEM/GRAY SHARKS)						
<i>Carcharhinus melanopterus</i>	x	-	-	-	-	-
MYLIOBATIDAE (EAGLE RAYS)						
<i>Aetobatus narinari</i>	-	-	-	x	-	-
ATHERINIDAE (SILVERSIDES)						
Unident. silversides	-	-	x	-	-	-
CIRRHITIDAE (HAWKFISHES)						
<i>Paracirrhites arcatus</i>	x	-	x	-	-	-
LETHRINIDAE (EMPERORS)						
<i>Monotaxis grandoculis</i>	x	-	-	-	-	-
MUGILOIDIDAE (SANDPERCHES)						
<i>Parapercis clathrata</i>	x	-	x	-	-	-
<i>Parapercis cephalopunctatus</i>	x	-	x	-	-	-
MULLIDAE (GOATFISHES)						
<i>Mulloides flavolineatus</i>	x	x	x	-	-	-
<i>Mulloides vanicolensis</i>	x	x	x	-	-	-
<i>Parupeneus multifasciatus</i>	x	x	x	x	-	-
<i>Parupeneus cyclostomus</i>	x	x	-	-	-	-
<i>Parupeneus barberinus</i>	-	x	-	-	-	-
<i>Parupeneus</i> sp. (juveniles)	x	-	-	-	-	-
ACANTHURIDAE (SURGEONFISHES)						
<i>Acanthurus guttatus</i>	x	x	x	-	-	-
<i>Acanthurus achilles</i>	x	x	-	x	-	-
<i>Acanthurus pyroferus</i>	-	x	x	-	-	-
<i>Acanthurus nigrofuscus</i>	x	x	-	-	-	-
<i>Acanthurus nigroris</i>	x	x	-	-	-	-
<i>Acanthurus striatus</i>	-	x	x	-	-	-
<i>Acanthurus triostegus</i>	x	x	x	x	x	x
<i>Acanthurus olivaceus</i>	x	x	-	x	-	-
<i>Acanthurus lineatus</i>	-	x	-	-	-	-
<i>Acanthurus mata</i>	x	x	x	-	-	-
<i>Acanthurus</i> sp. 1	x	-	-	-	-	-
<i>Acanthurus</i> sp. 2	x	-	-	-	-	-
<i>Naso lituratus</i>	x	x	-	-	-	-

TABLE D-3. FISHES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 2 of 5

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
ACANTHURIDAE (SURGEONFISHES) continued						
<i>Naso hexacanthus</i>	X	X	-	-	-	-
<i>Ctenochaetus strigosus</i>	X	-	-	-	-	-
<i>Ctenochaetus striatus</i>	-	X	-	-	-	-
<i>Zebrasoma scopes</i>	X	-	-	-	-	-
<i>Zebrasoma veliferum</i>	X	-	X	-	-	-
BALISTIDAE (TRIGGERFISHES)						
<i>Rhinecanthus rectangulus</i>	X	X	X	X	-	-
<i>Rhinecanthus aculeatus</i>	X	X	X	X	-	-
<i>Balistapus undulatus</i>	X	-	-	-	-	-
<i>Melichthys vidua</i>	X	-	X	-	-	-
<i>Sufflamen chysoptera</i>	X	-	X	-	-	-
FISTULARIDAE (CORNETFISHES)						
<i>Fistularia commersonii</i>	-	X	-	-	-	-
SCOMBRIDAE (TUNAS)						
Unident. small tunas	X	-	-	-	-	-
ZANCLIDAE (MOORISH IDOLS)						
<i>Zanclus cornutus</i>	X	X	X	-	-	-
SCARIDAE (PARROTFISHES)						
<i>Scarus sordidus</i>	X	X	X	-	-	-
<i>Scarus dubius</i>	X	X	-	-	-	-
<i>Scarus gibbus</i>	X	X	-	-	-	-
<i>Scarus oviceps</i>	-	X	-	-	-	-
<i>Scarus psittacus</i>	X	X	-	-	-	-
<i>Scarus</i> sp. 1	X	-	-	-	-	-
<i>Scarus</i> sp. 2	X	-	-	-	-	-
<i>Scarus</i> sp. 3	X	-	-	-	-	-
<i>Scarus</i> sp. 4	X	-	-	-	-	-
<i>Calotomus</i> sp.	-	X	-	-	-	-
LABRIDAE (WRASSES)						
<i>Anampses caeruleopunctatus</i>	X	-	-	-	-	-
<i>Anampses meleagrides</i>	X	X	-	X	-	-
<i>Bodianus axillaris</i>	X	X	X	-	-	-
<i>Bodianus bimaculatus</i>	X	X	X	-	-	-
<i>Cheilinus chlorurus</i>	X	X	X	-	-	-
<i>Cheilinus unifasciatus</i>	X	-	-	-	-	-
<i>Cirrhitlabrus</i> sp.	X	-	X	-	-	-
<i>Coris aygula</i>	X	X	X	-	-	-
<i>Coris gaimard</i>	X	X	X	-	-	-

TABLE D-3. FISHES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 3 of 5

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
LABRIDAE (WRASSES) continued						
<i>Coris</i> sp. 1	-	x	x	-	-	-
<i>Coris</i> sp. 2	x	-	-	-	-	-
<i>Gomphosus varius</i>	x	x	-	-	-	-
<i>Halichoeres chrysus</i>	x	x	-	-	-	-
<i>Halichoeres hortulanus</i>	x	x	x	-	-	-
<i>Halichoeres margaritaceus</i>	x	x	x	-	-	-
<i>Halichoeres marginatus</i>	x	-	x	-	-	-
<i>Halichoeres trimaculatus</i>	x	x	-	-	-	-
<i>Halichoeres</i> sp.	x	-	-	-	-	-
<i>Macropharyngodon meleagris</i>	x	x	x	-	-	-
<i>Thalassoma hardwicke</i>	x	x	x	-	-	-
<i>Thalassoma quinquevittatum</i>	x	x	x	-	-	-
<i>Thalassoma lutescens</i>	x	-	x	-	-	-
<i>Thalassoma amblycephalus</i>	x	-	x	-	-	-
<i>Thalassoma</i> sp. 1	x	-	-	-	-	-
<i>Thalassoma</i> (?)	x	-	-	-	-	-
<i>Novaculichthys taeniourus</i>	x	x	-	-	-	-
<i>Stethojulis bandanensis</i>	x	x	-	x	-	-
<i>Stethojulis axillaris</i>	x	-	x	-	-	-
<i>Labroides bicolor</i>	x	x	x	-	-	-
<i>Labroides dimidiatus</i>	x	-	x	x	-	-
OSTRACIIDAE (TRUNKFISHES)						
<i>Ostracion meleagris</i>	x	x	-	-	-	-
<i>Ostracion</i> sp.	x	-	-	-	-	-
TETRAODONTIDAE (PUFFERS)						
<i>Canthigaster solandri</i>	-	x	-	-	-	-
BLENNIDAE (BLENNIES)						
<i>Aspidontus taeniatus</i>	x	x	-	-	-	-
<i>Runula tapeinosoma</i>	x	-	x	-	-	-
Unident. blenny 1 (stripes)	x	-	-	-	-	-
Unident. blenny 2 (mottled)	-	-	-	x	-	-
KYPHOSIDAE (SEA CHUBS)						
<i>Kyphosus cinerascens</i>	x	x	x	-	-	-
<i>Kyphosus</i> sp.	x	-	-	-	-	-
SIGANIDAE (RABBITFISHES)						
<i>Siganus argenteus</i>	-	x	-	x	-	-
POMACANTHIDAE (ANGELFISHES)						
<i>Centropyge flavissimus</i>	x	x	x	-	-	-

TABLE D-3. FISHES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 4 of 5

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
MONACATHIDAE (FILEFISHES)						
<i>Oxymonacanthus longirostris</i>	-	x	x	-	-	-
CARANGIDAE (JACKS)						
<i>Caranx melampygus</i>	-	-	x	x	-	-
<i>Caranx</i> sp.	x	-	-	-	-	-
<i>Trachinotus blochii</i>	-	-	-	x	-	-
SERRANIDAE (GROUPERS)						
<i>Cephalopholis argus</i>	x	x	-	-	-	-
<i>Epinephelus hexagonatus</i>	-	x	x	-	-	-
<i>Epinephelus merra</i>	-	-	x	-	-	-
Unident. grouper	x	-	-	-	-	-
MURAENIDAE (MORAY EELS)						
<i>Echidna nebulosa</i>	-	-	-	-	x	-
HEMIRAMPHIDAE (HALFBEAKS)						
<i>Hyporhamphus</i> sp.	-	x	-	x	-	-
CHAETODONTIDAE (BUTTERFLY FISHES)						
<i>Chaetodon citrinellus</i>	x	x	x	-	-	-
<i>Chaetodon lunula</i>	x	x	x	x	-	-
<i>Chaetodon trifasciatus</i>	x	x	x	-	-	-
<i>Chaetodon auriga</i>	x	x	-	-	-	-
<i>Chaetodon ephippium</i>	x	x	-	-	-	-
<i>Chaetodon lineolatus</i>	x	-	-	-	-	-
<i>Chaetodon ornatissimus</i>	x	x	x	-	-	-
<i>Chaetodon reticulatus</i>	-	x	-	-	-	-
<i>Chaetodon</i> sp. 1	x	-	-	-	-	-
<i>Chaetodon</i> sp. 2	x	-	-	-	-	-
<i>Chaetodon</i> sp. 3 (juveniles)	x	-	-	-	-	-
POMACENTRIDAE (DAMSELFISHES)						
<i>Abudefduf sordidus</i>	x	x	x	-	-	-
<i>Abudefduf leucozona</i>	x	x	x	-	-	-
<i>Abudefduf leucopomus</i>	x	-	-	x	-	-
<i>Abudefduf sexfasciatus</i>	x	x	-	-	-	-
<i>Abudefduf sordidus</i>	x	x	x	-	-	-
<i>Abudefduf leucozona</i>	x	x	x	-	-	-
<i>Abudefduf leucopomus</i>	x	-	-	x	-	-
<i>Abudefduf sexfasciatus</i>	x	x	-	-	-	-
<i>Plectroglyphidodon dickii</i>	x	x	-	-	-	-
<i>Plectroglyphidodon lacrymatus</i>	x	x	-	-	-	-
<i>Stegastes fasciolatus</i>	x	x	-	-	-	-

TABLE D-3. FISHES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 5 of 5

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
POMACENTRIDAE (DAMSELFISHES) continued						
<i>Stegastes nigricans</i>	x	x	x	-	-	-
<i>Chromis margaritifer</i>	x	-	x	-	-	-
<i>Chromis viridis</i>	x	x	-	-	-	-
<i>Chromis</i> sp. 1	x	-	-	-	-	-
<i>Chromis</i> sp. 2	x	-	-	-	-	-
<i>Chromis</i> sp. 3	-	-	x	-	-	-
<i>Dascyllus reticulatus</i>	x	x	-	-	-	-
<i>Dascyllus aruanus</i>	x	x	-	-	-	-
<i>Pomacentrus pavo</i>	x	x	x	x	-	-
<i>Pomacentrus jenkinsi</i>	x	-	x	-	-	-
<i>Pomacentrus vaiuli</i>	x	-	x	-	-	-
<i>Pomacentrus</i> sp.	x	-	-	-	-	-
LUTJANIDAE (SNAPPERS)						
<i>Lutjanus fulvus</i>	x	x	-	-	-	-
<i>Lutjanus ehrenbergii</i>	x	-	x	-	-	-
Unident. snappers	x	-	-	-	-	-
SYNODONTIDAE (LIZARDFISHES)						
<i>Synodus variegatus</i>	-	x	x	x	-	-
Unident. lizardfish	-	x	-	-	-	-
HOLOCENTRIDAE (SQUIRRELFISHES)						
<i>Myripristis sammara</i>	x	x	x	-	-	-
<i>Myripristis kuntee</i>	x	x	-	-	-	-
<i>Sargocentron diadema</i>	x	x	-	-	-	-
Unident. holocentrid	x	-	-	-	-	-
AULOSTOMIDAE (TRUMPETFISHES)						
<i>Aulostomus chinensis</i>	x	x	-	-	-	-
GOBIIDAE (GOBIES)						
<i>Valenciennesa strigatus</i>	-	-	x	x	-	-
<i>Ptereleotris heteropterus</i> (?)	-	-	-	x	-	-
<hr/>						
Total Families	22	21	21	14	2	1
Total Species	115	81	60	21	2	1

*Survey Sites

- 1 = Kwadack Lagoon Terrace
- 2 = Meck Quarries
- 3 = Meck Lagoon Terrace
- 4 = Meck Harbor Basin
- 5 = Missile Assembly Building
- 6 = Photography Tower

TABLE D-4. INVERTEBRATES FOUND ON MECK AND KWADACK ISLANDS, KWAJALEIN ATOLL

Page 1 of 3

TAXA/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
PHYLUM PORIFERA (SPONGES)						
CLASS DEMOSPONGIAE						
Unident. Sponge 1 (green)	x	x	x	-	-	-
Unident. Sponge 2 (grey-blue)	-	x	x	-	-	-
Unident. Sponge 3 (grey)	-	-	-	x	-	-
Unident. Sponge 4 (red encrusting)	-	x	-	x	-	-
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
FAMILY NERITIDAE						
<i>Nerita polita</i>	-	-	-	-	x	x
<i>Nerita plicata</i>	-	-	-	-	x	x
FAMILY TROCHIDAE						
<i>Trochus niloticus</i>	x	x	x	-	-	-
FAMILY CYPRAEIDAE						
<i>Cypraea moneta</i> (shell only)	-	x	-	-	-	-
<i>Cypraea depressa</i> (shell only)	-	x	-	-	x	-
<i>Cypraea</i> sp. (worn shell)	-	-	-	-	x	-
FAMILY STROMBIDAE						
<i>Lambis truncata</i>	x	x	x	-	-	-
<i>Lambis crocata</i>	-	x	-	-	-	-
<i>Strombus luhuanus</i>	x	x	x	-	-	-
<i>Strombus</i> sp.	-	-	x	-	-	-
FAMILY VERMETIDAE						
<i>Dendropoma maxima</i>	-	-	x	-	-	-
FAMILY CONIDAE						
<i>Conus distans</i>	-	x	-	-	-	-
<i>Conus ebraeus</i> (shell only)	-	x	-	-	-	-
FAMILY THAIDIDAE						
<i>Drupa morum</i>	-	-	x	-	-	-
<i>Drupa</i> sp. (black)	-	-	x	-	-	-
<i>Morula</i> sp.	-	-	x	x	-	-
CLASS BIVALVIA						
FAMILY CHAMIDAE						
<i>Chama</i> sp.	-	-	x	-	-	-

TABLE D-4. INVERTEBRATES FOUND ON MECK AND KWADACK ISLANDS, KWAJALEIN ATOLL

Page 2 of 3

TAXA/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
FAMILY TRIDACNIDAE						
<i>Tridacna</i> sp. (<i>maxima</i> ?)	-	x	-	-	-	-
<i>Tridacna squamosa</i>	x	x	-	-	-	-
PHYLUM ANNELIDA						
CLASS POLYCHAETA						
FAMILY SABELLIDAE						
Unident. sabellid (orange-red)	-	x	-	-	-	-
PHYLUM ARTHROPODA						
CLASS MAXILLOPODA						
SUBORDER BALANOMORPHA						
FAMILY BALANIDAE						
<i>Tetraclita pacifica</i>	-	-	-	-	-	x
FAMILY CALLIANASSIDAE						
Unident. callianassid (burrowing)	-	-	-	x	-	-
FAMILY ALPHEIDAE						
<i>Alpheus</i> sp. (burrows in coral)	x	-	x	-	-	-
FAMILY COENOBITIDAE						
<i>Coenobita perlatus</i>	-	-	-	-	x	x
<i>Coenobita brevimanus</i>	-	-	-	-	x	x
FAMILY PORCELLANIDAE						
<i>Petrolisthes</i> sp.	-	-	-	-	-	x
FAMILY DIOGENIDAE						
<i>Calcinus elegans</i>	-	-	x	-	x	-
<i>Calcinus</i> sp.	-	-	x	-	x	-
<i>Cibanarius</i> sp.	-	-	-	-	x	x
Unident. hermit crab	-	-	-	-	x	x
FAMILY GRAPSIDAE						
<i>Grapsus tenuicrustatus</i>	-	-	-	-	x	x
<i>Pachygrapsus planifrons</i>	-	-	-	-	x	x
FAMILY OCYPODIDAE						
<i>Ocypode ceratophthalma</i>	-	-	x	-	-	-

TABLE D-4. INVERTEBRATES FOUND ON MECK AND KWADACK ISLANDS,
KWAJALEIN ATOLL

Page 3 of 3

FAMILY/GENUS/SPECIES	Survey Sites*					
	1	2	3	4	5	6
PHYLUM ECHINODERMATA						
CLASS HOLOTHUROIDEA						
FAMILY HOLOTHURIIDAE						
<i>Actinopyga echinites</i>	-	x	x	-	-	-
<i>Actinopyga mauritiana</i>	-	x	x	-	-	-
<i>Bohadschia argus</i>	x	x	x	x	-	-
<i>Holothuria atra</i>	x	-	x	x	-	-
<i>Holothuria leucospilota</i>	-	-	x	-	-	-
<i>Thelenota ananas</i>	-	-	-	x	-	-
CLASS ASTEROIDEA						
FAMILY OPHIDIASTERIDAE						
<i>Linckia multiflora</i>	x	-	-	-	-	-
CLASS ECHINOIDEA						
FAMILY DIADEMATIDAE						
<i>Diadema savignyi</i>	-	x	x	-	-	-
<i>Echinothrix diadema</i>	x	x	x	-	-	-
FAMILY ECHINOMETRIDAE						
<i>Echinometra mathaei</i>	-	x	x	-	-	-
<i>Echinometra oblonga</i>	-	-	x	-	-	-
<i>Echinostrephus aciculatus</i>	-	x	x	-	-	-
<i>Heterocentrotus mammillatus</i> (spines)	-	x	-	-	x	x
PHYLUM CHORDATA						
CLASS ASCIDIACEA						
FAMILY DIDEMNIDAE						
Unident. didemnids	-	x	-	-	-	-
<hr/>						
Total Species	10	22	25	7	13	11

*Survey Sites

- 1 = Kwadack Lagoon Terrace
- 2 = Meck Quarries
- 3 = Meck Lagoon Terrace
- 4 = Meck Harbor Basin
- 5 = Missile Assembly Building
- 6 = Photography Tower

TABLE D-5. WATER QUALITY PARAMETERS AROUND MECK ISLAND, KWAJALEIN ATOLL

STATION NO.	TIME (h)	DEPTH (m)	TEMP. (°C)	SALINITY (ppt)	DISS. OXYGEN (ppm)
4/18/89					
1	1035	0.1	33.4	33.2	8.90
	1039	0.1	33.4	33.2	8.87
2	1139	0.1	30.1	33.1	8.14
	1150	0.1	28.9	33.3	8.10
3	1042	0.2	28.9	33.1	7.84
	1155	0.2	28.9	33.2	8.13
4	1050	0.3	28.9	33.2	7.92
	1157	0.3	28.8	33.2	7.83
4/19/89					
5	0851	0.2	28.7	33.2	8.04
	1117	0.2	28.9	33.3	7.97
6	0906	0.5	28.9	33.2	8.20
	1040	0.5	28.9	33.0	7.94
7	0911	0.5	28.8	33.2	7.88
	0912	3.5	28.9	33.3	7.40
	1049	0.5	28.9	33.2	7.56
8	1049	3.5	28.9	33.1	7.93
	0929	0.5	28.9	33.2	8.03
	1055	0.5	28.8	33.3	8.14

*Measured 18-19 April 1989

Notes:

- h = hours
- m = meters
- °C = degrees Celsius
- ppt = parts per thousand
- ppm = parts per million

APPENDIX E

**THREATENED AND ENDANGERED SPECIES POTENTIALLY
AFFECTED BY THE HEDI KITE TEST ACTIVITIES AT
WHITE SANDS MISSILE RANGE,
NEW MEXICO**

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**THREATENED AND ENDANGERED SPECIES POTENTIALLY AFFECTED BY THE
HEDI KITE TEST ACTIVITIES AT WHITE SANDS MISSILE RANGE,
NEW MEXICO**

Review of the scientific and regulatory literature and relevant environmental documents indicates that a large number of protected species are known or potentially occur at WSMR. Eight federally designated threatened or endangered species, 26 candidate species, and 3 species designated as sensitive by the State of New Mexico might be present. Those species designated by the U.S. Fish and Wildlife Service (1986) as threatened or endangered species, along with "candidate species," are presented in Table E-1. Candidate species are those that may qualify for threatened or endangered status, but require further review. Table E-1 also lists additional species considered to be in jeopardy by the State of New Mexico.

Table E-2 lists those protected plants and animals that are or may be present in the specific areas to be used for the HEDI KITE tests. This listing reflects a refinement and narrowing of the list of protected species from the entire WSMR, as given in Table E-1. The protected species potentially within the HEDI KITE project area at WSMR occupy a wide variety of habitats. The physical and biological preferences of each species were investigated, and those species that may be present within the camera site and debris impact areas of the HEDI KITE project were retained for consideration in the field surveys and in the EA. These protected plant and animal species are listed in Table E-2.

Each of the protected species that could be affected by the HEDI KITE tests is discussed below. The rationale for omitting species from the master list (Table E-1) is given, and is based on the likelihood of its occurrence within the project area, considering the habitat preferences, seasonal range, and known distribution.

The following eight plants and animals designated by the Endangered Species Act may be present at WSMR.

The **bald eagle** (*Haliaeetus leucocephalus*) is an irregular transient to the WSMR during migration and in winter. Sightings have been reported from Lake Lucero. No impact on the bald eagle is expected, because no suitable habitat is present and the tests will not take place during the migratory periods or during winter.

The **northern Aplomado falcon** (*Falco femoralis septentrionalis*) is a bird of prairies and yucca flats that last nested in New Mexico in 1952. Although suitable habitat remains, it is now thought to be extirpated at WSMR, so no impacts will occur.

The **interior least tern** (*Sterna antillarum athalassos*) nests along the Mississippi River and other interior drainages of the central United States. It has been sighted on the Bosque del Apache National Wildlife Refuge, where it frequents sandbars on the Rio Grande. The State of New Mexico rates this bird in Group 2. Suitable habitat is absent from the WSMR, and this bird was omitted from further consideration.

TABLE E-1. PROTECTED SPECIES CONSIDERED FOR THE HEDI KITE ENVIRONMENTAL ASSESSMENT, WHITE SANDS MISSILE RANGE

Page 1 of 2

Federally listed species

Animals:

Bald eagle (Haliaeetus leucocephalus) Endangered
Aplomado falcon (Falco femoralis septentrionalis) Endangered
Interior least tern (Sterna antillarum athalassos) Endangered
Whooping crane (Grus americana) Endangered
American peregrine falcon (Falco peregrinus anatum) Endangered

Plants:

Sneed pincushion cactus (Coryphantha sneedii var. sneedii) Endangered
Lloyd hedgehog cactus (Echinocereus lloydii) Endangered, Critical Habitat
Todsens pennyroyal (Hedeoma todsenii) Endangered, Critical Habitat

Federal candidate species

Category 2

Fish:

White Sands pupfish (Cyprinodon tularosa)

Birds:

Swainson's hawk (Buteo swainsoni)
Ferruginous hawk (Buteo regalis)
Western snowy plover (Charadrius alexandrinus nivosus)
White-faced ibis (Plegatus chihi) - Great Basin population
Mountain plover (Charadrius montanus)
Long-billed curlew (Numenius americanus)
Western yellow-billed cuckoo (Coccyzus americanus occidentalis)
Southern spotted owl (Strix occidentalis lucida)

Mammals:

Spotted bat (Euderma maculatum)
Occult bat (Myotis lucifugus occultus)
Southwestern cave bat (Myotis velifer brevis)
Organ Mountains chipmunk (Eutamias quadrivittatus australis)

TABLE E-1. PROTECTED SPECIES CONSIDERED FOR THE HEDI KITE ENVIRONMENTAL ASSESSMENT, WHITE SANDS MISSILE RANGE

Page 2 of 2

Arizona prairie dog (Cynomys ludovicianus arizonensis)
White Sands pocket gopher (Geomys arenarius brevirostris)
White Sands woodrat (Neotoma micropus leucophaea)
New Mexican jumping mouse (Zapus hudsonius luteus)

Plants:

Dune unicorn plant (Proboscidea sabulosa)
Grama grass cactus (Pediocactus papyracanthus)
Nooding cliff daisy (Perityle cernua)
Alamo beard tongue (Penstemon alamosensis)
Gray sibara (Sibara grisea)
Organ Mountains evening primrose (Oenothera organensis)
Gypsum scalebroom (Lepidospartum burgessii)
Sand prickly pear (Opuntia arenaria)
Curl-leaf needle grass (Stipa curvifolia)

Category 3c

Birds:

Bell's vireo (Vireo bellii arizonae)

Plants:

Scheer's pincushion cactus (Coryphantha scheerii var. uncinata)

Additional species considered in jeopardy by the State of New Mexico

Reptiles:

Trans-Pecos rat snake (Elaphe subocularis) Group 2.

Birds:

Gray vireo (Vireo vicinior) Group 2.

Mammals:

Desert bighorn sheep (Ovis canadensis) Group 1.

**TABLE E-2. PROTECTED SPECIES KNOWN OR POTENTIALLY OCCURRING
WITHIN THE HEDI KITE CAMERA STATION AND DEBRIS
IMPACT AREAS AT WSMR**

Page 1 of 2

Category 2

Birds:

Swainson's hawk (Buteo swainsoni)
Southern spotted owl (Strix occidentalis lucida)
Mountain plover (Charadrius montanus)

Mammals:

Spotted bat (Euderma maculatum)
Occult bat (Myotis lucifugus occultus)
Southwestern cave bat (Myotis velifer brevis)
Arizona prairie dog (Cynomys ludovicianus arizonensis)

Plants:

Dune unicorn plant (Proboscidea sabulosa)
Grama grass cactus (Pediocactus papyracanthus)
Nooding cliff daisy (Perityle cernua)
Alamo beard tongue (Penstemon alamosensis)
Gray sibara (Sibara grisea)
Organ Mountains evening primrose (Oenothera organensis)
Gypsum scalebroom (Lepidospartum burgessii)
Sand prickly pear (Opuntia arenaria)
Curl-leaf needle grass (Stipa curvifolia)

Category 3c

Plants:

Scheer's pincushion cactus (Coryphantha scheerii var. uncinata)

New Mexico Listed species

Reptiles:

Trans-Pecos rat snake (Elaphe subocularis) Endangered, Group 2.

**TABLE E-2. PROTECTED SPECIES KNOWN OR POTENTIALLY OCCURRING
WITHIN THE HEDI KITE CAMERA STATION AND DEBRIS
IMPACT AREAS AT WSMR**

Page 2 of 2

Birds:

Gray vireo (Vireo vicinior) Endangered, Group 2.

Mammals:

Desert bighorn sheep (Ovis canadensis) Endangered, Group 1.

The **whooping crane** (*Grus americana*) is thought to fly over WSMR on occasion during migration, but probably does not stop to rest or feed. The HEDI KITE tests are not expected to take place during the seasons that the whooping crane may be present in New Mexico, and there are no known occurrences, so it was not included in the impact analysis.

The **American peregrine falcon** (*Falco peregrinus anatum*) is a resident bird of prey in the higher mountains of southern New Mexico. Although no known nesting sites exist in the HEDI KITE project area, thorough surveys are lacking, and its occurrence remains a possibility. Lack of water and areas of concentration for birds, the primary prey of the peregrine falcon, are believed to limit the suitability of the habitat at WSMR. The impacts of falling debris were judged to be insignificant to wildlife in the San Andres NWR. This fact, along with the lack of records from the project area, resulted in the omission of the peregrine falcon from the impact analysis. If there are any of these birds in the San Andres Mountains, mitigation measures developed for the protection of desert bighorn will also apply to the American peregrine falcon.

It is unlikely but possible that the **Sneed pincushion cactus** (*Coryphantha sneedii* var. *sneedii*) is present at the WSMR. Its preferred habitat is in the Franklin Mountains north of El Paso and the southern Organ Mountains and Bishop's Cap east of Las Cruces on limestone ledges at elevations of 1,310 to 1,646 meters (4,300 to 5,400 feet). All known populations are from Dona Ana County, New Mexico, and El Paso County, Texas. It may also be found on relatively flat lower-elevation limestone outcrops in desert and grassland communities. Because this cactus is not present in areas designated for new construction, it was not included in the impact analysis.

The **Lloyd hedgehog cactus** (*Echinocereus lloydii*) has been reported from the southeast corner of WSMR, in the Jarillo Mountains near Orogrande. Its primary range appears to be in dry, rocky hills of limestone and granite at 1,524-meter (5,000-foot) elevations in Texas. The plant was first collected in 1909 near Tuna Springs, Texas.

The U.S. Fish and Wildlife Service noted that the New Mexico locations for the Lloyd hedgehog cactus are probably in error, and that until further research proves otherwise, the range is confined to 20.7 square kilometers (8 square miles) in Texas. For this reason, along with the lack of suitable habitat in areas of new construction for the camera sites, this plant was not included in the impact analysis.

Todsen's pennyroyal (*Hedeoma todsenii*) is a small shrub of the mint family that has a very restricted known distribution, limited to WSMR. It occurs on steep, gravelly gypsum limestones. The critical habitat is limited to 2 square kilometers (0.8 square mile) and the estimated number of plants is 750. The U.S. Fish and Wildlife Service stated that there is little likelihood that the plants will be hit by missile debris in their protected canyon sites. Because Todsen's pennyroyal is believed to be a very narrow endemic restricted to the type locality, it was not included in the impact analysis. Even if suitable habitat and undiscovered populations do exist within the outer debris impact area on the east side of the San Andres Mountains, it is judged that falling debris will have an insignificant impact on the populations.

The Federal candidate species considered for the impact analysis are discussed below, along with the justification for retention in or exclusion from Table E-2.

The **White Sands pupfish** (*Cyprinodon tularosa*) is known only from Salt Creek, Mound Spring, and Malpais Spring. No suitable habitat exists within the HEDI KITE project area, and the pupfish was excluded from detailed consideration of biological impacts.

The **ferruginous hawk** (*Buteo regalis*) nests within New Mexico, and considerable foraging suitable habitat is present at WSMR. Because no nesting areas are known in the HEDI KITE project area and the flight tests are not expected to take place during the migratory and wintering periods, no impacts to this species are expected, and the ferruginous hawk was omitted from the impact analysis.

The **Swainson's hawk** (*Buteo swainsoni*) has been reported to nest near the Stallion site, and a possible nest was recently reported near the southern end of the Orogrande site (U.S. Department of the Army, 1985). Suitable habitat is absent from the HEDI KITE launch and debris impact areas, except for those migratory flocks that may fly over either area during the early spring and fall. The HEDI KITE flight tests are not expected to take place during the major migratory period, so the species is expected to be absent. However, this bird was retained for further consideration because of the possible overlap in seasonal distribution.

The **Western snowy plover** (*Charadrius alexandrinus nivosus*) is only a possible transient north of Lake Lucero, and suitable habitat is absent from the project area. This bird was therefore omitted from further consideration.

The **white-faced ibis** (*Plegatus chihi*, Great Basin population) is a waterbird that may occasionally fly over WSMR. No suitable nesting or foraging habitat is present within the area to be used by the HEDI KITE tests. It was omitted from the impact analysis.

The **mountain plover** (*Charadrius montanus*) has possible nesting habitat in the foothills of the San Andres Mountains and the grassland at the Stallion site. It might be present during the HEDI KITE flight tests, so was retained for further consideration in the biological impact analysis.

The **long-billed curlew** (*Numenius americanus*) is a possible transient near Malpais Spring, but does not have any suitable habitat in the camera station or debris impact area for HEDI KITE tests. No further consideration was given to this waterbird in the biological impact analysis.

The **Western yellow-billed cuckoo** (*Coccyzus americanus occidentalis*) occupies dense riparian vegetation along permanent watercourses. This type of habitat is lacking within the project area, and the cuckoo was omitted from the discussion of biological impacts.

The **southern spotted owl** (*Strix occidentalis lucida*) could have limited habitat in the San Andres Mountains. Because it might be present during the HEDI KITE flight tests within the debris impact area, it was retained for consideration of adverse biological impacts.

The **spotted bat** (*Euderma maculatum*) has a low potential for occurrence in the San Andres Mountains, although it prefers the higher elevation ponderosa pine community. It was retained for further consideration of biological impacts.

The **occult bat** (*Myotis lucifugus occultus*) also has potential habitat in the San Andres Mountains, although its primary range is to the west. Because it may be present in the mountainous regions of the outer debris impact area, it was retained for further consideration of biological impacts.

The **southwestern cave bat** (*Myotis velifer brevis*) might conceivably be found in the San Andres Mountains, although it is not known in this region. This bat is a colonial cave dweller, retained for further impact analysis, because of the possibility of occurrence.

The **Organ Mountains chipmunk** (*Eutamias quadrivittatus australis*) could be present in the southern San Andres Mountains. No surveys have been conducted for this chipmunk, so it was retained for consideration of biological impacts from the HEDI KITE project.

The **Arizona prairie dog** (*Cynomys ludovicianus arizonensis*) is reported by the U.S. Fish and Wildlife Service to be a possibility at WSMR. However, the New Mexico Department of Game and Fish recognizes the Tularosa Basin population of the black-tailed prairie dog (*C. ludovicianus*) as the protected animal, not stating whether it might be the nominate race (*C. ludovicianus*) or the Arizona race. In either case, prairie dog towns have been recently reported in the Tularosa Basin of WSMR in desert and grassland communities. No prairie dog towns were observed during the field inspection, but the possibility remains that active colonies might be present at the northern camera sites and within the debris impact zone. This species was retained for the impact analysis.

The **White Sands pocket gopher** (*Geomys arenarius brevirostris*) and **White Sands woodrat** (*Neotoma micropus leucophaea*) are races of these rodents that occupy only a small and specialized geographic range, namely the white gypsum sand dunes within the National Monument. Suitable habitat for these rodents is absent from the HEDI KITE project area, and they were omitted from the impact analysis.

The **New Mexican jumping mouse** (*Zapus hudsonius luteus*) is found locally in the Sacramento Mountains and in the central Rio Grande Valley. Its typical meadow habitat is lacking from the HEDI KITE test locations, and it was omitted from the impact analysis.

The **dune unicorn plant** (*Proboscidea sabulosa*) occupies sandy, mostly gypsum, soils. NASA and Orogrande are thought to provide habitat, and the sandy mesquite dunes near Launch Complex 37 could support populations, but none were seen during the field inspection. The possibility remains, however, that it could occur in the sandy habitat near the southern camera stations, and it was retained for the impact analysis.

The **grama grass cactus** (*Pediocactus papyracanthus*) prefers valleys and open slopes at elevations of 1,829 to 2,134 meters (6,000 to 7,000 feet), which are occupied by native grassland. The plant might be found within the debris impact area on the western foothills of the San Andres Mountains. It was retained for the impact analysis.

The **Noodling cliff daisy** (*Perityle cernua*) has been reported from crevices of limestone caprock mesas in the Organ Mountains at 1,981 meters (6,500 feet). This species may be present in the foothills of the San Andres Mountains, within the debris impact area, and was retained for the impact evaluation.

The **Alamo beard tongue** (*Penstemon alamosensis*) is a little-known plant reported from rocky mountainous areas of southern New Mexico and Texas at elevations of 1,371 to 1,524 meters (4,500 to 5,000 feet). It has a low possibility of occurrence within the debris impact area of the HEDI KITE flights, so was retained for the impact analysis.

The **gray sibara** (*Sibara grisea*) is a plant that could occur at WSMR in the Oscura Mountains. It prefers talus slopes at the base of cliffs, and suitable habitat is lacking within the HEDI KITE camera sites and debris impact areas. It was therefore omitted from further impact evaluation.

The **Organ Mountains evening primrose** (*Oenothera organensis*) is restricted to permanent seeps on canyon floors in the Organ Mountains at elevations of 1,828 to 2,286 meters (6,000 to 7,500 feet). The presence of this plant is very unlikely but possible at higher elevations of the San Andres Mountains, and so was retained for further environmental analysis.

The **gypsum scalebroom** (*Lepidospartum burgessii*) has not been reported from WSMR but potential habitat exists near Orogrande. No suitable habitat exists within the HEDI KITE project area, and the scalebroom was omitted from further environmental consideration.

The **sand prickly pear** (*Opuntia arenaria*) is known from sandy mesquite dunes and floodplains near El Paso at elevations of 1,067 to 1,372 meters (3,500 to 4,500 feet). It has been reported from similar habitat on Fort Bliss. Although very unlikely, this cactus may be present in the mesquite dunes near Launch Complex 37, and was retained for impact evaluation.

The **curl-leaf needle grass** (*Stipa curvifolia*) is known from rocky limestone outcrops in the Guadalupe Mountains at elevations of 1,524 to 1,828 meters (5,000 to 6,000 feet). The species may be present in the San Andres Mountains or foothills, and was retained for impact evaluation.

The **Bell's vireo** (*Vireo bellii*) is a migratory songbird that frequents riparian areas and mesquite thickets near water. Although the Arizona race of the Bell's vireo is no longer listed as a Federal candidate species, the State of New Mexico has placed this bird (of any race) in Endangered status, Group 2. The most likely race within WSMR would be the Texas Bell's vireo (*Vireo bellii medius*). No suitable habitat is present within the HEDI KITE debris impact area or at the Launch Complex. Therefore, the Bell's vireo was not retained for further consideration of potential adverse impacts.

The **Scheer's pincushion cactus** (*Coryphantha scheerii* var. *uncinata*) is known from sandy mesquite dunes near El Paso and has been reported from similar habitat on Fort Bliss. A chance exists that this plant could occur within the mesquite dune community present at Launch Complex 37, the location of many of the camera sites for the HEDI KITE project. Because this cactus is no longer a Federal candidate species, it was omitted from further evaluation.

The following additional protected species are designated by the State of New Mexico:

The **Trans-Pecos rat snake** (*Elaphe subocularis*) may inhabit the eastern slopes of the San Andres Mountains, the shrub-grassland community in the foothills, and adjacent desert communities. Because it may be present within the debris impact area, it was retained for the impact analysis.

The **Gray vireo** (*Vireo vicinior*) probably inhabits the eastern slopes and foothills of the San Andres Mountains. The area visited during the field inspection appeared to be suitable breeding habitat, although no individuals were seen. Because it may be present within the debris impact area, this bird was retained for impact analysis.

The **desert bighorn sheep** (*Ovis canadensis*) is known from the San Andres Mountains within the debris impact area. It is a species thought to be sensitive to noise and other possible disturbances from the HEDI KITE tests. It was therefore retained for further impact analysis and discussion in the EA.

TABLE E-3. DEFINITIONS OF STATUS DESIGNATIONS

FEDERAL DESIGNATIONS

E = Endangered. Any species that is in danger of extinction throughout all or a significant portion of its range.

T = Threatened. Any species that is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range.

Critical Habitat = All air, lands, and water deemed essential to the continued survival of an endangered or threatened species. The legal description of Critical Habitat is published in the Federal Register.

C1 = Category 1 candidate species. Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.

C2 = Category 2 candidate species. Taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules.

C3a = Extinct.

C3b = Taxonomically invalid.

C3c = Too widespread and/or not threatened. No longer considered as a federal candidate for listing.

NEW MEXICO DESIGNATIONS

Endangered, Group 1. Any species or subspecies whose prospects of survival or recruitment within New Mexico are in jeopardy.

Endangered, Group 2. Any species or subspecies whose prospects of survival or recruitment within New Mexico are likely to be in jeopardy within the foreseeable future.

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APPENDIX F

**HAZARDOUS OR TOXIC MATERIALS
USED IN HEDI KITE FLIGHT TESTS**

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APPENDIX F. HAZARDOUS OR TOXIC MATERIALS USED IN HEDI KITE FLIGHT TESTS

HEDI KITE 3 will involve a small amount (approximately 45 liters [12 gallons]) of MMH/N₂O₄ hypergolic liquid propellants, which are toxic and highly flammable. Use of a less dangerous substitute fuel for KV maneuvering is not feasible; however, plans for handling and use of the fuel do minimize any safety or environmental risk.

The KV will be fueled at a fueling bay (Building S-23363 at Launch Complex 36), which is especially designed to trap any spilled fuel in a catch basin. The catch basin drains into a sealed sump that holds leaked fuel until it is pumped into a disposal container for transportation to a disposal facility. The fueling process uses vacuum, and any spilled fuel is immediately diluted with water. The use of vacuum instead of pressure minimizes the possibility of an external leak. Dilution of spilled fuel with water reduces its toxicity, renders it nonflammable, and makes it safe to handle by conventional means.

During the time the missile is on the launch pad (a period of 4 to 6 weeks), the fuel tanks will not be pressurized, thus minimizing the possibility of a leak. Should leakage occur, the leaked fuel will be collected and disposed of as described above for fueling bay operations.

Other potentially hazardous or toxic materials (e.g., explosives, battery packs, cleaning fluids) utilized at the launch complex will be handled in accordance with existing WSMR regulations and Standard Operating Procedures (SOPs). Any excess materials will be removed from WSMR by the contractor at the conclusion of testing. Any wastes will be transported and disposed of by approved contractor(s), in accordance with State of New Mexico and Environmental Protection Agency (EPA) regulations.

The hypergolic liquid propellants aboard the missile will either be used up in the flight or consumed by the explosion of the missile warhead and/or the flight termination explosive package. There is a very remote possibility that an empty fuel tank might reach the ground in a relatively intact condition. If this were to happen, the fuel tank (a pressure vessel) might contain some fuel residue that would amount to less than 30 milliliters (1 ounce). The recovery team will be trained and equipped to deal with this possibility.

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APPENDIX G

**STATISTICAL DATA - DEBRIS IMPACT AREAS
WHITE SANDS MISSILE RANGE**

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STATISTICAL DATA - DEBRIS IMPACT AREAS, WHITE SANDS MISSILE RANGE

The McDonnell Douglas Space Systems Company (MDSSC) has calculated the trajectory and the debris impact zones of the HEDI KITE flight tests to be conducted at the White Sands Missile Range, White Sands, New Mexico (Figure 3-3). In order to evaluate safety requirements, the number of potentially lethal fragments that would fall within these impact areas resulting from the destruction of the kill vehicle (KV) was calculated. It is impossible to determine, exactly, the number of lethal fragments, but a number of models were developed that could be used to estimate the fragment characteristics that would result from the breakup of a vehicle. These models were used to estimate the number, size, weight, density, and construction of lethal fragments resulting from the destruction of the HEDI KV. The analysis that follows presents the data and calculations that were used in determining the various characteristics of the HEDI KITE debris and the probability of that debris falling into particular impact areas.

KILL VEHICLE WEIGHT

A breakdown of the KV by weight is presented below.

<u>Item</u>	<u>lbs</u>	<u>kg</u>
Total KV weight	806	366
Expendables	-77	-35
Residual expendables	-12	-5
Warhead installation	-81	-37
Warhead structure (skin)	-8	-4
External insulation erosion	<u>-7</u>	<u>-3</u>
Total weight of remaining debris	621	282

Expendables are assumed to be consumed by the KV's maneuvering and cooling during the flight, or expelled into the atmosphere as a result of breakup of their containment structure. The warhead mass is assumed to be consumed as a result of its detonation during the destruct event; testing has shown that the warhead breaks into small, light pieces that have a ground impact kinetic energy of less than the safety criterion of 58 foot-pounds.

LETHAL FRAGMENT WEIGHT AND SIZE

The KV is principally constructed of aluminum, steel, and titanium. A breakdown of the KV by material is presented below.

<u>KV subsystem/component</u>	<u>Material</u>
Controls	
Propellant tank Lines, Thrusters	Steel Titanium
Cooling	
Tank Valve, Lines	Graphite composite Titanium/Steel
Pressurization	
Case Valve, Manifold	Titanium Titanium
Avionics	
Various	Various
Main structure	
Skin	Graphite Polimide
Frames, Support	Aluminum
Bulkhead, Sta. 100	Titanium
Air Duct	to be decided
Window	Sapphire
Forebody	Steel
External insulation	RMSP

Based on the models, and the predominance of steel, titanium, and aluminum, the following fragment weights and lengths were determined:

<u>Material</u>	<u>Weight</u>	<u>Length</u>
Aluminum	0.234 lb (0.11 kg)	1.348 in (3.4 cm)
Steel	0.114 lb (0.05 kg)	0.739 in (1.9 cm)
Titanium	0.156 lb (0.07 kg)	

Fragments with a kinetic energy equal to the safety criterion (58 foot-pounds) were assumed to be cubic in shape.

NUMBER OF LETHAL FRAGMENTS

The number of lethal fragments was determined by: first, assuming that the fragments were divided into three density groups: titanium (283 lb/ft³), aluminum (165 lb/ft³), and those lighter than aluminum (100 lb/ft³). Each component of the KV was then placed in one of these three density groups. A summary of the distribution of these three groups by weight is as follows:

<u>Density Group</u>	<u>Density</u> (lb/ft ³)	<u>Weight</u> lb (kg)	<u>Percent Weight</u>
Titanium	283	129 (59)	20
Aluminum	165	212 (96)	35
Less than Aluminum	100	<u>280 (127)</u>	<u>45</u>
		621 (282)	100

If it is assumed that the KV will break into equal mass fragments, a limit value for the number of fragments can be determined. Mathematically this formula can be stated:

$$N = \frac{WT}{WF}$$

N = the number of fragments

WT = the total weight

WF = the fragment weight

Using the above figures as an example, if the total KV weight is 621 pounds and each aluminum fragment weighs 0.234 pounds, the limit value for the number of aluminum fragments will be:

$$N = \frac{621}{0.234}$$

N = 2,653 pieces of aluminum debris

This calculation is then made for each of the density groups, resulting in the following limit values:

Titanium	-	limit value = 3,980
Aluminum	-	limit value = 2,653
Less than aluminum	-	limit value = 1,899

In addition, MDSSC has generated a model value for each of the models used in this analysis. This model value, when multiplied by the percent of weight for each density group, yields the proportional number of lethal fragments that will be found in the KV (Table G-1).

Although the actual total number of lethal fragments calculated for the KV is shown as 183 in the table, for safety analysis purposes, 190 lethal fragments will be assumed.

In addition to the above calculations, planimetry was used to calculate the debris impact areas. They are as follows:

Sigma 1	=	55,460 acres
Sigma 3	=	119,236 acres
Sigma 3 minus Sigma 1	=	63,776 acres

As well, the percentage of debris pieces that will fall into a given area has been calculated:

Sigma 1	=	68 percent (68% of 190 fragments equals 129)
Sigma 3	=	95 percent (95% of 190 fragments equals 181)
Sigma 3 minus Sigma 1	=	27 percent (27% of 190 fragments equals 51)

Using these planimetered areas and the known number of fragments of lethal debris, the probability (P) of lethal debris falling into any given acre can be determined:

$$P = \frac{\text{percent of total debris pieces}}{\text{number of acres}}$$

TABLE G-1. SUMMARY OF NUMBER OF LETHAL FRAGMENTS

<u>CUMULATIVE NUMBER OF FRAGMENTS GREATER THAN M</u>					
Density Group	Lethal Weight, M (lb)	Percent of Weight	Limit Value (a)	Model Value (a)	Proportional Value (b)
Titanium	0.156	20	3,980	271	54
Aluminum	0.234	35	2,653	189	66
Less than aluminum	0.327	45	1,899	141	<u>63</u>
				TOTAL	183

- (a) Limit value and model value assume all weight (621 pounds) is in the specific density group.
- (b) Model value for density group times percent of weight in density group. Must sum the density groups for total number of fragments.

SIGMA 3

$$P = \frac{95\% \text{ of } 190}{119,236} = 0.002 = 2 \text{ out of } 1,000$$

$$P = 1 \text{ out of } 500 \text{ chances that lethal debris will fall into any given acre}$$

Using the same figures, the probability (P) of lethal debris hitting a bighorn sheep within the debris impact areas can be calculated. (For statistical purposes a bighorn sheep is considered as a 5-square-foot area.)

$$P = \frac{\text{percent of total debris pieces} \times 5 \text{ (sq. feet)}}{43,560 \text{ sq feet in an acre} \times \text{number of acres}}$$

SIGMA 1

$$P = \frac{68\% \times 190 \times 5}{43,560 \times 55,460} = \frac{646}{2,415,837,600} = 0.000000267 = 2.6 \text{ in ten million or}$$

1 in 4 million chances that a sheep would be hit by lethal debris in the Sigma 1 debris impact area.

SIGMA 3

$$P = \frac{95\% \times 190 \times 5}{43,560 \times 119,236} = \frac{903}{5,193,920,160} = 0.000000174 \text{ or } 1.7 \text{ in } 10 \text{ million or}$$

1 chance in 5.8 million that a sheep would be hit by lethal debris in the Sigma 3 impact area.

SIGMA 3 minus SIGMA 1

$$P = \frac{27\% \times 190 \times 5}{43,560 \times 63,776} = \frac{257}{2,778,082,560} = 0.000000093 \text{ or } 9 \text{ in } 100 \text{ million or}$$

1 chance in 11 million that a sheep would be hit by lethal debris in the Sigma 3 area outside of the Sigma 1 area.

Source: McDonnell Douglas Astronautics Corporation, 1988. High Endoatmospheric Defense Interceptor (HEDI) Kinetic Kill Vehicle Integrated Technology Experiment (KITE), Range Safety Data Package (U) CDRL AT12, July.

APPENDIX H
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Albuquerque, NM 87102

Branigan Memorial Library
200 E. Picacho
Las Cruces, NM 88001

Coffee County Lannon
Memorial Public Library
312 North Collins
Tullahoma, TN 37388

Coffee County Manchester Public
Library
1005 Hillsboro Highway
Manchester, TN 37355

El Paso Public Library
501 North Oregon
El Paso, TX 79901

Layton Public Library
155 North Wasatch Drive
Layton, UT 84041

The Lompoc Public Library
501 East North Avenue
Lompoc, CA 93436

Montgomery County
Department of Public Libraries
99 Maryland
Rockville, MD 20850

Ogden Public Library
2464 Jefferson Avenue
Ogden, UT 84401

Penrose Public Library
P.O. Box 1579
20 North Cascade
Colorado Springs, CO 80901

Office of Freely Associated
States Affairs (FAS)
Room 5317
Department of State
22nd & C Street, NW
Washington, DC 20520

U.S. Representative Office
P.O. Box 680
Republic of the Marshall Islands
Majuro, Marshall Islands 96960

Alele Museum/Library
c/o Ministry of the Interior and
Outer Island Affairs
Republic of the Marshall Islands
Majuro, Marshall Islands 96960

Defense Technical Information Center
FDAC Division
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Alexandria, VA 22304-6145

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