AD-A149 881 DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ACQUISITION CHAPTER 4 M-X/M.. (U) HENNINGSON DURHAM AND RICHARDSON SANTA BARBARA CA 02 OCT 81

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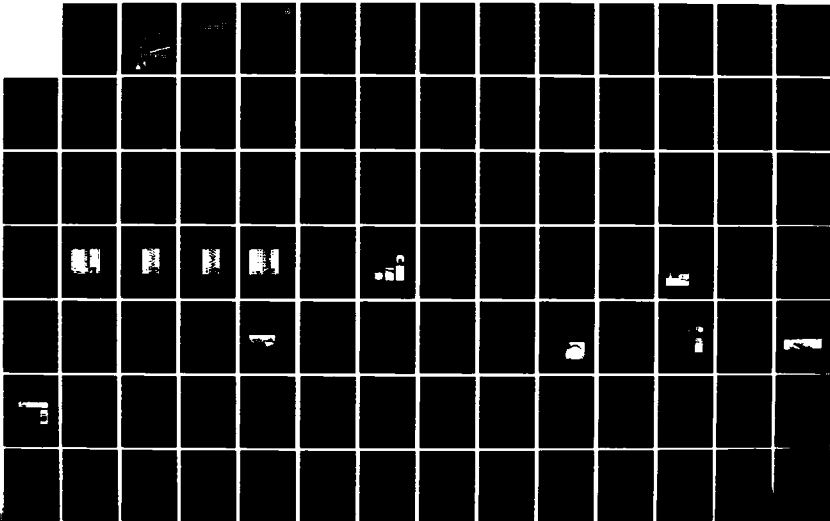

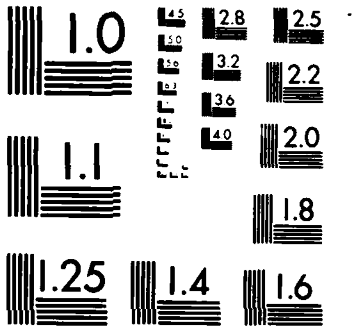

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IV
M-X/MPS
Volume I
Environmental Consequences to the Study Regions and Operating Base Vicinities

PRELIMINARY FEIS

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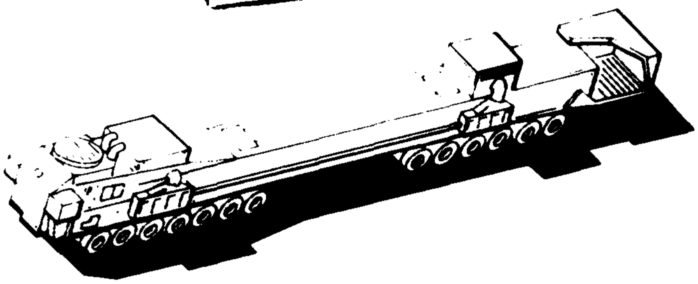

Environmental Impact Analysis Process

DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ ACQUISITION FEIS

DEPARTMENT OF THE AIR FORCE

Chapter 4

Volume I

ENVIRONMENTAL CONSEQUENCES TO THE STUDY REGIONS AND OPERATING BASE VICINITIES

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Prepared for

United States Air Force
Ballistic Missile Office
Norton Air Force Base, California

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2 October 1981

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE ASSISTANT SECRETARY

Federal, State and Local Agencies

On October 2, 1981, the President announced his decision to ~~com-~~ plete production of the M-X missile, but cancelled the M-X Multiple Protective Shelter (MPS) basing system. The Air Force was, at ~~the~~ that time, ~~of these decisions,~~ working to prepare a Final Environmental Impact Statement (FEIS) for the MPS site selection process. This These efforts have been terminated and the Air Force no longer intends to file a FEIS for the MPS system. However, the attached preliminary FEIS captures the environmental data and analysis in the document that was nearing completion when the President decided to deploy the M-X system in a different manner. Areas under consideration were in Utah, Nevada, Texas, and New Mexico. Topics examined in this volume include

The preliminary FEIS and associated technical reports represent an intensive effort at resource planning and development that may be of significant value to state and local agencies involved in future planning efforts in the study area. Therefore, in response to requests for environmental technical data from the Congress, federal agencies and the states involved, we have published limited copies of the document for their use. Other interested parties may obtain copies by contacting:

National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
Telephone: (703) 487-4650

Sincerely,

JAMES F. BOATRIGHT
Deputy Assistant Secretary
of the Air Force (Installations)

1 Attachment
Preliminary FEIS

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Introduction

INTRODUCTION

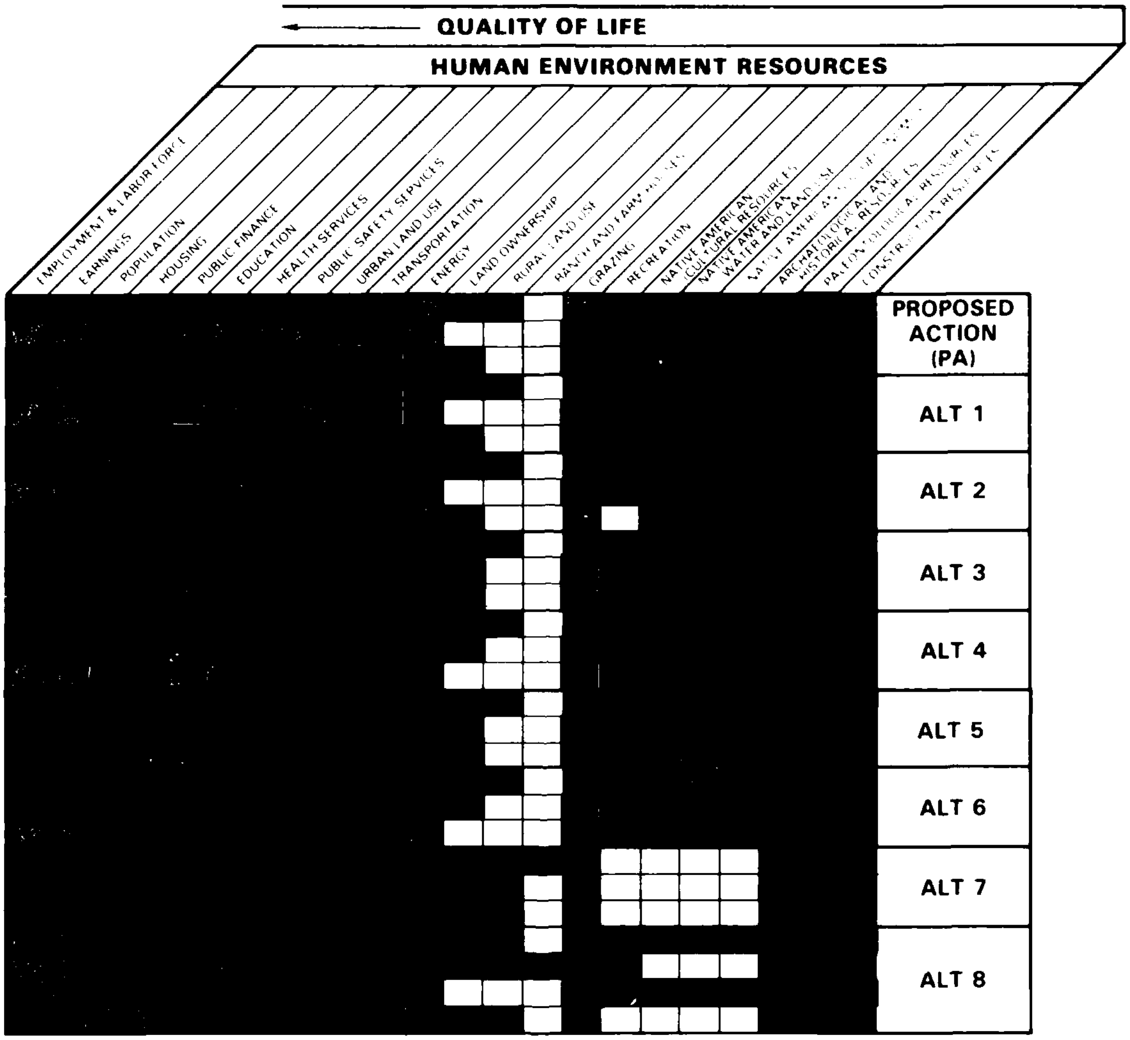
The resources which are analyzed in this chapter were identified on the basis of (a) scoping meetings which the Air Force conducted with state and federal agencies and the public and (b) a professional interdisciplinary review of the ten general environmental issues which had been identified. These general environmental issues were:

- rapid, large-scale growth
- water resources
- air quality
- terrestrial and aquatic biology
- land use and land rights
- public health
- archaeological and historical resources
- energy and nonrenewable resources
- Native Americans
- construction resources

These issues were organized under the three major headings Quality of Life, Natural Environment, and Human Environment which were then subdivided into resources for analysis.

Chapter 4 forms the scientific and analytic basis for the comparison of environmental consequences summarized in Chapter 2. Additional support can be found in the Environmental Technical Reports (ETRs). These reports are not necessary to review and evaluate the EIS but do provide additional supporting detail of concern to specialists in various disciplines. Section 4.2 presents a very brief summary description of the Proposed Action and alternatives (see Chapter 2, Section 2.2 for a more detailed description).

Section 4.3 provides a detailed examination resource-by-resource of the significant resources which are expected to be significantly impacted by the Proposed Action or any of the alternatives. Each discussion includes the following: unavoidable adverse impacts of the project, the relationship between the short-term uses of man's environment and the long-term productivity, cumulative impacts when



NOTE: NUMBERS IN MATRIX REFLECT NET CHANGE (DELTA) IN LEVEL OF SIGNIFICANCE BETWEEN DEIS AND PFEIS. FOR EXAMPLE, IF THE LEVEL OF SIGNIFICANCE IN THE DEIS WAS "LOW" AND WAS CHANGED TO "NO SIGNIFICANCE" IN THE PFEIS, A NUMBER VALUE VALUE OF [illegible] WAS ASSIGNED.

NO SIGNIFICANT IMPACT

SIGNIFICANT IMPACT

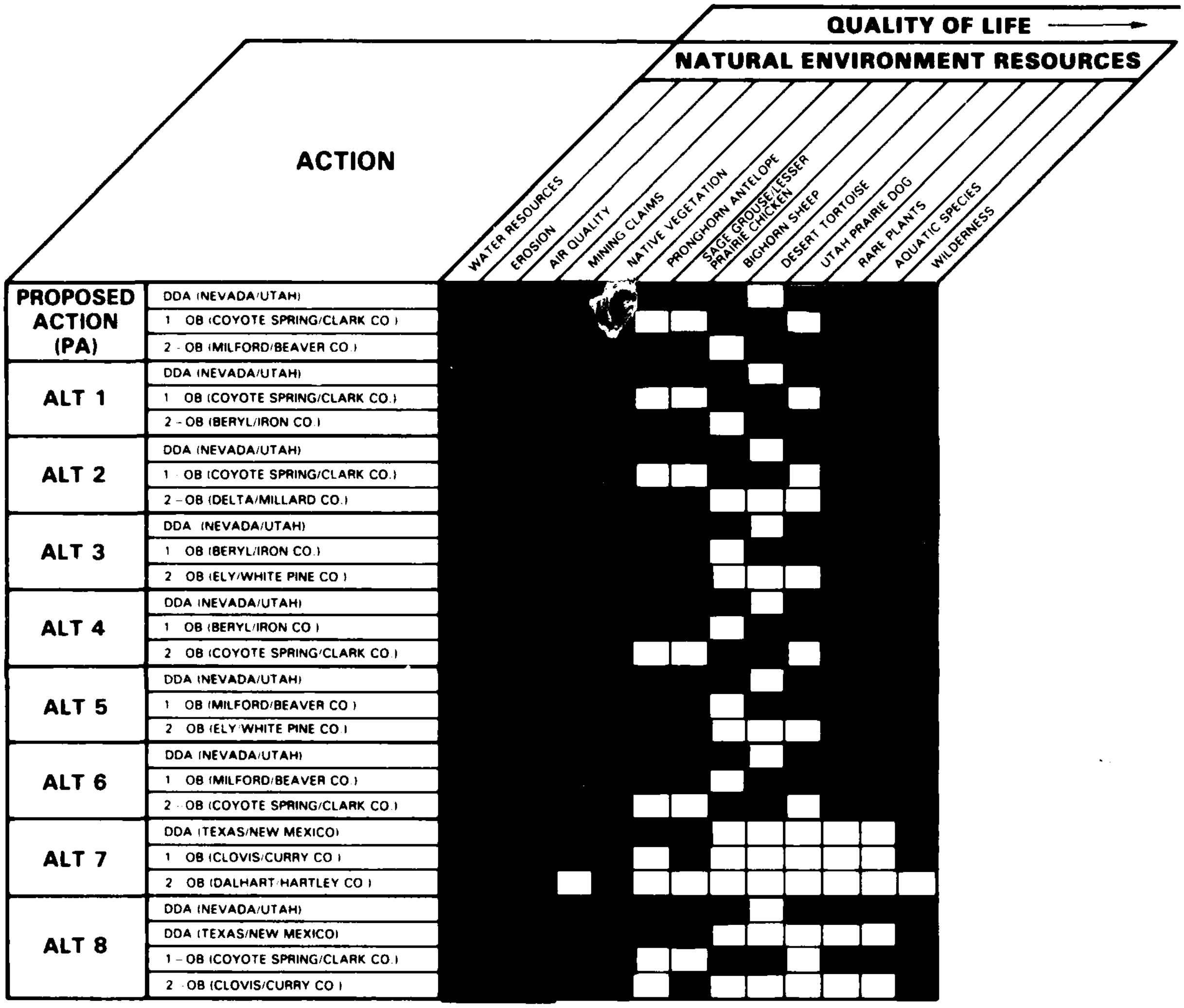
LOW

MODERATE

HIGH

3460-B-3

SUMMARY COMPARISON OF SHORT-TERM RELATIVE IMPACT SIGNIFICANCE BETWEEN THE PROPOSED ACTION AND ALTERNATIVES[1,2]



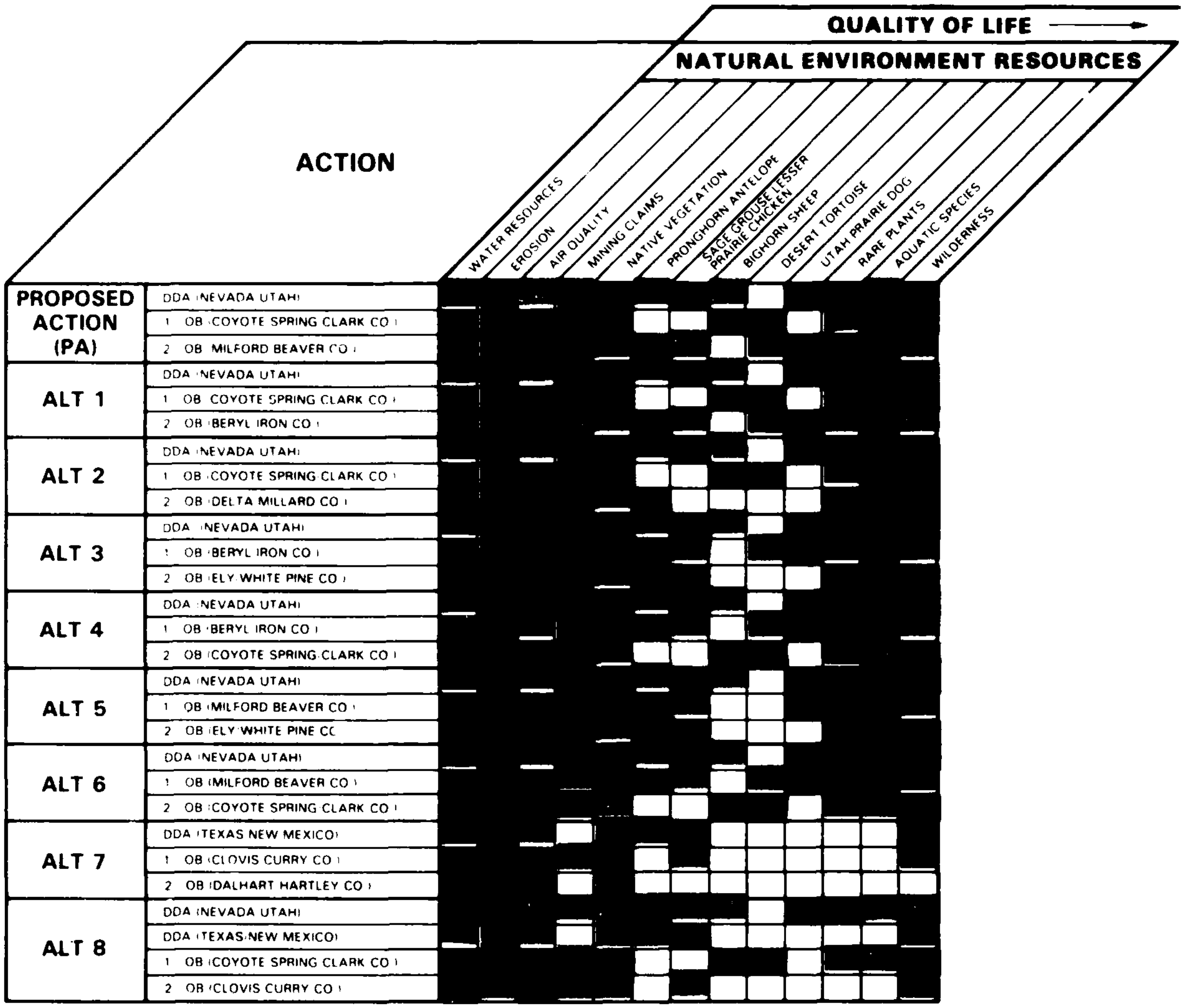
3460-B-3

1 WHILE THERE MAY BE AN OVERALL ESTIMATE OF NO IMPACT OR LOW IMPACT WHEN CONSIDERING THE DDA REGION AS A WHOLE, IT MUST BE RECOGNIZED THAT DURING SHORT TERM CONSTRUCTION ACTIVITIES, SPECIFIC AREAS OR COMMUNITIES WITHIN OR NEAR THE DDA COULD BE SIGNIFICANTLY IMPACTED. THESE LOCAL IMPACTS ARE ANALYZED ON A HYDROLOGICAL SUBUNIT OR COUNTY BASIS IN CHAPTER 4.

2 THE REDUCTION IN DDA SIZE FOR NEVADA/UTAH UNDER ALTERNATIVE 8 DOES NOT NECESSARILY CHANGE THE SIGNIFICANCE OF IMPACT ON A SPECIFIC RESOURCE. MANY IMPACTS OCCUR IN A LIMITED GEOGRAPHIC AREA WHICH IS INCLUDED IN BOTH THE FULL AND SPLIT DEPLOYMENT DDAs, OR ARE SPECIFIC TO THE OB SUITABILITY ZONE.

Figure 4.1-1. Summary comparison of short-term relative impact significance between the Proposed Action and alternatives.

SUMMARY COMPARISON OF LONG-TERM RELATIVE IMPACT SIGNIFICANCE BETWEEN THE PROPOSED ACTION AND ALTERNATIVES[1,2]



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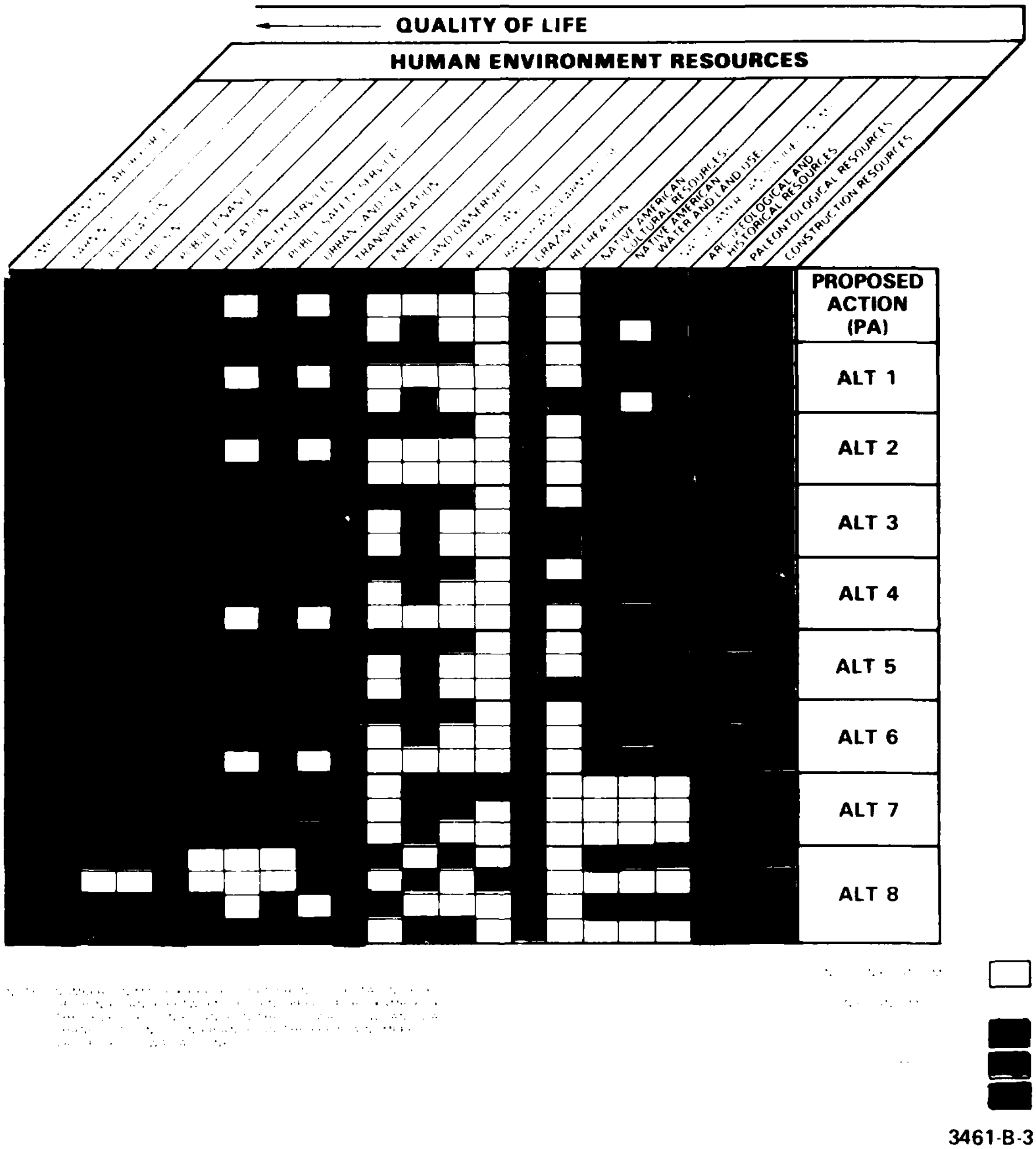


Figure 4.1-2. Summary comparison of long-term relative impact significance between the Proposed Action and alternatives.

other regional projects are considered, and the irreversible or irretrievable commitments of resources. The impact analysis includes direct and indirect impacts, and differentiates between impacts associated with construction and operations phases, and support measures for mitigative adverse impacts. For each resource, the potential for impact is assessed for conceptual layouts of full and split deployment in Nevada/Utah and Texas/New Mexico for DDAs and for OBs.

Analyses of the resources include maps which illustrate the relationsip between project activity and resource distribution for DDA and OB suitability areas and vicinities. Where applicable, tables are also included which summarize resource abundance and signficance of impact by hydrological subunits for the Nevada/Utah DDA and OBs, and by counties for the Texas/New Mexico DDA and OBs.

Section 4.4 adds significant resources from the natural environment and the human environment which were not found to be significantly impacted by the Proposed Action or alternatives. For example, an analysis of the relationship between project activity and the distribution of mule deer, waterfowl, and a variety of small game birds indicated that these resources would not be significantly impacted. Nevertheless, discussions of such analyses and findings are included in Section 4.4.

Figures 4.1-1 and 4.1-2 summarize the relative impact significance for short-term and long-term impacts, respectively. Short-term impacts are those which occur during construction, while long-term impacts are those which occur during the life of the system after construction is finished.

The figures divide the impacts on resources into two basic categories: significant and insignificant impacts. Significant impacts are displayed in color. Insignificant impacts are shown as white. Insignificant impacts are those where either there is no impact at all, or where the impact is minute. Significant impacts are those which are meaningful; those which, for one reason or another, should be drawn to the attention of decisionmakers.

Significance does not mean that all potential impacts are adverse. In many cases there is a mixture of beneficial and adverse impacts. In mining, for example, the long-term impact is expected on balance to be beneficial. Mining is therefore color-coded to alert decisionmakers to the significance of the impacts upon that resource. The text of the summary discussions following the figures must be consulted to determine the meaning of the significance flagged on the charts.

To aid the comparative evaluation of alternatives, significant impacts were further divided into three color-coded groups: low, moderate, and high. the subdivision provides a rough, visual ranking within each resource category. The criteria to separate two levels of significance vary by resource category, depending in part upon the range of impacts upon that resource. Levels of significance cannot be compared across resource categories. Within a resource category, however, relative levels of significance may be compared among alternatives. Ultimately, the importance of each resource must be determined by the decisionmakers. The Air Force has made no attempt to identify certain resources as more important than others. To do so would invade the prerogatives of the decisionmakers.

Description of Proposed Action and Alternatives

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section summarizes the description of the Proposed Action and alternatives presented in subsection 2.2 of Chapter 2. Additional details regarding the size, location, and timing of construction are presented in subsection 2.2. This abbreviated description is included so that readers of Chapter 4 will have rapid access to important project elements while reading the discussions of potential environmental impacts presented in subsections 4.3 and 4.4. Discussion of the No Action Alternative, presented in sections 2.2.6 and 2.13, identifies trends within deployment areas and evaluates the regional environmental ramifications of a no-deployment decision at this time.

The Proposed Action is full deployment (200 missiles) in Nevada/Utah, with the first OB in Coyote Spring Valley, Nevada and the second near Milford, Utah. Alternatives 1 through 6 use the same DDA layout and the alternate OB locations of Beryl and Delta, Utah and Ely, Nevada. Alternative 7, full deployment in Texas/New Mexico, has OBs near Clovis, New Mexico and Dalhart, Texas. Alternative 8 splits the system, with 100 missiles in Nevada/Utah and 100 missiles in Texas/New Mexico, and with a first OB at Coyote Spring Valley and a second OB near Clovis. The alternatives to the Proposed Action are numbered to facilitate discussion of them. Their numerical order is not hierarchical and does not indicate preference.

Table 4.2-1 shows the OB locations and components for the Proposed Action and alternatives. Table 4.2-2 shows the distribution of protective shelters by state and county for the Proposed Action and the alternatives. Tables 4.2-3 through 4.2-5 list the land requirements for facilities, roads, and temporary construction facilities, respectively. Table 4.2-6 is a summary of the M-X system land requirements. For full deployment, the total fenced area is about 33 sq mi. For split deployment, the total fenced area is about 37 sq mi.

The estimated construction resources for the Proposed Action and Alternatives 1, 2, 4, and 6 are shown in Table 4.2-7. Table 4.2-8 shows the estimated construction resources for Alternatives 3 and 5. These two tables provide the construction resource requirements for all the alternatives using full deployment in

Table 4.2-1. OB complex locations and components for Proposed Action and alternatives.

Alternative	First OB Complex		Second OB Complex	
	Location	System Components	Location	System Components
Proposed Action	Coyote Spring Valley, Nevada	OB, DAA, OBTS, Airfield	Milford, Utah	OB, Airfield
1	Coyote Spring Valley, Nevada	OB, DAA, OBTS, Airfield	Beryl, Utah	OB, Airfield
2	Coyote Spring Valley, Nevada	OB, DAA, OBTS, Airfield	Delta, Utah	OB, Airfield
3	Beryl, Utah	OB, DAA, OBTS, Airfield	Ely, Nevada	OB, Airfield
4	Beryl, Utah	OB, DAA, OBTS, Airfield	Coyote Spring Valley, Nevada	OB, Airfield
5	Milford, Utah	OB, DAA, OBTS, Airfield	Ely, Nevada	OB, Airfield
6	Milford, Utah	OB, DAA, OBTS, Airfield	Coyote Spring Valley, Nevada	OB, Airfield
7	Clovis, New Mexico	OB, DAA, OBTS, Airfield	Dalhart, Texas	OB, Airfield
8	Coyote Spring Valley, Nevada	OB, DAA, OBTS, Airfield	Clovis, New Mexico	OB, DAA, Airfield
No Action	-	-	-	-

T3601/9-13-81/F

Source: Department of the Air Force and HDR Sciences, 1980

Table 4.2-2. Distribution of protective shelters by state and county for Proposed Action (PA) and Alternatives.

State/County	Alternative PA, 1-6	7	8
Nevada			
Esmeralda	138	--	--
Eureka	323	--	--
Lander	84	--	--
Lincoln	953	--	920
Nye	1,324	--	629
White Pine	437	--	36
Subtotal	3,259	--	1,585
Utah			
Beaver	189	--	188
Juab	314	--	17
Millard	754	--	510
Tooele	84	--	--
Subtotal	1,341	--	715
Region Total	4,600	--	2,300
Texas			
Bailey	--	126	14
Castro	--	137	--
Cochran	--	61	51
Dallam	--	690	190
Deaf Smith	--	574	242
Hartley	--	354	250
Hockley	--	16	14
Lamb	--	42	9
Oldham	--	74	41
Parmer	--	246	1
Randall	--	55	--
Sherman	--	39	--
Swisher	--	26	--
Subtotal	--	2,440	812
New Mexico			
Chaves	--	481	474
Curry	--	196	43
DeBaca	--	137	115
Guadalupe	--	6	6
Harding	--	215	202
Lea	--	16	16
Quay	--	342	312
Roosevelt	--	542	165
Union	--	225	155
Subtotal	--	2,160	1,488
Region Total	--	4,600	2,300
Total	4,600	4,600	4,600

T2604/9-13-81/F

Source: HDR Sciences, 1981.

Table 4.2-3. Land requirements for fa[illegible]ties.

Facility	Number	Construction Phase Each (Acres)	Construction Phase Total (Acres)	Operations Phase Fenced Each (Acres)	Operations Phase Nonfenced (Acres)	Operations Phase Total (Acres)
Bases						
First Operating Base (OB)[1]	1	6,140	6,140	3,740	2,400	6,140
Second Operating Base (OB)[1]	1	4,240	4,240	2,740	1,500	4,240
Operational Base Test Site/Training Site (OBTS)[2]	1	250	250	30[8]	60	90
Designated Assembly Area (DAA)[3]	1	1,950	1,950	1,950	-	1,950
DDA						
Shelters	4,600	10	46,000	2.5	-	11,500
Cluster Maintenance Facilities (CMFs)	200	5.2	1,040	4.0	-	800[6]
Antennae	4,600	0.185	850	-	850	850
Area Support Centers (ASCs)	3-5	55	165-275	20	35	165-275
Remote Surveillance Sites (RSSs)[5]	200	0.35	70	0.25	-	50
Total			59,855-63,815			24,935-25,045[4,6]

T2690/10-2-81/b

[1] Includes runway and clear zones.

[2] Located near first OB.

[3] Co-located at first OB; for split deployment there would be 2 DAAs (1 at each OB).

[4] For Proposed Action, which analyzes four ASCs, the total fenced land is 20,890 acres; total non-fenced land is 4,150.

[5] There is a study presently underway that could revise the need for RSSs, thereby reducing the land requirements. Alternatives to the RSSs would be placed in areas already required for operations.

[6] Total does not include area required for power distribution centers (up to 50 acres).

[7] RSSs no longer required. Still included in analysis.

[8] Does not include temporary withdrawal to 1 mi around two shelters (see Sec. 1.2.3.9).

Source: Department of the Air Force and HDR Sciences, 1981.

Table 4.2-4. Land requirements for roads.[5]

Description	Length (Miles)	Area Required During Construction[4] (Acres)	Permanently Required Right-of-Way (Acres)
Designated Transportation Network (DTN)[1]	1,260-1,460	15,300-17,700	11,500-13,300
Cluster Roads[2]	5,940-6,200	72,000-75,200	54,000-56,400
Support Roads[3]	1,320	8,000	8,000
Total	8,520-8,980	95,300-100,900	73,500-77,700

T2601/10-2-81(b)

[1] DTN is 24 ft wide with 5 ft shoulders, 100 ft construction right-of-way, 75 ft permanent right-of-way.

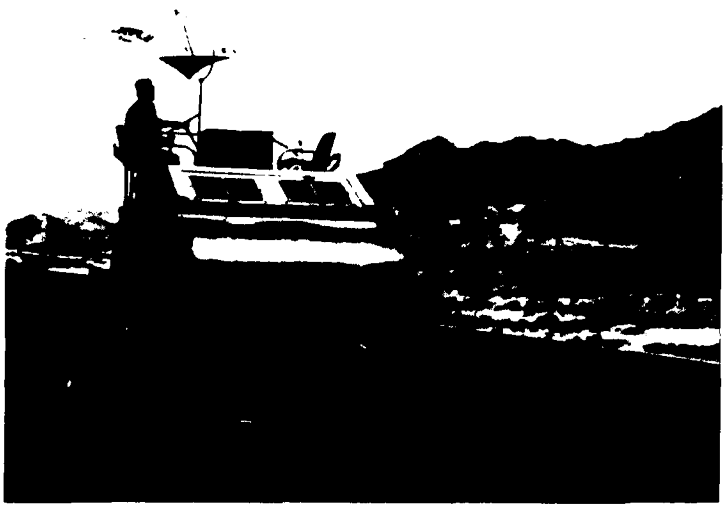
[2] Cluster roads are 21 or 27 ft wide with 5 ft shoulders, 100 ft construction right-of-way, 75 ft permanent right-of-way.

[3] Support roads are 10 or 20 ft wide with 5 ft shoulders, 50 ft construction and permanent rights-of-way.

[4] Same as disturbed area.

[5] This provides a range for all deployment alternatives. If the direct-connect roads concept is used, the land requirements would be less than shown.

Source: Department of the Air Force and HDR Sciences calculation, 1981.



Asphalt and prime cost materials will be used for the 24-ft wide DTN road. The DTN will be open to the public with limited delays during infrequent missile transport.

Table 4.2-5. Land requirements for temporary construction facilities.[1,4]

Description	Number or Length in Miles	Unit Area	Total Area (Acres)
Construction Camps	16-20	25 acres/each	400-500
Precast Concrete Plants	16-20	10 acres/each	160-200
Material Source Points[2]	100-125	10 acres/each	1,000-1,250
Water Wells	150-310	1 acre/each	150-310
Marshalling Yards	3-5	650 acres/each	1,950-3,250
Construction Roads[3]	250-350	3.6 acres/mile	900-1,300
Total			4,560-6,810

T2599/9-13-81/F

[1]This provides a range for all deployment alternatives.

[2]Includes plants and quarries.

[3]Roads to material sources, 30 ft roadway, including shoulders.

[4]See Appendix F of ETR-31 for information on latest design.

Source: HDR Sciences, 1981.

Table 4.2-6. Summary of M-X system land requirements[3]

Description	Number or Length in Miles	Construction Phase (Acres)	Operations Phase (Acres) Fenced[1]	Operations Phase (Acres) Total
Permanent Facilities				
OB Complexes				
First OB	1	6,140	3,740	6,140
Second OB	1	4,240-6,140[2]	2,740-3,740[2]	4,240-6,140[2]
OBTS	1	250	30	90
DAA	1-2[2]	1,950-3,900[2]	1,950-3,900[2]	1,950-3,900[2]
Subtotal		12,580-16,430[2]	8,460-11,410[2]	12,420-16,270[2]
DDA				
Shelters	4,600	46,000	11,500	11,500
CMFs	200	1,040	800	800
Antennae	4,600	850	N/A	850
ASCs	3-5	165-275	60-100	165-275
RSSs	200	70	50	50
DTN	1,260-1,460	15,300-17,700	N/A	11,500-13,300
Cluster Roads	5,940-6,200	72,000-75,200	N/A	54,000-56,400
Support Roads	1,320	8,000	N/A	8,000
Subtotal		143,425-149,135	12,410-12,450	86,865-91,175
Total Permanent Facilities		156,005-165,565	20,870-23,860	99,285-107,445
Temporary Facilities[4]				
Construction Camps	16-20	400-500	N/A	N/A
Precast Concrete Plants	16-20	160-200	N/A	N/A
Material Source Points	100-125	1,000-1,250	N/A	N/A
Water Wells	150-310	150-310	N/A	N/A
Marshalling Yards	3-5	1,950-3,250	N/A	N/A
Construction Roads	250-350	900-1,300	N/A	N/A
Total Temporary Facilities		4,560-6,810		
Grand Total		160,565-172,375	20,870-23,860	99,285-107,445

T3666/9-20-81/F

Notes: Not applicable = N/A
There is a study presently underway that could revise the need for RSSs, thereby reducing the land requirements. Alternatives to the RSSs would be placed in areas already required for operations.

[1] 20,870 acres = 32.6 sq mi (Proposed Action and Alternatives 1 through 7).

[2] High end of range reflects split deployment (Alternative 8).

[3] This provides a range for all deployment alternatives.

[4] See Appendix F of ETR-31 for information on latest design.

Source: Department of the Air Force and HDR Sciences, 1981.

Table 4.2-7. Total construction resources for DDA and OB facilities for Proposed Action and Alternatives 1, 2, 4, and 6, full deployment, Nevada/Utah, 1982-1989 (Page 1 of 2).

Construction Resources	Quantity per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Water (acre-ft)[1]								
Incremental	1,898	15,424	31,357	29,167	35,610	28,446	15,044	5,781
Cumulative	1,898	17,322	48,679	77,846	113,456	141,902	156,946	162,727
Disturbed Area (acres)[2]								
Incremental	1,986	13,652	27,364	29,713	35,383	28,839	17,319	7,331
Cumulative	1,986	15,638	43,002	72,715	108,098	136,937	154,256	161,587
Steel (tons)								
Incremental	377	796	2,137	80,755	87,590	81,681	91,527	51,328
Cumulative	377	1,173	3,310	84,065	171,655	253,336	344,863	396,191
Concrete (cu yd*1,000)								
Incremental	78	166	176	837	846	760	710	376
Cumulative	78	244	420	1,257	2,103	2,863	3,573	3,949
Asphalt (tons*1,000)								
Incremental	503	2,229	1,351	1,734	1,568	532	44	
Cumulative	503	2,732	4,083	5,817	7,385	7,917	7,961	

T3315/9-13-81/F

Table 4.2-7. Total construction resources for DDA and OB facilities for Proposed Action and Alternatives 1, 2, 4, and 6, full deployment, Nevada/Utah, 1982-1989 (Page 2 of 2).

Construction Resources	Quantity per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Aggregate (cu yd*1,000)								
Incremental	623	5,911	12,851	7,987	10,479	7,940	1,953	
Cumulative	623	6,534	19,385	27,372	37,851	45,791	47,744	
Prime Coat (tons)								
Incremental	2,269	9,057	5,850	7,731	6,885	2,859	384	
Cumulative	2,269	11,326	17,176	24,907	31,792	34,651	35,035	
Fencing (lin ft*1,000)								
Incremental	8	17	38	1,291	1,399	1,303	1,457	816
Cumulative	8	25	63	1,354	2,753	4,056	5,513	6,329

T3315/9-13-81/F

[1]Does not include A&CO or operations domestic uses.

[2]Does not include temporary disturbances.

Source: Department of the Air Force and HDR Sciences, 1981.

Table 4.2-8. Total construction resources for DDA and OB facilities for Alternatives 3 and 5, full deployment, Nevada/Utah, 1982-1989 (Page 1 of 2).

Construction Resources	Quantity per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Water (acre-ft)[1]								
Incremental	3,040	17,731	33,090	33,109	40,214	20,016	10,660	4,873
Cumulative	3,040	20,771	53,861	86,970	127,184	147,200	157,860	162,733
Disturbed Area (acres)[2]								
Incremental	2,886	15,664	28,847	33,163	39,389	21,850	13,580	6,208
Cumulative	2,886	18,550	47,397	80,560	119,949	141,799	155,379	161,587
Steel (tons)								
Incremental	377	796	6,353	82,878	87,430	83,172	91,700	43,485
Cumulative	377	1,173	7,526	90,404	177,834	261,006	352,706	396,191
Concrete (cu yd*1,000)								
Incremental	78	166	207	852	844	771	712	319
Cumulative	78	244	451	1,303	2,147	2,918	3,630	3,949
Asphalt (tons*1,000)								
Incremental	825	1,990	2,287	1,742	889	182	44	
Cumulative	825	2,815	5,102	6,844	7,733	7,915	7,959	

T5103/9-13-81/F

Table 4.2-8. Total construction resources for DDA and OB facilities for Alternatives 3 and 5, full deployment, Nevada/Utah, 1982-1989 (Page 2 of 2).

Construction Resources	Quantity per Year 1982	1983	1984	1985	1986	1987	1988	1989
Aggregate (cu yd*1,000)								
Incremental	1,031	6,959	13,162	9,551	12,621	4,352	69	
Cumulative	1,031	7,990	21,152	30,703	43,324	47,676	47,745	
Prime Coat (tons)								
Incremental	3,448	8,184	9,275	7,760	4,405	1,579	384	
Cumulative	3,448	11,632	20,907	28,667	33,072	34,651	35,035	
Fencing (lin ft*1,000)								
Incremental	8	17	105	1,325	1,397	1,327	1,459	692
Cumulative	8	25	130	1,455	2,852	4,179	5,638	6,330

T5103/9-13-81/F

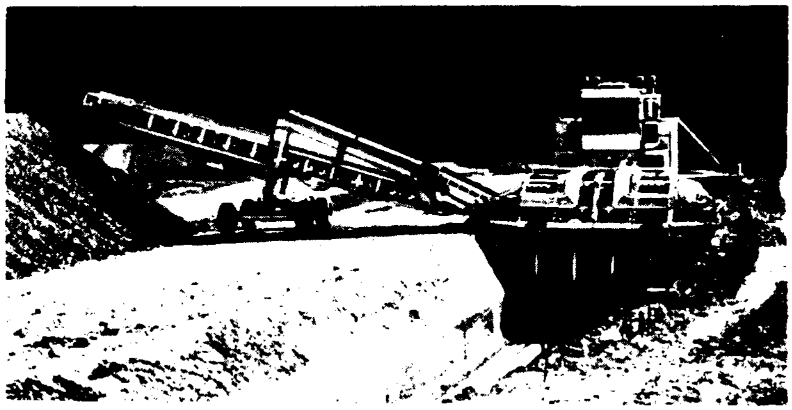
[1]Does not include A&CO or operations domestic uses.

[2]Does not include temporary disturbances.

Source: Department of the Air Force and HDR Sciences, 1981.

Nevada/Utah. The estimated construction resources for Alternative 7, full deployment in Texas/New Mexico, are included in Table 4.2-9. The corresponding estimates for split deployment, Alternative 8, are presented for Nevada/Utah in Table 4.2-10 and for Texas/New Mexico in Table 4.2-11. These project elements and construction resource requirements have been compared with the description of the deployment regions presented in Chapter 3 to produce the potential impacts presented in Chapter 4.

In these construction resources tables for each alternative, incremental and cumulative quantities are shown for each resource. Water quantities include both domestic, except for A&CO and operations, and construction uses. The disturbed area includes permanent facilities only. Steel quantities include shelter and building construction, as do the concrete quantities. Asphalt and prime coat are for DTN construction. Quantities for aggregate include only road construction. Fencing includes all fenced operations areas. Table 4.2-12 gives the total major construction resources required for the deployment alternatives. In this table, quantities of some resources have been converted from how they are shown in Tables 4.2-7 through 4.2-11 to their components. For example, concrete has been converted to cement, aggregate, and fly ash quantities. Asphalt has been converted to aggregate and asphaltic oil quantities. Additional information on water, cement, and steel may be found in ETRs 12, 25, and 26, respectively.



The Air Force has tested labor saving excavation equipment. Similar equipment could be used for shelter excavation.

Table 4.2-9. Total construction resources requirements for DDA and OB facilities for Alternative 7, full deployment, Texas/New Mexico, 1982-1989.

Construction Resources	Quantity Per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Water (acre-ft)[1]								
Incremental	3,924	16,010	32,901	26,359	37,764	21,333	12,701	4,824
Cumulative	3,924	19,934	52,835	79,194	116,958	138,291	150,992	155,816
Disturbed Area (acres)[2]								
Incremental	3,586	14,088	28,925	26,429	38,183	23,501	15,158	6,134
Cumulative	3,586	17,674	46,599	73,028	111,211	134,712	149,870	156,004
Steel (tons)								
Incremental	381	754	4,750	63,009	102,269	94,078	87,985	42,964
Cumulative	381	1,135	5,885	68,894	171,163	265,241	353,226	396,190
Concrete (thousands of cu yd)								
Incremental	79	157	196	710	955	853	685	315
Cumulative	79	236	432	1,142	2,097	2,950	3,635	3,950
Asphalt (thousands of tons)								
Incremental	1,112	2,228	961	1,492	810	395	45	0
Cumulative	1,112	3,340	4,301	5,793	6,603	6,998	7,043	7,043
Aggregate (thousands of cu yd)								
Incremental	1,340	6,165	13,499	7,636	10,932	4,368	1,144	0
Cumulative	1,340	7,505	21,004	28,640	39,572	43,940	45,084	45,084
Prime Coat (tons)								
Incremental	4,503	9,008	4,435	6,858	4,128	2,366	388	0
Cumulative	4,503	13,511	17,946	24,804	28,932	31,298	31,686	31,686
Fencing (thousands of ft)								
Incremental	8	16	80	1,010	1,632	1,501	1,400	683
Cumulative	8	24	104	1,114	2,746	4,247	5,647	6,330

T3316/10-2-81/F(a)

[1]Does not include A&CO or operations domestic uses.

[2]Does not include temporary disturbances.

Source: Department of the Air Force and HDR Sciences calculation.

Table 4.2-10. Total construction resources for DDA and OB facilities for portion of Alternative 8, split deployment, Nevada/Utah, 1982-1989 (Page 1 of 2).

Construction Resources	Quantity Per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Water (acre-ft)[1]								
Incremental	1,848	8,196	17,126	23,958	7,914	15,695	4,840	2,245
Cumulative	1,848	10,044	27,170	51,128	59,042	74,737	79,577	81,822
Disturbed Area (acres)[2]								
Incremental	2,051	7,987	15,449	23,310	9,261	15,975	6,073	2,853
Cumulative	2,051	10,038	25,487	48,797	58,058	74,033	80,106	82,959
Steel (tons)								
Incremental	369	779	3,322	40,615	45,264	45,940	42,485	19,996
Cumulative	369	1,148	4,470	45,085	90,349	136,289	178,774	198,770
Concrete (cu yd*1,000)								
Incremental	63	133	144	412	400	383	312	[illegible]
Cumulative	63	196	340	752	1,152	1,535	1,847	[illegible]
Asphalt (tons*1,000)								
Incremental	495	1,001	1,592	125	740	50		
Cumulative	495	1,496	3,088	3,213	3,953	4,003		

T3318/9-13-81/F

Table 4.2-10. Total construction resources for DDA and OB facilities for portion of Alternative 8, split deployment, Nevada/Utah, 1982-1989 (Page 2 of 2).

Construction Resources	Quantity Per Year 1982	1983	1984	1985	1986	1987	1988	1989
Aggregate (cu yd*1,000)								
Incremental	612	3,138	6,674	8,174	905	4,447		
Cumulative	612	3,750	10,424	18,598	19,503	23,950		
Prime Coat (tons)								
Incremental	2,140	4,360	6,481	1,083	3,079	435		
Cumulative	2,140	6,500	12,981	14,064	17,143	17,578		
Fencing (lin ft*1,000)								
Incremental	8	16	56	649	722	732	677	318
Cumulative	8	24	80	729	1,451	2,183	2,860	3,178

T3318/9-13-81/F

[1]Does not include A&CO or operations domestic uses.

[2]Does not include temporary disturbances.

Source: Department of the Air Force and HDR Sciences, 1981.

Table 4.2-11. Total construction resources for DDA and OB facilities for portion of Alternative 8, split deployment, Texas/New Mexico, 1982-1989 (Page 1 of 2).

Construction Resources	Quantity Per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Water (acre-ft)[1]								
Incremental	5,147	18,677	8,810	24,301	9,676	8,231	3,282	357
Cumulative	5,147	23,824	32,634	56,935	66,611	74,842	78,124	78,481
Disturbed Area (acres)[2]								
Incremental	4,651	17,027	9,556	24,065	10,884	9,657	3,926	282
Cumulative	4,651	21,678	31,234	55,299	66,183	75,840	79,766	80,048
Steel (tons)								
Incremental	338	669	23,660	50,591	44,790	48,914	27,465	2,023
Cumulative	338	1,007	24,667	75,258	120,048	168,962	196,427	198,450
Concrete (cu yd*1,000)								
Incremental	64	127	296	488	398	406	202	14
Cumulative	64	191	487	975	1,373	1,779	1,981	1,995
Asphalt (tons*1,000)								
Incremental	1,497	313	1,075	523	144	51		
Cumulative	1,497	1,810	2,885	3,408	3,552	3,603		

T3324/9-13-81/F

Table 4.2-11. Total construction resources for DDA and OB facilities for portion of Alternative 8, split deployment, Texas/New Mexico, 1982-1989 (Page 2 of 2).

Construction Resources	Quantity Per Year							
	1982	1983	1984	1985	1986	1987	1988	1989
Aggregate (cu yd*1,000)								
Incremental	1,788	7,856	2,320	7,804	1,820	1,092		
Cumulative	1,788	9,644	11,964	19,768	21,588	22,680		
Prime Coat (tons)								
Incremental	5,811	1,811	4,600	2,546	907	442		
Cumulative	5,811	7,622	12,222	14,768	15,675	16,117		
Fencing (lin ft*1,000)								
Incremental	7	14	380	809	714	779	437	32
Cumulative	7	21	401	1,210	1,924	2,703	3,140	3,172

T3324/9-13-81/F

[1]Does not include A&CO or operations domestic uses.

[2]Does not include temporary disturbances.

Source: Department of the Air Force and HDR Sciences, 1981.

The protective shelter will be constructed of reinforced concrete and will be similar in size to this test structure. Soil stabilization and revegetation will reduce surface erosion around the shelter.

Table 4.2-12. Construction resources requirements by alternative.[1]

Construction Resource	Alternative P.A., 1-6	Alternative 7	Alternative 8
Disturbed Area[3] (thousands of acres)	160-177	153-169	161-178
Water (thousands of acre-ft)	86-186[2]	56-175[2]	71-184[2]
Aggregate[3] (thousands of cu yd)	49,031-59,927	46,242-56,518	47,900-58,544
Steel[3] (thousands of tons)	376-416	376-416	377-417
Cement[3] (thousands of tons)	1,446-1,598	1,446-1,598	1,459-1,613
Fly Ash[3] (thousands of tons)	307-339	307-339	324-358
Lumber[3] (thousands of board-ft)	40,733-45,021	40,300-44,542	51,264-56,660
Asphaltic Oil[3] (thousands of tons)	461-564	409-500	441-539
POL[4] (millions of gal)	459-561	334-408	354-432
Electrical Energy (thousands of MMw-hr)	3,226-3,942	2,322-2,838	3,171-3,875

T3173/10-2-81/F(a)

[1] Ranges of resources allow for possible design changes and/or construction overruns.

[2] Low number is with no revegetation; high number is with revegetation requiring 9 in. of water on 100,000 acres.

[3] Does not include temporary facilities.

[4] POL = petroleum, oil, and lubricant.

Source: HDR Sciences calculation.

Comparative Analysis of Environmental Consequences




COMPARATIVE ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

Environmental consequences can be broadly defined as project-induced changes in the state of the natural and human environments which, in turn, cause changes in the perceived quality of life. To compare the Proposed Action with the various alternatives and satisfy the requirements of the environmental analysis process, these changes, both direct and indirect, must be described in qualitative or quantitative, spatial, and temporal terms or as intensity, location, and time of occurrence for each of the selected resources. This was accomplished by an interdisciplinary and systematic process, which analyzed the Proposed Action, alternatives, and siting regions and then developed and analyzed their environmental consequences.

The main elements of the environmental consequence comparison, i.e., potentially impacted resources and alternative locations, were determined as described in Sections 1.10.3 and 2.2. This information, together with a generalized construction scenario, was used in engineering analyses which developed construction plans, construction resource requirements, disturbed areas, and other direct effects of the Proposed Action and alternatives as described in Section 2.2 and ETR-31. All of this information was prepared in spatial and temporal contexts; spatial in that it was presented on maps, and temporal in that the construction camps, personnel, and system facilities were phased over time. On a broader scale, short-term effects are those caused by construction which takes place in any one specific area over about a three-year period, while the long-term effects are those of operation over a thirty-year period.

The environment of the siting regions, the project direct effects, and the construction estimates were used with computer models to produce the county and community population projections reported in ETR-37. The total population changes (direct and induced) distributed in time and location constitute a major first generation indirect effect which, in turn, is the source of the second and third generation effects on the resources of interest.

The environmental consequences on the natural environment were analyzed considering direct effects such as disturbed area, first generation induced effects such as population growth, and second gneration induced effects such as increased utilities. An example is air quality, for which such factors as dust generated by construction activities and traffic caused by direct and induced population growth must be considered.

Some of the second generation human environment effects are those on public finance and land use reported in Section 4.3.3.5 and 4.3.3.7, backed up by ETR-29 and ETR-36. Another important set of second generation human environment effects caused by population changes are those on utilities, for example, energy, water supply, wastewater treatment, roads, and so on. In general, these utilities cause third generation effects on basic natural environmental resources such as land, water, and air.

The results of this analysis of the environmental consequences of the Proposed Action and alternatives on natural and human resources are reported in Sections 4.3.2 and 4.3.3. An assessment of the consequences on the quality of life resulting from the totality of these impacts on natural and human resources is given in Section 4.3.1. Other impacts of importance in the analytical process but not among those selected to represent the issues are discussed in Section 4.4.

Short-term effects for specific valleys are those which take place in any one area over a three-year period. Long-term effects are those of operation over a thirty-year period. Both direct and indirect impacts stimulated by economic and population growth are compared for the Proposed Action and each alternative.

Quality of Life

QUALITY OF LIFE

INTRODUCTION (4.3.1.1)

This section addresses potential quality of life impacts which could occur should the M-X missile system be deployed in Nevada and Utah, or Texas and New Mexico. The concept of quality of life is defined and discussed, and potential impacts are presented. A cross section of public comments concerning quality of life impacts is also included. Potential mitigations are presented, and relative, county-level impacts of the various alternatives are shown. A basic assumption underlying quality of life impacts is that such impacts are primarily generated by rapid population growth. Beyond the complex effects of rapid population growth are the impacts created by the scale of the M-X deployment itself, especially by large demand on the region's land, capital, labor, and management. Such demands will greatly accelerate many processes currently at work in the Tier 1 Siting Area, such as the concentration and shift from family ownership of ranching, farming, mining, and small business. While such effects can be seen in economic terms, they are at the personal level quality of life issues related to job satisfaction, security, social structure, and personal trust.

In addition to the M-X missile system, there are several major nonmilitary projects scheduled for development in the southwestern United States. Work on these projects would coincide with M-X construction. Each project would generate impacts in areas which could also be impacted by the M-X system. Therefore, the cumulative effects on quality of life of all these projects are discussed here, in addition to the effects that the M-X system would generate by itself.

In recent years quality of life has been looked upon as an umbrella concept to describe personal satisfactions and concerns with the total setting in which we live (Liu, 1975). The concept of quality of life is very broad, and encompasses physical, ecological, economic, political, and social elements, all of which are continually changing as a result of natural processes and human actions. For most communities change occurs in a slow, intermittent, yet continued fashion, thereby gradually changing the quality of life. In contrast, changes resulting from M-X deployment would, in many instances, be significant and swift. Many Operating Base (OB) and

Designated Deployment Area (DDA) counties would have a period of rapid, large-scale in-migration triggered directly by OB and DDA facility construction and indirectly by ancillary employment requirements. In DAA counties, this would be followed by an equally abrupt population out-migration. A less marked out-migration would occur in the OB counties (Figures 4.3.1-1 to 4.3.1-3). This "boom-bust cycle" (with the "boom" referring to the period during construction when the construction work force and related population builds up to a peak, and the "bust" referring to the later phases of construction when the construction work force and related population begin to decrease, leaving the area) resulting from the M-X project construction could have profound quality of life consequences for many who live in the affected counties. Two related factors, the rate of growth and the enlarged size of community population, come to bear. Change in the population size has direct implications for changes in physical, ecological, economic, political, and social elements. Examples include:

- A larger population generates more traffic, which in turn produces more congestion and air pollutants.

- More people consume more water, which may reduce local groundwater supplies on which native vegetation and indigenous wildlife depend.

- School systems, public services, and government operations could have to expand their facilites and administrations, add new programs, and possibly new regulations to handle large-scale demands and emerging problems.

- An increase in population would result in greater use of existing outdoor recreational facilities, which could lead to overcrowding and the reduction in solitude that these sites may have afforded in the past.

- Paleontological, archaeological, and historical resources may also be disturbed by the intrusion of greater number of individuals and by construction.

All of these human and natural resources make up the regional and local environment from which the local population establishes levels of satisfaction in both the social and physical context that constitutes their existing quality of life. Consequently, changes in the human and natural environment have implications for the extent to which the local environment continues to provide levels of satisfaction for both the local and newcomer populations. The details of such changes are discussed in the other sections of Chapter 4.

Just as important, from the overall quality of life standpoint, is the rate with which changes in population size take place. Rapid population change allows little time for institutions and communities to make appropriate adjustments to a decrease or increase in numbers. Implicit here is the assumption that the quality of life can be changed or disrupted as much, if not more, by a fast rate of growth, as by the enlarged population size which results from growth.

Attempting to assess the impact of both the rate of population growth and the amount of that growth on the local quality of life is difficult, since the principal components of the quality of life are highly interrelated. It is difficult, if not

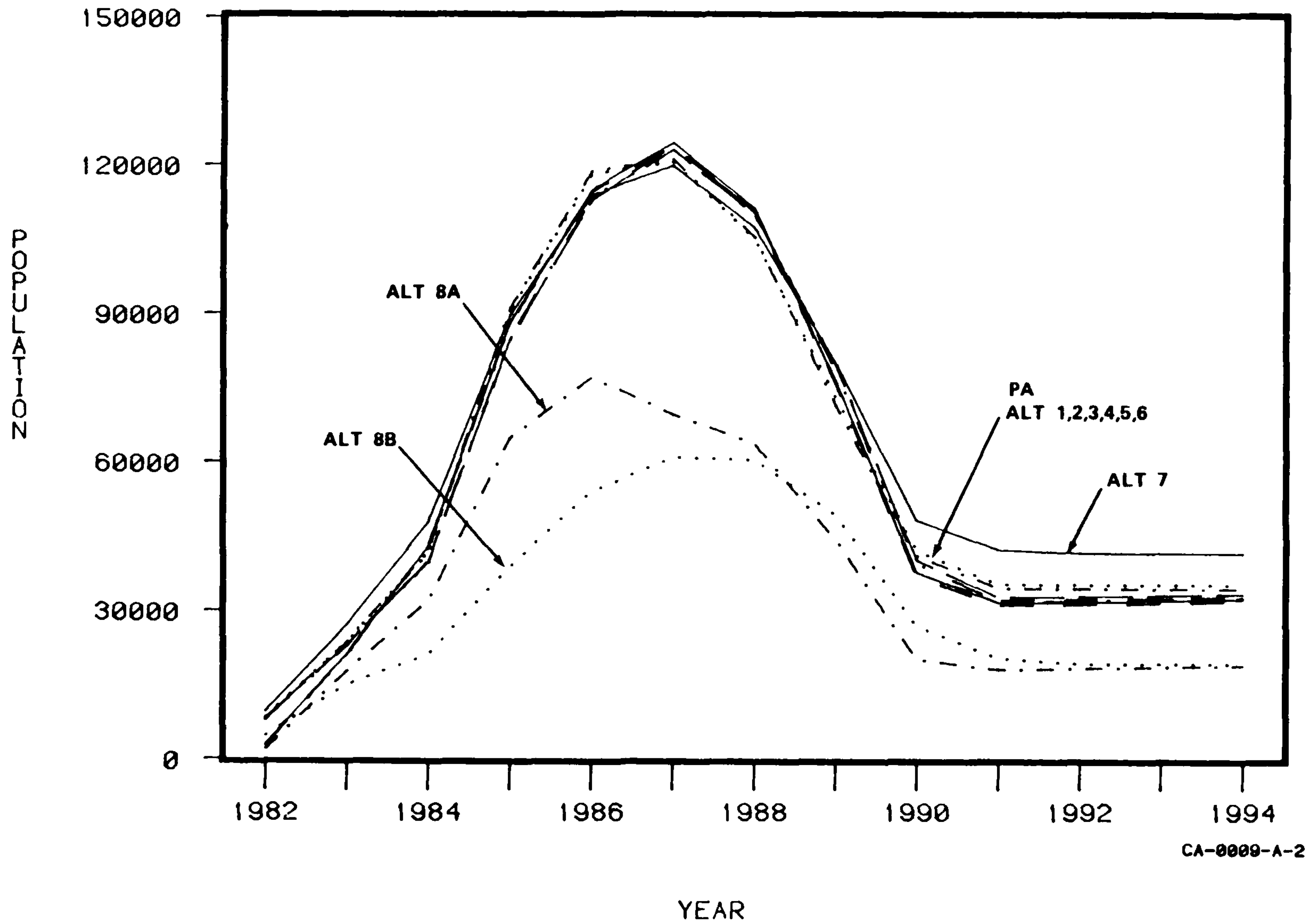


Figure 4.3.1-1. Regional population increase due to M-X deployment, by alternative.

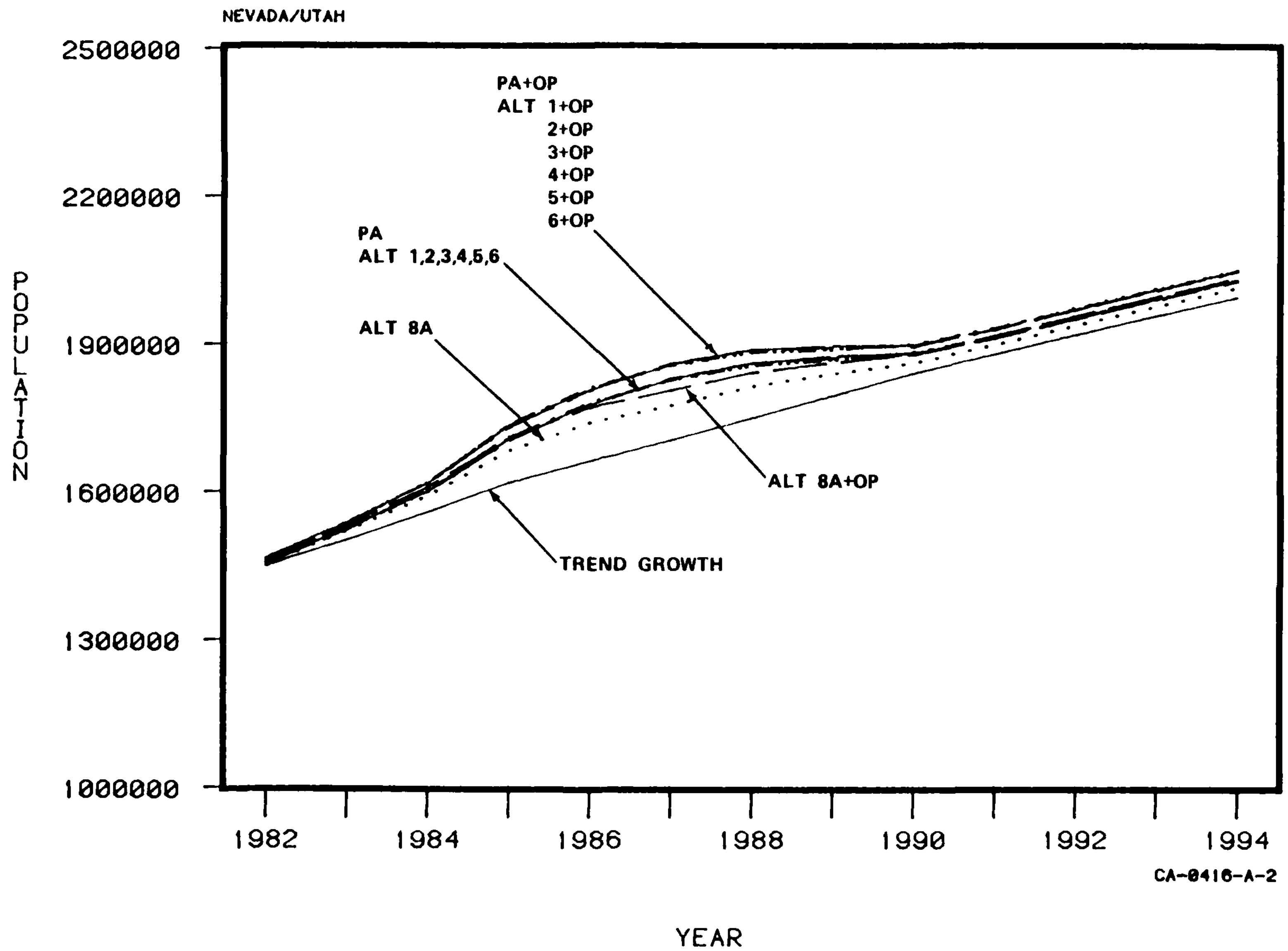


Figure 4.3.1-2. Population growth without M-X, with M-X, with M-X plus other projects.

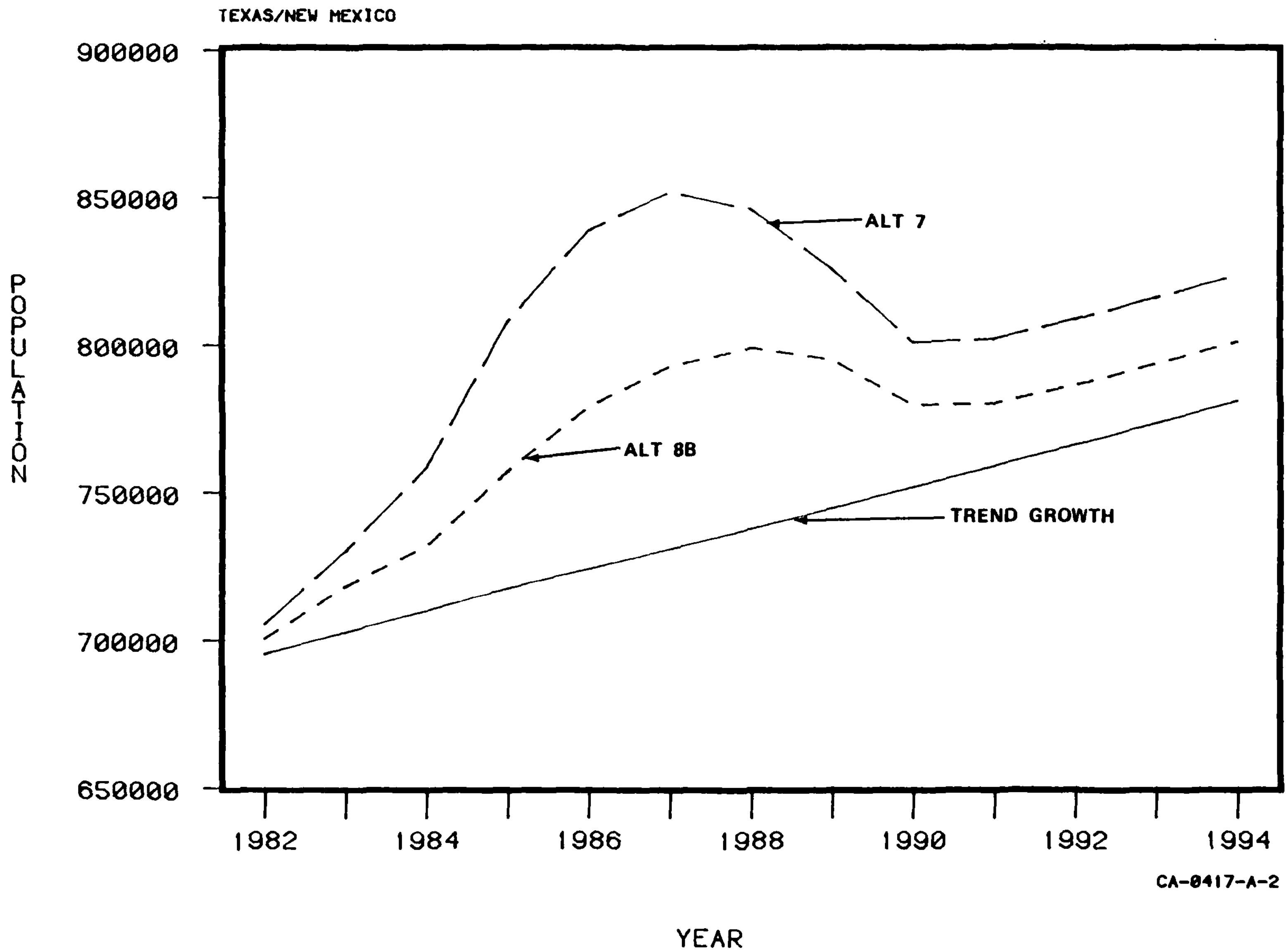


Figure 4.3.1-3. Population growth without M-X and with M-X.

impossible, to isolate specific variables, and be sure of the exact magnitude and direction of impact. Furthermore, evaluation of overall quality of life impact is affected by the values of the individual doing it, be he or she a private citizen, government official, the M-X decisionmaker, or anyone else. Impacts may be beneficial as well as detrimental, and often both at the same time. Individual preference functions are largely unknown and community preference functions are impossible to ascertain. Moreover, there is no rational or legal basis for deciding whose values and interests should be served (Wolf, 1974:5). Consequently, the final determination of what the M-X deployment would do to individual county residents' quality of life can only be determined by those make the evaluation either individually or collectively. Various concerns of residents are illustrated in this section and throughout the Quality of Life Environmental Technical Report (ETR-35) are in the form of direct quotations from public comments received through the public review process for the draft Environmental Impact Statement. While not necessarily statistically representative, they are nevertheless indicative of local residents' attitudes.

Quality of Life involves more than provision of community services and economic opportunities. It includes elements that are not totally under the control of formal institutions, such as access to the outdoors and friendliness of people. Rural residents generally are more satisfied with their overall quality of life than their urban counterparts, even though they recognize that community services and economic opportunities are less adequate in rural areas than in urban areas (Dillman and Tremblay, 1977:115). Rural residents regard these inadequacies as being offset by other important factors of their setting such as the desirability of their areas for raising children, access to the outdoors, open spaces and absence of congestion, friendliness of people, safety from crime, and "clean" air.

Furthermore, satisfaction with one's community is based less on quality of services and more on perceptions of social dimensions such as the distribution of political power, citizen participation, and commitment to community. Residents of small towns and rural areas find those communities most satisfying in which they have many strong personal relationships, where local people participate and take pride in civic affairs, where decisionmaking is shared, where people are committed to the community and its up keep, and where residents feel they have control over community affairs (Goudy, 1977: 380).

This does not mean that rural residents' perceptions of various community services, and access to them, do not relate to quality of life satisfaction, but rather that they appear to be less important than perceptions of social factors. The clear implication is that assessing the effects of the M-X project on quality of life, and attempting to mitigate the adverse impacts would be unsuccessful if only services and service shortfalls are addressed (Goudy, 1977:371).

The sections of the FEIS on the human environment deal with the impacts on housing, public finance, community infrastructure and services, traffic and land use, and other key attributes of quality of life. This section on quality of life emphasizes those forces that disrupt primary group relationships, the sense of participation in, and control of, civic affairs and that take away local residents' roles in decision-making and their sense of well-being. This approach emphasizes that the most salient subjective experiences are those that reflect the individual's perception of the degree of control he or she has over all kinds of experiences occurring in the community (Ladewig and McCann, 1980:117).

There is a body of literature on boom towns in which the experiences of both the local population and newcomers are examined. It is this literature that was used in the assessment of quality of life impacts. Unfortunately, only some of it is based on adequate research, both in quantity and quality. Also, in many respects there has been a lack of appropriate statistical analysis of evidence (see Section 4.1 in ETR-35). Undocumented assertions based on casual observation, and related in largely anecdotal journalistic accounts, have been frequently cited as evidence and taken as proof in subsequent studies. Since some of the available evidence on the consequences of rapid population growth is weak and incomplete, a variety of interpretations can be placed on it (Meidinger and Schnaiberg, 1980:516). Any interest group is able to find some form of nominally "scientific" corroboration for its own position. This is not to dismiss the propositions in the literature altogether, for some are based on valid research; merely to stress that it is impossible to be precise, given the state of the art, about some boom town effects.

Having emphasized this point, it can be said that the rapid large-scale population growth that would be experienced in most deployment area counties would result in some loss of recognition and social status for individuals in the resident population (Cortese, 1980a:24). The sentiments and symbolism attached to certain clubs, churches, schools, stores, and other organizations typically are not shared by newcomers. Shifts in friendship patterns can be expected, as friends who disagree on the merits of the project, or the means of overcoming the resultant local problems, may drift apart. But individuals who had nothing in common prior to the boom may develop friendships (Little, 1977:12). If housing, medical care, schools, shopping, restaurant, parking and recreational facilities, etc., are overtaxed and in too short supply, intergroup hostilities or animosities between newcomers and existing residents could occur. Some ranchers and farmers could find themselves in competition with M-X-related development for such resources as water, capital, land, and workers. Also, they may find their traditionally esteemed status reduced as other sectors of the economy become more important (Fradkin, 1977:124, Gold, 1974:17, Freudenburg, 1980:28, Christiansen and Clark, 1976:581, Smith, 1975:1).

Native Americans are one population subgroup that are particularly likely to be affected, not just by site-specific impacts, but by the deployment of M-X in general. Their culture is based upon a value system fundamentally different from that of the dominant American culture. Indians attach great importance to values associated with kinship and a world view relating to the sacred status of traditional land and all natural resources. As such, there are likely to be profound psychological impacts for those Native Americans who see their environment transformed from a sacred source of life into a scene of some environmental destruction and social dislocation. (See Sections 4.3.3.12 and ETR-21 for greater details.) Their dead are buried everywhere. The land is closely linked to the survival and nurturing of traditional Indian culture, which could suffer from dislocations created by the M-X project. Preservation of the traditional ways of life depends upon preservation of the natural resource base which makes it possible to maintain them. To the extent that the natural environment will be disturbed or destroyed (outlined in Section 4.3.2), the traditional lifestyles of the Native American in the area would be compromised.

Typically, there is an unequal sharing of the economic benefits from development that promotes rapid population growth, and an increase in social stratification is likely (Shaffer and Tweeten, 1974:269, Little, 1977:13-14). In one study, long-time residents of developing areas received fewer benefits (higher incomes, mobility, and employment opportunities) than did new residents in developing communities, but were no worse off than similar residents in nondevelopment communities (Murdock and Schriner, 1978:426).

There is a widespread belief that some of the existing residents would be more adversely affected than others. For example, a frequent assertion is that the elderly are among the most negatively affected of all groups, because of their fixed incomes and the improbability of their obtaining growth-related jobs (O'Hare and Sanderson, 1977; Nordlund, 1976:373). However, there is no evidence that elderly persons in a boom town felt significantly worse about the quality of their lives than did those in similar but non-boom communities (Freudenburg, 1980:33). However, there is some agreement that young people may actually be more vulnerable to the changes than are their elders (Freudenburg, 1980:35-37). Children, both of the newcomers and existing residents, would have adjustments to make in the schools, and there could be more delinquency and drug abuse (Cortese, 1980a:10).

In fact, estimating the impacts on education illustrates problems in trying to predict quality of life effects. Educational opportunities are thought to be a key dimension of quality of life (Dillman and Tremblay, 1977:122, Ladewig and McCann, 1980:123). Typically, the lack of adequate, accurate, and timely information about the potential number and characteristics of school age children of newcomer families prevents school officials from anticipating the ultimate impact (Greene and Curry, 1977:5-6, Cortese and Jones, 1977:128). Characteristically, the teacher-student ratio worsens, and the hiring of new teachers often comes at the expense of maintenance expenditures, supportive staff, and expansion of the curriculum (Albrecht, 1978:82). Student turnover and dropout rates may also be high. However, new ideas would be brought by the new students, and there could be new demands on schools to expand and vary the curricula, services, and facilities (Cortese and Jones, 1977:129). The very act of adding new school infrastructure and meeting the demands of the newcomers furthers change, in that previously held understandings or expectations of the educational system give way during periods of accelerated change. There is no way of estimating how all these changes in the educational sector balance each other, and so it is impossible to estimate the net effect on quality of life.

The level of social stress that might accompany rapid population growth is uncertain, despite the attention given to increases in the crime rate, divorce, juvenile delinquency rates, etc., in the press. Although higher incidences of crime, alcohol and substance abuse, divorce, and even suicide may occur, given the stresses and strains of adjusting to and coping with large-scale, rapid social change, the exact magnitude of impacts cannot be accurately predicted (see Section 4.1 of ETR-35).

The new ways of life, attitudes, and values present and the resultant social and political problems would command attention and solution; and as a result local political institutions would come under some strain. Adjustment to boomtown growth generally results in the replacement, or more accurately, the rapid turnover, of local elected officials. Also, local government service activities are forced to become more efficient and employ more technical specialists (Cortese and Jones, 1977:127, Little et al., 1979:37, Cortese, 1980a: 18-19, Freudenburg, 1980:20). For example, many of the small town officials may be required to design, prepare, and enforce planning and zoning ordinances, conduct new and complicated inter-governmental or government-Air Force relations, devise new tax schedules, or seek state or federal funds (Cortese and Jones, 1977:128). It has to be recognized that the existing population may not respond cooperatively to such changes. Small towns commonly have only part-time officials who receive few monetary rewards and, therefore, some might not have the degree of professionalism or experience required to deal with the newer different factions and conflicting demands (Albrecht, 1977:83). Local officials often find they are receiving less respect while devoting more time to their duties, and are criticized and blamed for many of the negative impacts that occur. Many simply quit, providing opportunity for newcomers to fill elected positions formerly held by long-term residents. This ascendancy of newcomers into positions of political and organizational power, together with all of the other social and cultural changes, can lead to dissatisfaction on the part of the local population who might see their degree of control over local situations disappearing. (Cortese, 1980a:19). On the other hand, some townspeople would see the newcomers as a positive factor bringing in "new blood" and new ideas from people with different or a wider range of experience (Cortese, 1980a:19, Graber, 1974:511, Summers, et al., 1976).

Other institutions likely to be affected are the churches, particularly the Church of Jesus Christ of Latter Day Saints (i.e., the Mormon Church) in Utah and Nevada. With rapid population growth there is likely to be an increase in the numbers, size, and denominational variety of churches (Cortese and Jones, 1977:129). Although the additional population may give churches in the area an opportunity to convert some newcomers, the churches themselves will not be immune from the strains and stresses of differences between the existing residents and newcomers' expectations of the institution(s) (Cortese, 1980a:21). Moreover, even strongly supported religious principles may very well be affected by the influx of people with different religious persuasions (Little, 1977:11-12). Virtually all churches could be impacted.

Again, the impacts on churches provide another example of the complexity and difficulty in making unequivocal quality of life impact assessments. Whereas the influence of a church itself may or may not be eroded in a relative sense, a church can provide "protective" functions and clarification of values for its members, a very important role when the external environment is rapidly changing. Similarly, some church bodies would most likely change or expand their orientation to add more social service functions, such as counseling, efforts to integrate newcomers, recreation facilities, and community betterment programs (Cortese, 1980a:20, Dixon, 1978:143-142). Such actions and roles may strengthen a church rather than weaken it, and could serve to reduce the severity of impacts for both local populations and newcomers.

One positive aspect of rapid population growth would be development of a wider range of goods and services and the increased choice that would become available as the population increases and the demand or threshold levels for the provision of particular goods and services are successively met. Any increases in income in the community (detailed in Section 4.3.3.2) would add to this effect, since greater purchasing power or disposable income in the community would allow new providers of goods and services to come in and establish themselves. For example, where fewer than 500 people are needed to support filling stations, food stores, appliance stores, and restaurants, in order to support floral shops, dentist offices, motion picture theatres and accountant services a population of 1,500 or more is required (Conkling and Yeates, 1976:176). Similarly, with growth would come greater choice, more competition, and therefore competitive prices as the number and variety of goods and services of a given type increase. A town of 400 people may be able to support only one auto repair shop, but a town with 2,000 people should be able to support three or more auto repair shops (Fonst and deSousa, 1978:91). Greater population size would also allow communities to realize economies of scale in the public sector. There are threshold city sizes for the efficient provision of educational facilities, transportation, hospitals, leisure and entertainment opportunities, and for most types of service infrastructure (Richardson, 1973:39-46). For some products, however, rapid growth could bring price increases beyond national inflation rates (e.g., housing, real estate, and building materials).

The increased diversity of goods and services, while a positive element for local customers, may or may not be good for local businessmen. While it appears that during the early stages of a construction project, sales increases accrue mainly to existing businesses (Thompson et al., 1978:15), it is not clear that they necessarily benefit in the long run. Growth often means the entry of new businesses rather than the expansion of older firms. These older businesses may find themselves facing larger, more efficient competition rather than more customers, particularly national chain stores and franchises (Muelen and Paananen, 1977: 312-313). In addition, as new entrepreneurs enter the area, the location of these new business activities may shift from the traditional small downtown main street location to new suburban or arterial strip areas (Dixon, 1978:153). However, illustrating again the mixed nature of the assessment, local residents may view the presence of a new retail outlet as a sign that the outside world has not forgotten or bypassed their community especially if the store is part of a recognized chain.

Ultimately quality of life impact assessments are very personal. People who review the potential impacts of the M-X system would probably reconcile its benefits and costs differently, depending on the trade-offs they would be willing to make. The great scale of the M-X, in comparison to the sparsely populated mining, farming and ranching areas in which the system is to be located, would not make it easy to balance benefits and costs. Residents of the potential deployment areas, recognizing this, are less likely to expect advantages from M-X than residents of preimpact areas scheduled for projects such as electric generating plants. Many public comments on the DEIS describe deeply felt concern with the potential adverse impacts of the M-X system on quality of life. A cross section of these comments are presented below:

PUBLIC COMMENTS ON THE DRAFT EIS:

"... One of the most significant factors is that (our) county is about a hundred percent privately owned. Continual conversion of privately owned land to public use is of growing concern to all ..." (B0471-1-008)

"... We live out here because we like the quiet life, the wide open space, small town friendships. Away from people, drugs, violence, and the plastic world ..." (A0027-2-001)

"... I am speaking as a senior citizen ... and I have lived here all my life ... and I come from a family of eight children and I am the only one left, but this is the best place I know how to live and I hate to see it change ..." (B0070-1-001)

"... We are basically a trusting, God-loving people. What happens to our thinking once the 'get-rich-quick, do-anything for the dollar' group comes in? ..." (B0520-5-010)

"... We want to keep our life as it is now if it is at all possible and I would like to see my family grow up, a family of a good many children; I would like to see them grow up with not having to be elbow-to-elbow in the classroom, and elbow-to-elbow in the county, and I would like to keep our county and our community as it is today ..." (B0074-3-002)

"... These are very small cohesive communities with tightly integrated social networks. People live in these communities by choice, not by edict ... One of the values which are considered most important is: rurality or the quality of life experienced in a small rural community ..." (A0975-2-054)

"... Have you ever ridden to the rim rock overlooking the green valleys and watched the wild colts play in the evening? Have you spent glorious fall days in bright sunshine and blue sky? Have you laid down to drink from our sparkling, clear, ice-cold streams? Have you chased wild mustangs and watched them from miles acress the valley for endless miles with their manes flying in the wind? Have you herded the bone-poor cattle in the drought years trying to get them to the stockyards in time and watch them lay down and die or go loco for lack of water and then cut the brand off of them to put it in a sack to get paid for in the tally from the U.S. government? Have you tried to save a baby lamb from dying in a spring blizzard or skinned a dead lamb to put its hide on an orphaned lamb to try and make the dead lamb's mother take it? Have you ever walked on the valley floor when the spring moisture would just rise and the whole valley is a carpet of flowers? This may only happen every six or seven years, maybe longer, but when it does it's a true joy to behold. This is something that the M-X construction will ruin forever ..."
(B0321-8-001)

"... To the traditional Indian, all land is sacred. The major disturbance to the land by the deployment of the M-X can be likened, in non-Indian values, to the driving of a bulldozer around the inside of a cathedral. The potential for exposing burial areas adds to this affront. The future of traditional Indians is also at stake as the historic source of their cultural identification--their land-- will be, in their judgement, forever desecrated." (A1160-0-098).

"... We choose to live and raise our families in a rural area. A rural environment that we feel is both beneficial and necessary to a productive way of life -- not only productive for us but also in producing food and fiber for other Americans as well as for foreign countries.

There is no need to go into great detail of all the assets of rural life that are so dear to us. The list is endless. We endure drought, hail, wind and low prices because we love our land and this is our chosen way of life. Placing the M-X in the Texas-New Mexico area will destroy many of the aspects of rural environment . . ." (B0508-0-002)

". . . I'm concerned with the impressing beauty one finds in the west desert of Utah and how it will be affected by the M-X project. I've spent hours sitting in the mountain range in the west desert looking out at the magnificant scenes one finds there and I just shudder at the thought of looking out over these spaces I love so much and seeing these projects going up; the dust storms being created from those holes being dug for M-X and what not. I'm just interested in the preservation of this beauty . . ." (B0006-5-001)

". . . One of the features of life in Utah that has been a cherished part of our culture is the interdependence of the community, church and schools working together to foster and protect the unique nature of life in Utah, and also in parts of Nevada that nurtures and perpetuates the envied and often imitated concept of family that is so dear to most Utahns . . ." (B0037-0-0004)

". . . The economic base . . . is farming and ranching. With a disturbance of this base, the long-term effects of the M-X would mean severe economic stress in local governments. And last, but not least, the quality of life as we know it, the rural, easygoing atmosphere, would be a thing of the past" (B0471-1-008)

". . . The main loss, however, will be our freedom. Perhaps it's not apparent from an altitude of 35,000 feet, but the Great Basin is one of the last places on earth where freedom still reigns. Not many people live down here, but we're damn happy to come and go as we please, to engage in gainful employment and work other than digging our own graves. When you abridge that freedom, when you insult the earth whence we came, you strike a blow against what is, or was, America . . ."
(A0999-2-007)

Whatever the mix of benefits and cost and how people perceive them, most communities in the impacted counties would simply never be the same. Since the local population would have little control over decisions affecting their region and community because large numbers of newcomers would move to the area, they would likely perceive the degree of control they have over community affairs as being progressively eroded. In this way their quality of life would be compromised. The degree to which it is compromised can reasonably be inferred to have some relationship to the size of the population influx and the rapidity with which it occurs.

There are no local, state, or national norms which provide unambiguous or generally accepted benchmark for evaluating the acceptability of population increases and a community's capacity to absorb different rates and sizes of population change. Gilmore claims that "in most boomtowns a 15 percent growth rate leads to institutional breakdown in the labor market, the housing market, and the system for financing local public facilities" (Gilmore, 1976:536), and that "five percent is generally as much growth as a small community can comfortably absorb" (Gilmore and Duff, 1975:2). However, he presents no data or evidence to support his judgments.

The more general view is that there is not a single maximum limit to population growth rate or size that applies to all counties or communities. Any assessment must be conditional, being contingent on the actions taken by policy makers and the degree to which mitigation measures are sought and applied. Moreover, the social impacts within a given county would not be uniform but rather would be concentrated where population growth and decline would occur.

Nonetheless, the best available clues for identifying quality of life impacts come from estimates of population growth and decline that could be expected with construction and operation of the M-X system. These estimates will be used to infer and assess the effects on quality of life of the various alternatives for locating the M-X system. The population estimates to be considered are based on county-level data.

The bust phase of the "boom-bust" cycle would occur when the construction work force began to decrease as M-X construction neared completion. Population would start to decline as construction workers and their families moved out of the project area. Jobs created to support the construction work force in retail and service sectors, schools and other sectors would no longer be needed. Unemployment would increase as persons in such secondary jobs were laid off (Kruse, 1979: A-35). Many women who entered the labor force during the boom period would exit from it, and some of the professional child care services that emerged to serve working mothers could fold (Baxter and Cortese, 1981). Young people who were able to remain in the area bec use of boom employment opportunities would likely leave for employment elsewhe e. Processes such as these would require the resident population to adjust once again to changing conditions and opportunity structures. The impacts of these processes on quality of life would be mixed, just as the impacts of the boom were mixed. Thus some people may regret the loss of employment opportunities and the sense of excitement that comes with increased population, activity and diversity, while others would be pleased to have things return to "near normal" once again.

The exact nature of the readjustment during the bust period would depend partly on an area's capacity for coping with the boom and the adjustments that local governments and residents would make to boom conditions.

The historical record is highly variable. In the 1950s, some communities expanded their retail sectors and public services, including education, to accommodate the boom, on the mistaken assumption that industrial development would follow completion of a large hydro-power project (Harnisch, 1980).

Social conditions do not necessarily return to what they were prior to project construction. The postconstruction period need not be a total "bust," especially in regard to overextension of facilities, if local communities engage in careful planning both for the boom and the bust phases associated with large construction projects.

The quality of such planning is dependent on several factors: the availability of technical and financial assistance to communities that lack such resources; accurate and continually updated information to be provided by impacting agencies, on the size of the construction work force and population growth to be anticipated; the community's consideration of its own goals--that is, what it can realistically expect to gain from the boom-bust cycle.

Counties which are part of the Designated Deployment Area would be more vulnerable to the boom-bust cycle than counties in which operating bases would be located. The former, especially, need to consider carefully what community goals they might be able to realize by taking advantage of the boom-bust situation.

PROPOSED ACTION (4.3.1.2)

The proposed action consists of deploying the M-X system in Nevada/Utah with bases at Coyote Spring and Milford. Table 4.3.1-1 displays the expedited rate of population growth and decline for each county to be affected by the Proposed Action.

Counties Affected by the Operating Base (OB) Locations

Although Clark County would experience the largest absolute population influx, and Beaver County the third largest, after Clark and Nye counties, their quality of life impacts experience would likely be very different. The larger, dynamic, more cosmopolitan and urbanized, and more heterogeneous communities would be able to cope with changes more easily than the comparatively smaller rural communities. Thus, Clark County, with some 460,000 residents in 1980, most of whom live in Las Vegas and its suburbs, would be the one potential operating base county that would be the least affected. Indeed, it experienced a faster rate of growth, 5.4 percent, in the last decade, than it could be expected to experience during the peak M-X construction period. Beaver County, on the other hand, could experience an annual compound rate of growth of 25 percent between 1982 and 1988, the boom period, resulting in a 327 percent increase over baseline. This would be followed by a decreasing rate of 6.8 percent between 1988 and 1991, and a long-term stable M-X-related population increase of 230 percent over baseline. All of this would be taking place in a county with only two communities of slightly more than 1,000 people. Such a very rapid rate of growth and overall population increase would have profound quality of life impacts.

Three other counties--Lincoln in Nevada, and Iron and Washington in Utah--would experience quality of life impacts due to population spill-over from Clark and Beaver counties, respectively. Iron and Washington counties with "boom" periods with only 5.6 and 3.8 percent annual compound rates of growth, and no real "busts" would not be substantially affected. Lincoln County, however, would also be affected by DDA facility construction and could be projected to experience a boom from 1982 to 1985 with a 47.5 percent annual compound rate of growth resulting in a 321 percent increase over baseline population. This would be followed by a six-year bust at a 19.8 percent annual compound rate of decrease and an eventual long-term increase over baseline of 17.6 percent thus Lincoln County would be substantially impacted.

Table 4.3.1-1. Magnitude and rate of population change: Proposed Action.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	5.2	2.6	5.2	2.6	7.7	2.3	7.9	2.4
Eureka	76.9	-50.9	76.9	-50.9	820.2	0.1	820.2	0.0
Lincoln	47.5	-19.8	47.5	-19.8	320.6	17.6	320.8	17.7
Nye	26.3	-23.9	26.3	-23.9	234.4	0.0	234.5	0.0
White Pine	17.7	-23.5	25.3	-20.5	124.4	0.0	207.5	57.8
Beaver	25.5	-6.8	25.2	-5.1	327.1	229.5	436.5	320.5
Iron	5.6	1.4	5.6	1.3	14.0	10.9	14.7	11.4
Juab	17.3	-10.2	16.5	-12.0	66.2	0.0	97.1	9.6
Millard	17.2	-11.9	21.1	-14.2	81.9	0.0	146.9	23.8
Salt Lake/Utah	3.4	1.6	3.5	1.6	0.7	0.0	1.4	0.4
Washington	3.8	2.3	3.8	2.3	1.8	0.6	1.8	0.6

T5577/10-2-81/F/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

Counties Affected by Other DDA Activities

All other counties in the deployment region would experience only short-lived impacts because of construction activity involving the protective structures, and the associated indirect workers' needs. Although short-lived, the quality of life impacts outlined above would be substantial. A ranking in decreasing order, of boom period growth rates amoung counties and overall increase in population over baseline and, therefore, presumed quality of life impacts, are as follows: Eureka, Nye, White Pine, Millard, and Juab Counties. Salt Lake and Utah counties, with a minimal growth rate and an almost imperceptable 0.7 percent increase over baseline in the peak- year should be minimally affected: when other projects are taken into account (M-X plus other projects), White Pine and Millard counties would be all the more impacted (Table 4.3.1-1).

ALTERNATIVE 1 (4.3.1.3)

Under this alternative, the DDA facilities would remain the same as under the Proposed Action, the Coyote Spring Valley first operating base remains, but the second operating base would be built near Beryl in Iron County, Utah. The resultant rates of population change and increases over baseline are shown in Table 4.3.1-2. It is clear that there are no differences between Alternative 1 and the Proposed Action for all of the Nevada counties, with the exception of Lincoln County, which, because of some additional overspill from Iron County, would increase at a slightly higher annual compound rate over the 1982 to 1985 boom period. From a quality of life standpoint, however, the difference between a 48.7 and a 47.5 percent growth rate is purely academic; as is the difference between a 334 and 320 percent increase over baseline population in the peak year (Tables 4.3.1-2 and 4.3.1-1).

The real differences would come in Utah. With the second operating base no longer in Beaver County, its projected rate of growth over the boom period falls from 25.5 percent to 17.6 percent and the peak year population increase over baseline falls from 328 percent to 99 percent (Tables 4.3.1-2 and 4.3.1-1). Although the base would not be near Milford, under this alternative, the county is expected to be impacted by population spillover from Iron County along with the population influx created by DDA facilities construction. Thus the quality of life impacts outlined in the introduction would not be felt as much. Iron County, now the host of a base near Beryl, would grow at an annual compound rate of 15.6 percent during the construction boom versus 5.6 percent under the Proposed Action. This would result in a peak year population increase over baseline of 79 percent versus 14 percent, and a long-term increase of 48 percent as opposed to only 11 percent under the Proposed Action. Thus, while Iron County would have probably been only marginally affected under the Proposed Action, it would now sustain major quality of life impacts. Millard County would now experience a slightly lower rate of growth and overall increase in peak-year population, but nothing that would change its degree of impact in comparison to the Proposed Action. Was' ıgton County's rate of growth would be 4.4 percent during the boom versus 3.8 percent under the Proposed Action, and its peak-year increase over baseline would be about 5 versus 1.8 percent; still probably not enough to compromise its quality of life. The effect on Salt Lake and Utah counties should still be insignificant.

Table 4.3.1-2. Magnitude and rate of population change: Alternative 1.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	5.2	2.6	5.2	2.6	7.7	2.3	7.9	2.4
Eureka	76.9	-50.9	76.9	-50.9	820.1	0.0	820.2	0.0
Lincoln	48.7	-17.8	48.7	-17.8	334.4	35.9	334.4	36.0
Nye	26.2	-23.9	26.2	-23.9	234.4	0.0	234.5	0.0
White Pine	17.7	-23.5	25.3	-20.5	124.4	0.0	207.5	57.8
Beaver	17.6	-15.1	25.1	-14.1	99.3	16.5	230.7	106.3
Iron	15.6	-3.6	15.6	-3.6	79.4	48.2	80.1	48.7
Juab	17.3	-10.2	16.4	-12.0	66.2	0.0	97.1	9.6
Millard	17.0	-11.7	21.8	-14.0	80.0	0.0	146.9	23.8
Salt Lake/Utah	3.3	1.6	3.5	1.6	0.7	0.0	1.4	0.4
Washington	4.4	2.2	4.4	2.2	5.3	3.9	5.3	3.9

T5578/10-2-81/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

ALTERNATIVE 2 (4.3.1.4)

Under this alternative, the DDA facilities remain the same as they were under the Proposed Action and the Coyote Spring Valley first operating base would remain the same. But the second operating base would be located near Delta in Millard County, Utah. Since the one base location and associated spillover effects are the only differences from the Proposed Action, the impacts only differ in Utah. In particular, without an OB in Beaver County, its predicted growth rate would fall from 25.5 percent to 16.8 percent during the boom period, but there would be a more marked bust period to follow (Table 4.3.1-3). The net peak-year population change over baseline, would be significantly different, however, being only 93 percent compared with 327 percent. As a result, Beaver County's quality of life impacts would not be as pronounced as those under the Proposed Action. Similarly, the spillover into adjoining Iron County that was predicted for the Proposed Action would not be as great under Alternative 2.

With the second operating base near Delta, Millard County's growth rate during the construction boom could be expected to be 25.2 percent, compared to 17.2 percent under the Proposed Action, but with a smaller bust due to the permanent nature of some of the in-migration. Peak-year population change over baseline would be 211 percent versus 82 percent under the Proposed Action and the long-term increase at 114 versus 0.0 percent under the Proposed Action. (Tables 4.3.1-3 and 4.3.1-1). Consequently, Millard County's quality of life would be more seriously affected than under the Proposed Action. It is expected that the remaining counties' impacts would not be substantially different than those estimated under the Proposed Action.

ALTERNATIVE 3 (4.3.1.5)

The DDA facilities would remain the same as under the Proposed Action, but the two operating base would be located near Beryl in Iron County, Utah and near Ely in White Pine County, Nevada. As a result, there would be some significant differences from the Proposed Action. With an operating base no longer in Clark County, its projected rate of growth would be reduced; of greater significance, Lincoln County would no longer experience population spillover from Clark and as a result its boom period rate of growth would be smaller, 28.7 percent versus 47.5 percent, although still of sufficient magnitude as to compromise quality of life for residents. However, the resultant long-term population would likely be larger (Table 4.3.1.-4). Also, Eureka County's rate of growth would be slower than under the Proposed Action, although at 56.5 percent per annum over the boom period, and with a peak year population increase over baseline of 761 percent, it would still seriously affect the county's quality of life.

With the main operating base near Beryl, Iron County's rate of growth during the construction boom would expand at a 22.0 percent compound annual rate, versus only 5.6 percent under the Proposed Action. Similarly, the peak-year population increase over baseline would be 131 percent, compared to 14 percent under the Proposed Action, so its quality of life would now be significantly impacted. Beaver County's impacts, partly due to spillover from Iron County and partly due to DDA facility construction, would still experience significant impacts, although less than under the Proposed Action.

Table 4.3.1-3. Magnitude and rate of population change: Alternative 2.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	5.1	2.7	5.2	2.7	7.6	2.3	7.8	2.4
Eureka	76.9	-50.9	76.9	-50.9	820.2	0.1	820.2	0.0
Lincoln	47.5	-19.8	47.5	-19.8	320.6	17.6	320.8	17.7
Nye	26.2	-23.9	26.2	-23.9	234.4	0.0	234.5	0.0
White Pine	17.7	-23.5	25.3	-20.5	124.4	0.0	207.5	57.8
Beaver	16.8	-18.3	24.8	-23.0	92.6	2.1	225.8	93.1
Iron	4.1	1.3	4.3	1.2	2.6	0.0	3.4	0.5
Juab	18.3	-10.4	17.1	-12.2	71.5	2.1	102.4	11.4
Millard	25.2	-7.0	27.0	-9.1	210.5	113.9	275.0	137.6
Salt Lake/Utah	3.4	1.6	3.5	1.5	0.8	0.0	1.5	0.4
Washington	4.4	2.3	4.4	2.3	1.8	0.0	1.8	0.0

T5579/10-2-81/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

Table 4.3.1-4. Magnitude and rate of population change: Alternative 3.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	3.9	3.4	4.0	3.4	1.6	0.0	1.8	0.1
Eureka	56.5	-50.4	56.5	-50.4	761.4	0.0	761.4	0.0
Lincoln	28.7	-13.7	28.7	-13.7	204.4	23.7	204.6	23.8
Nye	28.3	-21.3	28.3	-21.3	197.7	1.5	197.8	1.5
White Pine	47.7	-12.5	54.1	-12.5	372.9	174.4	464.6	231.8
Beaver	21.0	-10.7	27.4	-9.3	130.0	23.6	261.0	113.4
Iron	22.0	-3.8	22.1	-3.8	131.1	67.0	131.9	67.4
Juab	20.3	-17.7	16.6	-18.9	89.7	0.0	116.5	9.6
Millard	24.1	-9.1	30.4	-10.6	99.4	0.0	170.6	23.8
Salt Lake/Utah	3.7	1.6	3.8	1.6	0.9	0.0	1.6	0.4
Washington	5.3	1.5	5.3	1.5	9.3	4.3	9.3	4.3

T5580/10-2-81/F/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

With the second operating base near Ely, White Pine County would also experience significantly different impacts. Under Alternative 3 it could experience a boom between 1984 and 1987 with a compound annual growth rate of 47.7 percent, followed by a bust at an annual compound rate of decrease of 12.5 percent, between 1988 and 1991, in contrast to rates of 17.7 percent and 23.5 percent under the Proposed Action. The growth would produce a peak-year population of 373 percent over baseline and a long-term permanent influx representing a 175 percent increase over baseline, versus 124 and 0 percent, in the peak-year and long-term respectively, under the Proposed Action. Clearly, such a rapid rate of growth and overall increase of population over the projected baseline would alter current residents' quality of life substantially.

ALTERNATIVE 4 (4.3.1.6)

Under Alternative 4, while the DDA facilities remain essentially the same as under the Proposed Action, the two operating base locations are different. The first operating base is near Beryl in Iron County, Utah; and the second operating base becomes Coyote Spring in Clark County. With Coyote Spring being the site of the smaller second operating base, its projected rate of growth with M-X would be lower than under the Proposed Action, but not substantially different to change the quality of life impact conclusions. With the second operating base no longer in Beaver County its boom period rate of growth would be lower. However, the bust would be greater since there would be no permanent base related population, although there would still be some long-term population spillover from the base in Iron County. The quality of life impacts outlined in the introduction would still be felt, though to a lesser extent.

A base in Iron County could produce greater quality of life impacts, since the rate of growth during the "boom" period would occur at a 21.8 percent annual compound rate versus a 5.6 percent rate under the Proposed Action. Likewise, it could have a population in the peak-year of 129 percent over baseline, and one that could be 67 percent over baseline in the long-run, compared to 14 percent and 11 percent, respectively, under the Proposed Action. Washington County would experience a greater rate of growth and larger permanent population influx than under the Proposed Action, but these would not too seriously affect its quality of life (Table 4.3.1-5).

ALTERNATIVE 5 (4.3.1.7)

Under Alternative 5, the DDA facilities would remain essentially the same as under the Proposed Action. Clark County would no longer be the site of an operating base, and would therefore experience a lower rate of growth and less population increase. More significantly, Lincoln County would no longer experience population spillover from Coyote Spring base-related population, and therefore the "boom" period rate of growth would be smaller, as would be its peak-year population increase over baseline. Likewise, it would not be impacted by a permanent population influx. As a consequence, the quality of life impacts, while substantial, would be felt to a lesser degree than under the Proposed Action.

Beaver County, site of the second operating base under the Proposed Action would host the larger, first operating base under Alternative 5. Its compound annual rate of change during the construction boom would increase from 25.5 percent under

Table 4.3.1-5. Magnitude and rate of population change: Alternative 4.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	4.5	2.8	4.5	2.8	4.9	1.6	5.0	1.7
Eureka	76.9	-50.9	76.9	-50.9	820.2	0.0	820.2	0.1
Lincoln	49.6	-18.0	49.6	-18.0	345.3	36.8	345.5	36.9
Nye	26.2	-23.9	26.2	-23.9	234.4	0.0	234.5	0.0
White Pine	17.7	-23.5	25.3	-20.5	124.4	0.0	207.5	57.8
Beaver	20.0	-12.2	26.7	-11.0	120.2	23.6	251.3	113.4
Iron	21.8	-3.6	21.9	-3.6	129.0	67.0	129.9	67.4
Juab	17.3	-10.2	16.4	-12.0	66.2	0.0	97.1	9.6
Millard	17.0	-11.7	21.8	-14.0	80.0	0.0	145.0	23.8
Salt Lake/Utah	3.4	1.6	3.5	1.5	0.8	0.0	1,5	0.4
Washington	5.3	1.6	5.3	1.6	9.3	4.9	9.3	4.9

T5581/10-2-81/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

the Proposed Action to 51.3 percent, and its peak-year population increase over baseline would go from 327 percent to 602 percent under Alternative 5 (Table 4.3.1-6). Similarly, the long term population influx would represent a 318 percent increase over baseline, compared to a 230 percent increase under the Proposed Action. Consequently, quality of life impacts would be felt to a much greater degree. Millard County, would receive some spillover from Beaver County, and would also experience more pronounced quality of life impacts than under the Proposed Action.

With the second operating base near Ely, White Pine County's population could be expected to grow at a 47.4 percent annual compound rate over the boom period, compared to 17.7 percent under the Proposed Action (Table 4.3.1-6). Its peak- year and long-term populations would be similarly greater, so its residents would feel the quality of life impacts to a much greater degree than under the Proposed Action.

ALTERNATIVE 6 (4.3.1.8)

Under Alternative 6, the DDA facilities remain essentially the same as under the Proposed Action, but the first operating base would be located near Milford, Beaver County, Utah, and the second smaller base in Coyote Spring, Clark County, Nevada. With the smaller second operating base in Clark County it would experience a slower growth rate. But quality of life impacts would be very much the same as for the Proposed Action. Under Alternative 6, only Beaver County would be impacted significantly differently than under the Proposed Action.

Beaver County, site of the larger first operating base would sustain a 50.6 percent annual compound rate of growth during the construction boom, compared to 25.5 percent under the Proposed Action (Table 4.3.1-7). Consequently, the resultant peak-year increase over baseline would be larger, 586 percent versus 327 percent, as would be the permanent long-term increase over baseline-318 percent versus 230 percent (Tables 4.3.1-1 and 4.3.1-7). As a result, Beaver County's residents' quality of life would be affected to a substantially greater degree than under the Proposed Action. Iron County, affected by spillover from Beaver, would also experience a faster annual rate of growth, 7.6 percent versus 5.6 percent, over the boom period, and a larger peak-year and long-term influx of M-X-related population, but one that would be hard to distinguish from the quality of life experiences anticipated under the Proposed Action.

ALTERNATIVE 7 (4.3.1.9)

Although Curry County in New Mexico, and Dallam and Hartley counties in Texas would experience the largest absolute population growth of all of the counties in Texas/New Mexico deployment region, their quality of life impact experience would likely be very different. Larger, more dynamic, more urbanized and more heterogeneous counties are expected to be impacted least since they have the requisite resources, infrastructure, and experienced personnel to cope with change more readily than the smaller, more rural counties. Thus, Curry County, with some 42,000 residents in 1980, most of whom live in Clovis would be one of the potential operating base counties, along with Clark in Nevada, that would be the least adversely affected. This is not to deny that the projected 12.4 percent annual compound rate of population growth during the construction boom period, and the peak-year increase of 77 percent over baseline and 38 percent in the long-term would not produce some social, structural, and institutional impacts.

Table 4.3.1-6. Magnitude and rate of population change: Alternative 5.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	3.9	3.4	4.0	3.4	1.6	0.0	1.8	0.1
Eureka	56.5	-50.4	56.5	-50.4	761.4	0.0	761.4	0.0
Lincoln	30.4	-15.0	30.4	-15.0	161.0	0.0	160.2	0.1
Nye	28.3	-21.3	28.3	-21.3	197.7	1.5	197.8	1.5
White Pine	47.4	-12.5	54.1	-12.5	372.9	174.4	464.6	231.8
Beaver	51.3	-8.6	50.5	-8.3	601.9	317.8	732.9	408.8
Iron	7.7	-0.6	7.8	-0.6	30.4	16.1	30.3	16.0
Juab	20.3	-17.7	16.6	-18.9	89.7	0.0	116.5	9.6
Millard	24.6	-9.4	30.8	-10.8	102.5	0.0	173.7	23.8
Salt Lake/Utah	3.7	1.6	3.8	1.6	0.9	0.0	1.6	0.4
Washington	4.4	2.4	4.4	2.4	2.0	0.0	2.0	0.0

T5582/10-2-81/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

Table 4.3.1-7. Magnitude and rate of population change: Alternative 6.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	4.5	2.8	4.5	2.8	4.8	1.6	5.0	1.7
Eureka	76.9	-50.9	76.9	-50.9	820.2	0.0	820.2	0.0
Lincoln	46.4	-20.2	46.4	-20.2	308.0	12.7	308.1	12,8
Nye	26.2	-23.9	26.2	-23.9	234.4	0.0	234.5	0.0
White Pine	17.7	-23.5	25.3	-20.5	124.4	0.0	207.5	57.8
Beaver	50.6	-8.2	50.0	-7.9	585.7	317.8	716.7	408.8
Iron	7.6	-0.4	7.7	-0.5	29.6	15.5	30.3	16.0
Juab	17.3	-10.2	16.4	-12.0	66.2	0.0	97.1	9.6
Millard	17.3	-12.0	22.0	-14.2	82.3	0.0	151.0	23.8
Salt Lake/Utah	3.4	1.6	3.5	1.5	0.8	0.0	1.5	0.4
Washington	3.8	2.4	3.8	2.4	1.8	0.6	1.8	0.6

T5583/10-2-81/a

Source: HDR Sciences, August 9, 1981 – for detailed population figures, see Section 4.3.3.3.

Dallam and Hartley counties, however, with a much smaller population center, Dalhart (1980 population 6,800) and much large boom period growth rates, would most likely experience all of the quality of life impacts discussed in the introduction. Dallam County, for example, could be expected to experience a 27.8 percent annual compound rate of growth during the 1983 to 1987 boom period, resulting in a peak-year population influx that would be 222 percent over baseline. The peak would be followed by a bust between 1988 and 1992 when the county would be projected to lose population at a 14.6 percent annual rate of decrease, resulting in a long-term population that would be 37 percent greater than would be the case without M-X (Table 4.3.1-8). Hartley County's situation would be similar, with a boom period rate of growth of 41 percent, a peak-year influx 401 percent over baseline, and a long-term influx giving rise to a population that would be 250 percent over baseline.

Two counties, Moore in Texas, and Roosevelt in New Mexico, both adjacent to the two operating base counties, would receive long-term spillover effects from the two respective bases along with DDA facilities impacts. However, Moore County's expected growth rate during the boom would be low (3.7 percent), and the peak-year and long-term population influx small (Table 4.3.1-8) so that its quality of life would probably not be significantly compromised. Roosevelt County, on the other hand, could experience a 14.8 percent annual compound rate of growth during the construction boom, and a 96 percent increase over baseline population in the peak year. After the boom, the county could lose population at a nine percent annual compound rate, ending up with a long-term permanent population that would be 19 percent over baseline. Its residents' quality of life would therefore be impacted.

Other counties with DDA facilities construction that could experience quality of life impacts would be Harding County (48.4 percent growth rate, 426 percent over baseline in the peak year, followed by a bust with a 44 percent rate of annual decline), Bailey, Castro, Deaf Smith, and Sherman counties in Texas and Quay County in New Mexico (Table 4.3.1-8).

ALTERNATIVE 8 (4.3.1.10)

Under the split deployment alternative, the first operating base would be located in Coyote Spring, Clark County, Nevada, and the smaller second operating base near Clovis, in Curry County, New Mexico. With one-half of the DDA facilities in Nevada/Utah, the number of counties and the magnitude of quality of life impacts would be reduced. All deployment-area counties, with the exception of Beaver, Iron, Millard, and Washington counties would experience lower boom period rates of growth, and all, excepting Millard County, could be expected to have lower peak-year increases over baseline than under the Proposed Action (Tables 4.3.1-9 and 4.3.1-1). Nevertheless, with boom period rates of growth of 43.6, 20.9, 26.9, and 26.1 percent, Lincoln, Nye, Beaver, and Millard counties, respectively, would experience quality of life impacts. Eureka and Juab counties would experience significantly less quality of life impacts than under the Proposed Action (Table 4.3.1-9).

With the other half of the DDA facilities in Texas/New Mexico and the smaller, second operating base near Clovis, the impacts in this half of the split deployment region would be less pronounced than those under the full deployment system in Texas/New Mexico, under Alternative 7. All counties, with the exception

Table 4.3.1-8. Magnitude and rate of population change: Alternative 7

County	Compound Annual Rate of Population Growth or Decline, M-X Only		Percent Increase over Baseline, M-X Only	
	"Boom"	"Bust"	Peak	Long-Term
Bailey	8.4	-9.0	48.0	0.0
Castro	6.0	-12.1	30.7	0.0
Cochran	3.5	-5.2	12.6	0.0
Dallam	27.8	-14.6	221.8	37.1
Deaf Smith	6.5	-7.8	30.9	0.0
Hale	1.2	0.6	0.9	0.0
Hartley	40.9	-8.8	401.1	249.3
Hockley	1.1	0.3	1.6	0.0
Lamb	0.8	-0.7	3.0	0.0
Lubbock	1.8	0.8	2.0	0.5
Moore	3.7	-2.0	16.9	8.1
Oldham	4.9	-3.7	13.2	0.0
Parmer	5.2	-10.7	42.0	0.0
Potter/Randall	2.5	-0.7	9.1	3.1
Sherman	8.3	-9.1	36.4	0.0
Swisher	1.3	-1.3	2.5	0.0
Chaves	3.5	-2.5	8.2	0.0
Curry	12.4	-4.8	77.0	38.2
De Baca	5.3	-11.4	27.5	0.0
Harding	48.4	-43.9	426.2	0.0
Quay	7.7	-2.8	33.7	0.0
Roosevelt	14.8	-9.0	95.5	19.1
Union	2.7	-4.2	11.6	0.0

T5574/8-22-81

Source: HDR Sciences, August 10, 1981 – for detailed population figures, see Section 4.3.3.3.

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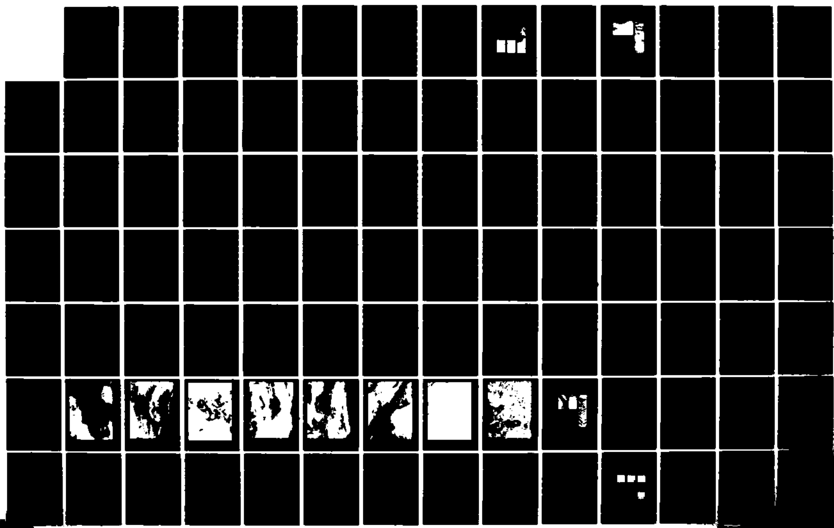

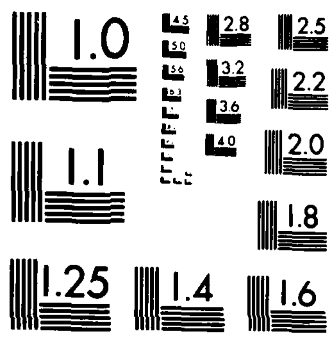

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Table 4.3.1-9. Magnitude and rate of population change: Alternative 8: Nevada/Utah.

County	Compound Annual Rate of Population Growth or Decline				Percent Increase over Baseline			
	M-X Only		M-X Plus Other Projects		M-X Only		M-X Plus Other Projects	
	"Boom"	"Bust"	"Boom"	"Bust"	Peak	Long-term	Peak	Long-Term
Clark	5.0	2.8	5.1	2.8	7.1	2.5	7.3	2.6
Eureka	10.0	-11.3	10.0	-11.3	51.5	0.0	51.5	0.0
Lincoln	43.6	-17.9	43.6	-17.9	277.7	19.1	277.9	19.1
Nye	20.9	-21.2	20.9	-21.2	122.5	0.0	122.5	0.0
White Pine	12.4	-13.4	23.6	-11.4	78.7	0.0	149.0	57.8
Beaver	26.9	-13.6	33.0	-10.7	88.3	0.0	219.3	91.6
Iron	6.1	-0.5	6.2	-0.6	8.8	0.0	9.6	0.5
Juab	5.1	-1.1	2.7	-4.8	6.5	0.0	37.4	9.6
Millard	26.1	-16.5	26.7	-17.6	121.5	0.0	186.1	23.8
Salt Lake/Utah	---	---	---	---	---	---	---	---
Washington	4.2	2.5	4.2	2.5	1.4	0.1	1.4	0.1

T5576/10-2-81/a

Source: HDR Sciences, August 9, 1981 — for detailed population figures, see Section 4.3.3.3.

of Hale, Sherman, Chaves, Harding, Quay, and Union would sustain lower boom period rates of growth, and all but the same counties would have lower peak-year population influxes (Tables 4.3.1-10 and 4.3.1-8). Among the exceptions, Sherman and Quay would experience greater impacts than those anticipated under the full-basing alternative (Table 4.3.1-10). Both Dallam and Hartley would experience less pronounced, but nevertheless marked impacts, particularly Hartley County.

Operating Base Effects on Quality of Life

The most fundamental and longest lasting effects on quality of life would occur in counties which would have M-X operating bases. The bases would result in population increases and would generate secondary employment in these counties after construction work forces leave. Much of the postconstruction population growth would consist of Air Force personnel and their families, many of whom have college degrees, hold conservative values, and in regard to community affairs, are concerned about the quality of education for their children. The Air Force ways of life would represent a new element in counties with operating bases, especially since some personnel would choose to live off base.

The effects on quality of life that operating bases would have depend on a county's capacity to absorb social change, i.e., resiliency. Again population can be used as a surrogate variable to suggest the magnitude of social change and effects on quality of life that would occur in operating base counties. In general, counties with larger populations, major urban centers, greater social heterogeneity and economic diversity, and which have experienced the effects of recent population growth would be more resilient. These counties could absorb expected change with little effects on quality of life, especially their larger cities. This would be less the case in rural portions of such counties. Counties that are rural in nature, with one or two small towns (average population 2,000-4,000), a socially homogeneous population, and which have experienced little population growth, or even population decline, would be less resilient. These counties would sustain greater social change and therefore greater effects on quality of life if M-X operating bases were located in them.

Using these general criteria, if an operating base is located in Clark County, the Las Vegas urban area would sustain the least social change and the least effects on quality of life, in comparison to other counties in which a base might be located. Comparatively, the greatest effects of an operating base would be experienced in the highly rural, sparsely populated counties of Hartley and Dallam in Texas; Beaver in Utah; and White Pine in Nevada.

Iron County, Utah, and Curry County, New Mexico, would sustain quality of life effects that are intermediate between those anticipated for the very rural counties and those for the Las Vegas area.

These conclusions are based on Table 4.3.1-11. The table presents population figures for counties which would have a main operating base under various alternatives, and for those which might have a secondary operating base but not a main base. The first two rows of the table present census figures for each county for 1970 and 1980 to show size and amount of population growth or decline for each county. The third row gives population estimates for the years in which M-X construction is scheduled to begin under selected alternatives; these estimates serve as baselines for many estimates presented throughout Chapter 4.

Table 4.3.1-10. Magnitude and rate of population change: Alternative 8B

County	Compound Annual Rate of Population Growth or Decline, M-X Only		Percent Increase over Baseline, M-X Only	
	"Boom"	"Bust"	Peak	Long-Term
Bailey	3.7	-3.1	18.4	0.0
Castro	1.1	0.0	2.0	0.0
Cochran	1.1	-1.4	3.6	0.0
Dallam	13.9	-25.2	83.6	0.0
Deaf Smith	4.9	-13.7	16.9	0.0
Hale	1.9	0.0	3.5	0.0
Hartley	25.3	-17.4	88.9	0.0
Hockley	---	---	---	---
Lamb	0.4	-0.1	0.9	0.0
Lubbock	1.4	1.1	0.7	0.5
Moore	3.3	-6.1	14.9	0.0
Oldham	3.0	-4.5	8.1	0.0
Parmer	0.7	-0.5	2.9	0.0
Potter/Randall	1.6	0.7	2.5	0.6
Sherman	11.7	-22.6	71.6	0.0
Swisher	---	---	---	---
Chaves	4.4	-4.2	12.0	0.0
Curry	8.1	-3.4	57.5	33.1
De Baca	4.7	-9.5	21.9	0.0
Harding	48.6	-54.7	427.8	0.0
Quay	14.8	-12.9	73.9	0.0
Roosevelt	6.6	-2.1	34.9	18.3
Union	2.9	-5.0	6.1	0.0

T5575/8-22-81

Source: HDR Sciences, August 10, 1981 — for detailed population figures, see Section 4.3.3.3.

Table 4.3.1-11. Magnitude of population changes in counties with operating bases under designated alternatives.

	Clark, Nev.[1] Proposed Action Alts. 1,2,8		Beaver, Utah[1] Alts. 5,6		Curry, N.M.[1] Alt. 7		Iron, Utah[1] Alts. 3,4		Millard, Utah[1] Alt. 2		White Pine, Nev.[1] Alts. 3,5		Dallam, Tex.[2] Alt. 7		Hartley, Tex[2] Alt. 7	
	Population	Year	Population	Year	Population	Year	Population	Year	Population	Year	Population	Year	Population	Year	Population	Year
U.S. Census	273,288	1970	3,800	1970	39,517	1970	12,177	1970	6,988	1970	10,150	1970	6,012	1970	2,782	1970
U.S. Census	461,816	1980	4,378	1980	42,019	1980	17,349	1980	8,970	1980	8,167	1980	6,431	1980	3,987	1980
Baseline[3]	495,378	1982	4,700	1982	43,900	1982	18,400	1982	9,600	1982	8,000	1983	6,900	1982	3,700	1982
Peak M-X Construction	615,000	1986	36,000	1987	78,500	1986	48,200	1986	35,500	1987	39,000	1987	23,300	1987	20,300	1987
Percent population change from 1980 to peak year	24%		725%		87%		178%		296%		378%		262%		409%	
Population after construction work force leaves	699,600	1991	15,400	1992	61,200	1991	39,700	1991	26,500	1991	23,000	1992	10,700	1991	15,400	1991
M-X and Other Projects																
Baseline[4]	495,600	1982	6,500	1982	No other projects		18,500	1982	11,900	1982	8,300	1983	No other projects in Texas area		No other projects in Texas area	
Peak Year	616,100	1986	42,600	1986	--	--	48,500 plus 100 people	1987	43,000	1987	46,600	1987	--	--	--	--
Year after construction completed	700,400	1991	27,600	1991	--	--	39,900	1991	29,300	1991	27,300	1991	--	--	--	--

T5379/9-12-81

[1]Designates counties which would have main operating bases under the alternatives listed.

[2]Designates counties which could have secondary operating bases under the alternatives listed.

[3]Baseline refers to the year when construction begins. Population for that year is calculated on the basis of past trends. See the Population section in Chapter 4 of FEIS and Population ETR.

[4]Baseline population would be higher with other projects than for M-X alone, since other projects would stimulate additional anticipatory growth.

The fourth row gives population estimates during the peak year of M-X construction. The fifth row shows the percent of population increase from 1982 to peak year of construction. These percentages give a rough indication of the magnitude of the social changes that construction of the operating bases are likely to induce, and the effects of these changes on quality of life. Both positive and negative effects on quality of life would be most dramatic in Beaver, Hartley, White Pine, Millard, and Dallam counties, in that order. In comparison to the other seven counties, the Las Vegas urban area, where the bulk of Clark County's population lives, would experience the least dramatic effects. Curry County would experience fairly noticeable effects, but not nearly as dramatic as those that would be sustained in counties with less population.

The sixth row of the table provides population estimates for the year when the construction work force leaves. For each county, the population drops from the peak construction period to a level that is still considerably higher than in the baseline year. Thus counties with operating bases would experience many significant long lasting social changes which in turn would influence quality of life.

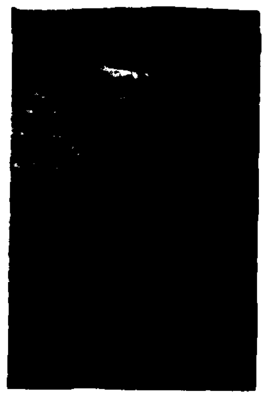
The last three lines of the table present similar information, but consider effects on population of both M-X and other major projects that may be started at the same time.

MITIGATIONS (4.3.1.11)

The extent to which adverse quality of life impacts outlined in this report may be mitigated is dependent in large measure on the attitudes and degree of planning which would be undertaken by the states, counties, and communities in the impact area. Some impacts may not be mitigable. Much of the boom town literature emphasizes mechanisms for planning and coordination in the management of rapid development (Jirovec, 1980:79-89; Bleiker, 1980:145-155). But the goals which planners set often exceed their grasp, and this needs to be recognized and incorporated into the planning process itself (Newitt, 1977:7). That is, the negative consequences of rapid development are inherent in the process and development plans would not necessarily prevent inadequate housing, overcrowding in schools and shopping areas, inflated prices, encroachment on wilderness, and other impacts. Also, these same actions would not preclude existing residents from losing control over community level decisions. Despite this, and "a consensus that to date there is no example of a local community or county which has successfully mastered the situation" (Myhra, 1976:12), there are a number of actions which can be taken to mitigate the adverse boom town impacts. Perhaps most important is the need for good projections of future population in-migration (HUD, 1976:2), since the ability of a community to ameliorate problems is only as effective as the information it receives from the sources of growth. Analysis for subsequent decisionmaking and local community and Air Force on-going planning process would provide this information. Section 4.3.3.3 provides the best estimate of the future population in-migration. But a flexible, adaptive local government management system must be developed since there could be differences between original forecasts and actual work forces. In order to avoid surprises, local people should be involved in a monitoring system to stay up to date with all developments (Raine, 1981:2). While specific mitigation measures are discussed in subsequent sections for separate resource categories in both the physical and human environment, and in the Mitigations ETR (ETR-38), examples of possible mitigation strategies for preserving community cohesion are given below.

The affected counties might consider establishing a community relations commission with citizen advisory committees to examine new approaches to improving the quality of life in the county, for example, a telephone referral service for information on available social and governmental services; orientation and education sessions; cultural and social activities; and coordinated membership drives of all volunteer organizations in the county (HUD, 1976:25, Gilmore and Dutt, 1975). Welcome wagons and other hospitality programs are good buffering mechanisms, easing the entry of newcomers into a community (HUD, 1976:25, Greene and Curry, 1977:7). Efforts to integrate newcomers with the community should center on a program to make them aware of "who is who" among existing residents and their organizations. Efforts also should be made to preserve community identity and pride without ignoring or denying the very real problems that might exist (Cortese, 1980a:24-25). Local government and groups could use radio, TV, and the news media and special newsletters to inform citizens to encourage their participation and activate community resources (Gilmore and Dutt, 1975). Local branches of state agencies could be established to help provide state services and technical assistance to communities (Greene and Curry, 1977:7). State universities or local colleges could provide community development, technical, or research assistance to various localities through the appropriate departments, particularly in identifying social values and social problems (Greene and Curry, 1977:7; Uhlmann, 1979:407). State universities could set up program training for students to work with professionals in communities in human service areas (Uhlmann, 1979:407). Above all else, people must rely on the essential nature of human inventiveness in the face of adversity and the great ability to cope, to get by, and eventually to come out ahead. As Dixon has so aptly put it, "a community is not merely a passive recipient of change; it has the power to affect the shape of change" (Dixon, 1978:119). However, the burden of such activity largely remains with the current citizenry, and while much of the work could be volunteer, it would also require expenditure of federal, state, and local resources.

Natural Environment



NATURAL ENVIRONMENT

Regions of the southwest considered as potential deployment areas for M-X are characterized by qualities of naturalness (minimal cultural modifications such as urban development) and solitude (low density human population). The historical constraints to development have been those environmental factors which define the regional fragility--scarce, unevenly distributed water, sensitive soils, and few physical features such as climate or waterways which create reliable natural centers for growth and commerce.

When effects of M-X deployment are superimposed upon such a region, several results can be anticipated. Those natural resources which characterized pristine or climax environments and are very fragile could suffer long-term irreversible effects of various magnitudes. These may include water resources, wilderness, and certain faunal elements such as bighorn sheep. The subclimax or successional resources are more adaptable. They may suffer serious short-term effect but can recover. Air quality, native vegetation, and pronghorn are in this category. This natural dichotomy is supported by recent history. Pronghorn, for example, recovered from early century levels of 10,000 animals to current levels of about one-half million.

The analysis of impacts for each natural resource was designed to incorporate the special qualities of that specific resource. Further, different project features affect separate resources in different degrees. The analyses reflect ecological areas (hydrologic subunits) in Nevada/Utah while political boundaries (counties) provide more identifiable areal units in Texas/New Mexico.

Water Resources

WATER RESOURCES

Nevada/Utah (4.3.2.1.1)

Land-based deployment of the M-X missile in multiple protective shelters would result in environmental consequences to water resources in the deployment area. The degree or severity of these effects would be determined by:

1. Local hydrologic conditions (both surface water and groundwater),

2. The current level of water resource development,

3. The final design elements in the deployment scheme, including water needs, construction methods, and the location and design of M-X wells or points of surface water diversion.

Construction of M-X facilities including roads, shelters, OBs, and ASCs would disrupt the physical setting and surface drainage characteristics. Resulting impacts could include erosion, sedimentation problems, and flooding, which, in turn, could cause deterioration of water quality or damage to wetland habitats. To some degree, these effects would be unavoidable and long term. However, mitigation measures would reduce such impacts. One simple but effective measure to minimize erosion, sedimentation problems, and flooding would be to ensure that pertinent hydrologic and geomorphic data are incorporated into the final design of roads, gully crossings, and runoff control structures.

Another water-related environmental effect would be from the amount of water required for construction and operation of the M-X system. In the arid to semiarid regions of Nevada/Utah that are under consideration, groundwater is the most dependable water supply. Surface water is available in some areas, but generally, surface water resources are scarce and/or fully appropriated. Impacts from the development of groundwater resources could include lowering of water levels, reduced spring flows, deterioration of water quality, and land subsidence. Such effects are largely determined by hydrogeologic conditions near withdrawal wells. Such impacts could be mitigated by carefully evaluating geology and hydrology at withdrawal sites to guide well placement and design.

Secondary environmental effects could also result from the development of groundwater resources for M-X. Diversion of natural groundwater discharge to wells could cause biological impacts where the discharge supports habitats for wildlife and plants. Secondary effects could also be felt by water users competing with M-X for available resources. Competing users include the agriculture, livestock, mining, and energy industries, urban and recreation uses, and Native American uses.

M-X Water Requirements

DDA construction would require water for structures, cluster roads, the DTN and ASCs. Construction activities that would require water are earthwork, concrete and concrete plants, aggregate plants, domestic uses, dust control, and irrigation for revegetation. These demands would require diversions at locations which are yet to be determined.

Table 4.3.2.1-1 presents estimates of the quantity of water that would be required in each hydrologic subunit in the siting area for the Proposed Action and Alternatives 1-6. The number of protective shelters and the miles of roads are also presented. Potential locations for construction camps are also presented in Table 4.3.2.1-1. Water for camps would be a significant portion of the total required for the subunit. The lower number of acre-ft, in columns which show a range of values, is the estimated demand without irrigation for revegetation. The higher value includes irrigation for revegetation. A description of the procedure used for calculating these demands is presented in Appendix A of ETR-12. Total M-X demands are presented in Table 2.2-1 of ETR-12.

Alternative 8, split-basing, locates facilities in fewer subunits than the full basing alternatives. Table 4.3.2.1-2 presents the affected subunits, the amount of facilities in each, and an estimate of water demands for construction activities. DDA operational water demands would be small and mostly for domestic uses at the ASCs. Water demands are estimated at less than 100 acre-ft per year per ASC. For the full basing alternatives, ASCs have been tentatively sited in the hydrologic subunits of Sevier Desert-Dry Lake, Utah, Stone Cabin, Nevada, Newark, Nevada, and Dry Lake, Nevada. ASCs for Alternative 8 have been located in the hydrologic subunits of Pine, Utah and Garden, Nevada.

Dependents of the construction force and in-migrants who provide support services will generate a short-term water demand that could stress the capacities of local communities. The magnitude of these indirect demands and a discussion of their impact is presented in ETR-39.

Potential Impacts to Surface Water Resources

The surface water resources of the proposed deployment area would be impacted by several M-X-related activities. These activities are primarily construction oriented, and would be short term. They include earthmoving, draining channel relocation and modification, devegetation, and camp development activities. Longer term impacts include placement of impervious surfaces, increased public accessibility, and materials handling and storage. The potential impacts of these activities can be separated into two general categories: physical impacts, which include changes or alterations to the physical characteristics of the

Table 4.3.2.1-1. M-X construction water requirements by hydrologic subunit for the DDA in Nevada/Utah.

Hydrologic Subunit No.	Hydrologic Subunit Name	No. of Protective Structures	Miles of Cluster Roads	Miles of DTN	No. of Construction Camps	Peak Year Range (Thousands of Acre-ft)	Peak Year MPQ[1] (Thousands of Acre-ft)	Total Project Range (Thousands of Acre-ft)	Total Project MPQ[1] (Thousands of Acre-ft)
4	Snake, Nev./Utah	345	464	88	1	2.8-5.0	4.4	5.1-11	10.7
5	Pine, Utah	115	155	65	1	2.4-3.3	3.0	3.8-6.0	5.7
6	White, Utah	161	216	87	1	2.2-3.5	3.1	4.0-6.9	6.4
7	Fish Springs Flat, Utah	69	93	22	0	0.3-1.0	0.6	0.6-1.8	1.7
8	Dugway, Utah	69	93	17	0	0.3-1.0	0.6	0.6-1.8	1.7
9	Government Creek, Utah	23	31	0	0	0.1-0.3	0.2	0.8-1.2	1.2
46	Sevier Desert, Utah	276	371	98	1[2]	2.4-5.8	5.5	4.5-12	7.0
46A	Sevier Desert-Dry Lake, Utah	92	124	47	1	2.1-3.0	3.0	2.4-4.4	4.1
54	Wah Wah, Utah	184	247	48	1	2.6-4.4	3.9	4.0-7.2	7.0
137B	Big Smoky-North, Nev.	115	155	27	0	0.6-1.8	1.3	1.0-3.0	2.4
139	Kobeh, Nev.	161	216	60	1	2.7-4.1	3.6	4.0-6.9	6.6
140	Monitor-North and South, Nev.	138	185	25	0[2]	0.7-3.8	1.2	1.1-6.0	3.4
141	Ralston, Nev.	207	278	60	1	3.8-6.0	5.7	5.1-8.8	8.5
142	Alkali Spring, Nev.	115	155	22	0	9.6-1.8	1.6	1.0-2.0	2.8
149	Stone Cabin, Nev.	138	185	59	1	2.4-4.0	3.4	3.01-5.5	5.2
151	Antelope, Nev.	138	185	40	1	2.3-3.9	3.5	3.3-5.7	5.5
154	Newark, Nev.	69	93	50	1	1.6-2.6	2.2	2.7-5.3	4.3
155A	Little Smoky-North, Nev.	92	124	30	0[2]	0.5-3.1	1.2	0.8-4.5	2.3
155C	Little Smoky-South, Nev.	69	93	12	1	1.4-2.2	2.2	2.1-3.3	3.3
156	Hot Creek, Nev.	184	248	48	0[2]	0.8-3.4	2.1	1.4-5.8	4.2
170	Penoyer, Nev.	138	185	22	0[2]	0.7-3.9	1.4	1.1-6.3	3.4
171	Coal, Nev.	115	155	42	1	1.8-3.0	3.5	4.7-6.4	4.3
172	Garden, Nev.	115	155	29	0[2]	0.6-3.0	2.1	1.0-6.4	2.9
173A	Railroad-South, Nev.	138	186	42	1	2.5-3.6	3.3	3.9-6.0	6.0
173B	Railroad-North, Nev.	207	278	116	1	2.0-3.9	3.9	2.6-6.0	5.4
174	Jakes, Nev.	92	124	33	0	0.5-1.5	1.1	0.8-2.5	2.3
175	Long, Nev.	69	93	40	1	1.6-2.1	1.9	2.6-3.9	3.7
178B	Butte-South, Nev.	92	124	30	0[2]	0.6-1.8	1.3	1.0-3.0	2.7
180	Cave, Nev.	69	93	10	0	0.6-1.6	1.5	0.6-1.7	1.7
181	Dry Lake, Nev.	230	109	35	2	1.9-2.7	2.8	5.3-3.9	8.6
182	Delamar, Nev.	69	93	20	0[2]	0.4-2.7	0.9	0.6-3.0	1.7
183	Lake, Nev.	115	155	28	1	2.1-3.5	3.5	2.6-4.4	4.3
184	Spring, Nev.	46	62	16	0[2]	0.4-2.5	1.1	0.4-2.7	1.2
196	Hamlin, Nev./Utah	138	185	40	0[2]	0.6-3.6	1.1	1.2-63	3.4
202	Patterson, Nev.	23	31	0	0	0.2-0.5	0.5	0.2-0.5	0.5
207	White River, Nev.	161	216	34	0	0.8-2.5	3.1	1.8-4.0	4.0
208	Pahroc, Nev.	0	0	20	0	0.1-0.2	0.1	0.1-02	0.1
209	Pahranagat, Nev.	0	0	14	0	0.1-0.2	0.1	0.1-0.2	0.1

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[1]MPQ - Most Probable Quantity, defined in ETR-12

[2]Indicates an additional construction camp is possible if proposed construction camp location is not acceptable.

Table 4.3.2.1-2. M-X water requirements by hydrologic subunit for construction of facilities in the DDA for Alternative 8, split basing.

Hydrologic Subunit	Number of Protective Structures	Cluster Road (Miles)	DTN (Miles)	Number of Construction Camps	Peak Year		Total Project	
					Range (Thousands of Acre-ft)	MPQ[1] (Thousands of Acre-ft)	Range (Thousands of Acre-ft)	MPQ[1] (Thousands of Acre-ft)
Snake, Nev./Utah	131	186	39	0	0.5-1.6	1.4	1.2-3.0	3.4
Pine, Utah	115	155	50	1	1.8-3.2	2.8	3.7-8.9	5.6
White, Utah	22	34	14	0	0.1-0.3	0.3	0.2-0.7	0.8
Fish Springs, Utah	4	5	0	0	m	m	m	m
Sevier Desert, Utah	165	217	45	0	0.9-2.8	2.5	1.4-4.2	4.1
Sevier Desert-Dry Lake, Utah	111	155	45	1	1.9-2.9	2.8	3.2-5.2	5.0
Wah Wah, Utah	181	248	53	1	2.4-4.1	3.9	4.7-7.9	7.6
Little Smoky-South, Nev.	55	62	10	0	0.3-2.0	0.9	0.4-2.9	1.2
Hot Creek, Nev.	152	217	41	1	2.6-4.8	4.1	3.2-5.9	5.7
Penoyer, Nev.	139	186	26	0	0.5-2.6	1.9	1.1-6.3	3.4
Coal, Nev.	115	155	40	0	0.5-3.7	1.2	1.0-6.5	2.9
Garden, Nev.	107	165	31	1	2.7-3.7	3.4	4.5-6.4	6.3
Railroad-South, Nev.	114	155	43	1	1.5-2.4	2.4	3.9-6.0	5.8
Railroad-North, Nev.	70	93	24	0	0.3-0.8	1.0	0.6-1.8	1.7
Cave, Nev.	69	93	9	0	0.2-0.6	0.5	0.6-1.7	1.7
Dry Lake, Nev.	216	279	73	1	1.7-2.8	2.4	4.0-7.7	7.5
Delamar, Nev.	66	93	22	0	0.3-2.1	0.5	0.6-3.8	1.7
Lake, Nev.	86	124	27	1	1.6-2.2	2.0	3.3-4.9	4.8
Spring, Nev.	46	62	16	0	0.2-0.5	0.3	0.4-1.2	1.2
Hamlin, Nev./Utah	145	186	42	0	0.6-3.0	1.9	1.2-6.3	3.6
Patterson, Nev.	23	31	0	0	0.1-0.2	0.2	0.2-0.5	0.5
White River, Nev.	159	217	34	0	0.6-2.0	1.4	1.4-4.0	4.0
Pahroc, Nev.	10	14	2	0	0.1-0.2	0.1	0.1-0.3	0.3

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[1] MPQ - Most Probable Quantity
M = minor demand, 0.1 acre-ft

surface water resource, and supply impacts, which may be defined as alterations to the system due to reduced water flow or the alteration of spatial distributions of flow.

Potential Physical Impacts

Three potential primary physical impacts to water resources would result from the construction and installation of the M-X facilities. First, erosion may increase during intense rainfall resulting in higher concentrations of suspended and settleable solids in the storm runoff. This would have numerous impacts downstream in the affected area, including higher flood damages, impacts to fish, vegetation, and wildlife, and water quality degradation due to sediment borne pollutants.

The second potential primary physical impact to the surface water resource would be increased storm runoff caused primarily by impermeable surfaces, such as roads, and rooftops. A lesser cause of increased runoff would be compaction of surface soils by construction equipment. Higher peak rates of runoff would increase sheet erosion and channel erosion. Higher peak erosion would cause higher flood elevations downstream, which could cause increased flood damages, channel meander, and bed degradation. Higher runoff volumes would result in increased flood damage and more sediment in downstream areas.

The third potential primary physical impact to surface water resources would be the alteration of natural drainage courses and channels due to the placement of roads, shelters, etc. This would cause instability to existing channels and increased channel erosion, and bed degradation, which would affect vegetation and wildlife downstream.

Potential Supply Impacts

If surface waters are used to meet M-X water requirements, four potential primary supply impacts would result. First, existing users downstream would potentially be impacted. Reduction in surface water supplies would lessen groundwater recharge near the stream. These wells could eventually run dry, pumping costs could increase and capacities decrease. Existing users who have not obtained either a right or an allocation because of the small magnitude of their use would be impacted, again due to reduced supplies. Existing users will also be impacted due to water quality degradation, which is the second potential primary supply impact.

Second, water quality downstream of the withdrawal points for M-X usage will be degraded due to the reduced supply available for mixing and dilution. This will result in increased concentrations of settlable and suspended solids, total dissolved solids, and dissolved oxygen. The mixing characteristics of thermal effluents will also be impacted, due to reduced flow velocities and volumes.

The third potential primary supply impact related to M-X use of surface water would be the potential depletion of groundwater supplies. This is caused by two factors. First, there would be an increased discharge into the stream from surficial aquifers and interflow zones, since water elevations in the stream will be lower. Second, a lesser quantity of water would be available for recharge. It is anticipated, however, that the magnitude of these impacts would be small.

The fourth potential primary supply impact of this project on surface waters will be a reduced capacity to support future development. Again, this is due to the diminished supplies available. Although secondary impacts of reduced development are widespread, the magnitude of the impacts are impossible to assess due to the speculative nature of future development.

Drought interrupts the flow of water supplies and increases the consumption requirements from water in storage. Man can cope partially with drought by installing additional wells for immediate use or by constructing surface water storage facilities for emergency use. Longer droughts tend to require water conservation measures by all users.

Potential Impacts to Groundwater Resources

It was observed by some ten different sources that a local water table decline, or a cone of depression around an active water well, could cause highly significant impacts. They asked that the EIS indicate the level of impact that is possible with M-X. They further commented that provision should be made for increased monitoring and mitigation if any anticipated or actual impacts affect any surface water sources. "This should be discussed in greater detail in the FEIS" was the recurring comment.

Implementation of the M-X project would require significant development of groundwater resources to meet both the relatively short-term (2-5 years) construction needs and the long-term (about 30 years) support facility needs. Available groundwater resources in the regions of the southwestern United States being considered for M-X deployment are not large when viewed in the context of the existing legal and economic constraints on resource development. Changes in the availability of water could affect many sectors of life in these regions.

The potential direct effect of M-X water development on groundwater resources is the lowering of the potentiometric surface in source aquifers. The potentiometric surface is an imaginary surface defined by levels to which water would rise in tightly cased wells, each open to a given point in the same aquifer. The water table is a particular potentiometric surface in an unconfined aquifer (an aquifer open to the atmosphere through interconnected pores in the earth materials above the water table). The potentiometric surface reflects both the elevation of the well opening to the aquifer and the pressure of the water at that point. Pumping water from an aquifer or decreasing aquifer recharge results in a lowering of water pressure within the aquifer and, consequently, a lowering of water levels in other wells within the pumped well's zone of influence. The essential factors that determine the spatial and temporal responses of aquifers to development by wells were set forth in detail by Theis, 1940 and are summarized as:

- Distance to, and character of, the aquifer's recharge sources
- Distance to the location(s) of natural groundwater discharge
- Hydraulic properties of the aquifer which control its ability to transmit and store groundwater
- The rate and duration of pumping

Thus, within an area the size of the Great Basin (or the High Plains Region of west Texas and eastern New Mexico), the specific aquifer responses to groundwater development will vary widely, as the above four factors may be expected to vary in both time and space.

Several potential impacts could result from the lowering of the potentiometric surface.

It would increase the pumping costs for competing water users. The Governor of Utah and several others commented that the impacts of reduced groundwater levels need to be calculated as increased pumping cost in the FEIS, and asked who would pay for these increased costs or those costs that could occur if it is necessary to deepen a well? Thus, it becomes clear that economic burden may be conveyed to existing and future groundwater users (if significant volumes of water are removed from aquifer storage) which, in turn, may lead to significant socioeconomic impacts.

It would also reduce stream and spring flows. A reduction of stream and/or spring flow could result from a lowering of the water table in the source aquifer(s). If the surface flow is currently fully diverted for beneficial use then the user(s) would be immediately impacted. Unlike the well user who could still pump from a well with a lowered water table, the spring or stream user would have no immediate means of retrieving the lost water. Corresponding socioeconomic impacts may be felt in areas which depend on springs or streams. If M-X water development disrupts regional groundwater flow, then surface water flow, comprised in part, or totally, of groundwater discharge in adjacent valleys or regions, could be affected.

The following figures and discussion are intended to show hypothetical impacts on spring flows which could result from M-X groundwater development. The discussion also applies to impacts on effluent (gaining) streams. Whether or not such hydraulic responses actually occur will depend on well placement and design, pumping schedules, and the hydraulic properties of the aquifer(s).

Figure 4.3.2.1-1 shows a generalized cross section of a hypothetical valley with a discharging playa. The springs shown represent discharge from an idealized groundwater flow system as discussed for the Great Basin region by Maxey (1968). Pumping from the valley fill could intercept all or a portion of the natural discharge as shown in Figure 4.3.2.1-2. M-X groundwater development in a valley fill aquifer could also affect springs which discharge from carbonate rocks. Figure 4.3.2.1-3 is a cross section showing hypothetical springs discharging from openings and cracks in carbonate rocks. The springs recharge the valley fill aquifer. The springs transmit groundwater flow and allow a degree of hydraulic continuity between the carbonate rocks and the valley fill. Hydraulic responses (changes in water pressure and water levels) caused by pumping of the valley fill could be transmitted into the carbonate rocks and eliminate or reduce spring flow. In Figure 4.3.2.1-4, the alluvial well has effectively intercepted groundwater discharge from the carbonate rocks and diverted it to the well. Discharge from regional flow systems may also issue from fault zones. Such springs often occur along the margins of valleys in the Great Basin region. Hydraulic responses of these springs to pumping could be similar to those shown in Figure 4.3.2.1-4.

The U.S. Geological Survey conducted a study in Ash Meadows, Nye County, Nevada to investigate the effects of groundwater pumping on spring flows and water

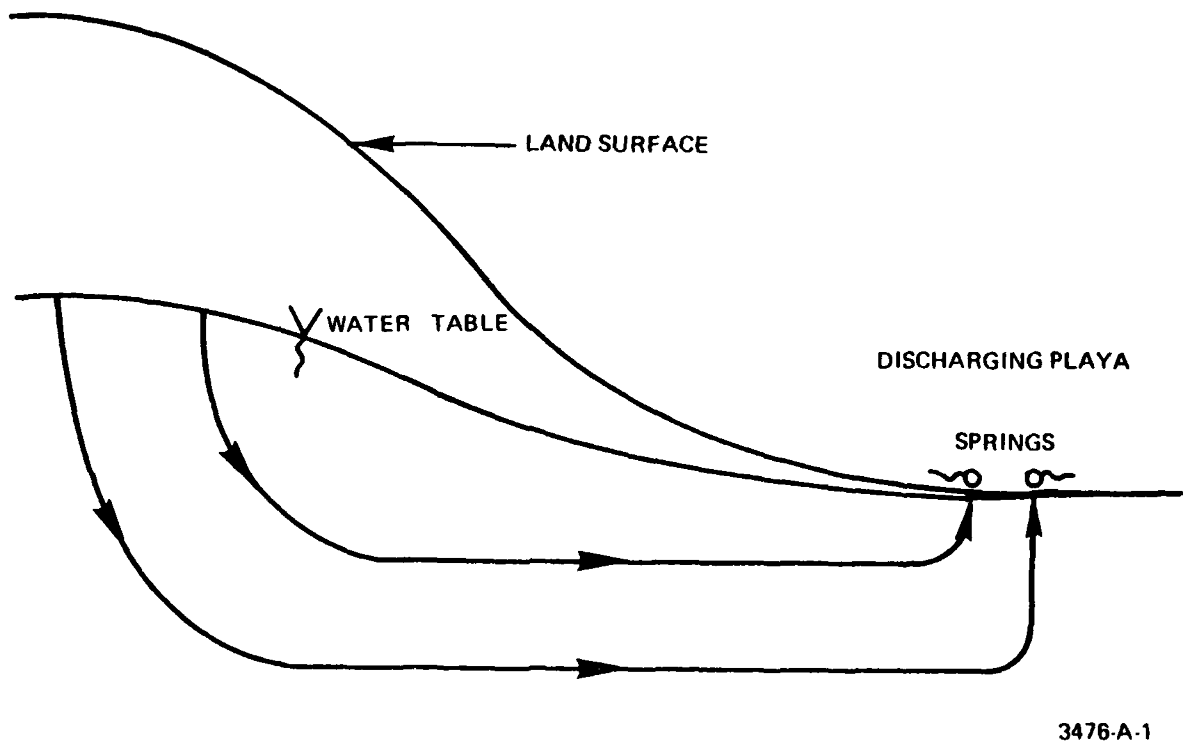

Figure 4.3.2.1-1. Idealized groundwater flow system for drainage basin in the Great Basin (Maxey, 1968).

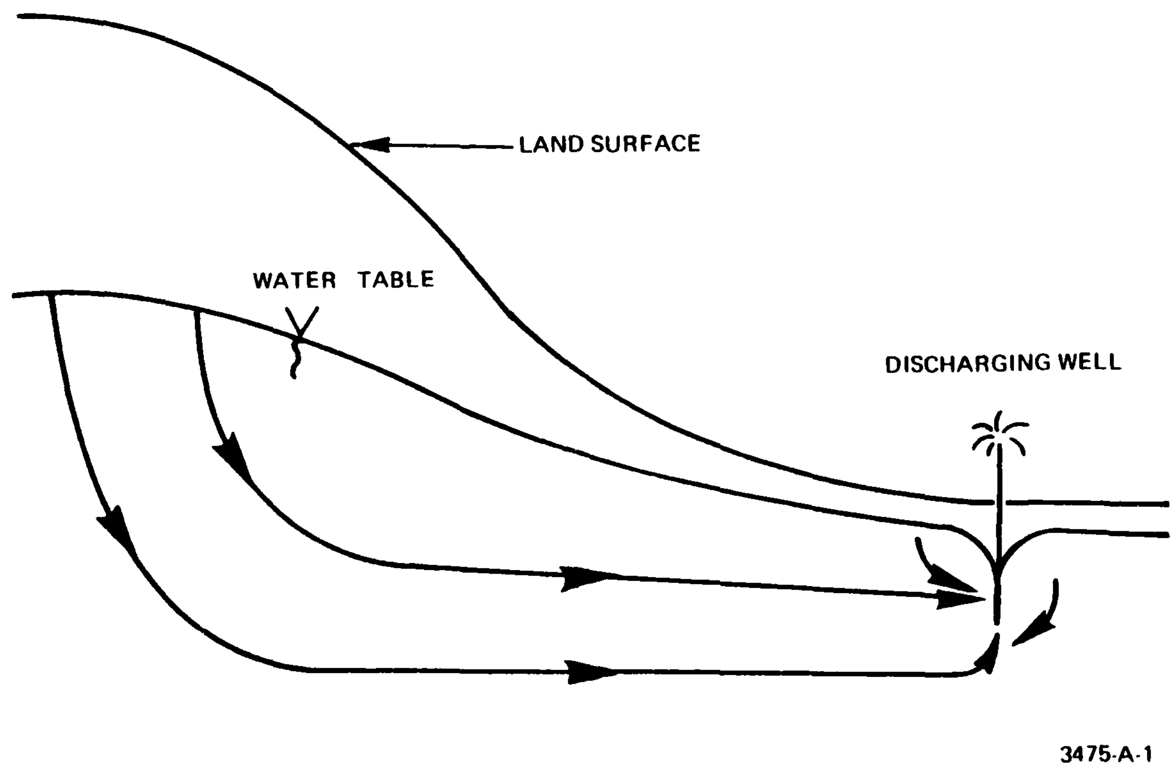

Figure 4.3.2.1-2. Idealized groundwater flow system with discharging well intercepting natural discharge (Maxey, 1968).

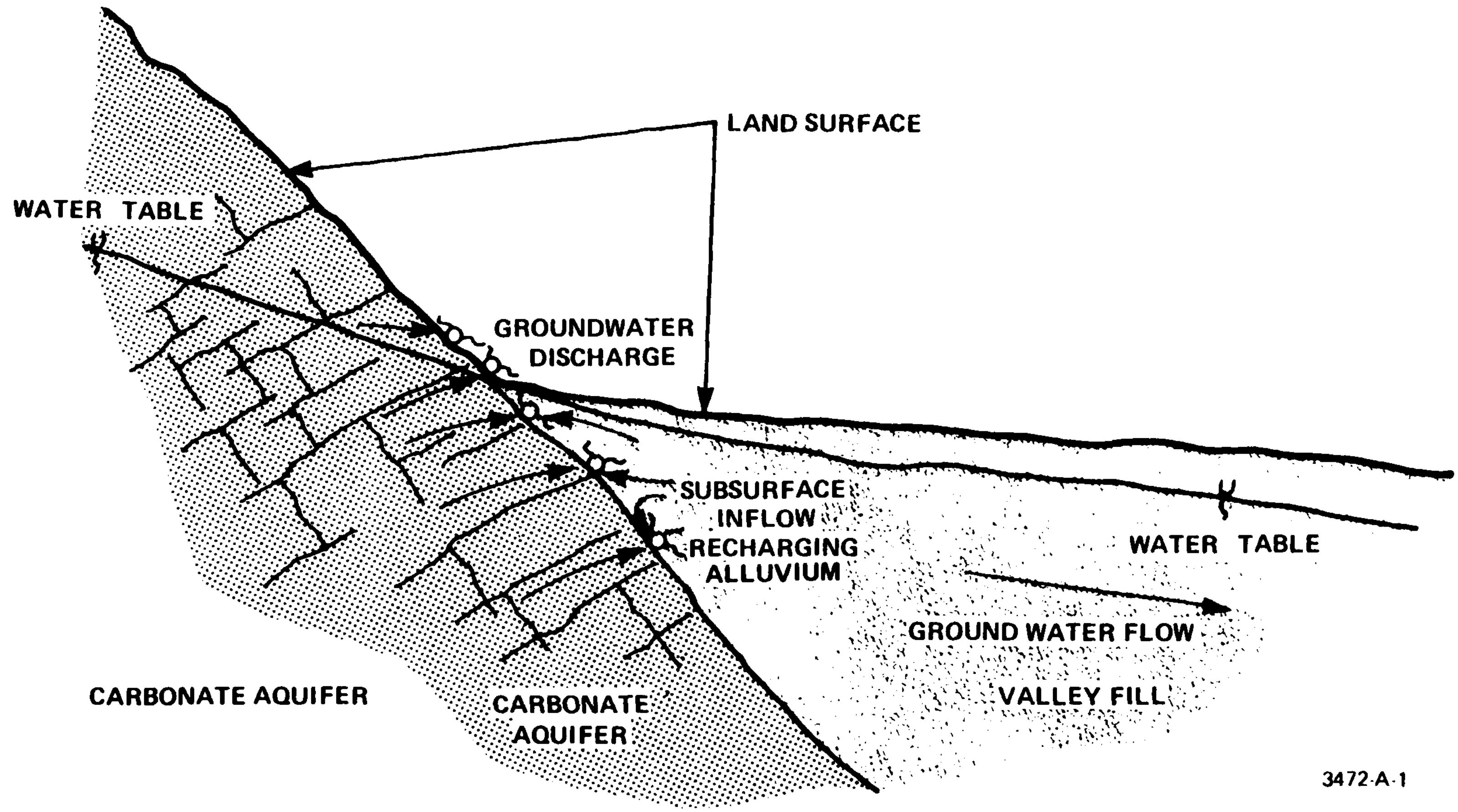

Figure 4.3.2.1-3. Idealized cross section showing recharge of valley fill by discharge from carbonate aquifer (Maxey, 1968).

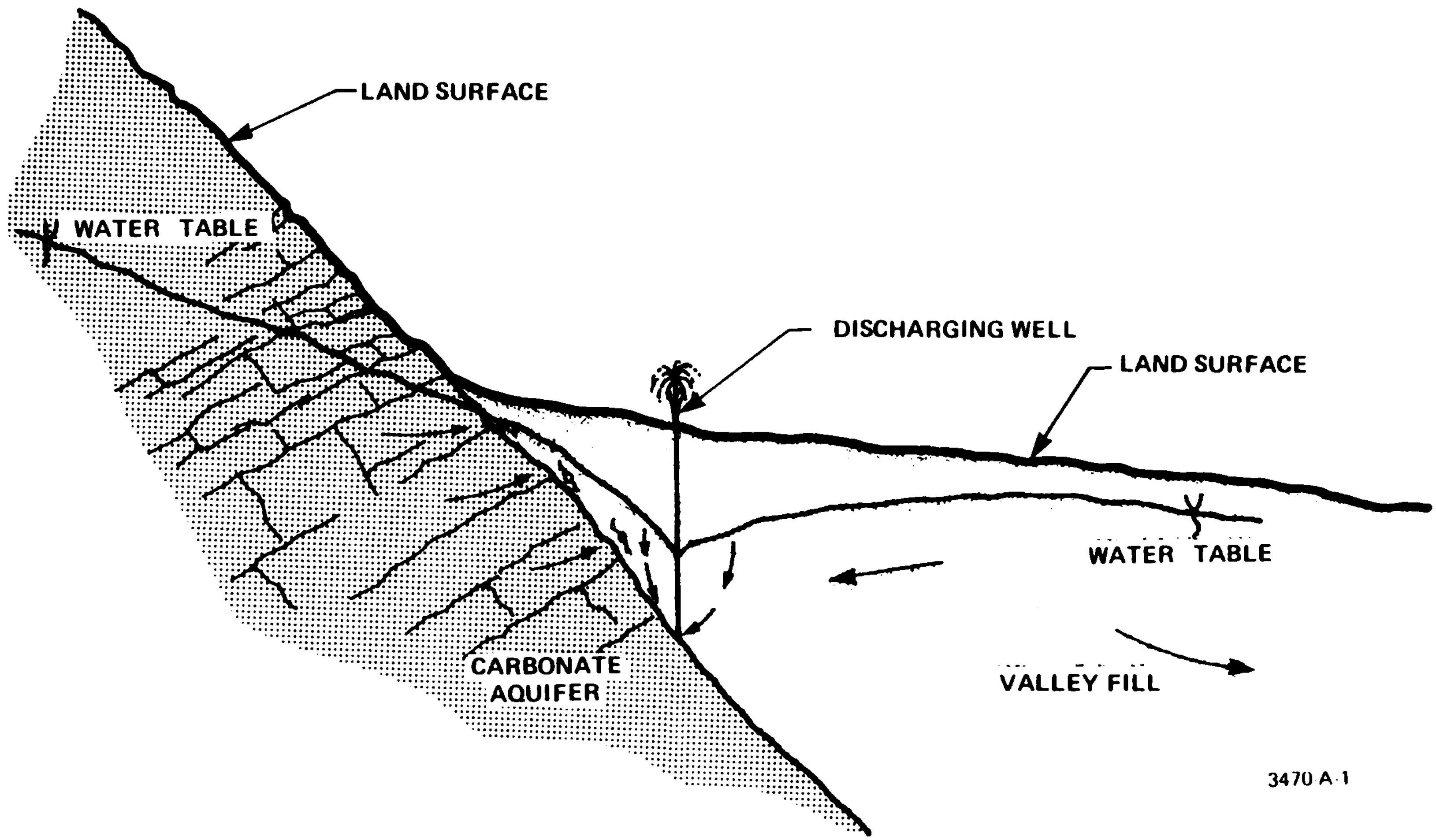

Figure 4.3.2.1-4. Idealized cross-section showing possible effect of groundwater development in valley fill on springs discharging from the carbonate aquifer.

levels in limestone dissolution or collapse features (Dudley and Larson, 1976). The springs are fed by discharge from a regional groundwater flow system, which is developed largely in a deep carbonate aquifer extending over an area of several thousand square miles in southern Nevada. The investigation confirmed that pumping from the shallow aquifers effected significant hydraulic responses in the springs and collapse features. The authors conclude that the hydraulic relationships between the local and regional aquifer systems are exceedingly complex and remain poorly understood. However, it is clear that many of the shallow wells effectively draw water from the lower carbonate aquifer by lowering the water table and potentiometric surface in the local aquifers, which in turn induces more discharge from the regional system to the east of Ash Meadows (Dudley and Larson, 1976).

Water quality could be adversely impacted if M-X diversions remove significant volumes of water from aquifer storage. As an alluvial aquifer is dewatered, water from relatively impermeable silt and clay layers drains to the well. Often this water is of poor quality because of its contact with the fine-grained materials containing a much higher percentage of soluble salts than the more permeable sand and gravel.

Groundwater quality could also be adversely affected by saline water intrusion caused by extensive pumping. This could occur where fresh water aquifers are underlaid by aquifers containing saline water under artesian pressure, or where the fresh water aquifer is bordered by saline water. Pumping from fresh water aquifers which are hydraulically connected to a saline water aquifer tends to cause migration of saline water toward the well. As fresh water levels are lowered by pumping, saline waters will rise and migrate toward the discharging well.

Water uses most sensitive to changes in water quality include domestic, industrial, and to a lesser extent, irrigation. In areas where existing water quality is marginal, further deterioration could render the source unfit.

Another potential impact is the disruption or destruction of wildlife habitat. Springs could dry up because of M-X-related groundwater development. This could reduce or destroy wetlands habitats and areas of phreatophyte vegetation. From a purely water management point of view, a project which derives water largely from intercepted natural groundwater discharge is viewed with favor because water that was formerly being lost or "wasted" to evapotranspiration, is being put to beneficial use. In many areas, however, natural groundwater discharge maintains an important habitat for native plants and wildlife. Some of these areas support important water-based activities such as hunting and fishing and may be of critical cultural significance to Native Americans. If such areas of natural groundwater discharge are partially desiccated, the ability of the land to support such uses would be damaged or destroyed. In confined aquifers, interception of natural discharge could occur quickly as the pressure effects of pumping can be transmitted over large distances in short periods of time. In unconfined aquifers, considerable volumes of water usually must be removed from aquifer storage before a spring or natural discharge is disrupted.

Land subsidence from the withdrawal of groundwater, is usually most severe in areas close to well fields and can be serious, particularly in metropolitan areas where damage to buried pipes, building foundations, or other structures might occur. Land subsidence is caused primarily by the compaction of clays as hydrostatic pressure declines, and more and more of the lithostatic load is supported by the column of earth materials. Land subsidence is most often a problem when wells are completed in thick sequences of poorly consolidated sediments such as the valley fill aquifers in the Great Basin Region. Subsidence also leads to vertical cracking in the alluvial materials which can threaten aquifer integrity from a water quality point of view.

As discussed above, it is clear that if groundwater resources are affected in areas where an important interaction exists between groundwater and other natural or human resources, then impacts are possible. However, when proper well field design techniques are employed and a careful monitering program is maintained, the potential for impacts can be considerably decreased or minimized.

Potential Long- and Short-Term Impacts

All impacts can be short or long term. Short-term impacts are those which are assumed to occur during the pumping period or for two years afterward. Long-term impacts are considered to be those which persist for a period greater than two years after pumping ceases.

Whether impacts on groundwater availability are long or short term will depend on where M-X withdrawals occur, and the hydrogeologic conditions that control aquifer response at those sites. Factors that control the rate and completeness of water level recovery in wells include:

- The rate and duration of pumping.
- The water-transmitting and storage properties of the source aquifer(s).
- The proximity to areas of natural or artificial groundwater recharge and discharge.

Impacts such as lower water levels in wells and reduced spring flows may be of short or long duration, depending on one, or a combination of these factors. Long-term impacts are arbitrarily considered those which persist for a period greater than two years, or after pumping ceases.

Water quality deterioration, as a result of excessive groundwater withdrawals, will generally persist for many years after pumping is either altered or eliminated. If M-X withdrawals led to either saline water intrusion or to extensive dewatering of fine-grained alluvial materials, then long-term water quality degradation could result. Mitigations could reduce this impact. However, experience shows that such measures are rarely completely successful. Groundwater quality problems would be most likely at OB sites, where withdrawals would be large for many years. Disruption of wildlife habitat caused by reduced spring flows and lower water levels in discharge areas would be a likely long-term impact. Such a disruption in a biologic community could persist for many years beyond the time required for spring flows and water levels to recover. Similarly, land subsidence caused by groundwater pumping, if it occured, would be essentially permanent. Subsidence would be most likely at OB sites and could create problems with foundations or buried pipelines.

Impact Analysis of Potential Impact Occurrence

Determination of how much water can be withdrawn from an area without creating undesirable effects requires analysis of both the hydrologic relationships between a pumped well and the source aquifer, and the legal constraints that define the degree to which specific impact can be tolerated. Performing such analysis on the large aquifer systems of the arid southwest is particularly difficult because both the physical and legal factors change radically over very short distances. Consequently, the specific location of pumping greatly influences the impacts of water development in any given case. Because data on aquifer performance coefficients are not available in most valleys or areas being considered, and because M-X wells have not yet been located, it is not possible to evaluate the specific impacts of M-X water development in any detailed or quantitative sense.

Since the most significant potential impact of M-X on groundwater resources would be its effect on groundwater availability, this analysis is a preliminary assessment of the potential for impacts on groundwater availability. It uses generalized resource information from published reconnaissance-level and regional-scale hydrologic studies. The scale of the analysis allows for evaluation and comparison of results from one valley (Nevada/Utah) or groundwater region (Texas/New Mexico) to another. This analysis does not delineate where impacts could occur within valleys or regions, nor are impacts quantified in terms of water level declines, reductions of spring flows, loss of wildlife habitat, deterioration of water quality, or land subsidence.

The results of this analysis provide valuable information to those responsible for planning and directing future M-X groundwater investigations and groundwater development strategies. For example, regions or valleys with a low potential for impact are those which are likely to be capable of sustaining additional groundwater development beyond present levels to satisfy M-X demands. Impacts on groundwater availability should be within legally and environmentally acceptable limits when groundwater development plans are based on the results of onsite aquifer performance testing and on a thorough knowledge of existing wells and springs in the vicinity.

Regions or valleys with a high potential for impact are those where a combination of physical and/or legal constraints on groundwater development suggest that some unacceptable impacts are more likely to occur from new development. Specific care will be needed in the design of the well field and the monitering program to assure that unacceptable impacts do not occur. If after the analysis of an area, a well field cannot be safely located, importation of water could be required. Where legal factors constrain new development, the importation of water or arrangements for purchasing or leasing existing water rights could be required. The best strategies to follow will be determined after detailed on-site studies. This includes aquifer testing and well and spring inventories. These studies would be completed as part of subsequent environmental tiering processes.

The method used in assessing groundwater impacts examines gross resource characteristics in the context of factors such as current use, M-X use, legal constraints, perennial yield, and aquifer depletion rates. The method calls for an evaluation of these factors to distinguish between "low", "medium", or "high" potential for significant impact. By necessity, reliance had to be placed on an information base which was available for areas considered for M-X deployment. This information base was developed in part by hydrologists and geologists who have studied water resources in the project area on a reconnaissance level. Because these assessments were arrived at through subjective "professional judgment," they relfect, to some extent, the individual biases of the original authors.

The evaluation of impacts of the M-X project on groundwater resources is based on the assumption that M-X water needs for both short-term construction and long-term operations would be met by developing local groundwater sources beyond the current level of development. This may not turn out to be the case, particularly in areas where legal constraints are significant, but until water development plans are better defined, this assumption provides a consistent framework for comparing potential impacts from one area to another.

Other assumptions used in the analysis are:

- M-X impacts are potentially more significant if M-X water needs are large compared to current groundwater use, perennial yield of the hydrologic system, and available aquifer storage

- M-X impacts are potentially more significant if the groundwater system is already under some stress either by high current aquifer depletion rates, or by situations where current groundwater use is large compared to perennial yield of the system and available aquifer storage.

The input data considered in the analysis were as follows:

- Estimates of economically recoverable groundwater in storage for sites in Texas and New Mexico (Woodward-Clyde, 1980).

- The magnitude of current groundwater use (Nevada and Utah) (Desert Research Institute, 1980; Utah Water Research Lab, 1980; Price et al., 1979).

- Estimated perennial yield of the hydrologic system (Nevada and Utah) (State of Nevada, 1971 and Price, 1979).

- Current groundwater depletion rates (Texas and New Mexico) (Woodward-Clyde, 1980)

- Legal constraints on groundwater development (Nevada and Utah State Engineer's Office, 1981).

- Estimated M-X water demands.

Approximately thirty public and agency comments pointed out that the low, moderate, and high impact ratings should be quantified; that groundwater impacts were not analyzed in sufficient detail to allow meaningful conclusions to be drawn or to provide useful information to decisionmakers, and that the discussion of water resources impacts is evasive and inconclusive. In addition, a number of comments asked this question: How will the FEIS handle impacts when data are not available?

In the absence of aquifer performance data it is felt that the perennial yield, which reflects the estimated quantity of water that can be withdrawn annually for an extended period without serious consequences, is the most sensitive and useful resource characteristic available for evaluating potential impacts of water development projects. Although the analysis in this report relies heavily on perennial yield, it is realized that the volume of groundwater in storage and areal extent of the valleyfill aquifer are also useful indicators of potential for impacts. For example, using the conservative, or "worst case," assumption that all M-X water requirements will come from aquifer storage, (i.e., natural recharge and discharge remain unaffected) then it follows that the more water that is available in storage, the less the impact will be on water availability. Similarly, if the areal extent of the valleyfill aquifer is large, as reflected by groundwater storage, then more options are available for locating and spacing wells to minimize significant impact. This also allows more room to avoid impermeable boundary conditions which, if encountered by the zone-of-influence of a discharging well, would lead to greater localized drawdown.

For sites in Nevada/Utah, the analysis of potential impact was carried out primarily by comparing the current usage and the M-X demands in each valley with the estimated perennial yield. The nature of the potential impact is not determinable by this analytic procedure, but is considered in the discussion of the individual sites (subsection 4.1.4.5 of ETR-12). The total water in storage and the size of the hydrologic unit were also considered, but are not definitive. For example, there is no case where the total of M-X demand and current usage exceeds one percent of the water estimated to be stored in the top 100 feet of each aquifer.

In evaluating the potential for short-term impacts, a "high" potential was assigned if a significant stress would be added to an aquifer already subjected to high demands (sum of current usage and peak M-X demand exceeds perennial yield). In valleys where the total stress (sum of current usage and peak M-X demand) was less than the perennial yield, a "high" potential was also assigned if a large new stress would be applied (peak M-X demand greater than 75 percent of perennial yield), a "moderate" potential was assigned if a medium sized new stress would be applied (peak M-X demand between 25 and 75 percent of perennial yield), and a "low" potential was assigned if a small new stress would be added (peak M-X demand less than 25 percent of perennial yield.) However, in those hydrographic subunits where current use is less than 100 acre-ft per year, the level of potential for impact was decreased to the next lower category.

The same data were used for evaluating the potential for long-term impacts, but the criteria were modified from the short term. For DDAs, nearly all the water demand would occur during the construction phase. Consequently, long-term effects, if they occur, would be due to a large localized stress which may result in changes to the aquifer structure or recharge system. Thus a high potential for long-term impact was assigned if the total stress (peak M-X demand, plus the current use during that year) exceeded twice the perennial yield, a moderate potential was assigned if the total stress was between one and two times the perennial yield, and a low potential was assigned if the total stress was less than the perennial yield. In those hydrographic subunits where the present usage is less than 200 acre-ft per year, the level of potential for impact was decreased to the next lower category.

To summarize, quantitative evaluation of the occurence, nature, and degree of M-X-related groundwater impacts will depend on the location and construction details of M-X wells, the pumping rate and duration, the hydraulic characteristics of the aquifer(s) in the area of pumping, and the degree of hydraulic continuity between M-X wells and points of current water use. These data are not currently available for the Tier 1 analysis, but will be developed in subsequent environmental tiering processes. However, the analysis method used to evaluate potential for impact of M-X development on groundwater availability provides an indirect qualitative measure of potential for significant groundwater impacts on a valley-by-valley basis for Nevada/Utah and on a region by region basis for Texas/New Mexico. Table 4.3.2.1-3 and 4.3.2.1-4 summarizes the basic data used to evaluate potential for impact for DDA construction in each hydrologic subunit in Nevada and Utah, and presents the resulting impact assessment. Figures 4.3.2.1-5 through 4.3.2.1.1-8 present the relationships between the parameters which formed the basis for the analysis. The actual numeric values of different parameters are presented in the previous tables. This analysis is made on a worst-case basis. Through proper well field design and the implementation of an effective water resources management program, the impacts will be significantly decreased or minimized.

A more detailed description of the potential for impact is presented in Section 4 of ETR-12 on a valley by valley basis.

Texas/New Mexico (4.3.2.1.2)

Land-based deployment of the M-X missile in multiple protective shelters result in several types of environmental consequences which are related to area water resources. The degree or severity of these effects will be determined by:

- Local hydrologic conditions (both surface water and groundwater).
- The current level of water resource development.
- The final design elements in the deployment scheme, including: water needs, construction methods, and the location and design of M-X wells or points of surface water diversion.

Construction of M-X facilities including roads, shelters, OBs, and ASCs would disrupt the physical setting and surface drainage characteristics. Resultant impacts could include erosion, sedimentation, and flooding problems, which, in turn, could cause deterioration of water quality or damage to wetland habitats. To some degree, these effects would be unavoidable and long term in nature. However, mitigation measures could reduce these impacts. One simple but effective measure to help minimize flooding and erosion and sedimentation problems would be to ensure that pertinent hydrologic and geomorphic data are incorporated into the final design of roads, gully crossings, and runoff control structures.

Another water-related environmental effect may result from the water required for construction and operation of the M-X system. In the arid to semiarid regions of Texas/New Mexico, groundwater is the most dependable water supply. Ute Reservoir in eastern New Mexico could be an important exception to this. There are currently approximately 15,000 acre-ft/year of surface water available for appropriation through contact with the New Mexico Interstate Stream Commission. Potential impacts resulting from development of groundwater resources could include lowering of water levels, reduced spring flows, deterioration

Table 4.3.2.1-3. DDA construction impact assessment - full basing, Nevada/Utah (Page 1 of 3).

Hydrologic Subunit No.	Hydrologic Subunit Name	Perennial Yield[2] (Thousands of Acre-ft Per Yr)	Current Groundwater Use[3] (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Peak (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Total (Acre-ft)	Volume[5] in Storage (Thousands of Acre-ft)	Ratio of Peak M-X Demand to Perennial Yield (Percent)	Ratio of Peak M-X Demand Plus Current Use to Perennial Yield (Percent)	Potential for Impact[6] Short Term	Potential for Impact[6] Long Term
4	Snake, Nev./Utah	49	15.8	5.0	11.0	12,000	10	42	Low	Low
5	Pine, Utah	7	M[7]	3.3	6.0	1,200	47	47	Low	Low
6	White, Utah	32	M	3.5	6.9	700	11	11	Low	Low
7	Fish Springs, Utah	35	0.4	1.0	1.8	600	3	4	Low	Low
8	Dugway, Utah	12	3.3	1.0	1.8	3,800	8	36	Low	Low
9	Government Creek, Utah	1	0.7	0.3	1.2	700	30	100	High	Moderate
46	Sevier Desert, Utah			5.8	12.0					
		25	49.2			8,200	35	232	High	High
46A	Sevier Desert - Dry Lake, Utah			3.0	4.4					
54	Wah Wah, Utah	10	M	4.4	7.2	800	44	44	Low	Low
137A	Big Smoky(s), Nev.[8]	6	30.4	1.8	3.0	7,000	536	536	High	High
139	Kobeh, Nev.	16	3.3	4.1	6.9	2,700	26	46	Moderate	Low
140A	Monitor, Nev.	8	M	3.8	6.0	1,000	48	48	Low	Low
141	Ralston, Nev.[8]	6	1.0	6.0	8.0	2,700	100	117	High	Moderate
142	Alkali Spring, Nev.	3	0.3	1.8	2.9	1,300	60	70	Moderate	Low
149	Stone Cabin, Nev.[8]	2	1.0	4.0	5.5	2,200	200	250	High	High
151	Antelope, Nev.	4	0.4	3.9	5.7	1,200	98	108	High	Moderate
154	Newark, Nev.	18	6.5	2.6	5.3	1,500	14	51	Low	Low
155A	Little Smoky, N, Nev.	5	M	3.1	4.5	1,500	62	62	Low	Low
155C	Little Smoky, S, Nev.	1	M	2.2	3.3	900	220	220	Moderate	Moderate
156	Hot Creek, Nev.	6	0.3	3.4	5.8	2,300	57	62	Moderate	Low
170	Penoyer, Nev.[8]	5	5.7	3.7	6.3	2,200	74	188	High	Moderate

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Table 4.3.2.1-3. DDA construction impact assessment - full basing, Nevada/Utah (Page 2 of 3).

Hydrologic Subunit No.	Hydrologic Subunit Name	Perennial Yield[2] (Thousands of Acre-ft Per Yr)	Current Groundwater Use[3] (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Peak (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Total (Acre-ft)	Volume[5] in Storage (Thousands of Acre-ft)	Ratio of Peak M-X Demand to Perennial Yield (Percent)	Ratio of Peak M-X Demand Plus Current Use to Perennial Yield (Percent)	Potential for Impact[6] Short Term	Potential for Impact[6] Long Term
171	Coal, Nev.	6	M	3.0	6.4	1,500	50	50	Low	Low
172	Garden, Nev.	6	0.1	3.0	6.4	1,500	50	52	Moderate	Low
173A	Railroad, S, Nev.					2,100				
		75	4.2	7.5	12.0		10	16	Low	Low
173B	Railroad, N, Nev.					6,000				
174	Jakes, Nev.	12	M	1.5	2.5	1,000	13	13	Low	Low
175	Long, Nev.	6	1.0	2.1	3.9	1,600	35	52	Moderate	Low
178B	Butte, S, Nev.	14	M	1.8	3.0	2,200	13	13	Low	Low
180	Cave, Nev.	2	M	1.6	1.7	1,000	80	80	Moderate	Low
181	Dry Lake, Nev.	3	M	2.7	8.9	2,800	90	90	Moderate	Low
182	Delamar, Nev.	3	M	2.7	3.9	1,200	90	90	Moderate	Low
183	Lake, Nev.[8]	12	14.2	3.5	4.4	1,800	29	*148*	*High*	*Moderate*
184	Spring, Nev.	100	4.8	2.5	2.7	4,200	3	7	Low	Low
196	Hamlin, Nev./Utah	25	0.9	3.6	6.3	1,200	14	18	Low	Low
202	Patterson, Nev.	5	0.4	0.5	0.5	1,800	10	18	Low	Low
207	White River, Nev.[8]	37	5.3	2.5	4.0	4,900	7	21	Low	Low
208	Pahroc, Nev.	2	M	0.2	0.2	1,300	10	10	Low	Low
209	Pahranagat, Nev.	25	2.9	0.7	0.7	1,700	3	14	Low	Low

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[1]Potential impact ratings represent a worst case. Groundwater in storage exceeds M-X demands by mor of 100 in all DDAs. The Air Force has committed to avoid impcts through careful well-field design, and to monitor and mitigate unexpected impacts.

[2]Nevada data from: State of Nevada Map, 1971: Water Resources and Inter-Basin Flows, Division of Water Resources, State Engineers Office, Utah, data from: Don Price, 1979; Summary Appraisal of the Water Resources of the Great Basin in RMHG-UGA 1979 Basin and Range Symposium.

[3]Groundwater use is defined as water pumped from wells.

[4]Represents high range of demand as shown on Table 4.1.1.2-2 of ETR 39.

[5]Estimated volume of water stored in the top 100 feet of the aquifer.

Table 4.3.2.1-3. DDA construction impact assessment - full basing, Nevada/Utah (Page 3 of 3).

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[6]Potential for impact, based on current usage and M-X demand as follows:

Water Use Item	Potential for Impact
Short-term impacts	
Ratio of current usage plus peak M-X demand to perennial yield ≥ 1	High
Ratio of current usage plus peak M-X demand to perennial yield <1	
and:	
$\frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} \geq 75\%$	High
$25\% \leq \frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} < 75\%$	Moderate
$\frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} < 25\%$	Low
Current use ≤ 100 acre-ft: decrease to next lower impact category.	
Long-term impacts	
$\frac{100 \times (\text{Peak M-X Demand + Present Use})}{\text{Perennial Yield}} \geq 200\%$	High
$100\% \leq \frac{100 \times (\text{Peak M-X Demand + Present Use})}{\text{Perennial Yield}} < 200\%$	Moderate
$\frac{100 \times (\text{Total M-X Demand + Present Use})}{\text{Perennial Yield}} < 100\%$	Low
Current use ≤ 100 acre-ft: decrease to next lower impact category.	

[7]M = Minor or less than 100 acre-ft per year.

[8]Nevada State Engineers Office considering legal constraints.

Sources: Unless otherwise noted, all figures are from: Industry Activity Inventory: Nevada M-X siting area Desert Research Institute, University of Nevada system in ERTEC, Inc., 1980, M-X siting investigation, industry Activity Inventory. Other Utah figures from: Industry Activity Inventory, Utah Water Research Lab, 1980. Beryl-Enterprise and Milford estimates are from: Don Price and others, 1979, groundwater conditions in Utah, spring of 1979: Utah Department of Natural Resources, Cooperative Investigation Report No. 18, 68 p. Butte, Jakes, and Long valleys were not inventoried as part of the industry activities study. However, the aggregate of wells inventoried in Butte and Jakes valleys during the valley reconnaissance program do not appear to have the combined capactiy to produce over 1,000 acre-ft/yr in either valley. Wells in Long Valley appear to have an aggregate capactiy of about 1,000 acre-ft/yr, but some wells were not in use at the time of the field reconnaissance.

Table 4.3.2.1-4. DDA construction impact assessment[1] – split basing, Nevada/Utah (Page 1 of 2).

Hydrologic Subunit No.	Hydrologic Subunit Name	Perennial Yield[2] (Thousands of Acre-ft Per Yr)	Current Groundwater Use[3] (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Peak (Thousands of Acre-ft Per Yr)	M-X DDA Construction Demands[4] Total (Acre-ft)	Volume[5] in Storage (Thousands of Acre-ft)	Ratio of Peak M-X Demand to Perennial Yield (Percent)	Ratio of Peak M-X Demand Plus Current Use to Perennial Yield (Percent)	Potential for Impact[6] Short Term	Potential for Impact[6] Long Term
4	Snake, Nev./Utah	49	15.8	1.6	3.6	12,000	3	36	Low	Low
5	Pine, Utah	7	M[7]	3.2	8.9	1,200	46	46	Low	Low
6	White, Utah	32	M	0.3	0.7	700	1	1	Low	Low
7	Fish Springs, Utah	35	0.4	M	M	600	0	1	Low	Low
46	Sevier Desert, Utah	25	49.2	2.8	4.2	8,200	23	220	High	High
46A	Sevier Desert-Dry Lake, Utah			2.9	5.2					
54	Wah Wah, Utah	10	M	4.1	7.9	800	41	41	Low	Low
155C	Little Smoky, Nev.	1	M	2.0	2.9	900	200	200	Moderate	Moderate
156	Hot Creek, Nev.	6	0.3	4.6	5.9	2,300	77	82	High	Low
170	Penoyer, Nev.[8]	5	5.7	2.6	6.3	2,200	52	166	High	Moderate
171	Coal, Nev.	6	M	3.7	6.5	1,500	62	62	Low	Low
172	Garden, Nev.	6	0.1	3.7	6.4	1,500	62	63	Moderate	Low
173A	Railroad, S, Nev.	75	4.2	2.4	6.0	2,100	4	10	Low	Low
173B	Railroad, N, Nev.			0.8	1.8	6,000				
180	Cave, Nev.	2	M	0.6	1.7	1,000	30	30	Low	Low
181	Dry Lake, Nev.	3	M	2.8	7.7	2,800	93	93	Moderate	Low
182	Delamar, Nev.	3	M	2.1	3.8	1,200	70	70	Low	Low
183	Lake, Nev.[8]	12	14.2	2.2	4.7	1,800	18	137	High	Moderate
184	Spring, Nev.	100	4.8	0.5	1.2	4,200	1	5	Low	Low
196	Hamlin, Nev./Utah	25	0.9	3.0	6.3	1,200	12	16	Low	Low
202	Patterson, Nev.	5	0.4	0.2	0.5	1,800	4	12	Low	Low
207	White River, Nev.[8]	37	5.3	2.0	4.0	4,900	5	20	Low	Low
208	Pahroc, Nev.	2	M	0.2	0.3	1,300	10	10	Low	Low

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Table 4.3.2.1-4. DDA construction impact assessment — split basing, Nevada/Utah (Page 2 of 2).

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[1]Potential impact ratings represent a worst case. Groundwater in storage exceeds M-X demands by more than a factor of 100 in all DDAs. The Air Force has committed to avoid impacts through careful well field design, and to monitor and mitigate unexpected impacts.

[2]Nevada data from: State of Nevada Map, 1971: Water Resources and Inter-Basin Flows, Division of Water Resources, State Engineers Office. Utah data from: Don Price, 1979; Summary Appraisal of the Water Resources of the Great Basin in RMHG-UGA 1979 Basin and Range Symposium.

[3]Groundwater use is defined as water pumped from wells.

[4]Represents high range of demand as shown on Table 4.1.1.2-2 of ETR 12.

[5]Estimated volume of water stored in the top 100 feet of the aquifer.

[6]Potential for impact based on current usage and M-X demand as follows:

Water Use Item	Potential for Impact
Short-Term Impacts	
Ratio of current usage plus peak M-X demand to perennial yield ≥ 1	High
Ratio of current usage plus peak M-X demand to perennial yield < 1 and:	
$\frac{100\text{xPeak M-X Demand}}{\text{Perennial Yield}} \geq 75\%$	High
$25\% \leq \frac{100\text{xPeak M-X Demand}}{\text{Perennial Yield}} < 75\%$	Moderate
$\frac{100\text{xPeak M-X Demand}}{\text{Perennial Yield}} < 25\%$	Low
Current use ≤ 100 acre-ft: decrease to next lower impact category.	
Long-Term Impacts	
$\frac{100\text{xPeak M-X Demand + Present Use}}{\text{Perennial Yield}} \geq 200\%$	High
$100\% \leq \frac{100\text{xPeak M-X Demand + Present Use}}{\text{Perennial Yield}} < 200\%$	Moderate
$\frac{100\text{xPeak M-X Demand + Present Use}}{\text{Perennial Yield}} < 100\%$	Low
Current use ≤ 100 acre-ft: decrease to next lower impact category.	

[7]M = Minor or less than 1,000 area ft/year but specifically estimated.

[8]Nevada State Engineer's Office considering legal constraints.

Sources: Unless otherwise noted, all figures are from: Industry Activity Inventory: Nevada M-X siting area Desert Research Institute, University of Nevada system in Ertec, Inc., 1980, M-X siting investigation, industry activity inventory. Other Utah figures from: Industry Activity Inventory, Utah Water Research Lab, 1980. Beryl-Enterprise and Milford estimates are from: Price, Don and others, 1979, groundwater conditions in Utah, spring of 1979: Utah department of Natural Resources, Cooperative Investigation Report No. 18, 68 p. Butte, Jakes and Long valleys were not inventoried as part of the industry activities study. However, the aggregate of wells inventoried in Butte and Jakes valleys during the valley reconnaissance program do not appear to have the combined capacity to produce over 1000 acre-feet per year in either valley. Wells in Long Valley appear to have an aggregate capacity of about 1000 acre-feet per year, but some wells were not in use at the time of the field reconnaissance.

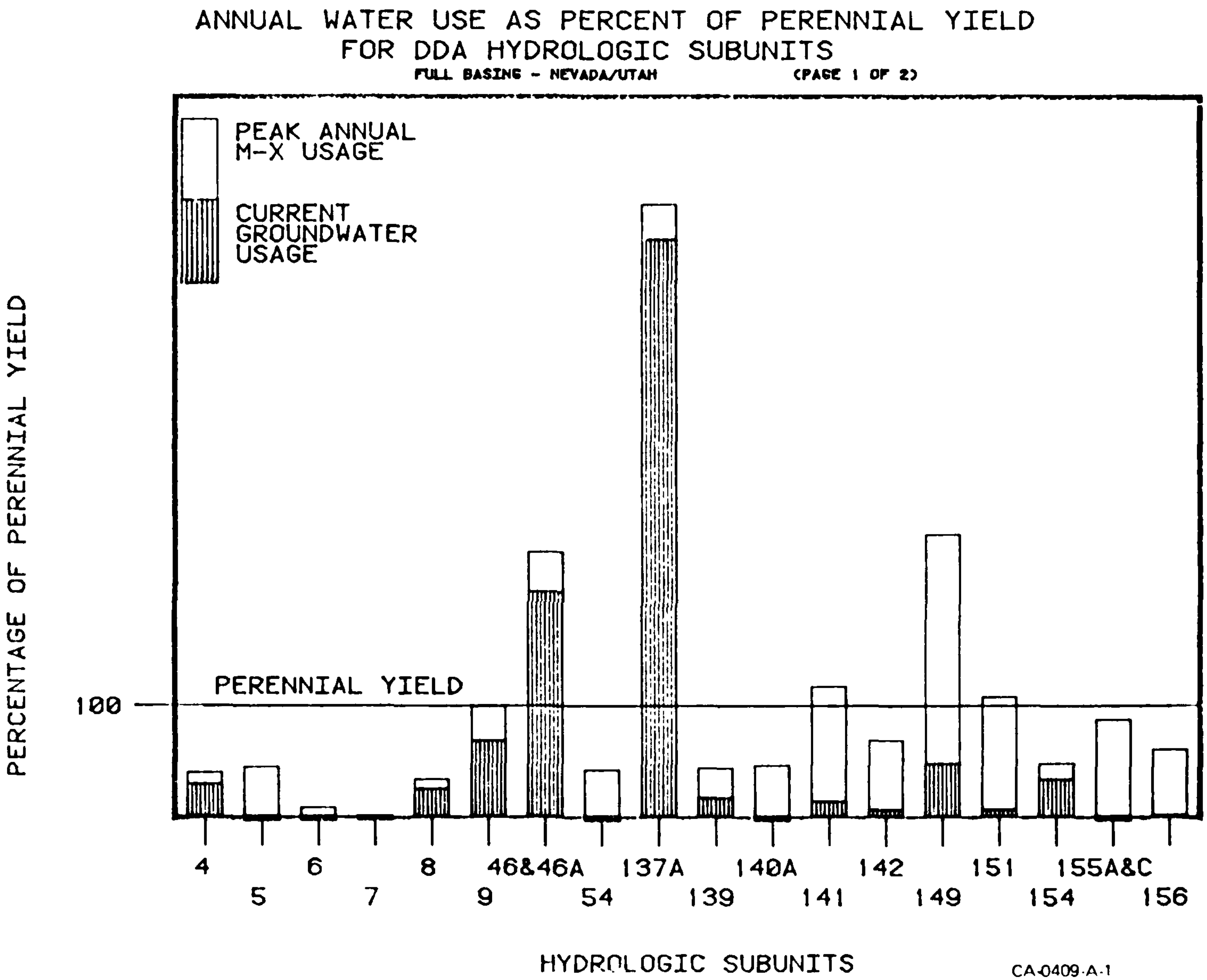
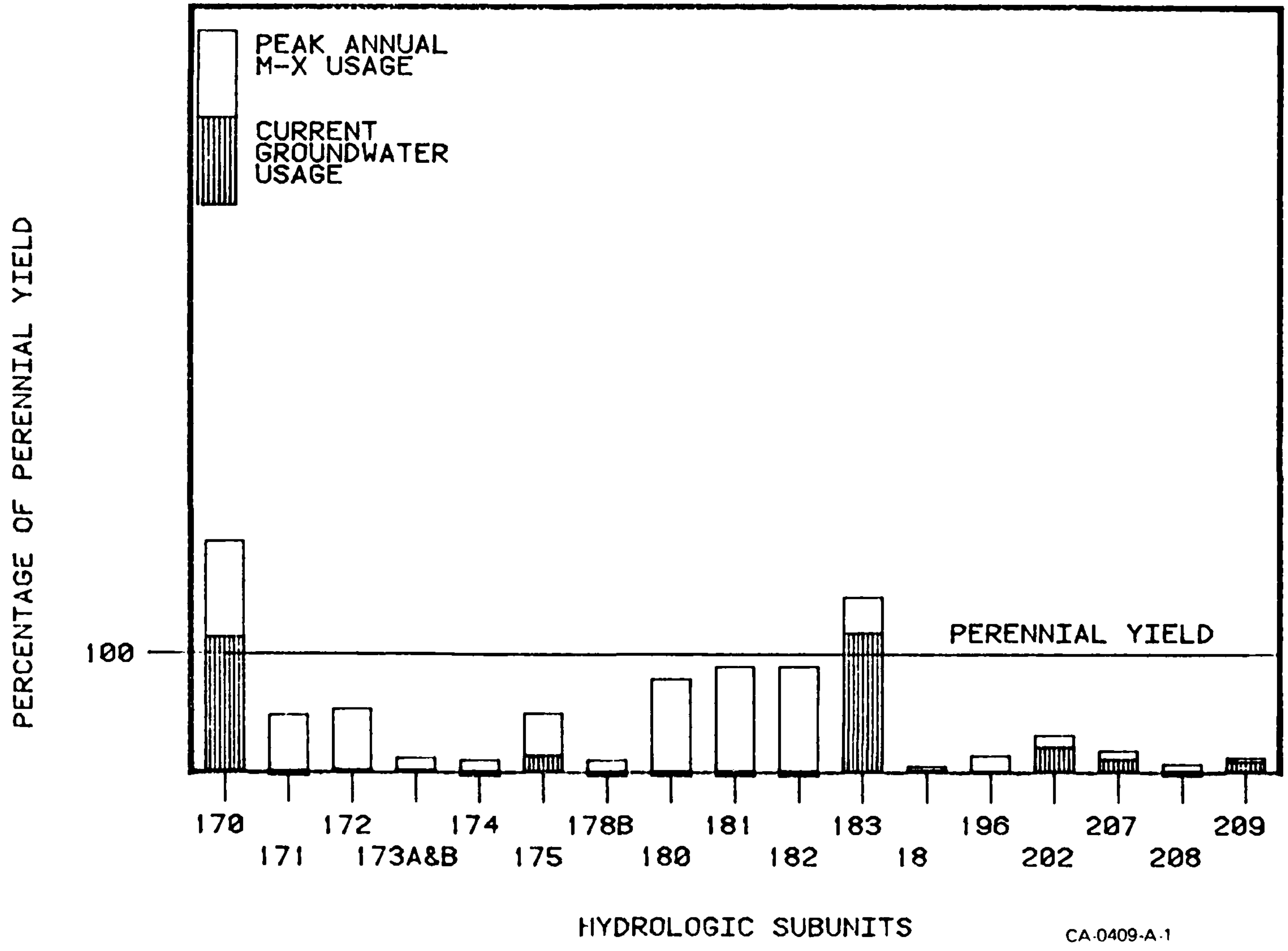


Figure 4.3.2.1-5.

ANNUAL WATER USE AS PERCENT OF PERENNIAL YIELD
FOR DDA HYDROLOGIC SUBUNITS
FULL BASINS - NEVADA/UTAH (PAGE 2 OF 2)



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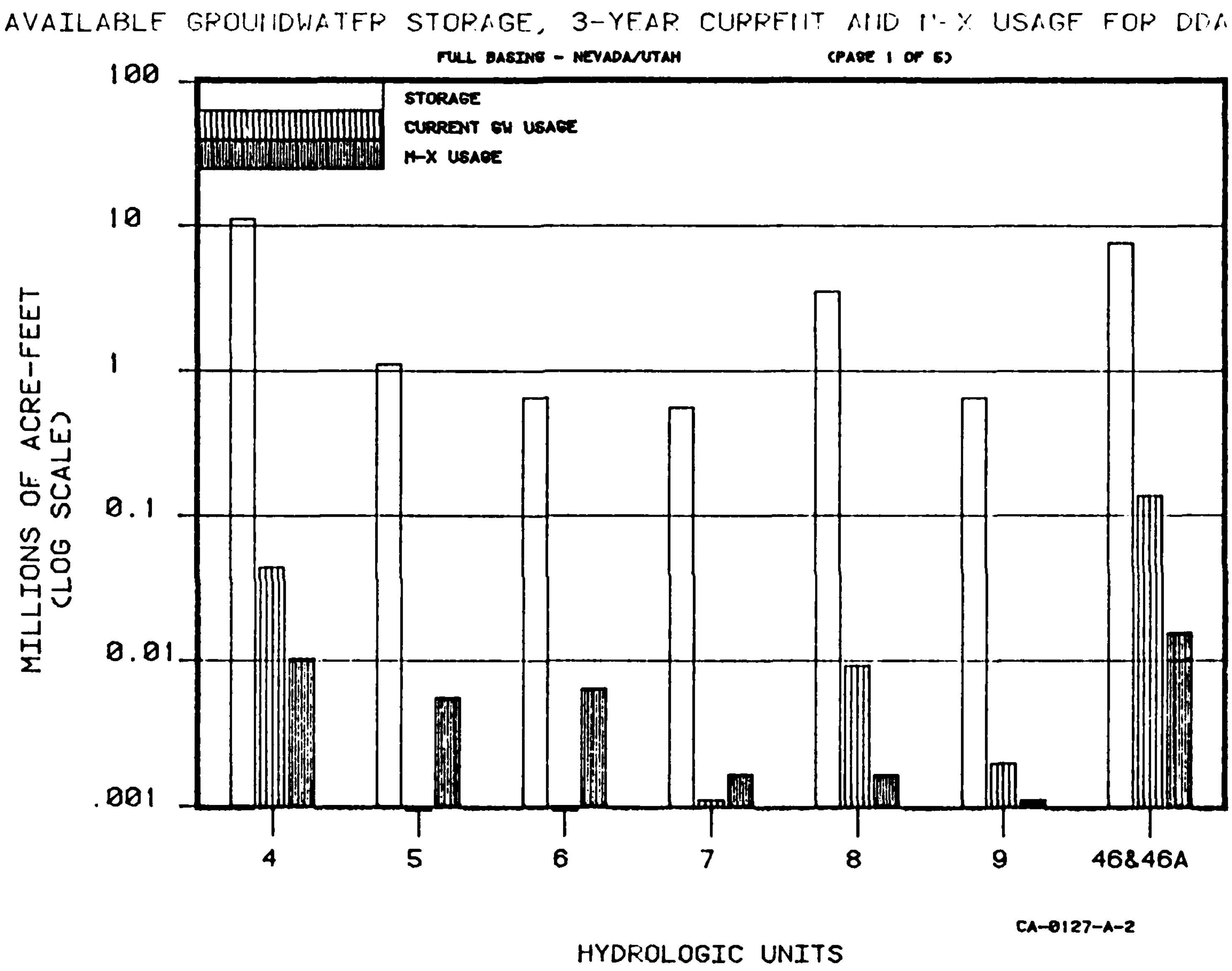


Figure 4.3.2.1-6.

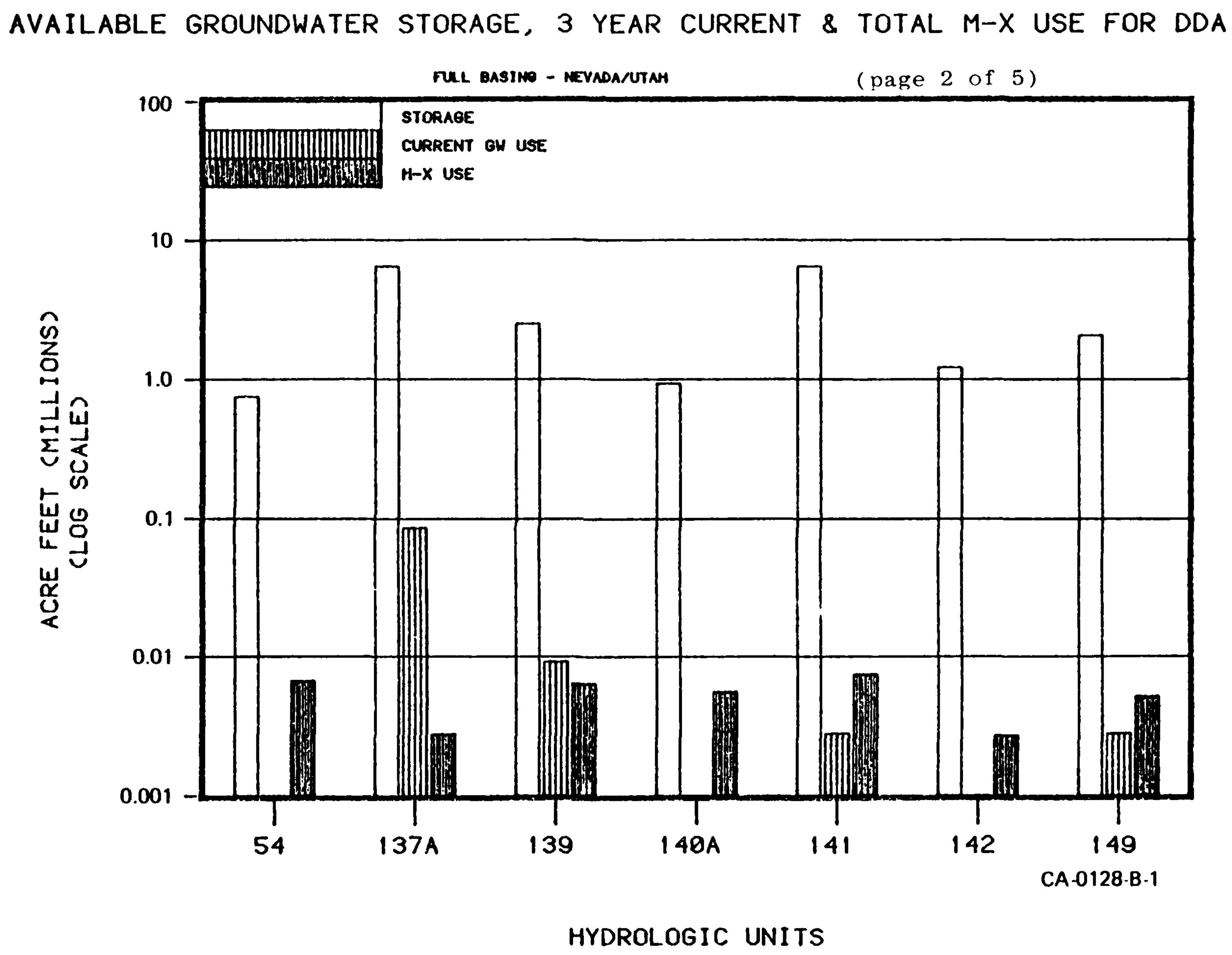


Figure 4.3.2.1-6.

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE FOR DDA

(page 3 of 5)

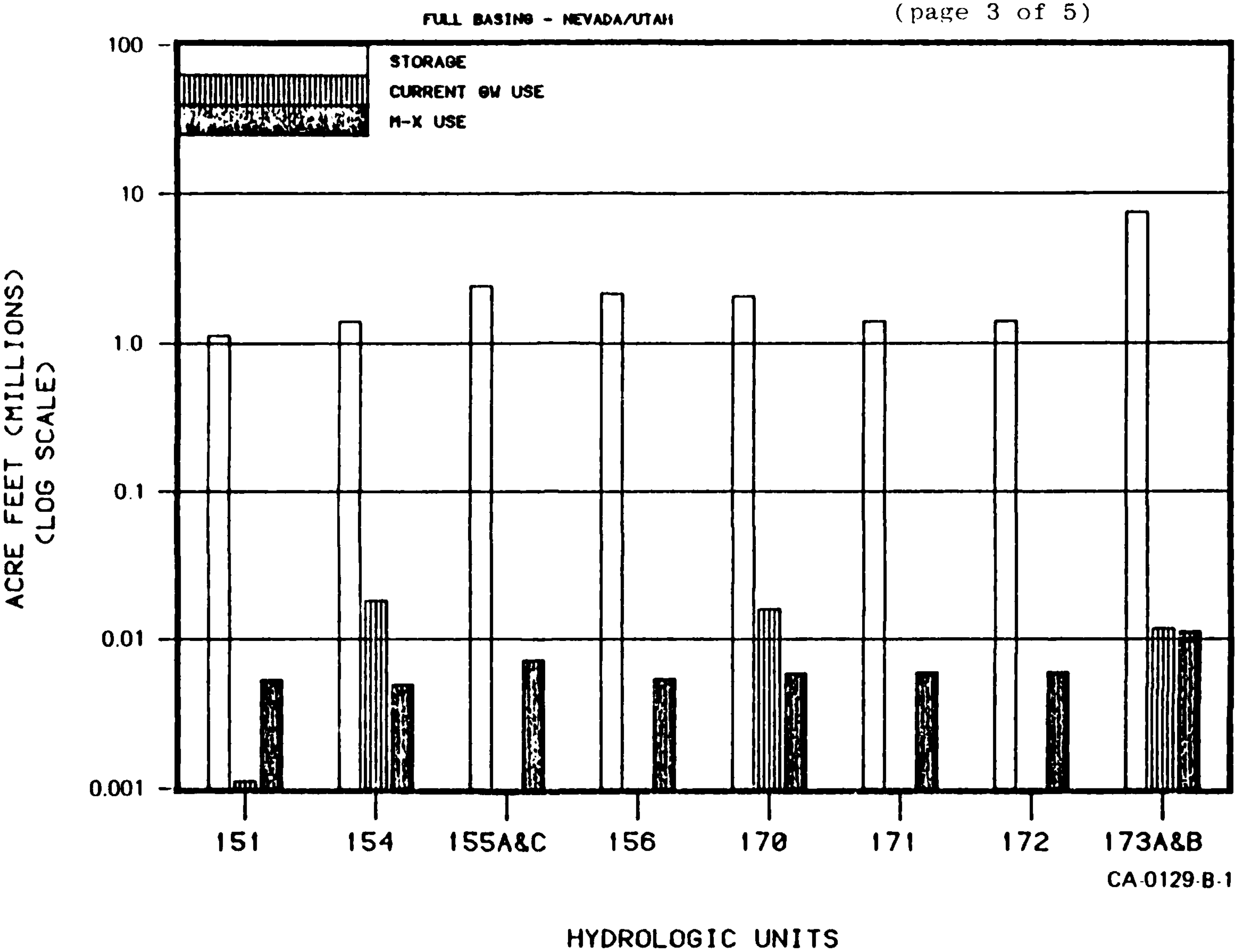


Figure 4.3.2.1-6

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE FOR DDA

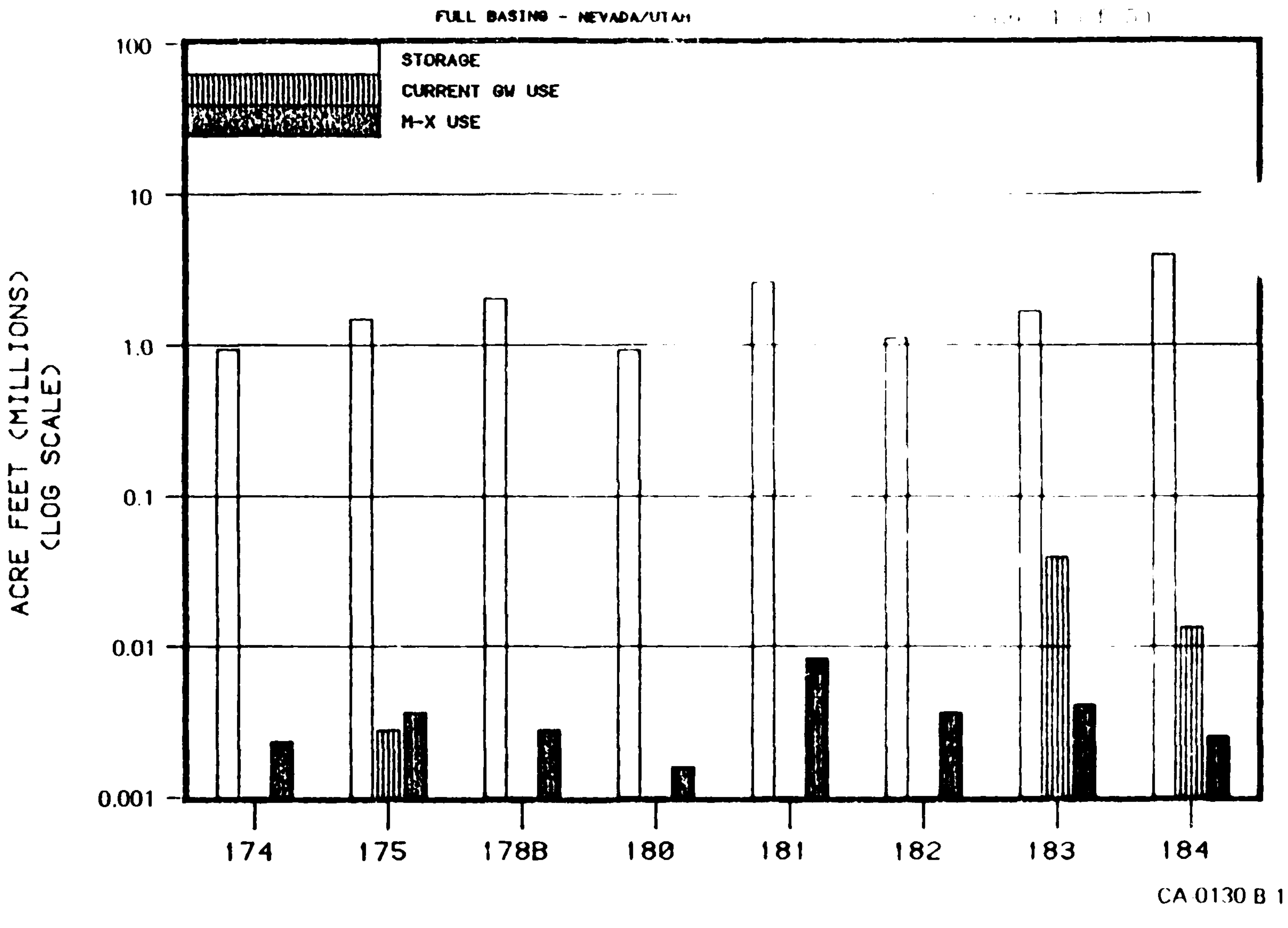


Figure 4.3.2.1-6.

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE FOR DDA

(page 5 of 5)

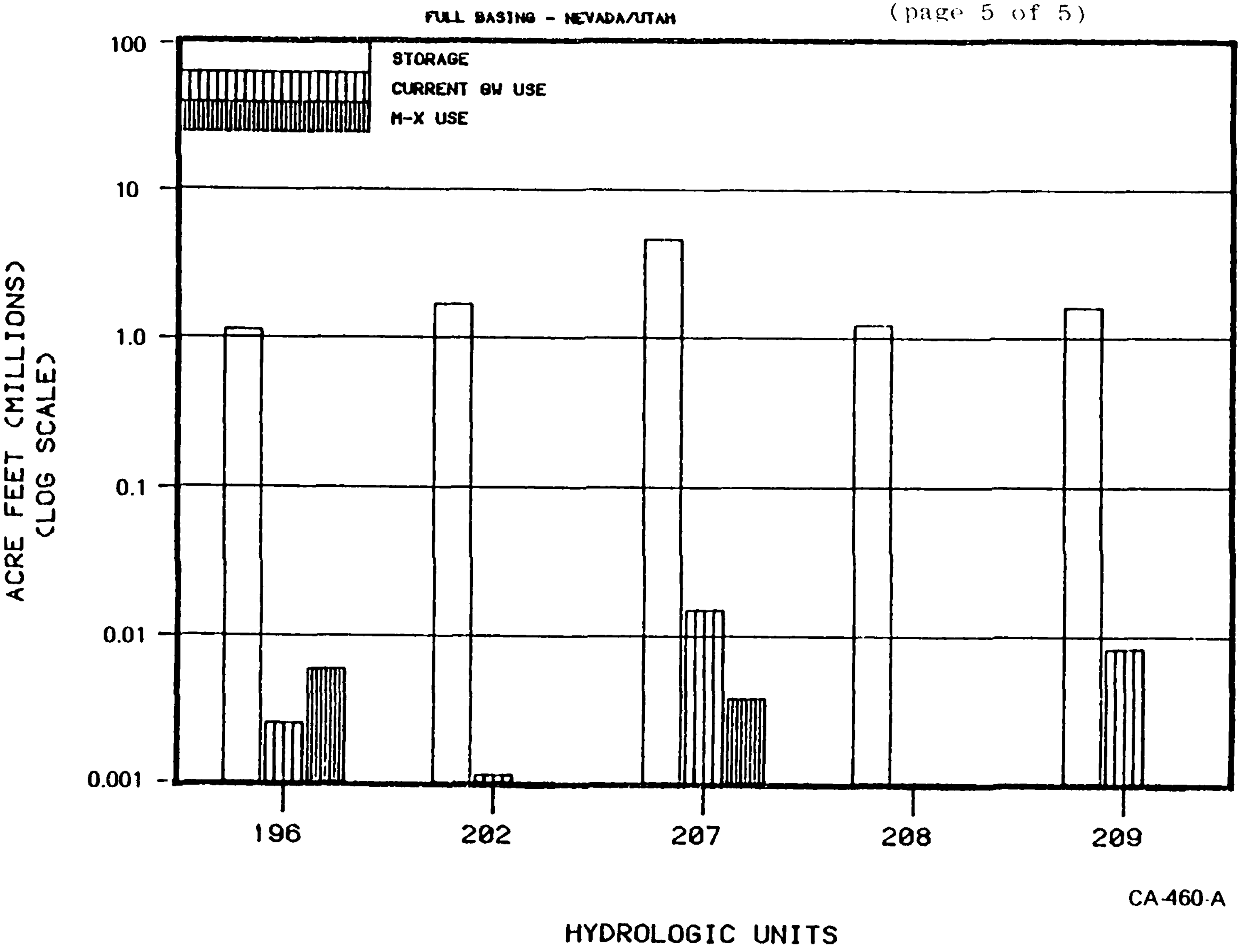


Figure 4.3.2.1-6.

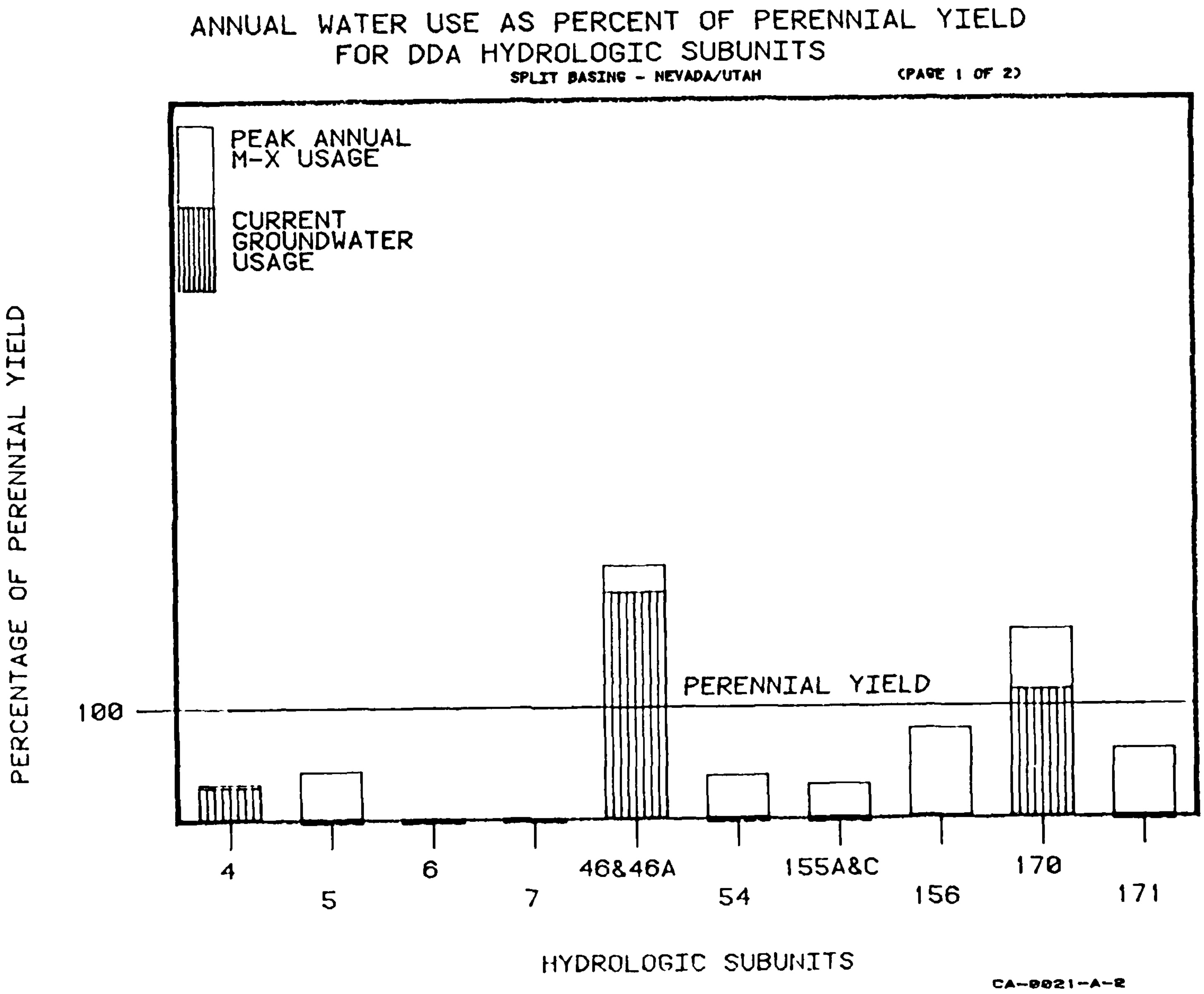


Figure 4.3.2.1-7.

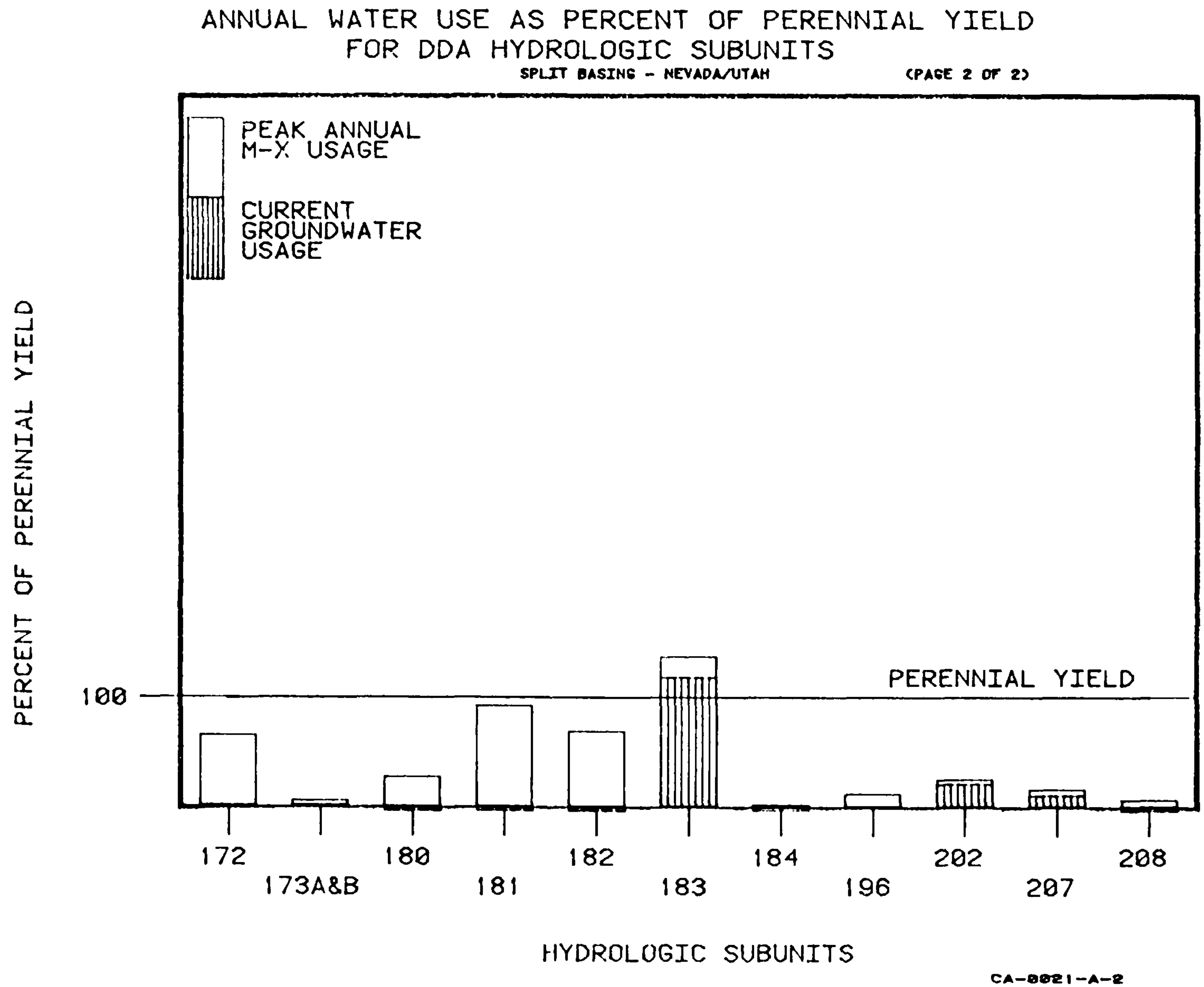


Figure 4.3.2.1-7.

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE FOR DDA

(page 1 of 3)

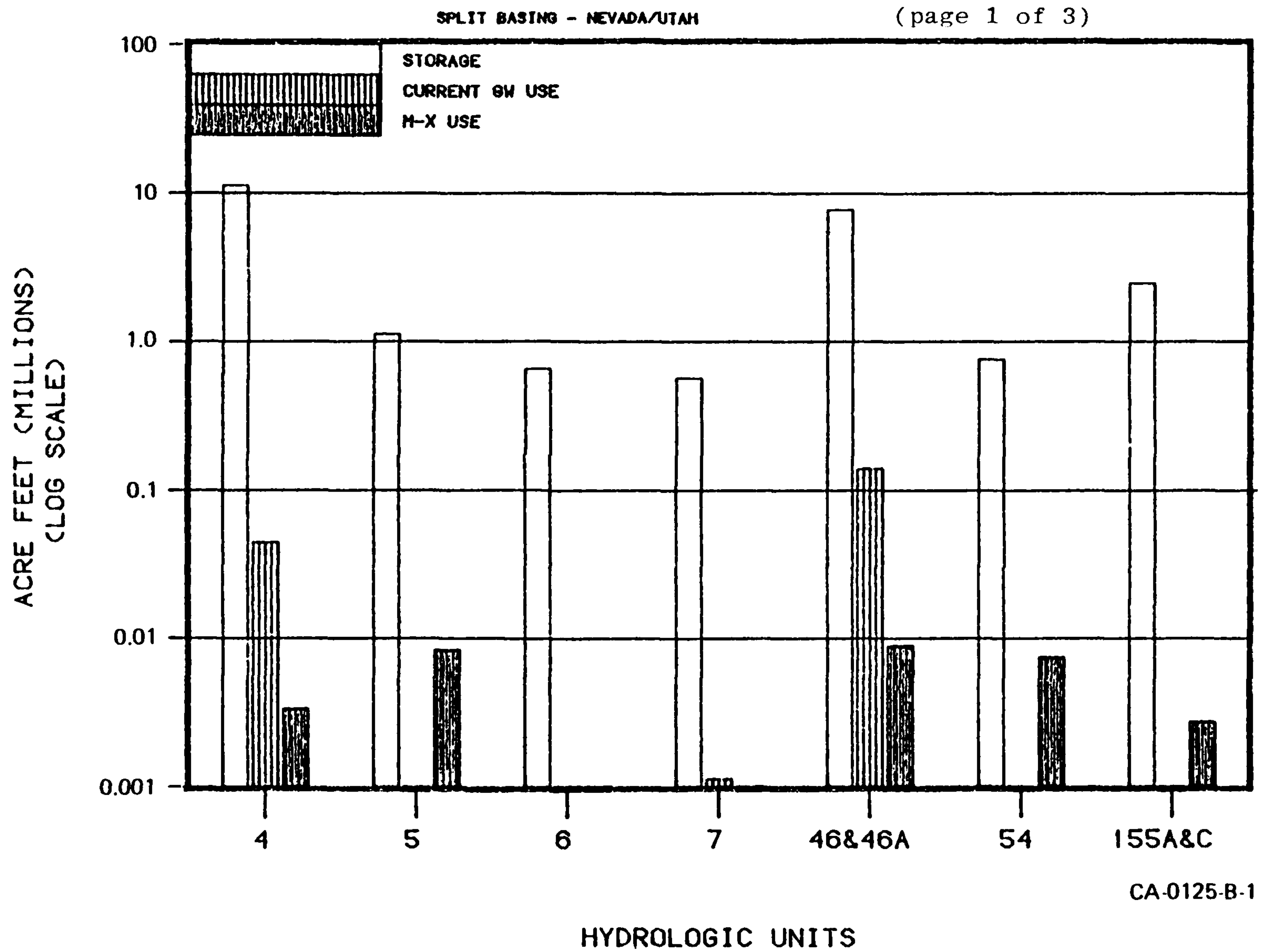


Figure 4.3.2.1-8.

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE FOR DDA

(page 2 of 3)

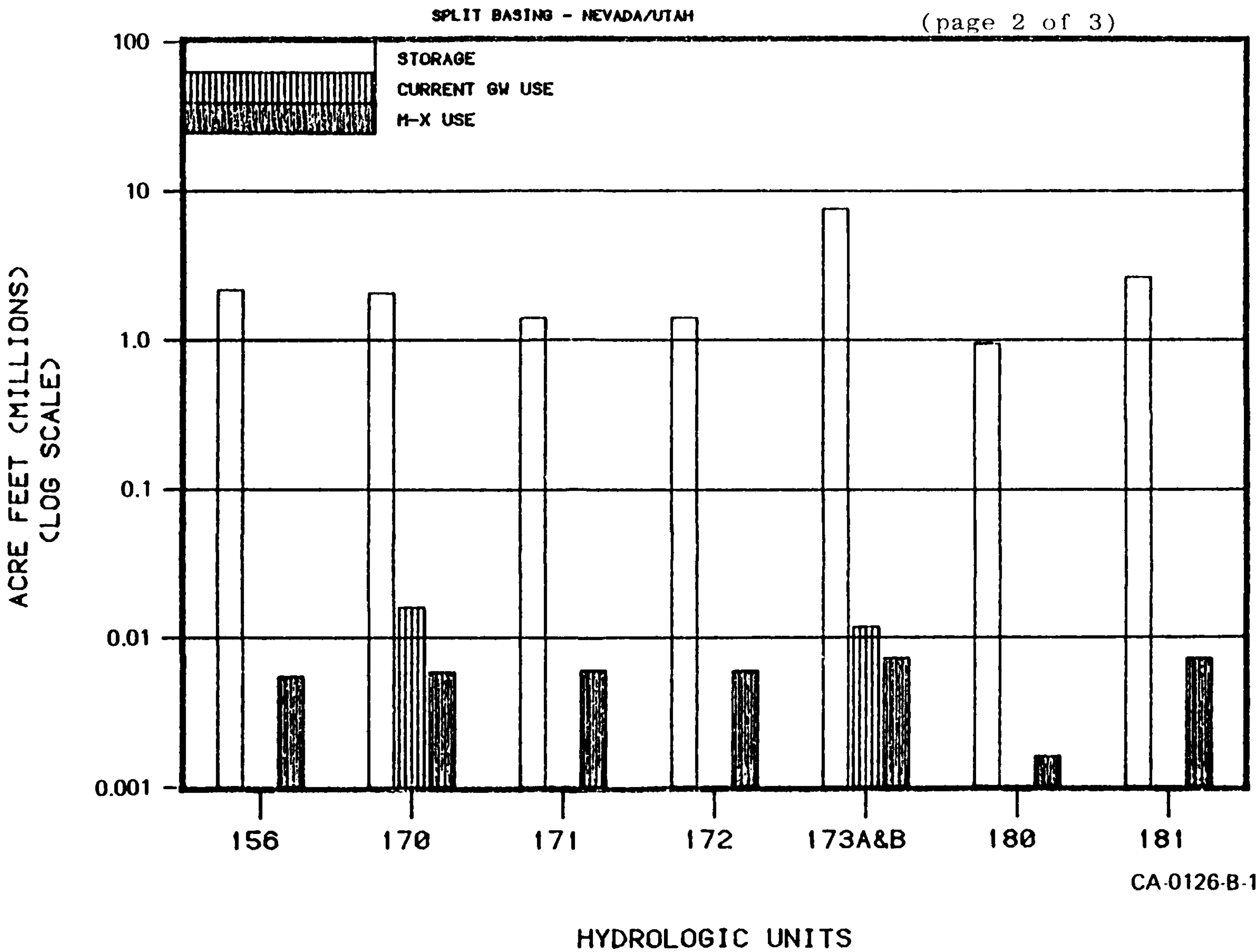


Figure 4.3.2.1-8.

AVAILABLE GROUNDWATER STORAGE, 3 YEAR CURRENT & TOTAL M-X USE DDA

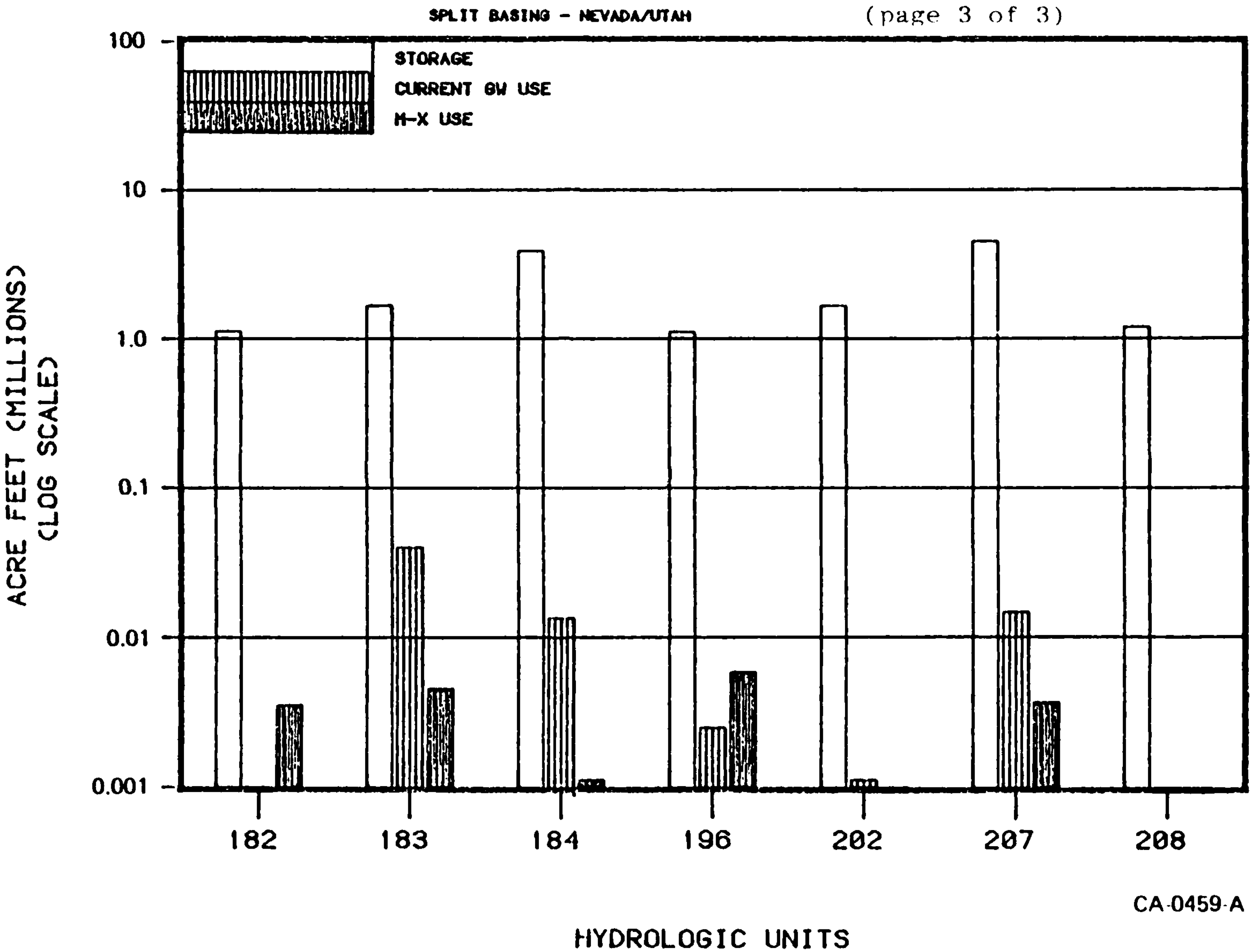


Figure 4.3.2.1-8.

of water quality, and land subsidence. Such effects are largely determined by hydrogeologic conditions near withdrawal wells. Effective mitigation of such impacts could be accomplished by careful evaluation of local geology and hydrology at withdrawal sites to guide well placement and design.

Indirect environmental impacts could also result from the development of groundwater resources for M-X. Diversion of natural groundwater discharge to wells could cause biological impacts where groundwater discharge supports important habitats for wildlife and nature plants. Secondary effects could also be felt by current and future water users competing with M-X for available resources. Competing users include the agriculture, livestock, mining and energy industries, urban and recreation uses, and Native American uses.

M-X Water Demands

DDA construction would require water for protective structures, cluster roads, DTN and ASCs. Construction activities would require water for earthwork, concrete and concrete plants, aggregate plants, domestic uses, dust control and irrigation for revegetation. This would necessitate diversions at locations yet to be determined throughout the project area.

Tables 4.3.2.1.2-1 and 4.3.2.1.2-2 present the estimated quantity of water that would be required in each county in the siting area for Alternative 7, full basing. The number of protective shelters and the miles of roads by county are also presented. In Alternative 8, split basing, fewer clusters and roads would be located in each county. Table 4.3.2.1.2-3 presents the affected counties, the amount of facilities in each, and an estimate of water demands for construction. The analysis of impacts which follows is based on the groundwater regions presented in Chapter 3. Projected M-X demand, by groundwater region, is presented in Tables 4.3.2.1.2-4 and 4.3.2.1.2-5.

The range of values listed for water demands reflects exclusion (minimum values) or inclusion (maximum values) of irrigation for revegetation of disturbed areas.

DDA operational water demands would be small, mostly for domestic uses at the ASCs. Water demands are estimated at less than 100 acre-ft per year per ASC. For the full basing alternatives, ASCs have been sited in the counties of Hartley and Deaf Smith (Texas) and Roosevelt (New Mexico).

ASCs for Alternative 8 have been located in the counties of Quay and Roosevelt (New Mexico).

Impacts to Surface Water Resource

Impacts to surface water resources in the Texas/New Mexico siting area are similar to those presented for Nevada/Utah.

Impacts to Groundwater Resources

Impacts on groundwater availability which could result from M-X deployment in the Texas/New Mexico deployment area are similar to those in the impact analysis for groundwater in Nevada and Utah.

Table 4.3.2.1.2-1. M-X water requirements for construction of dedicated deployment area in Texas.

County	No. of Protective Structures	Miles of Cluster Roads	Miles of DTN	No. of Construction Camps	Peak Year Range (Thousands of Acre-ft)	Peak Year MPQ[1] (Thousands of Acre-ft)	Total Project Range (Thousands of Acre-ft)	Total Project MPQ[1] (Thousands of Acre-ft)
Bailey	92	119	31	1	1.2-2.5	2.2	2.6-6.0	5.2
Castro	161	208	50	1/2	1.1-3.4	3.1	1.9-3.5	5.3
Cochran	92	119	2	0	0.2-1.0	0.9	0.5-2.3	2.2
Dallam	667	861	165	3	4.7-13.2	12.3	9.1-27.8	23.9
Deaf Smith	598	772	90	2-1/2	2.5-7.7	7.2	6.9-22.7	19.6
Hartley	345	446	80	1	2.0-5.7	5.2	4.6-14.6	12.1
Hockley	23	30	0	0	0.1-0.3	0.3	0.1-0-7	0.6
Lamb	46	59	15	0	0.1-0.8	0.6	0.3-1.3	1.2
Oldham	46	59	3	0	0.1-0.3	0.3	0.3-1.2	1.2
Parmer	138	178	90	1-1/2	1.4-3.6	3.2	2.7-7.3	6.2
Randall	69	89	12	1/2	0.7-2.2	1.8	1.0-3.4	2.5
Sherman	46	59	5	0	0.1-0.8	0.6	0.3-1.2	1.2
Swisher	23	30	0	0	0.1-0.5	0.4	0.1-0.7	0.7

T2464/10-2-81

[1]MPQ - Most Probable Quantity.

Table 4.3.2.1.2-2. M-X water requirements for construction of dedicated deployment area in New Mexico.

County	No. of Protective Structures	Miles of Cluster Roads	Miles of DTN	No. of Construction Camps	Peak Year Range (Thousands of Acre-ft)	Peak Year MPQ[1] (Thousands of Acre-ft)	Total Project Range (Thousands of Acre-ft)	Total Project MPQ[1] (Thousands of Acre-ft)
Chaves	483	624	104	1	2.1-7.1	6.5	4.7-16.6	14.6
Curry	184	238	130	0[2]	1.0-3.7	3.4	1.4-5.6	4.9
DeBaca	115	149	8	1	1.4-3.3	3.0	2.7-6.8	6.7
Harding	207	267	62	1	1.8-4.8	4.3	3.6-10.9	8.5
Lea	23	30	0	0	0.1-0.4	0.3	0.1-0.6	0.6
Quay	460	595	145	1[2]	2.2-7.0	6.3	5.0-18.5	14.7
Roosevelt	552	713	210	2	2.0-6.0	5.3	7.1-22.0	19.0
Union	230	297	50	0[2]	0.6-2.5	2.2	1.4-6.1	5.3

T2463/10-2-81

[1]MPQ - Most Probable Quantity.

[2]Indicates an additional construction camp is possible if proposed construction camp location is not acceptable.

Table 4.3.2.1.2-3. M-X water requirements for construction of designated deployment area in Texas and New Mexico, split basing.

County	Number of Protective Structures	Cluster Road (miles)	DTN (miles)	Number of Construction Camps	Peak Year Range (Thousands of Acre-ft)	Peak Year MPQ[1] (Thousands of Acre-ft)	Total Project Range (Thousands of Acre-ft)	Total Project MPQ[1] (Thousands of Acre-ft)
Bailey, Tex.	14	18	26	0	0.1 - 0.3	0.3	0.2 - 0.6	0.5
Cochran, Tex.	51	66	0	0	0.3 - 1.1	0.9	0.7 - 2.1	1.8
Dallam, Tex.	190	245	50	1	1.7 - 5.2	4.7	2.3 - 7.4	6.4
Deaf Smith, Tex.	242	313	40	1	1.8 - 5.3	4.9	2.8 - 9.1	7.9
Hartley, Tex.	250	323	51	1	1.8 - 5.6	5.1	3.0 - 9.7	8.4
Hockley, Tex.	14	18	0	0	m - 0.2	0.2	0.1 - 0.6	0.5
Lamb, Tex.	9	12	1	0	m - 0.2	0.2	0.1 - 0.4	0.3
Oldham, Tex.	41	53	0	0	0.3 - 1.0	0.8	0.5 - 1.6	1.4
Parmer, Tex.	1	2	0	0	m	m	m	m
Chaves, N. Mex.	474	611	71	1	3.4 - 9.5	8.5	5.5 - 18.0	15.6
Curry, N. Mex.	43	56	80	0	0.3 - 1.6	1.3	0.6 - 1.6	1.5
DeBaca, N. Mex.	115	149	18	0	0.8 - 2.7	2.3	1.4 - 4.5	3.9
Harding, N. Mex.	202	261	51	1	1.5 - 4.5	3.9	2.7 - 7.2	7.1
Lea, N. Mex.	17	22	0	0	0.1 - 6.5	0.4	0.2 - 0.7	0.6
Quay, N. Mex.	312	401	95	1	2.2 - 7.0	6.3	3.7 - 12.0	10.4
Roosevelt, N. Mex.	164	212	125	1	1.2 - 3.7	3.2	2.1 - 6.6	5.7
Union, N. Mex.	155	200	40	0	0.4 - 3.0	2.5	0.6 - 3.5	3.3
Guadalupe, N. Mex.	6	8	0	0	m - 0.2	0.2	m - 0.2	0.2

T4177/10-2-81

[1]MPQ = Most Probable Quantity. (See Appendix A, ETR-12).
m = Minor Demand, 0.1 acre-ft or less.

Table 4.3.2.1.2-4. M-X water requirements for construction of the DDA by groundwater region for Texas/New Mexico — Alternative 7.

Region	Number of Shelters	Miles of Cluster Roads	Miles of DTN	Peak Year		Total Project	
				Range (Thousands of Acre-ft)	MPQ[1] (Thousands of Acre-ft)	Range (Thousands of Acre-ft)	MPQ[1] (Thousands of Acre-ft)
I	1,311	1,565	359	7.1-15.7	14.5	22.1-46.0	43.5
II	-	-	-	-	-	-	-
III	1,127	1,345	309	6.4-13.5	12.5	19.1-40.0	37.5
IV	-	-	-	-	-	-	-
V	575	686	158	3.3-7.2	6.4	9.7-22.0	19.1
VI	46	55	13	0.5-1.5	1.2	0.5-1.8	1.5
VII	506	604	139	3.0-6.4	5.6	8.6-19.3	16.8
VIII	1,035	1,235	284	5.9-12.4	11.5	16.8-37.2	34.4

T5785/10-2-81

[1]MPQ - Most Probable Quantity.

Table 4.3.2.1.2-5. M-X water requirements for construction of the DDA by groundwater region for Texas/New Mexico -- Alternative 8, Split Basing.

Region	Number of Shelters	Miles of Cluster Roads	Miles of DTN	Peak Year Range (Thousands of Acre-ft)	Peak Year MPQ[1] (Thousands of Acre-ft)	Total Project Range (Thousands of Acre-ft)	Total Project MPQ[1] (Thousands of Acre-ft)
I	368	475	104	2.2-4.7	4.2	6.6-14.2	12.6
II	-	-	-	-	-	-	-
III	437	564	123	2.6-5.4	5.0	7.8-16.3	14.9
IV	-	-	-	-	-	-	-
V	460	594	130	2.7-5.7	5.2	8.2-17.9	15.7
VI	69	89	19	0.9-1.8	1.6	1.2-2.6	2.3
VII	253	327	71	1.5-3.3	2.9	4.5-9.9	8.6
VIII	713	921	201	4.3-9.1	8.1	12.7-27.5	24.3

T5784/10-2-81

[1] MPQ - Most probable quantity (See Appendix A, ETR-12).

Impact Analysis

The analysis method used to evaluate potential impacts of M-X water development on groundwater resources in Texas/New Mexico is different from that used for the Nevada/Utah deployment alternatives, largely because of the different systems of water appropriation. In both Texas and New Mexico, large volumes of water may be legally removed from aquifer storage and put to beneficial use. In New Mexico, this is allowed in certain groundwater basins where the State Engineer has decided that the only way to derive significant economic benefit from the groundwater resource is to mine or pump it at a rate which greatly exceeds the natural rate of groundwater recharge. In such groundwater basins, water rights are issued on the basis of an assigned "economic life of the aquifer" (generally 40 years). This controls the rate at which the groundwater will be depleted. In other areas, like major parts of Curry County, for example, overdrafting is permitted by default because the State Engineer has not declared an Underground Water Basin for the purpose of administering water rights.

In Texas, overdrafting is permitted without legal control. Water is a property right that is conveyed with the land and in accordance with the "English" or "common law" rule. Landowners have the right to capture, for use or sale, all water they can from beneath their land. In some areas, landowners have adopted voluntary regulations which control well spacing, but not withdrawal volumes. As a result of this, in large areas of both western Texas and eastern New Mexico, aquifer storage in the Ogallala Formation (the area's principal aquifer) is being depleted.

The Texas/New Mexico siting area was divided into nine groundwater regions on the basis of similar hydrologic characteristics and the Texas/New Mexico state line (see Figure 3.3.2.1-2). The analysis method used to evaluate potential impacts of M-X water development basically focused on answering the following question: Could M-X water requirements lead to a significant increase in the rate of aquifer depletion that already exists within a given groundwater region, and thus shorten "the economic life of the aquifer"?

This involved comparing projected M-X water needs with resource availability (aquifer storage) and competition for the resource (current aquifer depletion rates). Any increases in aquifer depletion is assumed to have greater significance if the projected economic life of the aquifer is already relatively short (less than 40 years). Table 4.3.2.1.2-6 summarize the potential impact of M-X DDA construction on groundwater availability in Texas and New Mexico. A high potential for impact was assigned if M-X water requirements are greater than 5 percent of the current aquifer depletion rate, and the aquifer life within the region is less than 40 years. A moderate rating was assigned if the M-X water requirements were greater than 1 percent but less than 4 or equal to 5 percent of the current aquifer depletion rate; or, if the M-X water requirements were greater than 5 percent of the current aquifer depeltion rates and the aquifer life within the region is equal to or greater than 40 years. A low rating was assigned if M-X requirements represent less than 1 percent of the current aquifer depletion rate.

A citizens' group in Texas pointed out that the method used to evaluate impacts of the M-X incorporates the assumption that needs will be met by developing water resources beyong the current level. Yet elsewhere the report notes that except for a few minor supplies, all water in Texas/New Mexico is

Table 4.3.2.1.2-6. Potential impacts on groundwater availability in Texas and New Mexico.

Region	Aquifer Depletion Rate (Thousands of Acre-ft per year)	Aquifer Life (yrs)[1]	Alternative 7 (Full Basing): Peak Year Water Requirements for M-X/DDA Construction (Thousands of Acre-ft)	Alternative 7 (Full Basing): M-X Requirement as Percentage of Aquifer Depletion Rate (Percent)	Alternative 7: Subjective Impact Assessment[2] Short-Term	Alternative 7: Subjective Impact Assessment[2] Long-Term	Alternative 8 (Split Basing): Peak Year Water Requirement for M-X/DDA Construction (Thousands of Acre-ft)	Alternative 8 (Split Basing): M-X Requirement as Percentage of Aquifer Depletion Rate (Percent)	Alternative 8: Subjective Impact Assessment[2] Short-Term	Alternative 8: Subjective Impact Assessment[2] Long-Term
I	796.0	35	14.5	1.8	Moderate	Low	4.2	0.5	Low	Low
II	-	-	-	-	-	-	-	-	-	-
III	936.0	77	12.5	1.3	Moderate	Low	5.0	0.5	Low	Low
IV	-	-	-	-	-	-	-	-	-	-
V	148.6	7,100	6.4	4.3	Moderate	Low	5.2	3.5	Moderate	Low
VI	22.7	7,100	1.2	5.3	Moderate	Low	1.6	7.0	Moderate	Low
VII	154.0	37	5.6	3.6	Moderate	Low	2.9	1.9	Moderate	Low
VIII	26.4	47	11.5	43.6	High	Low	8.1	30.7	High	Low

T5789/10-2-81

[1] From Table 3.3.2.1-5.

[2] Criteria for evaluating potential impacts on groundwater availability in Texas and New Mexico:
Low = M-X demand represents less than 1 percent of current aquifer depletion rate.
Moderate = M-X demand represents 1 to 5 percent of current aquifer depletion rate, or M-X demand represents greater than 5 percent of current aquifer depletion rate and aquifer life greater than 50 years.
High = M-X demand represents greater than 5 percent of current aquifer depletion rate and aquifer life greater than 50 years.

allocated and that M-X can come in only if present users are "retired." Nowhere is there an attempt to quantify the number of users, or who they might be, that would be retired and/or the subsequent economic impact on the area.

Projected M-X withdrawals were essentially distributed evenly throughout each groundwater region to determine their possible influence on the "average" depletion rate in each region as a whole. In reality, M-X withdrawals would be distributed under the entire groundwater region, but would be concentrated near construction camps and operating bases. Consequently, the analysis does not provide information useful in determining specific impacts on water levels, nor does it quantify or identify areas where groundwater would actually be removed from storage.

Figures 4.3.2.1.2-1 and 4.3.2.1.2-2 present the relationships between the parameters which forms the basis for the analysis. The actual numeric values of the different parameters are presented in Table 4.3.2.1.2-6. A more detailed description of the potential for impacts in each groundwater region is found in Chapter 4 of ETR-12.

Beneficial Impacts

As in the Nevada/Utah siting region, the local Texas/New Mexico communities could benefit from newly developed water supplies and infrastructure when these supplies are no longer needed for M-X.

<u>Beryl OB Site</u> (4.3.2.1.3)

General

The Beryl site is proposed as a first operating base in Alternatives 3 and 4 and as a second operating base in Alternative 1. As a first operating base, it would occupy approximately 6,000 acres and include an airfield, support facilities, clear zones, a designated assembled area (DAA), an operational base test site (OBTS), a designated transportation network (DTN), and a railroad spur. A second operating base is smaller as it has no DAA or OBTS and houses fewer personnel. The proposed location for the base is shown in Figure 4.3.2.1.3-1 (page 4-123).

M-X Water Demands

Construction would require water most likely be obtained from the groundwater supply. The quantities required would depend upon the facilities constructed. The Beryl site could be a first or a second OB depending upon the alternative chosen. Estimated water demands for construction of a first and second OB at Beryl are presented in Table 4.3.2.1.3-1.

Operational water requirements for first and second OBs are presented in Table 4.3.2.1.3-2. The OB and community water requirements assume that 80 percent of military personnel and dependents would live onbase and 20 percent off-base. The operating base requirements would be essentially independent of the region. However, a first OB would require more water because of the additional people required for the DAA and OBTS.

Operation of the OB's would cause an in-migration of people to work at the base, and to provide services to those working at the base. These people would

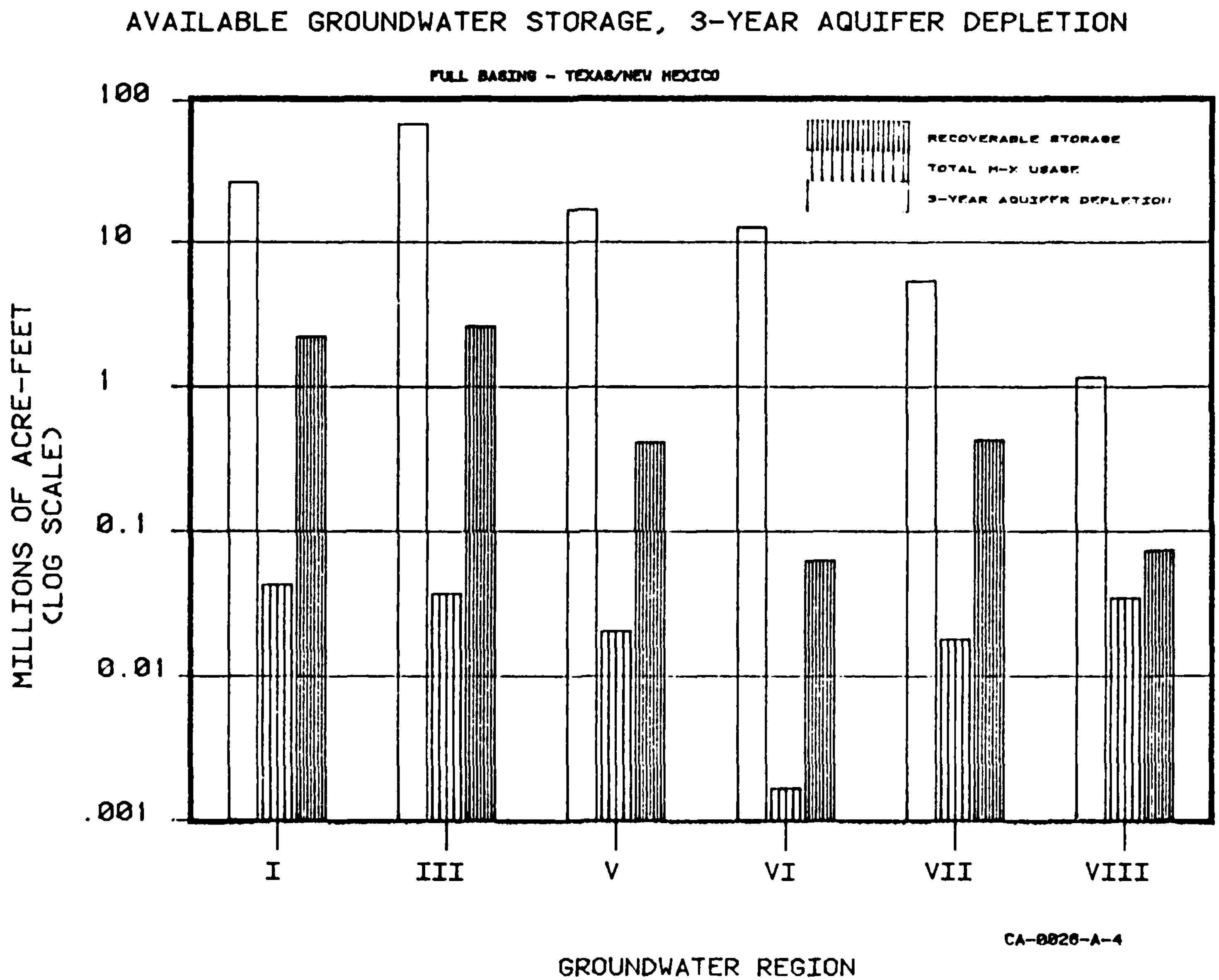


Figure 4.3.2.1.2-1.

AVAILABLE GROUNDWATER STORAGE, 3-YEAR AQUIFER DEPLETION

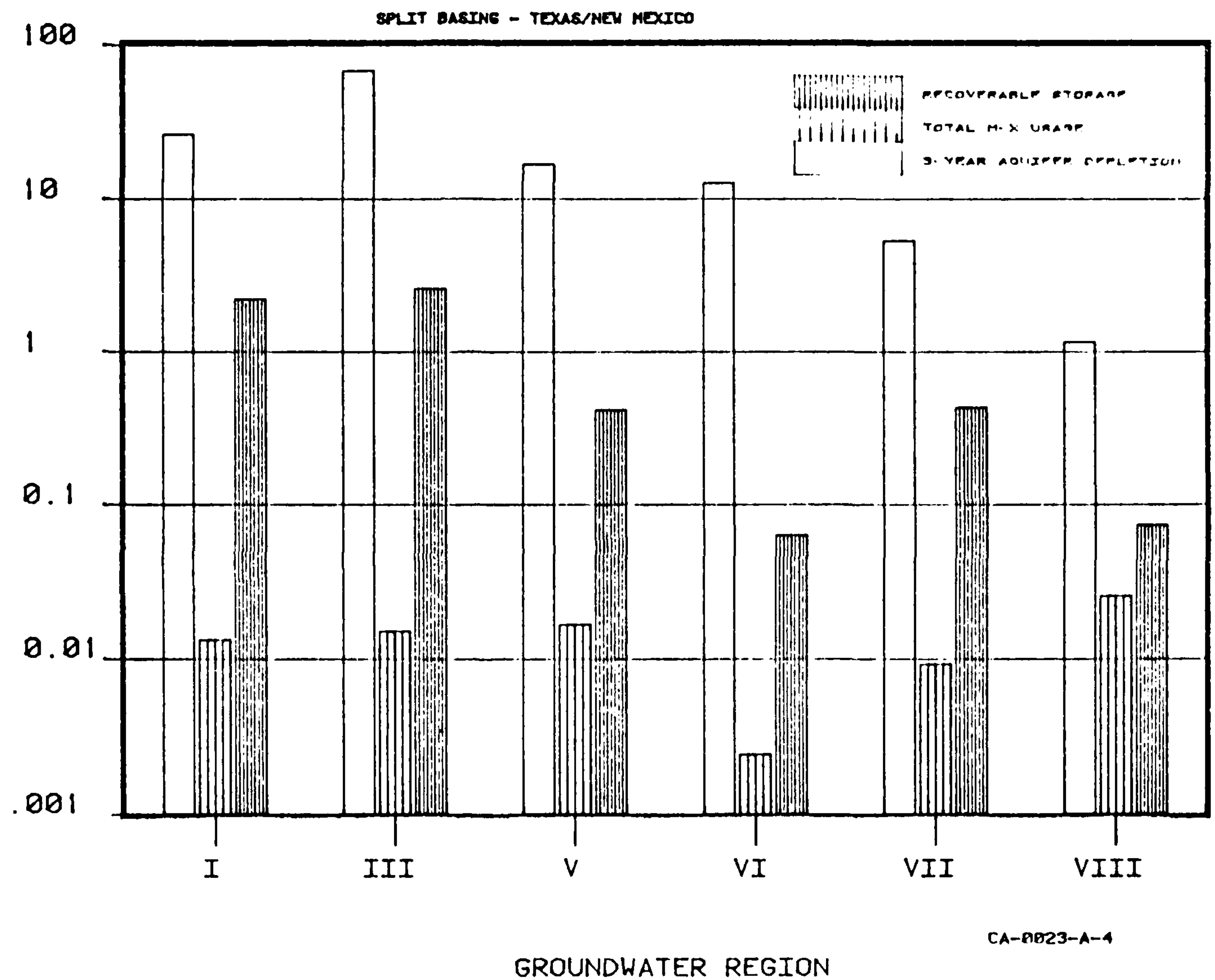


Figure 4.3.2.1.2-2.

Table 4.3.2.1.3-1. OB construction water demands.

OB Type	OB Construction Demands (Thousands of Acre-ft)	
	Range	MPQ[1]
First OB	2.0 - 3.6	2.8
Second OB	1.7 - 3.1	2.4

T4050/10-2-81

[1]Most probable quantity.

Table 4.3.2.1.3-2. OB operational requirements.

OB Type	Peak Year			Permanent Yearly		
	Number of Personnel	Water Demand (Thousands of Acre-ft) Range	MPQ[1]	Number of Personnel	Water Demand (Thousands of Acre-ft) Range	MPQ[1]
First OB						
Military - living offbase	1,180	0.07	0.07	1,180	0.07	0.07
Military and dependents	12,275	2.06 - 2.75	2.75	12,275	2.06 - 2.75	2.75
Civilians	1,220	0.07	0.07	1,000	0.07	0.07
A&CO	1,300	0.12	0.12	0	--	--
Base and construction workers	0	--	--	0	--	--
Total		2.3 - 3.6	3.6		2.2 - 3.5	3.5
Second OB						
Military - living offbase	815	0.05	0.05	815	0.05	0.05
Military and dependents	8,781	1.5 - 2.0	2.0	8,781	1.5 - 2.0	2.0
Civilians	1,035	0.06	0.06	1,035	.06	0.06
A&CO	0	--	--	0	--	--
Base construction workers	0	--	--	0	--	--
Total		1.6 - 2.1	2.1		1.6 - 2.1	2.1

T4051/10-2-81

[1]Most probable quantity

settle in present communities near the OB site, or new communities might be developed. ETR-39 presents potential additional water demands in communities near the Beryl site. Since water use for the proposed OB would be mainly domestic, treatment of wastewater could make additional water available to these communities.

Surface Water Related Impacts

Surface water impacts would be similar to those described in Section 4.3.2.1.1.

Potential Impacts to Groundwater Resources

An analysis similar to that performed for the Nevada/Utah DDAs was done for each of the potential OB sites in Texas and New Mexico. The data used in the analysis of these sites are shown in Figures 4.3.2.1.3-2 and 4.3.2.1.3-3. Figure 4.3.2.1.3-2 illustrates the relationship among annual OB operational water requirements (including requirements of support communities), current annual usage, and the estimated perennial yield. Figure 4.3.2.1.3-3 shows the relationship of 30 years of use to the total groundwater storage in the top 100 feet of the aquifers. The estimates for 30 years of use assume M-X use as shown in Table 4.3.2.1.3-2 and assume other uses would continue at the present rate. Table 4.3.2.1.3-3 summarizes these data and presents the resulting impact assessment.

The area in the vicinity of the proposed OB near Beryl has been closed to further development of water resources by the Utah State Engineer, primarily because current use greatly exceeds the perennial yield (Figure 4.3.2.1.3-2). The estimated M-X usage, 2,100 to 3,500 acre-ft per year, would increase the current aquifer depletion rate by about 7 percent. Increased mining will reduce the groundwater availability by removing water from storage and could potentially reduce the storage capacity by permanent compaction of some areas. Water quality could also be degraded by inducement of poor quality water into the area and by removing water and leaving salts (evapotranspiration).

M-X impacts would be greater on irrigated agriculture since it uses 80 percent or more of the total water used (Price, 1979). Pumping costs would increase pumping costs due to accelerated water level declines and reduced well yields. In general, springs in the area of the potential base are elevated above the valley fill aquifer, so additional development or a change in the present development would probably have no large impact on spring flow in the area.

<u>Coyote Spring Valley</u> (4.3.2.1.4)

General

The Coyote Spring Valley site is proposed as a first operating base in the Proposed Action and in Alternatives 1, 2, 3, and 8. It would be used as a second operating base in Alternatives 4 and 6. The proposed site shown in Figure 4.3.2.1.4-1 (page 4-124) is about 34 mi from Nellis Air Force Base. Its proximity to the Muddy River Springs should be noted. The facilities included at a first or second OB are the same as those listed for the proposed Beryl site.

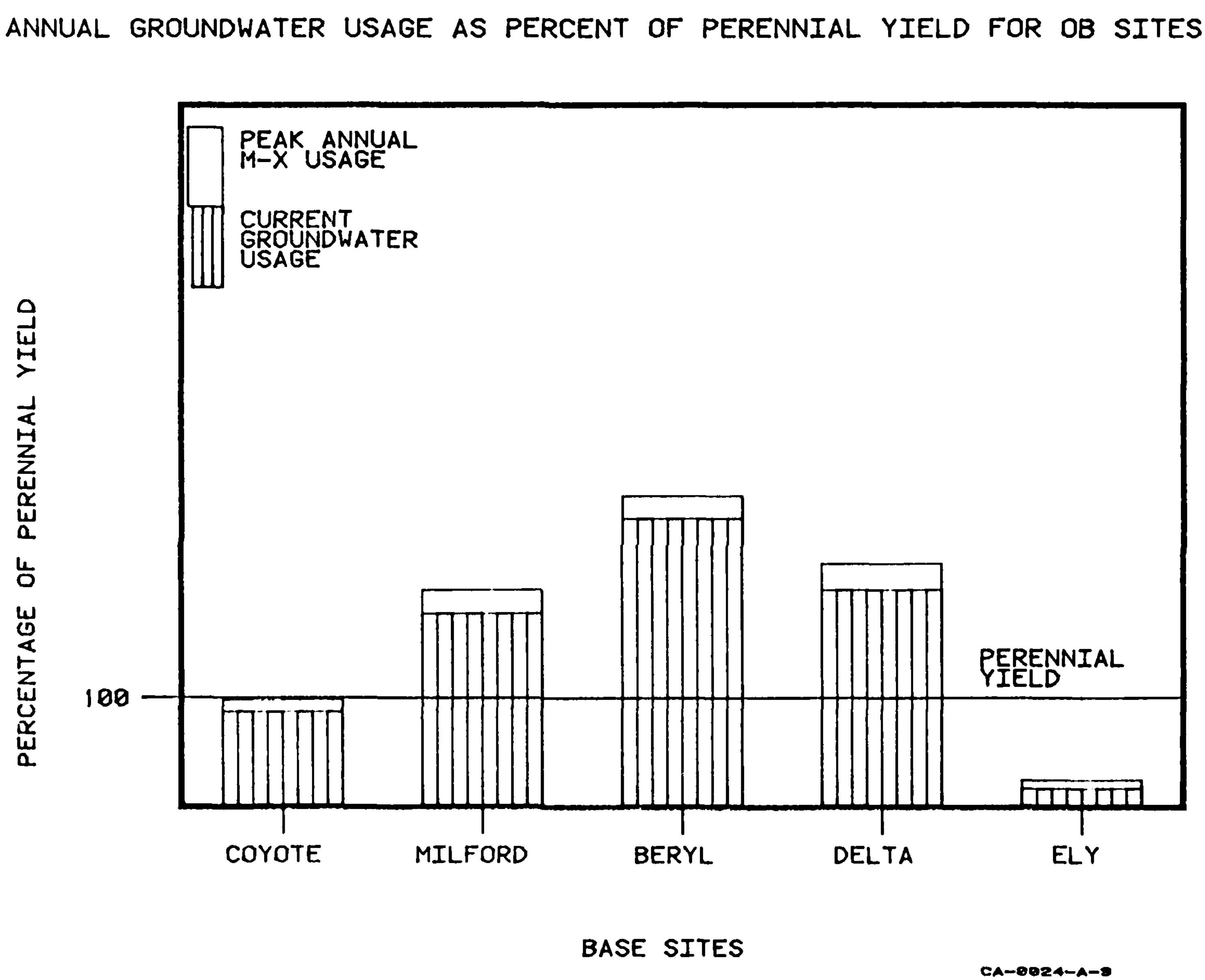
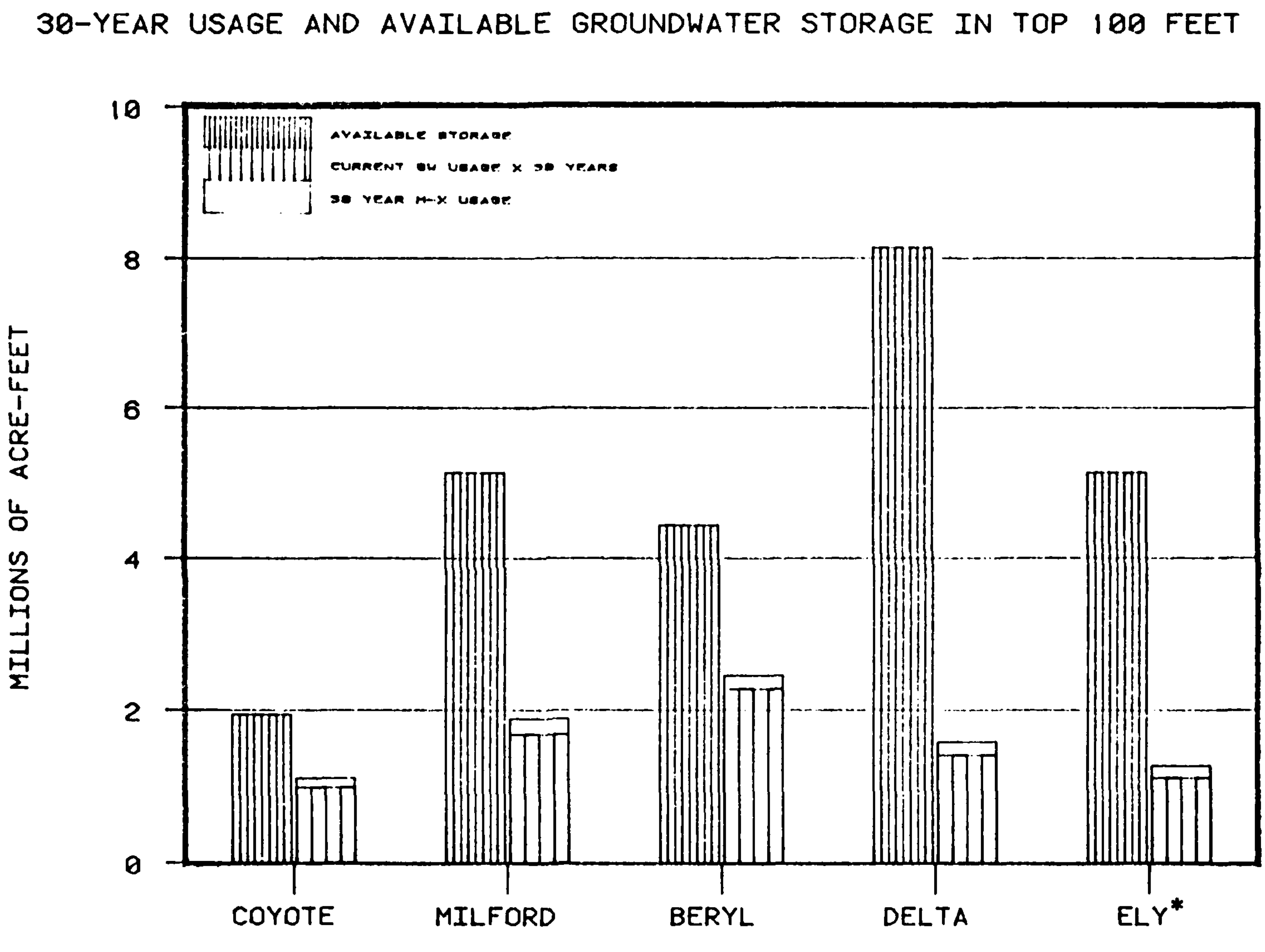


Figure 4.3.2.1.3-2.



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*Projected 30 yr usage includes est. 26000 acre-ft per year for White Pines Power Project (WPPP)

Figure 4.3.2.1.3-3.

Table 4.3.2.1.3-3. Potential for impact to groundwater availability in Nevada/Utah for OB sites.

Site	Volume in Storage[1] (10 acre-ft in 1st 100 ft)	Current Groundwater Use[2] (Thousands of Acre-ft per year)	Perennial Yield[1] (Thousands of Acre-ft per year)	M-X Demands[3] Total (Thousands of Acre-ft per year)	M-X Demands[3] Annual (Thousands of Acre-ft per year)	Ratio of M-X Demand to Perennial Yield (percent)	Ratio of Current Use Plus M-X Demands to Perennial Yield (percent)	Potential for Impact[5] Short Term	Potential for Impact[5] Long Term
Coyote Spring	20	35	40	210	7.0	18	105	High	High
Milford[4]	52	58	33	210	7.0	21	197	High	High
Beryl[4]	45	78	30	210	7.0	23	283	High	High
Delta[4]	82	49	25	210	7.0	28	224	High	High
Ely[4]	50	13	70	210	7.0	10	29	Low	Low

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[1] Nevada numbers, except Coyote Spring, from: 1971 Map, State of Nevada: Water Resources and Inter-Basin Flows, Division of Water Resources, State Engineers Office. Utah numbers from: Don Price, 1979, Summary Appraisal of the Water Resources of the Great Basin in RMAG-UGA-1979 Basin and Range symposium. Coyote Spring includes Muddy River Springs area.

[2] All use groundwater use (from wells) except Coyote Spring which includes surface water (spring fed) in the Muddy River Springs area. Ely use estimate from: Industry Activity Inventory, Desert Research Institute, 1980. Delta use estimate from: Industry Activity Inventory, Utah Water Research Lab, 1980. Beryl and Milford use estimates from: Price et al., Ground Water Conditions in Utah, Spring of 1979, Utah Department of Natural Resources, Cooperative Investigation Report No. 18.

[3] Total demands assumed to include increased indirect population.

[4] State Engineer Office has placed legal constraints on granting water appropriations in the OB areas.

[5] Potential for impact, based on current usage and M-X demand as follows:

Water Use Item	Potential for Impact
Short-term and long-term impacts:	
Ratio of current usage plus peak M-X demand to perennial yield > 1	High
Ratio of current usage plus peak M-X demand to perennial yield < 1	
and:	
$\frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} > 75\%$	High
$25\% < \frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} < 75\%$	Moderate
$\frac{100 \times \text{Peak M-X Demand}}{\text{Perennial Yield}} < 25\%$	Low

Current use < 100 acre-ft: decrease to next lower impact category.

M-X Water Demands

Construction activities would be similar to those in the DDA. The quantity of water required would depend upon the facilities constructed. The Coyote Spring site could be a first or second OB depending upon the final alternative chosen. Estimated water demands for construction of an OB at Coyote Spring are the same as those presented in Table 4.3.2.1.3-1.

Operational water requirements are presented in Table 4.3.2.1.3-2. The OB and community water requirements assume that 80 percent of military personnel and dependents live onbase and 20 percent offbase.

The operation of the OBs would cause an in-migration of people to work at the base and be provide services to those working at the base. The people would settle in present communities near the OB site or in new communities that would be developed. ETR-39 discusses potential additional water demands in communities near the Coyote Spring site. Since water use for the proposed OB would be mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Water Resources

Impacts to surface water resources would be similar to those discussed in Section 4.3.2.1.1.

Potential Impacts to Groundwater Resources

The site lies in close to an area which has been designated a critical groundwater basin (Moapa Springs) by the Nevada State Engineer (Figure 4.3.2.1.4-1). This area has the major discharge point (springs in the Moapa area) of the regional groundwater flow system defined by the drainage of the White River (Figure 4.3.2.1.4-2). It is thought that the flow from springs in the Moapa area are recharged from this regional system, so a disturbance (water removal) could have some effect downstream. Since the Coyote Spring Valley site is upstream from the Moapa Springs, groundwater pumping at the OB site could reduce the flow in those springs. Currently, all the flow of the springs in the Moapa area is beneficially used. The Muddy River Springs "are the base of the agricultural economy of the Moapa Valley" (Eakin, 1964) and agriculture is the economic base of the Moapa Reservation. Substantial groundwater is also pumped for power plant cooling and municipal uses.

M-X withdrawals could impact socioeconomic and biological resources because of direct impacts to groundwater resources. Socioeconomic impacts would stem from reduction of the supply available to spring appropriations. This could result in spring appropriators having to drill wells in order to obtain water. A permanent loss of supply would also be possible if a new type of supply were not economically feasible. Wildlife habitat could also be lost because of reduction of flow from Moapa Springs. Certain protected and endangered species would be adversely impacted by this loss of habitat.

The estimated water requirements (current requirements plus projected M-X) shown in Figures 4.3.2.1.3-2 and 4.3.2.1.3-3 are below the estimated perennial yield. This should indicate a situation for low potential impact. However, the perennial

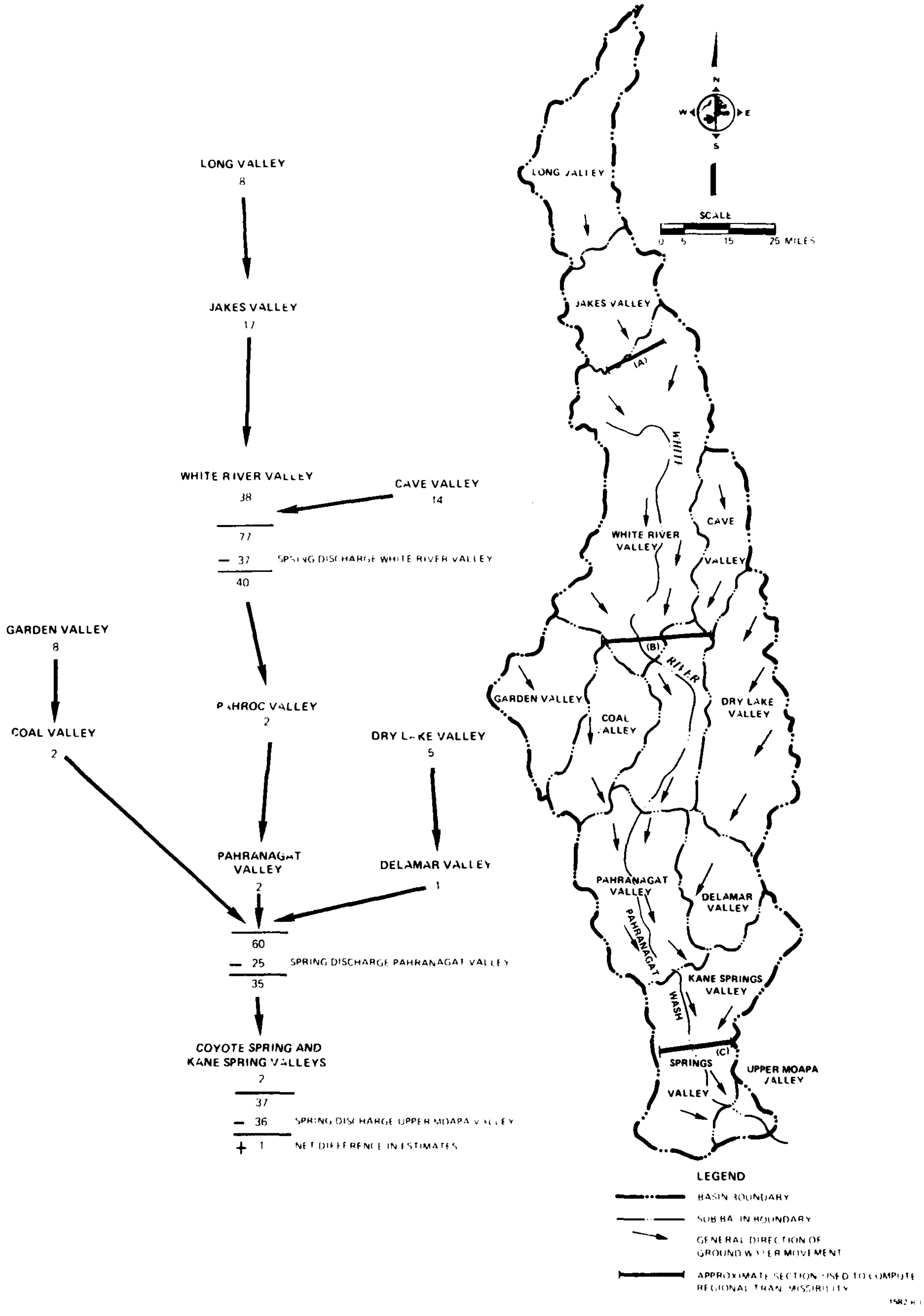

Figure 4.3.2.1.4-2. White River regional groundwater system.

yield use is based partly on inclusion of regional flows. The effect of withdrawing part of these regional flows on downstream uses is not known. This site has the smallest available storage of all the potential basing areas, making it the most sensitive to any stress.

Delta OB Site (4.3.2.1.5)

The Delta area is proposed as a site for a second operating base in Alternative 2. Figure 4.3.2.1.5-1 (page 4-125) shows the proposed base location. A large amount of irrigated land exists to the northeast of the site. Heavy use of water for irrigation has caused an overdraft condition in this area. Also, the Intermountain Power Project (IPP) is planned for this area. This project has received tentative approval of water rights. Transfers were approved for about 5,000 acre-ft of groundwater, with the remaining water requirements to be met from surface sources.

M-X Water Demands

Construction activities would be similar to those in the DDA. The quantities required depend upon the facilities constructed. Estimated water demands for construction of the OB at Delta are the same as those presented in Table 4.3.2.1.3-1.

Operational water requirements are presented in Table 4.3.2.1.3-2 for a second OB. The OB and community water requirements assume that 80 percent of military personnel and dependents would live onbase and 20 percent offbase.

The operation of the OBs would cause an in-migration of people to work at the base and to provide services to those working at the base. These people would settle in present communities near the OB site or new communities that might be developed. ETR-39 discusses potential additional water demands in communities near the Delta site. Since water use for the proposed OB is mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Waters Resources

Potential impacts relative to surface water resources would be similar to those discussed in Section 4.3.2.1.1.

Potential Impacts to Groundwater Resources

Irrigation demands are satisfied mostly by surface water. However, average annual groundwater withdrawals in excess of 50,000 acre-ft/year have resulted in a declining water table. Reduced surface water flows have also been noted. Because of the heavy use, the State Engineer has designated the basin in order to administer area water resources development.

Present use of groundwater is almost entirely for irrigation. Because new appropriations may not being approved, M-X-induced demands may have to be met by acquisition of water rights from present users. This acquisition would remove about 15 percent of the irrigated land in the Delta area from production. This could permanently affect the economic structure of the area. However, these economic changes would be far overshadowed by those that would result from locating an OB in the area, except for the individuals whose rights would be purchased, and perhaps for them as well.

The potential for impacts at Delta is rated high because the system is currently under stress and the addition of M-X demands would increase that stress.

However, M-X construction and operations water usage would represent only about 1.4 percent of present water usage, and if the State Engineer granted appropriation rights in nonagricultural areas, additional waterlevel decline due to the M-X project is anticipated to be small.

The presence of the IPP could significantly increase the potential for long-term impacts occurring in the Delta area, although most of the water purchased for IPP has been surface water, and impacts to groundwater will be of a more secondary nature. M-X will compete not only with present users, but also with this large energy project.

Ely OB Site (4.3.2.1.6)

General

The Ely site is proposed as a second operating base in Alternatives 3 and 5. The OB facilities would occupy approximately 4,000 acres and include an airfield, support facilities, clear zones, and a railroad spur. Three possible locations are being considered for an Ely OB and these are presented in Figures 4.3.2.1.6-1 and 4.3.2.1.6-2 (page 4-126 and 4-127).

M-X Water Demands

The quantities of water required for construction activities similar to those in the DDA depend upon the facilities constructed. Estimated water demands for construction of an OB at Ely are those shown for a second OB in Table 4.3.2.1.3-1.

The operational water requirements are similar to those for a second OB and are presented in Table 4.3.2.1.3-2. The OB and community water requirements assume 80 percent of military personnel and dependents live onbase and 20 percent offbase.

The operation of the OBs will cause an inmigration of people either to work at the base, or provide service to those working at the base. They will settle in present communities near the OB site, or perhaps in new communities. ETR-39 presents potential additional water demands in affected communities near the Ely site. Since water use for the proposed OB is mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Water Resources

Potential impacts to surface water resources will be similar to those discussed in Section 4.3.2.1.3.

Potential Impacts to Groundwater Resources

This site lies within an area designated as a critical groundwater basin by the Nevada State Engineer. The designation is mainly due to an application for appropriation by the White Pine Power Project which, if used in total, could put usage over the estimated perennial yield. Current groundwater use in Steptoe Valley is estimated to be 13,000 acre-ft/year (Desert Research Institute, 1980), while perennial yield is estimated to be 70,000 acre-ft/year (Eakin, Hughes and More, 1967).

Although Steptoe Valley is a designated critical groundwater basin, current groundwater usage is less than the perennial yield, and sufficient quantities may exist for M-X purposes. There is some doubt that WPPP would utilize its total appropriation request. Based on this unappropriated water would be available. A proposed base could utilize part of this quantiy. On this basis a low rating of potential for impact was assigned.

Increased surface runoff during major storms would be minimal. Local increases in sheet and stream-channel erosion may occur, however, construction activities could degrade surface-water quality during thunderstorms, but no significant impact on groundwater quality would be expected.

Milford OB Site (4.3.2.1.7)

General

The Milford site is proposed as a first operating base in Alternatives 5 and 6 and use a second OB for the Proposed Action. As a first OB, it would occupy about 6,000 acres, including an airfield, support facilities, clear zones, DTN, and a railroad spur. As a second OB, it would occupy about 4,000 acres, with no DAA or OBTS and fewer personnel. The site for the proposed base is shown in Figure 4.3.2.1.7-1 (page 4-128).

M-X Water Demands

The water required by construction activities similar to those in the DDA will most likely be obtained from the groundwater supply, though surface water rights might also be purchased. The quantities required depend upon the facilities constructed. Water demands at the Milford site, which could be a first or a second OB, depending upon the final alternative, are similar to those at the Beryl site.

The OB and community water requirements assume 80 percent of military personnel and dependents live onbase and 20 percent offbase. The operation of the OBs will cause an in-migration of people either to work at the base and provide services to those working at the base. They will settle in present communities near the OB site or perhaps in new communities. ETR-39 presents potential additional water demands in affected communities near the Milford site. Since use at the proposed OB is mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Water Resources

Potential impacts to surface water resources will be similar to those discussed in Selection 4.3.2.1.3.

Potential Impacts to Groundwater Resources

This site lies within an area designated a critical groundwater basin by the Utah State Engineer. The area's inhabitants are currently mining its groundwater resources. The estimated perennial yield of 33,000 acre-ft per year (Price, 1979) is substantially less than the estimated groundwater diversion rate of 65,000 acre-ft per year (Price et al., 1979). This groundwater mining is reducing the groundwater availability by removing water from storage. This inturn probably reduces the storage capacity by causing permanent dewatering (compaction) of some areas. As substantial amounts of water are removed from storage, water quality will also be degraded (Mower and Cordova, 1974).

Since irrigated agriculture represents about 98 percent of the current water use in the area (Gates, et al., 1978), M-X impacts would be primarily felt by agriculture. Water table declines caused by M-X withdrawals would cause impacts of increased pumping costs.

An M-X operating base at the Milford site would need approximately 3,600 acre-ft per year for 30 years. This withdrawal would increase the current aquifer depletion rate (current use above perennial yield is 3,600 acre-ft per year) by 25 percent, a very significant impact.

M-X water requirements, combined with present usage rates, exceed perennial yield, and the Utah State Engineer's office will probably not permit additional groundwater withdrawals appropriations in the Milford area. For a graphic representation of these factors, see Figures 4.3.2.1.3-2 and 4.3.2.1.3-3. The impact on groundwater levels, underflow, and groundwater storage would be minor. In general, springs are elevated above the valley-fill deposits, and withdrawals would not be expected to impact spring flow.

Clovis OB Site (4.3.2.1.8)

General

An M-X operating base (OB) might be located about 10 mi west from Clovis, New Mexico, adjacent to Cannon Air Force Base. The OB would include the existing Cannon Air Force Base airfield, some existing support facilities and clear zones, and additional facilities consistent with use of the base as either a first OB or as an OB under the split basing mode (see Figure 4.3.2.1.8-1 on page 4-129). The base would occupy about 6,000 acres including the existing airfield.

M-X Water Demands

The quantities of water required for construction activities similar to those in the DDA depend upon the facilities constructed. The Clovis site could be a first, or a split basing OB, depending upon the alternative chosen. The facilities required for a first OB include the OB, DAA, and OBTS. There is no OBTS at the split base OB. Estimated water demands for construction of an OB at Clovis are presented in the discussion for a first OB in Table 4.3.2.1.3-1.

Operation

The operational water requirements are the same as shown in Table 4.3.2.1.3-1 for a first OB. The OB and community water requirements assume 80 percent of military personnel and dependents live onbase and 20 percent offbase.

The operation of the OBs will cause an in-migration of people either to work at the base or provide services to those working at the base. They will settle in present communities near the OB site or perhaps in new communities. ETR-39 presents potential additional water demands in affected communities near the Clovis site. Since water use for the proposed OB is mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Water Resources

Potential impacts to surface water resources will be similar to those discussed in Section 4.3.2.1.3.

Potential Impacts to Groundwater Resources

The Clovis area has experienced major depletion of groundwater, and most of this has been due to agricultural use. The operation of the OB will place an additional demand upon the aquifer. The operating base demand will be greater than 5 percent of the present depletion rate (see Figure 4.3.2.1.2-1). Since the demand occurs over a projected 30-year period, it is considered quite significant.

The significance of M-X withdrawals is increased by the short projected economic life of the Ogallala Aquifer in Region VII and by the proximity of the proposed OB to the city of Clovis. Competition between the operating base and Clovis for the available groundwater resource could increase the rate of aquifer depletion in the area. Based on this, Clovis was assigned a high rating for potential for impacts.

Dalhart OB Site (4.3.2.1.9)

General

Under Alternative 7, an operating base would be located in Texas, about 20 mi southwest of Dalhart (see Figure 4.3.2.1.9-1 on page 4-130). The second OB would include an airfield, support facilities, clear zones, a railroad spur, and additional facilities consistent with either a split- or full-basing mode. The operating base would occupy about 4,000 acres.

M-X Water Demands

The quantities of water required for construction activities similar to those in the DDA depend upon the facilities constructed. The Dalhart site is being considered for a second OB in Alternative 7. There is no DAA or OBTS at the second OB. Estimated water demands for construction of an OB at Dalhart are presented for a second OB in Table 4.3.2.1.3-1.

The operational water requirements are the same as those presented for a second OB in Table 4.3.2.1.3-2. Community water requirements assume 80 percent of military personnel and dependents live onbase and 20 percent offbase.

The operation of the OBs will cause an in-migration of people either to work at the base or provide services to those working at the base. They will settle in present communities near the OB site or perhaps in new communties. ETR-39 presents potential additional water demands in affected communities near the Dalhart site. Since water use for the proposed OB is mainly domestic, treated wastewater could be available for reuse.

Potential Impacts to Surface Water Resources

Potential impacts to surface water resources will be similar to those discussed in Section 4.3.2.1.3.

Potential Impacts to Groundwater Resources

Large volumes of economically recoverable groundwater are available in Region III (see Figure 4.3.2.1.2-1). M-X uses represent less than 1 percent of the current aquifer depletion rate and though some localized impacts may be felt near M-X pumping centers, the overall potential for significant regional impacts on groundwater availability is low. Further use will cause continuing depletion of the aquifer. Therefore, the potential for a long-term impact is moderate.

Mitigations (4.3.2.1.10)

Mitigation measures for water resources should be directed toward reducing water demands, and selecting points of diversion which will minimize interference with present users. In order to accomplish this, the Air Force will comply with all state water laws, and may purchase or lease existing water rights. The Air Force will establish a comprehensive water monitoring program in cooperation with state water engineers.

In addition, the Air Force will investigate and develop new water sources, will practice water conservation at all construction and operational facilities, will import water in areas which cannot support further water resource development, will practice sound well-field management, will build temporary facilities for water storage, and will advocate the reclamation of wastewater for nonpotable uses.

To mitigate possible impacts on surface waters, the Air Force will minimize the area of disturbance, will implement a revegetation program, will use landscaping erosion, and drainage control techniques, will construct retention ponds where required, and will manage groundwater withdrawal as it affects surface waters.

There were many comments on the DEIS to the effect that the mitigation measures proposed would be inadequate from a variety of standpoints. The measures would not include the use of waste or saline water with water-conserving plants for revegetation or the importation of water; in addition, no mitigations for the livestock industry were discussed. Many proposed mitigations would require an individual EIS or mitigation at the source from which the water comes. Federal grants or loan funds would be insufficient to meet the needs of impacted communities and the list of mitigations could not possibly offset all prol impacts.

Additional discussion of mitigations are contained in ETR-. Resources) and ETR-38 (Mitigations).

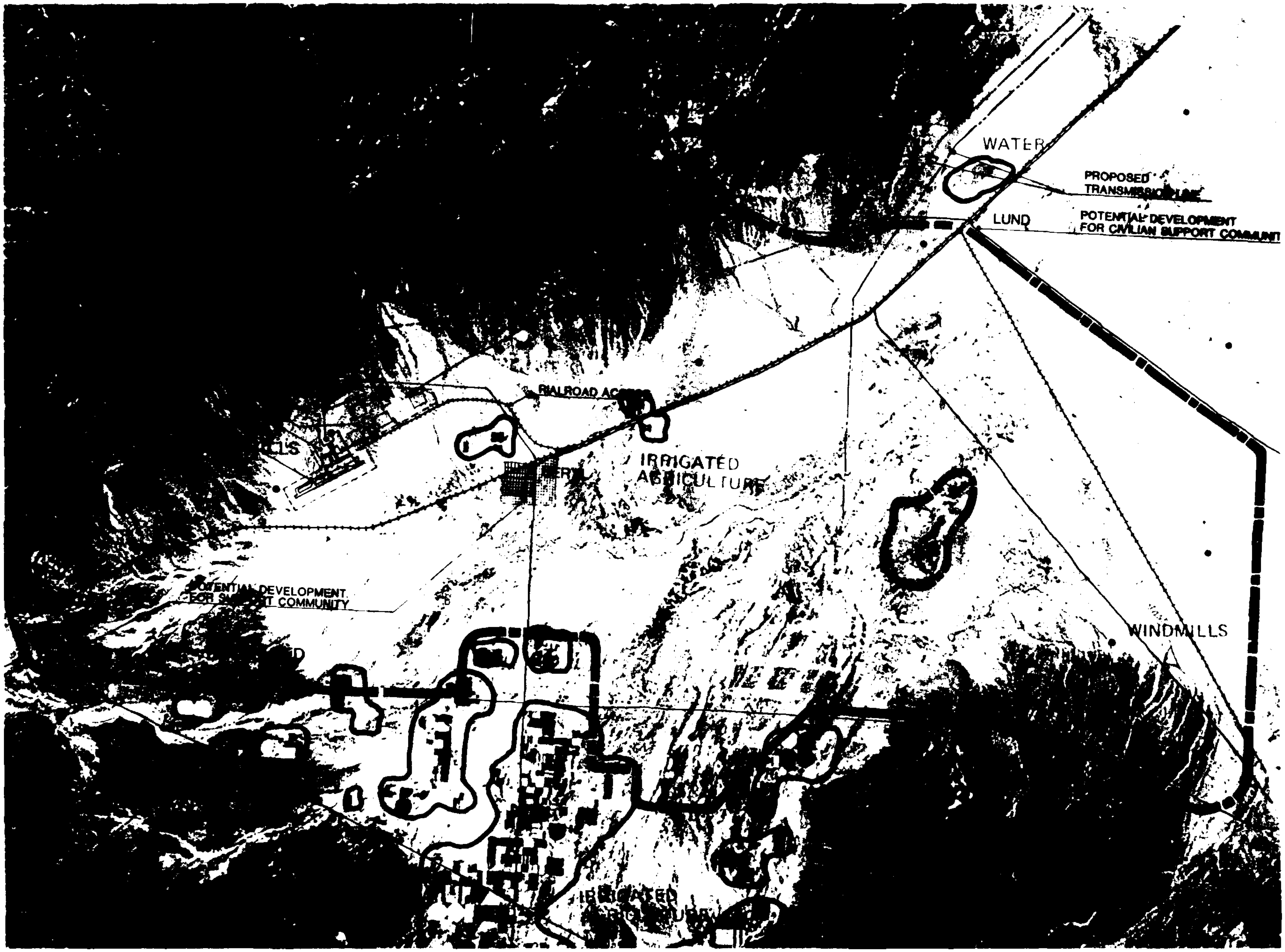

Figure 1.3.2.1.3-1. Beryl OB zone with watercourses, irrigation, and wetlands outlined. 4251 B

4249-B

Figure 4.3.2.1.4-1. Coyote Spring OB zone with water courses, irrigation, and wetlands outlined.

Figure 4.3.2.1.5-1. Delta OB zone with water courses, irrigation, and wetlands outlined.

4252-B

4254-B

Figure 1.3.2.1.6-1. Ely OB zone, central and north sites, with water courses, irrigation, and wetlands outlined.

Figure 1.3.2.1.6-2. Ely OB zone, south site, with courses, irrigation, and wetl outlined.

Figure 4.3.2.1.7-1. Milford OB zone with water courses, irrigation, and wetlands outlined.

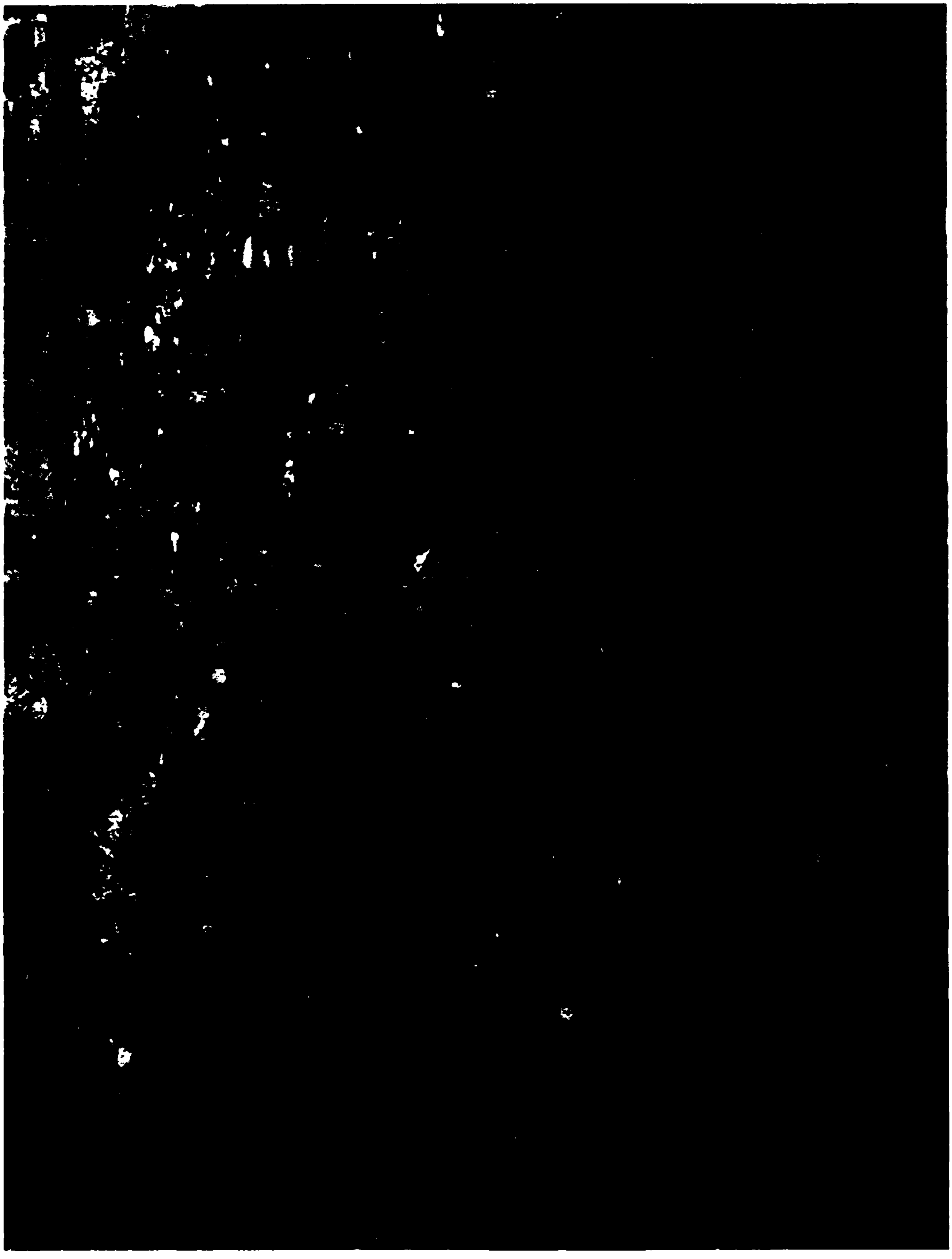

Figure 4.3.2.1.8-1. Clovis OB zone with water courses, irrigation, and wetlands outlined.

4255-B

4256 B

Figure 4.3.2.1.9-1. Dalhart OB zone with water courses, irrigation, and wetlands outlined.

Erosion

EROSION

INTRODUCTION (4.3.2.2.1)

As the soil is disturbed during construction activities, it will become more susceptible to wind and water erosion. Accelerated erosion will produce more sediment and remove the more productive surface layers of soil making revegetation more difficult, degrading vegetation and possibly burying some objects. Detailed discussions of water and wind erosion, including the methodologies used for estimating potential erosion and impact ranking criteria, can be found in ETR-11 ane ETR-34.

PROPOSED ACTION (4.3.2.2.2)

DDA Impacts

The potential for water erosion and sedimentation within each valley, in the Nevada/Utah study region was determined using three factors: (1) the number of miles of road construction planned per valley, (2) the number of stream crossings (project defined) per valley, and (3) the average annual amount of runoff which flows from the mountains to the valleys. Relative values were assigned to these three factors for each valley, and each valley was given an overall rating ranging from high potential erosion impact to low potential erosion impact (see ETR-11, Geology and Mining).

Predicted water erosion impacts are summarized in Table 4.3.2.2-1 for each hydrologic subunit. Those valleys determined to have a high short-term erosion impact rating include Snake, Pine, Tule (White), Wah Wah, Kobeh, Monitor, Antelope, Garden, Jakes, and Cave. These valleys have a high density of road construction, relatively high stream crossing densities, and a moderate to high average annual runoff from the mountains. Those valleys determined to have low short-term potential erosion impact ratings include Government Creek, Sevier Desert, Cactus Flat, Steptoe, Pahroc, and Pahranagat. These valleys generally have low construction densities and either low stream crossing densities or low runoff or both. The remaining valleys have moderate short-term potential erosion impact ratings.

Table 4.3.2.2-1. Potential water erosion impacts in the Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Name	Short Term Impacts[1]	Long Term Impacts[1]
	Subunits with M-X Clusters and DTN		
4	Snake, Nev./Utah	*****	***
5	Pine, Utah	*****	***
6	White, Utah	*****	*
7	Fish Springs, Utah	***	*
8	Dugway, Utah	***	*
9	Government Creek, Utah	*	*
46	Sevier Desert, Utah	*	*
46A	Sevier Desert-Dry Lake, Utah[2]	*	*
54	Wah Wah, Utah	*****	***
137A	Big Smoky-Tonopah Flat, Nev.	***	*
139	Kobeh, Nev.	*****	***
140A	Monitor-North, Nev.	*****	***
140B	Monitor-South, Nev.	*****	***
141	Ralston, Nev.	***	*
142	Alkali Spring, Nev.	***	*
148	Cactus Flat, Nev.	*	*
149	Stone Cabin, Nev.	***	*
151	Antelope, Nev.	*****	***
154	Newark, Nev.[2]	***	*
155A	Little Smoky-North, Nev.	***	*
155C	Little Smoky-South, Nev.	***	*
156	Hot Creek, Nev.	***	*
170	Penoyer, Nev.	***	*
171	Coal, Nev.	***	*
172	Garden, Nev.	*****	***
173A	Railroad-South, Nev.	***	*
173B	Railroad-North, Nev.	***	*
174	Jakes, Nev.	*****	***
175	Long, Nev.	***	*
178B	Butte-South, Nev.	***	*
179	Steptoe, Nev.	*	*
180	Cave, Nev.	*****	***
181	Dry Lake, Nev.[2]	***	*
182	Delamar, Nev.	***	*
183	Lake, Nev.	***	*
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	***	*
202	Patterson, Nev.	***	***
207	White River, Nev.[2]	***	*
208	Pahroc, Nev.	*	*
209	Pahranagat, Nev.	*	*
	Overall DDA Impact	***	*

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Center (ASC).

Water erosion impacts will be greatest during the construction period. Revegetation of the disturbed soils and proper engineering design of the roads will help mitigate the impacts after construction has been completed. Long-term impacts should be minimal if mitigation measures are undertaken.

Predicted wind erosion impacts are summarized in Table 4.3.2.2-2 for each hydrologic subunit. Activities related directly to M-X construction and operation are expected to be confined largely to gentle slopes, and valley bottoms. The influence of climatic factors (wind speed, aridity, etc.) on the erodibility values can be expected to be great for these sites (see ETR-34, Wind Erosion). Although actual values will vary considerably, most piedmont slope soils in the Nevada/Utah study area, approximately 39 to 94 tons of soil per acre per year can be expected to be removed during support road construction. The values for large areas (such as OB construction sites) can be expected to be between 86 and 172 tons per acre per year. Although soils with moderately high erodibility predominate on the piedmont slope, sandy soils also exist. Placing facilities on these soils would result in much higher erosion rates.

Disturbance and destabilization of dune areas by recreational ORVs could mobilize thousands of tons of sands. Traffic on playa beds could mobilize considerable quantities of suspendable particulates. Dust from eroded playa beds could reduce plant photosynthesis if accumulated in sufficient quantities. Additionally, high levels of airborne particulates may present a health hazard.

Operating Base Impacts

Construction of the operating bases will produce conditions that will make the sites more susceptible to wind and water erosion. Based on the available soil survey information, each operating base site was rated as to its potential erosion impact. Slopes, soil types, vegetation, and climatic conditions were taken into consideration. As a result of this, relative values of high, moderate, and low potential impacts were assigned to each base (see ETR-11, Mining and Geology and ETR-34, Wind Erosion).

Coyote Spring Valley OB Impacts

The construction of the Coyote Spring Valley OB located in the Coyote Spring and Muddy River Spring hydrologic subunits will result in a moderate short-term potential water erosion impact rating as shown in Table 4.3.2.2-3. This rating is due primarily to the large construction activity density per unit area of the valley, the moderate erosion condition class of the undisturbed soils, and the steeper slopes found at this site. Revegetation of the disturbed soils as well as employment of proper engineering design will help mitigate the impacts after construction has been completed. The long-term impacts will not be significant if mitigation measures are employed.

Short-term potential wind erosion impacts at the Coyote Spring Valley OB site are expected to be high if proper mitigation measures are not taken (Table 4.3.2.2-4). These high impacts are anticipated due to the large area to be devegetated; the general susceptibility of piedmont slope and valley floor soils to wind erosion, particularly when gravel pavement surfaces are removed; general climatic conditions favoring wind erosion, and the intensity of construction activity

Table 4.3.2.2-2. Potential wind erosion impacts in the Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Name	Short-Term Impacts[1]	Long-Term Impacts[1]
	Subunits with M-X Clusters and DTN		
4	Snake, Nev./Utah	*****	*
5	Pine, Utah	*****	*
6	White, Utah	*****	*
7	Fish Springs, Utah	*****	*
8	Dugway, Utah	*****	*
9	Government Creek, Utah	***	*
46	Sevier Desert, Utah	***	*
46A	Sevier Desert-Dry Lake, Utah[2]	*****	*
54	Wah Wah, Utah	*****	*
137A	Big Smoky-Tonopah Flat, Nev.	***	*
139	Kobeh, Nev.	*****	*
140	Monitor, North and South, Nev.	***	*
141	Ralston, Nev.	*****	*
142	Alkali Spring, Nev.	*****	*
148	Cactus Flat, Nev.	See Stone Cabin	
149	Stone Cabin, Nev.[2]	*****	*
151	Antelope, Nev.	*****	*
154	Newark, Nev.[2]	***	*
155	Little Smoky-North, Nev.	*****	*
156	Hot Creek, Nev.	*****	*
170	Penoyer, Nev.	*****	*
171	Coal, Nev.	*****	*
172	Garden, Nev.	*****	*
173A	Railroad-South, Nev.	*****	*
174	Jakes, Nev.	*****	*
175	Long, Nev.	***	*
178B	Butte-South, Nev.	***	*
179	Steptoe, Nev.	*	*
180	Cave, Nev.	*****	*
181	Dry Lake, Nev.[2]	*****	*
182	Delamar, Nev.	*****	*
183	Lake, Nev.	*****	*
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	*****	*
202	Patterson, Nev.	***	*
207	White River, Nev.[2]	***	*
208	Pahroc, Nev.	***	*
209	Pahranagat, Nev.	***	*
	Overall DDA Impact	***	*

T5922/10-2-81/a

[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Center (ASC).

Table 4.3.2.2-3.

Hyc

No.	
	Beryl, Utah (Alternative
52	Lund Distric
53	Beryl-Enter
	Coyote Sprir (P.A. and Al
210	Coyote Sprir
219	Muddy River
	Delta, Utah (Alternative
46	Sevier Deser
46A	Sevier Deser
	Ely, Nev. (Alternative
179	Steptoe, Nev
	Milford, Uta (P.A. and Al
50	Milford, Uta
52	Lund Distric
	Clovis, N. M (Alternative
	Roosevelt C Curry Count
	Dalhart, Tex (Alternative
	Hartley Cou

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[1] - = No impac
* = Low imp
*** = Moderat
***** = High imp

[2] Conceptual locatio and Alternatives 1-

[3] Conceptual locatio

...hich could result from construction
...d Action and Alternatives

Short Term Impacts[1]	Long Term Impacts[1]
***	*
***	*
***	*
***	*
*	*
*	*
***	-
*	*
*	*
***	***
***	*
*****	***

...for the Proposed Action

...for Alternative 7.

Table 4.3.2.2-4. Potential w...
result from ...
for the Prop...
1-8.

Operating Base
Beryl, UT (Alternatives 1,3,4)
Coyote Spring Valley, NV (P.A. and Alternatives 1,2,4,6,8)
Delta, UT[2] (Alternative 2)
Ely, NV (Alternatives 3,5)
Milford, UT[2] (P.A. and Alternatives 5,6)
Clovis, NM[3] (Alternatives 7,8)
Dalhart, TX[3] (Alternative 7)

T5923/9-22-81/F

[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area S...
Proposed Action and Alternati...

[3] Conceptual location of Area S...
tive 7.

per unit of valley area. Long-term wind erosion impacts will be low once the site has been revegetated.

Milford OB Impacts

The construction of an operating base in the Milford area will result in a low potential water erosion impact rating (see Table 4.3.2.2-3) due to the generally level topography. Where local areas of sloping topography do exist, disturbed soils should be revegetated and proper engineering design should be employed. Long-term impacts are expected to be insignificant if mitigation measures are undertaken.

Construction of the OB is anticipated to result in high short-term potential wind erosion impacts if proper mitigation measures are not taken (Table 4.3.2.2-4). The high impacts are expected due to the large area to be devegetated during construction, the general susceptibility of piedmont slope and valley floor soils to wind erosion, and general climatic conditions favoring wind erosion. Long-term wind erosion impacts will be low once the site has been revegetated.

ALTERNATIVE 1 (4.3.2.2.3)

Alternative 1 DDA impacts and the Coyote Spring Valley OB impacts are identical to those described for the Proposed Action. The second operating base for this alternative is near Beryl, Utah. Short-term water erosion impacts are expected to be moderate due to the high number of channel crossings in the area and the moderate erosion hazard already present in the predominating soils of the area (see Table 4.3.2.2-3). Wind erosion impacts would be similar to the Proposed Action (Table 4.3.2.2-4). Impacts at the site can be mitigated through revegetation and proper engineering design. Long-term impacts are expected to be minimal with proper mitigation.

ALTERNATIVE 2 (4.3.2.2.4)

Alternative 2 DDA impacts and the Coyote Spring Valley OB impacts are identical to those described for the Proposed Action. The second operating base for this Alternative is near Delta, Utah. Short-term water erosion impacts are expected to be low (see Table 4.3.2.2-3) due to the limited runoff over the entire watershed, relatively low construction density, level topography, and the present slight erosion hazard of most of the soils in the area. Wind erosion would be similar to the Proposed Action (Table 4.3.2.2-4). The area northeast of the OB site is intensively farmed. Wind blown particles emanating from the OB could cause crop damage through abrasion and burial. Erosion can be mitigated through revegetation of the disturbed soils and proper engineering design. Long-term impacts are expected to be low with mitigation measures.

ALTERNATIVE 3 (4.3.2.2.5)

Alternative 3 DDA impacts and the Beryl OB impacts are identical to those described for the Proposed Action and Alternative 1. The second operating base for this alternative is near Ely, Nevada. Short-term water erosion impacts are expected to be moderate (see Table 4.3.2.2-3) due to the present moderate erosion hazard rating of the predominating soils of the area, the presence of slopes of three to five percent, and relatively high runoff from the mountains. Water erosion impacts can be mitigated through revegetation of the disturbed soils and proper engineering design. Long-term impacts are expected to be low with proper mitigation measures. Wind erosion impacts would be similar to the Proposed Action (Table 4.3.2.2-4).

ALTERNATIVE 4 (4.3.2.2.6)

Alternative 4 DDA impacts are identical to those described for the Proposed Action. The wind and water erosion impacts for the Beryl, Utah OB are the same as those described under Alternative 1; the impacts for the Coyote Spring Valley OB are the same as those described under the Proposed Action.

ALTERNATIVE 5 (4.3.2.2.7)

Alternative 5 DDA impacts are identical to those described for the Proposed Action. The water and wind erosion impacts for the Milford, Utah OB are the same as those described under the Proposed Action; the impacts for the Ely OB are the same as those described under Alternative 3.

ALTERNATIVE 6 (4.3.2.2.8)

Alternative 6 DDA impacts are identical to those described for the Proposed Action. The water and wind erosion impacts for the Milford, Utah OB are the same as those described under the Proposed Action; the impacts for the Coyote Spring Valley OB are also the same as those described under the Proposed Action.

ALTERNATIVE 7 (4.3.2.2.9)

To assess potential water erosion impacts in the Texas/New Mexico study region, it was assumed that the region has approximately the same rainfall patterns and an equal distribution of the different soil types. Although the study region is remarkably level, areas of steep slopes were identified.

Water erosion impacts in the Texas/New Mexico study region range from low to high, but are expected to be moderate overall (see Table 4.3.2.2-5). The Dalhart OB is primarily located in Hartley County, which is rated as a high potential water erosion impact area. A small portion of the OB site is located in Oldham County, and it has low potential erosion impact rating. The Clovis OB is located in Curry and Roosevelt counties. These counties are rated as being moderate and high water erosion impact areas, respectively. Areas are rated as having a moderate or high potential for water erosion impacts because of the large proportion of soils that will be disturbed in these counties. In areas sensitive to water erosion, disturbed soils should be revegetated and proper engineering design should be employed. Any long-term impacts are expected to be insignificant with proper mitigation.

The broad flat landscapes of the Texas/New Mexico region provide little resistance to winds, especially during late winter and spring. Short-term wind erosion impacts are potentially severe (Table 4.3.2.2-6). This alternative is considered to have the greatest potential for high wind erosion impacts. Climatic factors are as severe as, or more severe than, for Nevada/Utah and increase in severity from south to north. Highly wind erodible, soils dominate the uplands in the southern portion of the study area; however, wind erosion hazards may be greatest in the north even with its greater proportion of clay soils due to climatic factors (Table 4.3.2.2-6).

Table 4.3.2.2-5. Potential water erosion impacts in Texas/New Mexico DDA for Alternative 7.

County	Short Term Impact[1]	Long Term Impact[1]
Bailey, Tex.	***	*
Castro, Tex.	***	*
Cochran, Tex.	***	*
Dallam, Tex.	*****	***
Deaf Smith, Tex.[2]	*****	***
Hartley, Tex.[2]	*****	***
Hockley, Tex.	*	*
Lamb, Tex.	*	*
Oldham, Tex.	*	*
Parmer, Tex.	*****	***
Randall, Tex.	*	*
Sherman, Tex.	*	*
Swisher, Tex.	*	*
Chaves, N. Mex.[2]	*	*
Curry, N. Mex.[2]	***	*
DeBaca, N. Mex.	*	*
Guadalupe, N. Mex.		
Harding, N. Mex.	***	*
Lea, N. Mex.	*	*
Quay, N. Mex.	***	*
Roosevelt, N. Mex.[2]	*****	***
Union, N. Mex.	*	*
Overall DDA Impacts	***	*

T3841/9-16-81/F

[1]- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2]Conceptual location of Area Support Centers (ASCs).

Table 4.3.2.2-6. Potential wind erosion impact in Texas/New Mexico DDA for Alternative 7.

County	Short-Term Impact[1]	Long-Term Impact[1]
Counties	with M-X Clusters and DTN	
Bailey, Tex.	*****	*
Castro, Tex.	***	*
Cochran, Tex.	***	*
Dallam, Tex.	*****	*
Deaf Smith, Tex.[2]	*****	*
Hartley, Tex.[2]	*****	*
Hockley, Tex.	See Lamb County	
Lamb, Tex.	***	*
Oldham, Tex.	***	*
Parmer, Tex.	***	*
Randall, Tex.	*	*
Sherman, Tex.	*	*
Swisher, Tex.	See Castro County	
Chaves, N. Mex.	*****	*
Curry, N. Mex.[2]	*****	*
DeBaca, N. Mex.	*	*
Gaudalupe, N. Mex.	See Quay County	
Harding, N. Mex.	***	*
Lea, N. Mex.	*	*
Quay, N. Mex.	*****	*
Roosevelt, N. Mex.[2]	*****	*
Union, N. Mex.	***	*

T5924/9-22-81/F

[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Centers (ASCs).

Accelerated soil loss at construction sites would have adverse impacts on areas downwind of the site. Dust accumulations on crops could reduce yields. Similarly, wind erosion in the deployment area would degrade air quality in an area already troubled by high concentrations of particulates.

These public comments reflect the concerns of people who live in the Texas/New Mexico region:

PUBLIC COMMENTS ON THE DRAFT EIS:

"The Farm Bureau contends placing M-X in eastern New Mexico could create a dust bowl as bad as during the wind swept era of the 1930s. At a recent Legislative hearing in Santa Fe, Air Force officials acknowledged the fact that the draft environmental impact statement for the project, released in December, did not address to any great extent the effect of the project on wind erosion." (A0463-9-015)

"This area is very delicate in nature and this project can cause a dust bowl condition that would equal that of the 1930s. Conservation Districts have worked for over forty years to control erosion. In a short period of time conservation efforts could be set back to the beginning." (A0565-1-004)

"The people who depend upon the land and water for farming and ranching should not be jeopardized by a plan to use their resources and their soil, by a plan which has not thoroughly researched the consequence of wind erosion, the water level, the disruption of the towns in eastern New Mexico and western Texas, affecting the quality of human life here and throughout the world. This land is used to produce food for me and you and for our children and future generations. It must not be destroyed by M-X." (A0591-7-002)

"The Environmental Impact Study is lacking as it does not take into account the wind erosion. Eastern New Mexico and west Texas have the largest incidence of dust in the air in the United States." (A0610-5-002)

"Wind erosion will really be a big problem. No one who doesn't live on the land here knows what can happen when the winds come. Farming has enough problems with droughts, low prices, government say so; without the M-X missile added to it." (A0768-1-004)

"We are farmers living in Roosevelt County and proudly serving our country by providing food for our people. This land is good, productive land now, with all the wind erosion and irrepairable damage to our lands, we could be cutting our own throats." (A0500-8-003)

"Because of the semi-arid nature of our area, nearly all soils are disturbed and robbed of vegetation. What are these "barriers" that will be erected at the clusters do to contribute to the wind erosion problem, as a result of construction activities? Spring is the driest period of the year, extreme winds cause serious soil erosion, especially on land having little or no cover." (B0604-7-005)

The basic strategies to mitigate wind erosion impacts in this region includes minimizing removal of vegetation on construction areas until the latest possible moment, revegetating with native species, and designing roads, protective structures, and wind breaks when appropriate. Long-term wind erosion impacts will be low following site revegetation (Table 4.3.2.2-6).

ALTERNATIVE 8 (4.3.2.2.10)

Water erosion impacts in the split-basing alternative will be intermediate to moderate for the Nevada/Utah region and moderate overall for Texas/New Mexico study region as shown in Table 4.3.2.2-7. Short-term wind erosion impacts would be generally high in the Nevada/Utah DDA valleys used for Alternative 8 (Table 4.3.2.2-8). Short-term impacts in the Texas/New Mexico DDA would be less than for the Alternative 7 in many counties because fewer shelters would be required. Mitigating measures for areas where wind and water erosion occur include revegetation and proper engineering design of the roads and facilities. Long-term impacts are expected to be minimal with proper mitigation measures (Tables 4.3.2.2-7 and 4.3.2.2-8).

Erosion impacts for the Coyote Spring Valley OB are discussed under Proposed Action; the erosion impacts for the Clovis, New Mexico operating base are discussed under Alternative 7.

MITIGATIONS (4.3.2.2.11)

The Air Force will establish erosion control program including selection of appropriate sites where drainage, topography, and soils are favorable for planned use, minimization of disturbed areas, control of runoff, revegetation of disturbed areas, minimizing soil mixing, paving of roads as early in project life as practicable, application of dust palliatives on roads, and control of off road travel. Additional discussion of mitigation is contained in ETR-11 (Mining and Geology), ETR-34 (Wind Erosion), and ETR-38 (Mitigations).

Table 4.3.2.2-7. Potential water erosion impacts in the Nevada/Utah and Texas/New Mexico DDA for Alternative 8 (split basing).

Hydrologic Subunit No.	Name	Short Term Impacts[1]	Long Term Impacts[1]
	Subunits with M-X Clusters and DTN		
4	Snake, Nev./Utah[2]	*****	***
5	Pine, Utah	*****	***
6	White, Utah	*****	***
7	Fish Springs, Utah	***	*
46	Sevier Desert, Utah	*	*
46A	Sevier Desert-Dry Lake, Utah[2]	*	*
54	Wah Wah, Utah	*****	***
155	Little Smoky, Nev.	***	*
156	Hot Creek, Nev.	***	*
170	Penoyer, Nev.	***	*
171	Coal, Nev.[2]	***	*
172	Garden, Nev.	*****	***
173A	Railroad-South, Nev.	***	*
173B	Railroad-North, Nev.	***	*
180	Cave, Nev.	*****	***
181	Dry Lake, Nev.[2]	***	*
182	Delamar, Nev.	***	*
183	Lake, Nev.	***	*
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	***	*
202	Patterson, Nev.	***	*
207	White River, Nev.	***	*
	Bailey, Tex.	***	*
	Cochran, Tex.	***	*
	Dallam, Tex.	*****	***
	Deaf Smith, Tex.	*****	***
	Hartley, Tex.	*****	***
	Hockley, Tex.	*	*
	Lamb, Tex.	*	*
	Oldham, Tex.	*	*
	Parmer, Tex.	*****	***
	Chaves, N. Mex.	*	*
	Curry, N. Mex.	***	
	DeBaca, N. Mex.	*	
	Guadalupe, N. Mex.		
	Harding, N. Mex.	***	*
	Lea, N. Mex.	*	*
	Quay, N. Mex.[2]	***	*
	Roosevelt, N. Mex.[2]	*****	***
	Union, N. Mex.	*	*
	Overall DDA Impact	***	*

T3842/9-16-81/F

[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Centers (ASCs).

Table 4.3.2.2-8. Potential wind erosion impacts in Nevada/Utah and Texas/New Mexico DDA for Alternative 8 (split basing).

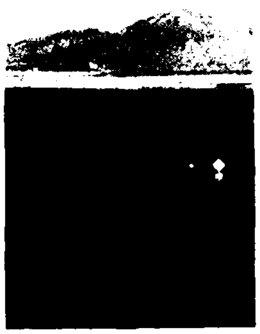
Hydrologic Subunit No.	Name	Short-Term Impacts[1]	Long-Term Impacts[1]
	Subunits with M-X Clusters and DTN		
4	Snake, Nev./Utah[2]	*****	*
5	Pine, Utah	*****	*
6	White, Utah	*****	*
7	Fish Springs, Utah	*****	*
46	Sevier Desert, Utah	***	*
46A	Sevier Desert-Dry Lake, Utah[2]	*****	*
54	Wah Wah, Utah	*****	*
156	Hot Creek, Nev.	*****	*
170	Penoyer, Nev.	*****	*
171	Coal, Nev.[2]	*****	*
172	Garden, Nev.	*****	*
173A	Railroad-South, Nev.	*****	*
180	Cave, Nev.	*****	*
181	Dry Lake, Nev.[2]	*****	*
182	Delamar, Nev.	*****	*
183	Lake, Nev.	*****	*
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	*****	*
202	Patterson, Nev.	***	*
207	White River, Nev.	***	*
	Bailey, Tex.	*	*
	Cochran, Tex.	***	*
	Dallam, Tex.	***	*
	Deaf Smith, Tex.	***	*
	Hartley, Tex.	*****	*
	Lamb, Tex.	*	*
	Oldham, Tex.	*	*
	Parmer, Tex.	*	*
	Chaves, N. Mex.	*****	*
	Curry, N. Mex.	***	*
	DeBaca, N. Mex.	*	*
	Harding, N. Mex.	***	*
	Lea, N. Mex.	*	*
	Quay, N. Mex.[2]	*****	*
	Roosevelt, N. Mex.[2]	***	*
	Union, N. Mex.	***	*

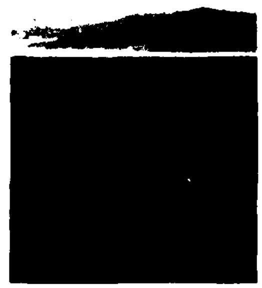
T5925/9-22-81/F

[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Centers (ASCS).

Air Resources





AIR RESOURCES

INTRODUCTION (4.3.2.3.1)

Air quality impacts were assessed using air quality models that predict pollutant concentrations by the use of meteorological and emissions data. Models used included IMPACT, a model used by the California Air Resources Board, as well as the EPA-approved HIWAY model and the EPA UNAMAP models PAL and ISC. The Point-Area-Line (PAL) and IMPACT models were used to predict particulate concentrations due to fugitive dust emissions from construction activity and wind erosion. The HIWAY model was run to predict gaseous pollutant levels due to vehicular emissions at the operating base during operations. The IMPACT model was also used to predict regional carbon monoxide (CO) and nitrogen oxides (NO_x) levels in the operating base vicinity and community due to vehicles and space heating and cooling emissions. The ISC model was used to assess the long-term impacts of wind erosion during the system operation. It was determined from the modeling results that certain primary disturbances, or M-X associated activities, would result in significant air quality impacts. Significant primary disturbances considered for the short term were the following: operation of construction support facilities (NO_x and particulate matter), construction of clusters (particulate matter), and construction of the primary or secondary operating base and protective structures (particulate matter). Primary disturbances considered to be significant for the long term were operation of the system (particulate matter) and operation of the primary or secondary operating base (particulate matter and CO).

The severity of impact in a given hydrologic subunit or county depends on the level and type of M-X activity (or primary disturbance) in a basin, as well as any air quality-related features of the basin such as proposed or existing air pollutant sources and the geographic relation to nonattainment areas, Class I areas, or other sensitive receptors. The air quality-related features of the hydrologic subunits of the deployment area for the Proposed Action and Alternatives 1 through 6 are shown in Table 4.3.2.3-1.

It was not possible to determine if additional combustion-related air pollutants such as SO_x might cause significant air quality impacts at the operating base during

Table 4.3.2.3-1. Summary of air quality resource characteristics for each hydrologic subunit for the deployment areas of the Proposed Action and the Alternatives 1-6 (Page 1 of 4).

Hydrologic Subunit No.	Hydrologic Subunit Name	Potential Pollutant Sources	Nonattainment Areas	Class I Areas	Sensitive Receptors
4	Snake	--	None[1]	None	Within 100 mi of Lehman Caves
5	Pine	Pine Grove molybdenum mine	None	Within 100 mi of Zion and Bryce Canyon	Within 30 mi of Lehman Caves
6	White	--	None	None	Within 30 mi of Lehman Caves
7	Fish Springs	--	None[1]	None	--
8	Dugway	--	None[1]	None[1]	--
9	Government Creek	--	None[1]	None	--
46	Sevier Desert	IPP Power Plant, modular home factory, cement plant	None	Within 100 mi of Zion and Bryce Canyon	Town of Delta nearby
46A	Sevier Desert-Dry Lake	--	None	Within 100 mi of Zion and Bryce Canyon	Within 100 mi of Cedar Breaks
50	Milford	Molybedenum Mine, geo-thermal plant	None	Within 40 mi of Zion and Bryce Canyon	Within 40 mi of Cedar Breaks
54	Wah Wah	--	None	None	Within 100 mi of Death Valley
137A	Big Smoky-Tonopah Flat	Anaconda molybdenum mine	Near Gabbs	None	Within 100 mi of Death Valley
139	Kobeh	--	None	None	--

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Table 4.3.2.3-1. Summary of air quality resource characteristics for each hydrologic subunit for the deployment areas of the Proposed Action and the Alternatives 1-6 (Page 2 of 4).

Hydrologic Subunit No.	Hydrologic Subunit Name	Potential Pollutant Sources	Nonattainment Areas	Class I Areas	Sensitive Receptors
140A	Monitor-North	--	None	None	--
140B	Monitor-South	--	None	None	--
141	Ralston	Anaconda	None	None	Within 100 mi. of Death Valley
142	Alkali Springs	Anaconda	None	None	Within 100 mi. of Death Valley
148	Cactus Flat	--	None	None	Within 100 mi. of Death Valley
149	Stony Cabin	--	None	None	Within 100 mi. of Death Valley
151	Antelope	--	None	None	--
154	Newark	--	None	None	--
154A	Little Smoky-North	--	None	None	--
155C	Little Smoky-South	--	None	None	--
156	Hot Creek	-	None	None	Within 100 mi of Death Valley
170	Penoyer	--	None	None	Within 100 mi. of Death Valley
171	Coal	--	None	None	Within 100 mi. of Death Valley
172	Garden	--	None	None	Within 100 mi of Death Valley
173A	Railroad-South	--	None	None	Within 100 mi. of Death Valley

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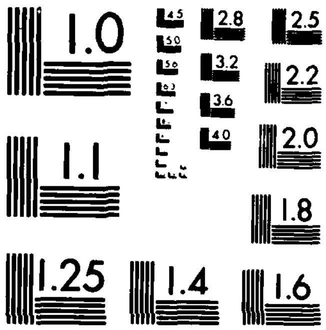

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 4.3.2.3-1. Summary of air quality resource characteristics for each hydrologic subunit for the deployment areas of the Proposed Action and the Alternatives 1-6 (Page 3 of 4).

Hydrologic Subunit No.	Hydrologic Subunit Name	Potential Pollutant Sources	Nonattainment Areas	Class I Areas	Sensitive Receptors
173B	Railroad-North	--	None	None	Duckwater Indian Reservation
174	Jakes	--	Adjacent to Steptoe Valley[3]	None	--
175	Long	--	Adjacent to Steptoe Valley[3]	None	--
178B	South Butte	--	Adjacent to Steptoe Valley[3]	None	-- None
179	Steptoe[4]	McGill smelter, Kennecott Copper Mine	Entire valley (SO_2) considered for (TSP)	None	City of Ely
180	Cave	--	Adjacent to Steptoe Valley[3]	None	--
181	Dry Lake	--	Near Steptoe Valley[3]	Within 100 mi of Zion	Within 100 mi of Cedar Breaks
182	Delamar	--	None	Within 100 mi of Zion	Within 100 mi of Cedar Breaks
183	Lake	--	Adjacent to Steptoe Valley[3]	Within 100 mi of Zion	Within 100 mi of Cedar Breaks
184	Spring	--	Adjacent to Steptoe Valley[3]	Within 100 mi of Zion	Within 10 mi of Lehman Caves
196	Hamlin	--	Near to Steptoe Valley[3]	Within 100 mi of Zion	Within 10 mi of Lehman Caves
202	Patterson	--	None	Within 100 mi of Zion	Within 100 mi of Cedar Breaks

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Table 4.3.2.3-1. Summary of air quality resource characteristics for each hydrologic subunit for the deployment areas of the Proposed Action and the Alternatives 1-6 (Page 4 of 4).

Hydrologic Subunit No.	Hydrologic Subunit Name	Potential Pollutant Sources	Nonattainment Areas	Class I Areas	Sensitive Receptors
207	White River	--	Adjacent to Steptoe Valley[3]	None	--
208	Pahroc	--	None	None	--
209	Pahranagat	--	None	Within 100 mi of Zion	Within 100 mi of Death Valley
210	Coyote Spring	Near to proposed Harry Allen Power Plant	Adjacent to Las Vegas (03, TSP, and CO)	Within 100 mi of Zion	--
53	Beryl	--	None	Within 100 mi of Zion	Within 100 mi of Cedar Breaks

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[1]Nearby Tooele County is nonattainment for SO_2, which is not a significant M-X pollutant.

[2]Nearby Cedar City is nonattainment for SO_2, which is not a significant M-X pollutant.

[3]Steptoe Valley is nonattainment for SO_2 and being considered as nonattainment for TSP.

Short-term visibility impacts to the scenic vistas of Cedar Breaks National Monument could result from construction-caused elevated dust levels.

operations, since sufficient data were not available on the exact source of electrical energy or of heating and cooling for the operating base. However, the worst-case assumption of a coal-fired central cooling and heating facility (CCHF) at the OBs would produce sulfur oxides (SO_x) emissions comparable to a very small (30 Mw_e) coal-fired power plant. Also, sufficient data were not available on the magnitude, type, and extent of hydrocarbon and NO_x emissions to determine if oxidant problems would occur at any of the proposed or alternative operating base sites. Impacts occurring at potential operating base locations may be addressed in subsequent tiered decisionmaking. Further NO_x emissions from the generators used at the construction camp could cause elevated NO_x levels to occur in the camp and vicinity; however, data concerning the generators were not sufficient to quantify the severity of the impacts. A conservative estimate of NO_x impacts indicates that the OSHA standard for industrial hygiene will not be exceeded.

PROPOSED ACTION (4.3.2.3.2)

DDA Impacts

The level of impact on air quality during the short and long term was assessed as no, low, moderate, or high impact. This ranking should be viewed as relative to each other as none of the impacts identified is irreversible and high impacts are due only to transient construction activites. A summary of the short- and long-term impacts by hydrologic subunit for the DDA of the Proposed Action and Alternatives 1-6 is presented in Table 4.3.2.3-2. Existing air quality in the Nevada/Utah area is generally considered excellent with the exception of specifically identified areas such as the Steptoe Valley, Las Vegas Valley, and the Gabbs Valley nonattainment areas. Due to a copper smelter northeast of Ely, the Steptoe Valley has been identified by EPA as a nonattainment area for SO_2. The area is also being considered for redesignation to nonattainment status for particulate matter (TSP). The deployment area is characterized by complex terrain features. Locally poor dispersion conditions frequently occur during the evening and early morning hours due to low-level inversion. The meteorological and terrain conditions tend to localize and increase air quality impacts for the periods when such conditions occur.

Significant air quality impacts would occur due to particulate emissions from M-X construction activity in Nevada/Utah. Under modeled conditions within the valleys, incremental 24-hour particulate levels could occur as high as 90 μg/cu m averaged over a 4 km square grid cell (the cell size used for modeling) due to construction of the DTN, cluster roads, and protective structures (ETR 13, Sec. 5.1.3). This compares to the 24-hour NAAQS for TSP of 260 μg/cu m. Even greater particulate level increases that exceed state and federal air quality standards would occur in localized construction areas. These standards do not, however, apply to construction activity. Therefore, basins with very dense M-X system activities were designated high impact in the short term due to predicted elevated dust levels. Related effects are generally short-term visibility impacts and long-range transport effects that could extend short-term visibility impacts to the scenic vistas of Cedar Breaks National Monument, Zion National Park, Bryce Canyon National Park, Lake Mead National Recreation Area, Great Basin National Park (proposed), or the Lehman Caves National Monument Area. This is reflected in the analysis by impact significance levels of moderate to high impact in M-X basins within 40 to 100 mi of designated scenic areas. Temporarily increased dust levels would also occur at the Duckwater Indian Reservation under certain wind and

Table 4.3.2.3-2. Potential direct impact to air quality in the Nevada/Utah DDA for Alternatives 1-6.

Hydrologic Subunit or County No.	Name	Short Term Impacts[1]	Long Term Impacts[1]
	Subunits or Counties with M-X Clusters and DTN		
4	Snake, Nev./Utah	***	*
5	Pine, Utah	***	***
6	White, Utah	***	*
7	Fish Springs, Utah	***	***
8	Dugway, Utah	***	*
9	Government Creek, Utah[2]	***	*
46	Sevier Desert, Utah[2]	***	*
46A	Sevier Desert-Dry Lake, Utah[2]	***	*
54	Wah Wah, Utah	*****	***
137A	Big Smoky-Tonopah Flat, Nev.	***	*
139	Kobeh, Nev.	***	***
140A	Monitor-North, Nev.	***	*
140B	Monitor-South, Nev.	***	*
141	Ralston, Nev.	*****	***
142	Alkali Spring, Nev.	*****	***
148	Cactus Flat, Nev.	*	-
149	Stone Cabin, Nev.	***	*
151	Antelope, Nev.	*****	***
154	Newark, Nev.	***	*
155A	Little Smoky-North, Nev.	***	*
155C	Little Smoky-South, Nev.	***	*
156	Hot Creek, Nev.	***	***
170	Penoyer, Nev.	*****	***
171	Coal, Nev.	*****	***
172	Garden, Nev.	*****	***
173A	Railroad-South, Nev.	***	*
173B	Railroad-North, Nev.	***	*
174	Jakes, Nev.	*****	***
175	Long, Nev.	***	*
178B	Butte-South, Nev.	***	*
179	Steptoe, Nev.	*	-
180	Cave, Nev.	***	***
181	Dry Lake, Nev.[2]	*****	***
182	Delamar, Nev.	***	***
183	Lake, Nev.	*****	***
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	*****	***
202	Patterson, Nev.	***	*
207	White River, Nev.	***	*
208	Pahroc, Nev.	*	-
209	Pahranagat, Nev.	***	*
	Overall DDA	*****	***

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[1] - = No impact.
* = Low impact (a basin with a low level of construction activity, no major pollutant sources, no construction camp, and not within a significant distance of Class I or nonattainment areas).
*** = Moderate impact (a moderate level of construction activity, or pollutant sources within a significant distance of Class I or nonattainment areas).
***** = High impact (a high level of construction activity, and/or a construction camp within a significant distance of Class I nonattainment areas, or major pollutant sources).

stability conditions. In addition, these areas would be potentially affected by increased dust from disturbed and exposed soil surfaces remaining after construction. Potential health problems associated with zeolites and radioactive dust are discussed in the section on Public Health Concerns.

A number of comments were received which expressed concern over the potential impacts of increased wind erosion and fugitive dust emissions.

PUBLIC COMMENTS ON THE DRAFT EIS:

"Even when partially stabilized by natural growth (sage, rabbitbrush, bitterbrush, juniper, pinyon, etc.) dust can be a problem in Nevada. If 160,000 acres are stripped, dust will become a major air pollutant." (A0526-3-007)

"Dust suppression and other mitigation measures have not been adequately described. Dust does pile up on windshields and covers eye wear to an amazing degree. I have seen it on the desert - 'poof dust' it almost acts like a liquid or gas!" (A0576-8-001)

"Wasatch Mountain Club is also concerned about the dust from the 8,500 miles of roads which would severely affect the air pollution and the visibility from the numerous mountain peaks in the region." (A0685-7-002)

"You will cause air pollution by great clouds of dust, with no rain to provide relief. Such air pollution will undoubtedly be carried east by prevailing winds to the Salt Lake Basin, already suffering from 'brown clouds'." (A0849-9-065)

"You will not be around when Nevada/Utah become another sterile dust bowl." (A0980-2-002)

"Fugitive dust also presents many more problems than addressed. It causes respiratory problems, not only in people but in livestock and wildlife, causes increased in maintenance of all kinds of machines, presents problems in homes, businesses, and community facilities, and reduces photosynthesis in vegetation; thereby reducing vegetative productivity, and since livestock would rather not eat dirty grass, it reduces red meat production." (B0569-2-032)

"A secondary effect of wind is the fact that it raises dust. Keep in mind that all the land in Utah selected for M-X was once under Lake Bonneville. Nevada was under Lake Lahontan. Every foot of land selected for M-X was once a lake bottom. As a result, the soil is a fine silt. While the OB structures are to some degree on the bajadas, all the rest is on lake sediment. At the present time, nearly all of this land is covered by some kind of brush or grass, preventing wind erosion. But if this natural cover is ever removed, it will expose this lake bottom silt to the wind." (A0073-6-031)

"The Environmental Impact Study is lacking as it does not take into account the wind erosion. Eastern New Mexico and West Texas have the largest incident of dust in the air in the United States." (A0610-5-002)

"The New Mexico - West Texas studied is, as the DEIS notes, an area of the highest level of naturally caused wind-blown dust in the United States. Our particular concern is the fugitive dust problem created during the construction phase of the proposed system. We feel this is inadequately addressed and the possibility of mitigation over stated." (B0398-6-003)

A preliminary analysis was performed to address the impact of wind erosion from disturbed surfaces during the system operation on PSD Class I areas in Utah. Using the ISC model, the impact of suspendible (less than 30 microns in diameter) wind erosion emissions from Pine and Wah Wah Valleys in Utah was calculated for Bryce Canyon National Park and Zion National Park. The model results are extremely sensitive to input assumptions. Assuming that the particles disperse as a gas, annual TSP increases at Bryce Canyon and Zion are 6.9 μg/cu m and 11.4 μg/cu m respectively (ETR-13, Sec. 8.4). These levels would exceed the PSD Class I increment of 5 μg/cu m. However, using an assumed size distribution and characteristic settling velocities (ETR-13, Table 8.4-1) for the particles results in modeled predictions of 0.3 μg/cu m and 1.1 μg/cu m for Bryce and Zion. The impact of increased TSP concentrations on the current excellent visibility (> 180 km) in these Class I areas is a function of the exact particle size distribution, which is unknown. However, using regression relationships (Trijonis and Yuan, 1977) established for the effect of TSP on light extinction, it appears that the worst case concentration estimates would result in a decrease in annual visual range of about 10 to 20 percent when particle setting is neglected. A more accurate estimate, in which particle settling is assumed to occur, yields a calculated decrease in annual visual range of 1 to 3 percent (ETR-13, Sec. 7.4).

Public concern for these two issues was evidenced in a number of comments:

PUBLIC COMMENTS ON THE DRAFT EIS:

"No long-range transport was modeled. Impacts must be calculated for Utah's Wasatch Front in terms of particulate loading (visibility), NOx, SO_2, O_3, hydrocarbons, toxic materials, etc. Estimates of impacts on scenic or wilderness areas need to be made as well. Ambient air standards will be violated, according to the model's results." (B0156-8-415)

"The effects of medium- and long-range transport of pollutants on visibility at Class I PSD areas were not modelled or estimated, even though ETR 13, 6-8 also states ". . . long-range transport effects could extend short-term visibility impacts to scenic areas . . ." (B0125-3-204)

"Very little is said in the DEIS about the impacts that the M-X will have on visibility in Zion, Bryce, or Grand Canyon National Parks. Reports from the Environmental Protection Agency indicate that the days with the highest visibility in these parks usually occur when the wind carries an air parcel over the proposed deployment area. The impact on the M-X on visibility needs to be highlighted." (A0799-6-041)

"Dust generated by construction may restrict visibility in scenic vistas of Cedar Breaks National Monument, Zion National Park, Bryce Canyon, Lake Mead National Recreation Area, and the Lehman Caves National Monument (the area of the bristlecone pine)." (B0136-0-003)

"Visibility impacts should be assessed and discussed in detail, especially in view of the recent identification by the Department of Interior of consideration of integral vistas in southern Utah in and adjacent to the listed national parks. This section should be modified as necessary in the FEIS." (B0156-8-414)

"Several important issues such as M-X impacts on non-attainment areas, Prevention of Significant Deterioration (PSD), visibility in Class I areas and long range transport of pollutants are mentioned but are not discussed in detail in either the DEIS or ETR 13." (B0085-9-005)

It is difficult to quantify air quality constraints which might be imposed on future development opportunities as a result of M-X. Although long-term wind erosion emissions from disturbed surfaces would not consume PSD increments, these emissions could increase background TSP concentrations to a level close enough to the NAAQS that any new major source in the area would be forced to employ more complex emission control technology or obtain emission off sets from other emitters. Initial modeling of wind erosion emissions with the ISC model (ETR-13, Sec. 5.5) indicates that the annual TSP standard could be exceeded at various locations within DDA valleys during the system operation if the revegetation of exposed surfaces or some other long-term dust mitigation program were not carried out. The proposed mitigation program to reduce wind erosion emissions by 50 to 80 percent would greatly reduce impacts to annual maximum TSP incremental increases of 3 to 20 μ g/cu m. Valleys with unfavorable climatic conditions or highly erodible soil would require the greatest amount of mitigation.

The level of impact assigned to the hydrologic subunits with operating bases is given in Table 4.3.2.3-3. The hydrologic subunits with operating bases were considered high impact areas during the short term due to high particulate levels. During the long term, elevated CO and particulate levels would cause moderate impact in the operating base vicinity.

Coyote Spring Valley OB Impacts

The Coyote Spring Valley OB site, located in hydrologic subunit 210, is not within 100 mi of any Class I areas. It is within 20 mi of two existing power plant, the Reid Gardner Power Plant and the Harry Allen Power Plant. Since the energy source for the operating base is uncertain, the potential cumulative air quality impact of these two power plants and the Coyote Spring Valley OB site is not precisely known. However, the quantity of emissions from M-X-related sources is much less than that of the power plants. The Coyote Spring Valley hydrologic subunit is adjacent to Las Vegas Valley, designated as a nonattainment area for TSP,

Table 4.3.2.3-3. Potential overall impact to air quality resulting from construction and operation of M-X operating bases for the Proposed Action and Alternatives 1-8.

		Estimated Short Term Overall Impact[1]							
Hydrologic Subunit or County		Proposed Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 8
No.	Name	Coyote Spring/ Milford	Coyote Spring/ Beryl	Coyote Spring/ Delta	Beryl/ Ely	Beryl/ Coyote Spring	Milford/ Ely	Milford/ Coyote Spring	Coyote Spring/ Clovis
	Subunits or Counties within OB Suitability Zone								
46	Sevier Desert, Utah	-	-	*****	-	-	-	-	-
46A	Sevier Desert-Dry Lake, Utah	-	-	***	-	-	-	-	-
50	Milford, Utah	*****	-	-	-	-	*****	*****	-
52	Lund District, Utah	***	***	-	***	***	***	***	-
53	Beryl-Enterprise, Utah	-	*****	-	*****	*****	-	-	-
179	Steptoe, Nev.	-	-	-	*****	*****	*****	-	-
210	Coyote Spring, Nev.	*****	*****	*****	***	-	-	*****	*****
219	Muddy River Springs, Nev.	***	***	***	-	-	-	***	***
	Overall OB Impact	*****	*****	*****	*****	*****	*****	*****	*****

		Estimated Long Term Overall Impact[1]							
Hydrologic Subunit or County		Proposed Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 8
No.	Name	Coyote Spring/ Milford	Coyote Spring/ Beryl	Coyote Spring/ Delta	Beryl/ Ely	Beryl/ Coyote Spring	Milford/ Ely	Milford/ Coyote Spring	Coyote Spring/ Clovis
	Subunits or Counties within OB Suitability Zone								
46	Sevier Desert, Utah	-	-	***	-	-	-	-	-
46A	Sevier Desert-Dry Lake, Utah	-	-	***	-	-	-	-	-
50	Milford, Utah	*****	-	-	-	-	*****	*****	-
52	Lund District, Utah	***	***	-	***	***	***	***	-
53	Beryl-Enterprise, Utah	-	***	-	***	***	-	-	-
179	Steptoe, Nev.	-	-	-	***	-	***	-	-
210	Coyote Spring, Nev.	*****	*****	***	*	*****	-	*****	*****
219	Muddy River Springs, Nev.	***	***	***	***	***	-	***	***
	Overall OB Impact	***	***	***	***	***	***	*****	*****

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[1] - = None.
* = Low.
*** = Moderate.
***** = High.

Note: Hydrographic basins with operating bases were considered high air quality impact areas during the short term due to the high level of construction activity, causing elevated particulate levels. During the long term, elevated CO and particulate levels could cause moderate impact in the operating base vicinity.

O_3, and CO. During construction of the operating base, fugitive dust from construction could aggravate the particulate problem in Las Vegas Valley. During operation, CO, HC, NO_x, and O_3, would increase at the operating base site and would increase to some degree at Las Vegas Valley due to population growth as a result of the M-X system. However, the OB emissions would be typical of small communities engaging in light industry and would be small (less than 5 percent) compared to emissions in Las Vegas Valley.

The State of Nevada and the City of Las Vegas were among those to comment on the potential for M-X interference with the Las Vegas Valley nonattainment area.

PUBLIC COMMENTS ON THE DRAFT EIS:

"The Las Vegas Valley will experience direct and indirect impacts from the M-X missile system. The DEIS and ETRs have not identified what will be the impact of the population increases, and supporting infrastructure development. Even the direct emissions from the OB have not been modeled to determine the effect on the Las Vegas non-attainment area. Las Vegas Valley is non-attainment for carbon monoxide (CO) and particulates (TSP); with the additional M-X-related growth it will be hard-pressed to reach National Ambient Air Quality Standards for CO and TSP as required by federal law. The DEIS and ETRs have shown no commitments to mitigate M-X transportation-induced problems (i.e., traffic increases and transportation conflicts) in the Las Vegas Valley." (B0165-9-420)

"During the operational phase of the OB, concentration of CO, HC, NOx, and 0_3 will increase in the Las Vegas Valley due to population growth as a result of the MX system. This could be problematic in that concentrations of carbon monoxide and photochemical oxidents already come close to or exceed National Ambient Air Quality Standards in certain portions of the Valley throughout the year. The DEIS and the ETR-13 do not adequately address the air quality problems due to increases in population." (A1152-7-105)

The increase of the population associated with the M-X in Clark County could interfere with the attainment of air quality standards in the Las Vegas Valley. This area is currently classified as nonattainment for TSP, ozone, carbon monoxide, and lead. The Las Vegas Valley Air Quality Implementation Plan indicates that the lead standard will be easily attained by 1982. However, vehicle emissions associated with the peak M-X-related population influx in 1986 and 1987 may delay attainment of the carbon monoxide standard beyond the planned attainment date of 1987 (ETR-13, Sec. 9.0). The effect of M-X-related population growth on the attainment of the TSP and ozone standards is uncertain, due to the lack of local air quality planning to meet these standards. The location of the OB site with respect to the points of ozone standard violation makes the possibility of the OB emissions interfering with standard attainment unlikely. The ozone nonattainment problem in Las Vegas Valley is extremely localized. The TSP nonattainment problem is primarily due to fugitive dust emissions. Revision of the TSP standard to an inhalable particulate standard by EPA would likely result in the Las Vegas Valley being redesignated to attainment status. However, due to the uncertainties in the TSP and ozone situations, as well as the potential effect of M-X population growth on carbon monoxide levels, the hydrologic subunit with the Coyote Spring Valley operating base (No. 210) was designated high impact for the long term.

Milford OB Impacts

The Milford OB is in hydrologic subunit 50. The base is within 100 mi of Zion and Bryce Canyon Class I areas. This site is the closest of all sites considered to existing PSD Class I areas. Also, the Milford OB airfield is approximately 40 mi from the Cedar Breaks proposed Class I area. Elevated particulate levels due to fugitive dust caused by construction of the operating base, increased SO_x, NO_x; or oxidant levels during operation of the operating base could affect visibility at these Class I areas. These OB emissions during operation would be typical of small communities engaging in light industry and would be small (less than 5 percent) compared with other emissions in the control region (AQCR). Operation base community vehicular traffic would cause elevated CO concentrations to occur in the immediate vicinity of the operating base and the support community; however, these concentrations during peak-hour traffic would be well below the federal 1-hour standard.

ALTERNATIVE 1 (4.3.2.3.3)

The location of the secondary operating base is the only difference between the Proposed Action and Alternative 1. See Table 4.3.2.3-2 for the impact significance of the DDA and Table 4.3.2.3-3 for the impact significance of the primary and secondary operating base. The secondary OB site for Alternative 1 is at Beryl, Utah, located in hydrologic subunit 53, rather than in basin 50 as in the Proposed Action. All impact significance values assigned to the remaining basins do not change because the configuration of clusters and roadways is identical under both alternatives. Impacts within hydrologic subunit 53 are significant for Alternative 1, during both short and long-term periods. Impacts in hydrologic subunit 50 change to a no impact level for Alternative 1. The Beryl, Utah, OB site is within 100 mi of the Cedar Breaks proposed Class 1 area and Zion National Park, an existing Class I area. It is not near areas designated nonattainment for pollutants significant to M-X system impacts.

ALTERNATIVE 2 (4.3.2.3.4)

The location of the second operating base is the only difference between the Proposed Action and Alternative 2. See Table 4.3.2.3-2 for the impact significance of the DDA, and Table 4.3.2.3-3 for the impact significance of the second operating base. The secondary OB site for Alternative 2 is at Delta, Utah, located in hydrologic subunit 46, rather than in basin 50 as in the Proposed Action. All the impact significance values assigned to the remaining basins do not change because the configuration of clusters and roadways is identical under both alternatives. For Alternative 2, hydrologic subunit 46 is ranked high during the short-term period and moderate during the long-term period. Hydrologic subunit 50 changes to a no impact level. The Delta OB site is greater than 100 mi from the Cedar Breaks proposed Class 1 area and Zion National Park, a Class I area. It is not near any areas designated nonattainment for a pollutant considered significant to the M-X system. Since plans for the energy source of the operating base have not been finalized, the potential cumulative impact of the planned IPP power plant and the OB power plant is unknown.

ALTERNATIVE 3 (4.3.2.3.5)

The DDA for Alternative 3 is the same as that of the Proposed Action. Therefore, impact significance assigned to all hydrologic subunits in the deployment area are the same for Alternative 3 as for the Proposed Action, with the exception of those basins with the first and second operating base sites. Beryl, Utah, in hydrologic subunit 53, is the location of the primary operating base site for Alternative 3. See Table 4.3.2.3-2 for the impact significance of the DDA and Table 4.3.2.3-3 for the impact significance of the secondary operating base site at Ely, Nevada, located in hydrologic subunit 179. These basins are assigned the high impact significance level for the short-term period and a moderate level for the long-term period. Short-term problems concern elevated particulate levels caused by particulate emissions from the construction of the operating base. CO emissions from vehicles would cause elevated CO concentrations in areas adjacent to high density vehicular traffic in the operating bases and support communities. This would be a long-term impact.

Impact significance for the Beryl first operating base is nearly identical to that described under Alternative 1 for the second base configuration. Differences were considered to be undetectable at the level of this analysis.

ALTERNATIVE 4 (4.3.2.3.6)

The significance of air quality impacts on air resources in Nevada and Utah due to the M-X system for Alternative 4 is nearly identical to that described for Alternative 1. Differences were considered insignificant for purposes of this analysis.

ALTERNATIVE 5 (4.3.2.3.7)

The impact significance for Alternative 5 is the same for the DDA as that described in the Proposed Action. The impact of the Milford first operating base is nearly identical to that described for the Milford second operating base of the Proposed Action. The impact significance is considered identical at the level of this analysis. The impact significance for the second operating base at Ely is the same as that described in Alternative 3.

ALTERNATIVE 6 (4.3.2.3.8)

The significance of air quality impacts on air resources in Nevada and Utah due to the M-X system for Alternative 6 is close to that described for the Proposed Action. Differences were considered insignificant for purposes of this analysis.

ALTERNATIVE 7 (4.3.2.3.9)

The methodology used to determine impact significance for the Texas/New Mexico region was the same as that discussed for the Nevada/Utah region. The county is the geographic unit considered in the Texas/New Mexico region as opposed to the hydrologic subunit, the geographic unit used in the Nevada/Utah basin and range province. For air quality purposes the county does not portray any boundaries to atmospheric processes, however, the county is a useful unit for this analysis as a geographic area defined by a certain density of M-X system activity and having certain baseline environment characteristics.

Table 4.3.2.3-4 shows the level of air quality impact in counties of the DDA. The type and level of M-X system activity in the county as well as the air quality-related characteristics of the county were considered in assessing the level of potential impact. County-specific features taken into account are shown in Table 4.3.2.3-5.

The same air pollution-related primary disturbances were considered in the Texas/New Mexico region as for Nevada/Utah. Fugitive dust emissions would be of primary concern in the deployment area during the short and long term. Fugitive dust emissions from construction activity and from the stationary sources that process construction materials would cause increased localized particulate concentrations. Increased NO_x levels would occur due to the generators being located at construction camps. These levels are not likely to violate OSHA standards for protection of workers. All counties with one or more construction camps received a moderate to high impact rating for the short term.

Construction of the operating bases would cause significant localized elevated particulate concentrations. Therefore, the counties with operating bases (Curry, New Mexico and Hartley, Texas) were considered to be high impact areas during the short and long term. Curry and Hartley counties received long-term moderate impact ratings because of increased CO concentrations expected due to vehicles and space heating and cooling. The particulate nonattainment areas in Eddy County, which is south of and adjacent to Lea County, did not affect ratings for Lea County because of the transport distance and the prevailing southerly winds. M-X system impacts on existing and proposed Class I areas of White Mountain, Pecos, Wheeler Peak, Salt Creek, and Capulin Mountain, New Mexico were reflected in higher ratings assigned to counties within 100 mi of the Class I areas.

ALTERNATIVE 8 (4.3.2.3.10)

The split basing alternative is identical in level of impact to portions involved for the Proposed Action and Alternative 7. See Table 4.3.2.3-6 for the impact significance of the DDA and the operating bases. Impacts described for the Coyote Spring Valley OB (Proposed Action) and for the Clovis OB (Alternative 7) were considered to be identical at this level of analysis.

MITIGATIONS (4.3.2.3.11)

The Air Force will implement a program of air quality monitoring in the deployment areas during construction and operation. The monitoring program will include measurements of both particulate and gaseous pollutants. The purpose of this program is to identify potential air quality problems, monitor the effectiveness of mitigation measures, and identify where the need exists for additional mitigation of emissions.

Air quality will be managed primarily through implementation of a dust control program and an emissions control program. The dust control program will

Table 4.3.2.3-4. Direct impact to air quality in the Texas/New Mexico DDA for Alternative 7.

County	Short Term Impacts[1]	Long Term Impacts[1]
Counties with M-X Clusters and DTN		
Bailey, Tex.	***	***
Castro, Tex.	*****	***
Cochran, Tex.	***	***
Dallam, Tex.	*****	***
Deaf Smith, Tex.	*****	***
Hartley, Tex.	*****	***
Hockley, Tex.	***	*
Lamb, Tex.	***	*
Oldham, Tex.	***	*
Parmer, Tex.	*****	***
Randall, Tex.	***	***
Sherman, Tex.	***	*
Swisher, Tex.	***	*
Chaves, N. Mex.	***	***
Curry, N. Mex.	*****	***
DeBaca, N. Mex.	***	*
Guadalupe, N. Mex.	*	-
Harding, N. Mex.	***	***
Lea, N. Mex.	***	*
Quay, N. Mex.	*****	***
Roosevelt, N. Mex.	*****	***
Union, N. Mex.	***	*
Overall DDA	*****	***

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[1] - = No impact.

* = Low impact (a county with a low level of construction activity, no major pollutant sources, no construction camp, and not within a significant distance of Class I or nonattainment areas).

*** = Moderate impact (a moderate level of construction activity, or pollutant sources within a significant distance of Class I or nonattainment areas).

***** = High impact (a high level of construction activity, and/or a construction camp within a significant distance of Class I nonattainment areas, or major pollutant sources).

Table 4.3.2.3-5. Summary of air quality characteristics by county for Alternatives 7 and 8.

County Name	Existing sources	Nonattainment Areas	Class 1 Areas	Sensitive Receptors
Chaves (N. Mex.)	9-TSP, 1-SO_x, 4-NO_x, 3-CO,4-HC	Adjacent to Eddy Co. (TSP)	Within 100 mi of Carlsbad, Salt Creek, and White Mountains	Near city of Roswell Bitter Lake NMR, and Salt Creek Wilderness
Curry (N. Mex.)	3-TSP	None	Within 100 mi of Salt Creek	Near City of Clovis
DeBaca (N. Mex.)	1-TSP	None	Within 100 mi of Salt Creek	--
Harding (N. Mex.)	—	None	Within 100 mi of Capulin Mountains	--
Lea (N. Mex.)	14-TSP, 11-SO_x, 11-NO_x, 1-CO, 13-HC	None	Within 100 mi of Salt Creek	--
Quay (N. Mex.)	3-TSP, 1-SO_x, 1-NO_x, 1-CO, 1-HC	None None	Within 100 mi of Capulin Mountains	Near city of Tucumcari
Roosevelt (N. Mex.)	5-TSP, 1-SO_x, 5-NO_x, 5-CO, 5-HC	None	Within 100 mi of Salt Creek	Near city of Portales and Grulla NWR
Union (N. Mex.)	1-TSP, 1-SO_x 1-NO_x, 1-CO, 1-HC	None	Within 100 mi of Capulin Mountains	Kiowa National Grass-land
Bailey (Tex.)	7-TSP, 1-CO, 1-HC	None	None	Near Muleshoe NWR
Castro (Tex.)	12-TSP, 1-NO_x, 1-CO, 1-HC	None	None	--
Cochran (Tex.)	3-TSP, 1-SO_x, 1-NO_x, 1-CO, 1-HC	None	None	--
Dallam (Tex.)	4-TSP	None	Within 100 mi of Capulin Mountains	Rita Blanca National Grassland
Deaf Smith (Tex.)	15-TSP,2-SO_x 2-NO_x, 2-CO, 2-HC	None	None	Near town of Hereford
Hartley (Tex.)	4-TSP	None	Within 100 mi of Capulin Mountains	Near town of Dalhart
Hockley (Tex.)	6-TSP, 2-SO_x, 2-NO_x, 2-CO, 3-HC	None	None	Near town of Levelland
Lamb (Tex.)	19-TSP, 2-SO_x, 2-NO_x, 2-CO, 2-HC	None	None	Near town of Littlefield
Oldham (Tex.)	5-TSP	None	None	--
Parmer (Tex.)	16-TSP, 1-NO_x, 1-CO, 1-HC	None	None	--
Randall (Tex.)	4-TSP	None	None	Near cities of Amarillo and Canyon and near Buffalo Lake NWR
Sherman (Tex.)	5-TSP	None	None	--
Swisher (Tex.)	16-TSP, 1-NO_x, 1-HC,	None	None	Near town of Tulia

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Table 4.3.2.3-6. Direct impact to air quality in the Nevada/Utah and Texas/New Mexico DDAs for Alternative 8.

Hydrologic Subunit or County No.	Name	Short Term Impacts[1]	Long Term Impacts[1]
	Subunits or Counties with M-X Clusters and DTN		
4	Snake, Nev./Utah	***	*
5	Pine, Utah	***	***
6	White, Utah	***	*
7	Fish Springs, Utah	-	-
46	Sevier Desert, Utah	***	*
46A	Sevier Desert-Dry Lake, Utah[3]	***	*
54	Wah Wah, Utah	*****	***
155C	Little Smoky-South, Nev.	***	*
156	Hot Creek, Nev.	***	***
170	Penoyer, Nev.	*****	***
171	Coal, Nev.	*****	***
172	Garden, Nev.	*****	***
173AB	Railroad-North & South, Nev.	***	*
180	Cave, Nev.	***	***
181	Dry Lake, Nev.[3]	*****	***
182	Delamar, Nev.	***	***
183	Lake, Nev.	***	***
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	*****	***
202	Patterson, Nev.	***	*
207	White River, Nev.	***	*
210	Coyote Spring[2]	*****	*****
	Bailey, Tex.	***	*
	Castro, Tex.	*	-
	Cochran, Tex.	***	***
	Dallam, Tex.	***	***
	Deaf Smith, Tex.	*****	***
	Hartley, Tex.[3]	*****	***
	Hockley, Tex.	***	*
	Lamb, Tex.	***	*
	Oldham, Tex.	***	*
	Parmer, Tex.	*	-
	Randall, Tex.	*	-
	Sherman, Tex.	*	-
	Swisher, Tex.	*	-
	Chaves, N. Mex.	***	***
	Curry, N. Mex.	*****	***
	DeBaca, N. Mex.	***	*
	Harding, N. Mex.	***	***
	Lea, N. Mex.	***	*
	Quay, N. Mex.	***	***
	Roosevelt, N. Mex.[3]	***	***
	Union, N. Mex.	***	*
	Overall DDA Impact	*****	***

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Does not contain M-X clusters or DTN.

[3] Conceptual location of Area Support Centers (ASCs).

Table 4.3.2.3-5. Summary of air quality characteristics by county for Alternatives 7 and 8.

County Name	Existing sources	Nonattainment Areas	Class I Areas	Sensitive Receptors
Chaves (N. Mex.)	9-TSP, 1-SO_x, 4-NO_x, 3-CO, 4-HC	Adjacent to Eddy Co. (TSP)	Within 100 mi of Carlsbad, Salt Creek, and White Mountains	Near city of Roswell Bitter Lake NMR, and Salt Creek Wilderness
Curry (N. Mex.)	3-TSP	None	Within 100 mi of Salt Creek	Near City of Clovis
DeBaca (N. Mex.)	1-TSP	None	Within 100 mi of Salt Creek	--
Harding (N. Mex.)	—	None	Within 100 mi of Capulin Mountains	--
Lea (N. Mex.)	14-TSP, 11-SO_x, 11-NO_x, 1-CO, 13-HC	None	Within 100 mi of Salt Creek	--
Quay (N. Mex.)	3-TSP, 1-SO_x, 1-NO_x, 1-CO, 1-HC	None None	Within 100 mi of Capulin Mountains	Near city of Tucumcari
Roosevelt (N. Mex.)	5-TSP, 1-SO_x, 5-NO_x, 5-CO, 5-HC	None	Within 100 mi of Salt Creek	Near city of Portales and Grulla NWR
Union (N. Mex.)	1-TSP, 1-SO_x 1-NO_x, 1-CO, 1-HC	None	Within 100 mi of Capulin Mountains	Kiowa National Grass-land
Bailey (Tex.)	7-TSP, 1-CO, 1-HC	None	None	Near Muleshoe NWR
Castro (Tex.)	12-TSP, 1-NO_x, 1-CO, 1-HC	None	None	--
Cochran (Tex.)	3-TSP, 1-SO_x, 1-NO_x, 1-CO, 1-HC	None	None	--
Dallam (Tex.)	4-TSP	None	Within 100 mi of Capulin Mountains	Rita Blanca National Grassland
Deaf Smith (Tex.)	15-TSP, 2-SO_x 2-NO_x, 2-CO, 2-HC	None	None	Near town of Hereford
Hartley (Tex.)	4-TSP	None	Within 100 mi of Capulin Mountains	Near town of Dalhart
Hockley (Tex.)	6-TSP, 2-SO_x, 2-NO_x, 2-CO, 3-HC	None	None	Near town of Levelland
Lamb (Tex.)	19-TSP, 2-SO_x, 2-NO_x, 2-CO, 2-HC	None	None	Near town of Littlefield
Oldham (Tex.)	5-TSP	None	None	--
Parmer (Tex.)	16-TSP, 1-NO_x, 1-CO, 1-HC	None	None	--
Randall (Tex.)	4-TSP	None	None	Near cities of Amarillo and Canyon and near Buffalo Lake NWR
Sherman (Tex.)	5-TSP	None	None	--
Swisher (Tex.)	16-TSP, 1-NO_x, 1-HC.	None	None	Near town of Tulia

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Table 4.3.2.3-6. Direct impact to air quality in the Nevada/Utah and Texas/New Mexico DDAs for Alternative 8.

Hydrologic Subunit or County No.	Name	Short Term Impacts[1]	Long Term Impacts[1]
	Subunits or Counties with M-X Clusters and DTN		
4	Snake, Nev./Utah	***	*
5	Pine, Utah	***	***
6	White, Utah	***	*
7	Fish Springs, Utah	-	-
46	Sevier Desert, Utah	***	*
46A	Sevier Desert-Dry Lake, Utah[3]	***	*
54	Wah Wah, Utah	*****	***
155C	Little Smoky-South, Nev.	***	*
156	Hot Creek, Nev.	***	***
170	Penoyer, Nev.	*****	***
171	Coal, Nev.	*****	***
172	Garden, Nev.	*****	***
173AB	Railroad-North & South, Nev.	***	*
180	Cave, Nev.	***	***
181	Dry Lake, Nev.[3]	*****	***
182	Delamar, Nev.	***	***
183	Lake, Nev.	***	***
184	Spring, Nev.	***	*
196	Hamlin, Nev./Utah	*****	***
202	Patterson, Nev.	***	*
207	White River, Nev.	***	*
210	Coyote Spring[2]	*****	*****
	Bailey, Tex.	***	*
	Castro, Tex.	*	-
	Cochran, Tex.	***	***
	Dallam, Tex.	***	***
	Deaf Smith, Tex.	*****	***
	Hartley, Tex.[3]	*****	***
	Hockley, Tex.	***	*
	Lamb, Tex.	***	*
	Oldham, Tex.	***	*
	Parmer, Tex.	*	-
	Randall, Tex.	*	-
	Sherman, Tex.	*	-
	Swisher, Tex.	*	-
	Chaves, N. Mex.	***	***
	Curry, N. Mex.	*****	***
	DeBaca, N. Mex.	***	*
	Harding, N. Mex.	***	***
	Lea, N. Mex.	***	*
	Quay, N. Mex.	***	***
	Roosevelt, N. Mex.[3]	***	***
	Union, N. Mex.	***	*
	Overall DDA Impact	*****	***

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Does not contain M-X clusters or DTN.

[3] Conceptual location of Area Support Centers (ASCs).

include procedures to monitor air quality throughout the construction of the system. This will ensure compliance with the overall program and identify areas where excessive dust is generated. Most fugitive dust will be caused by vehicles and equipment, or by exposed surfaces. The program will establish design policy and construction procedures that will minimize surface disturbance and control erosion. Construction traffic will stay on road surfaces, and off-road construction travel will be subject to restrictions. Dust palliatives will be applied to roads to minimize dust generated by moving vehicles. Vehicle travel will be kept at a minimum and a bus system will transport workers to work areas. Speed limits will be established and enforced. The DTN will be paved as early in the project life as practicable in order to reduce fugitive dust.

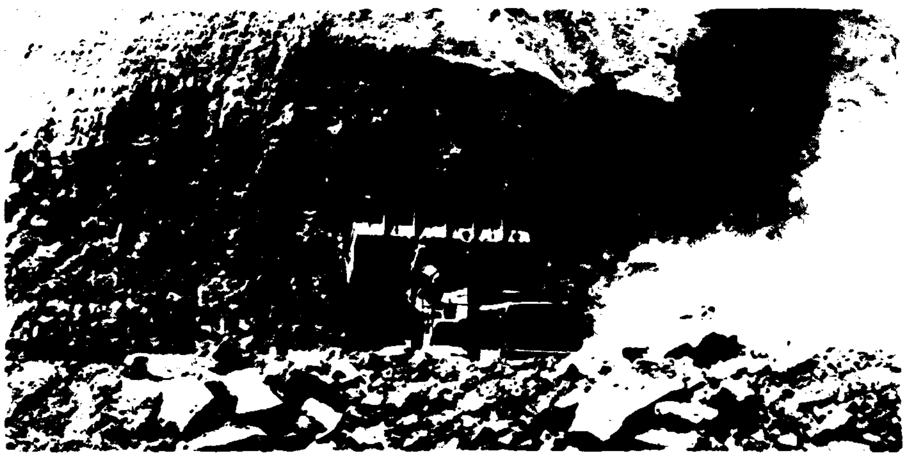
Dust control equipment will be provided on stationary sources. Aggregate storage areas and areas experiencing construction activity will be designed to minimize dust. Respiratory protection devices will be provided for workers, when required.

In order to prevent temporarily disturbed areas from becoming long-term sources of dust, a revegetation program will be established. The revegetation program is discussed in Section 2.3.

The emissions control program will ensure that emission levels comply with federal, state, and local air quality standards through establishment of air quality monitoring. Emissions will be minimized by designing the operating base for both reduced vehicle travel and nonmotor vehicle transportation. Nonpolluting energy sources will be utilized, where feasible. Bus systems will be established both for construction personnel and operating base personnel to travel within the base itself and to communities. Emission control equipment will be provided and an inspection and maintenance program will be established for construction and Air Force vehicles and equipment.

Additional information on mitigations is contained in ETR-38 (Mitigations).

Mining and Geology



MINING AND GEOLOGY

INTRODUCTION (4.3.2.4.1)

The deployment of the M-X system would not directly preempt any working mine by acquisition of its location. The cluster and road network in three Utah counties (Juab, Millard, and Beaver), and four Nevada counties (Lincoln, White Pine, Nye, and Eureka) might, however, impact individual mine workings and might interfere with access efficiency and ease of mine operation. These impacts would be limited to road delays during movement of heavy equipment and might not be expected to be significant. The cluster and road network might also intrude on areas of potential minerals development. Geologic surveys and exploration might be inconvenienced or delayed during the M-X construction phase.

More significantly, perhaps, the M-X project would affect the mining community through competition for the local labor resources. Individuals living in the area affected by M-X development might elect to give up their present employment in favor of working on the construction of M-X. Competition for labor resources would be most strongly felt in construction and construction-related industries such as mining. The larger unionized mines would experience less impact as workers would in most cases be unwilling to trade security for the short-term construction phase of M-X. As employees quit mining for M-X construction opportunities, the marginal mining establishments might lose employees. The larger firms and operations with lower overhead or high-grade areas should stay in the bidding for labor resources, although their costs might increase somewhat.

Pacific Silver Corporation summarized most of the concerns of the small miners with the following comments:

PUBLIC COMMENTS ON THE DRAFT EIS:

"We are a small mining company with claims under exploration and development throughout Nevada. Our concerns center on the availability and cost of water, air, land, labor, and supplies needed to put our

> properties into production once M-X deployment is initiated. We expect competition not only from M-X itself, but also from fellow multiple-use land users such as ranchers, sportsmen, wilderness proponents and conservationists."

The areas of high resource value, whether metal, non-metal, oil and gas, or geothermal, where M-X could conflict with known resource locations are listed in Table 4.3.2.4-1 for the Nevada/Utah valleys. Siting flexibility reduces the potential for major conflicts with mineral resource development activities.

An opposing set of factors represents the favorable impact of M-X on the minerals and energy resources industries. These factors are (a) increased demand, and subsequent industry expansion as a result of M-X construction activities, for local raw minerals, building materials, e.g., sand and gravel, stone, gypsum, clays, lime, perlite, pumice, and volcanic cinder resulting in an expanded economic level base; and (b) improved access to remote areas of east central Nevada and west central Utah as a result of the M-X road network. Incorporation of these factors into the net impacts calculation involves the assumption of continuing operation and expansion of local quarrying and mining of building materials, with the M-X system as a prime consumer in the 1980s. Improved access for mineral prospecting and exploration is a long-term benefit which would accrue over several years. However, a number of public comments indicate that extra access to mines may be a detriment. In-migrating construction workers could have craft skills for mining operations and some may remain to seek permanent employment in the mining industry after M-X construction.

The method used to evaluate quantifiable impacts of the M-X program consisted of the following steps:

1) An overlay of the map of the proposed deployment of M-X system components on a map of mining claims.

2) An assumption that impacts would occur and be significant wherever a system component would cover an area having a large number of claims.

The method is illustrated by the following worst case analysis. In the southern end of Cave Valley is a concentration of 227 claims on the geotechnically suitable area, covering 4,886 acres. In this area the conceptual system places four shelters and 4 mi of road directly affecting 60 acres. Overall, however, M-X would occupy a 4 sq mi area from which potential open pit mines could be excluded. For this reason, proposed Air Force policy is to identify and avoid all high potential mineral areas and claim blocks with development potential. The areas of mining claim concentration in Cave, Lake, and Coal valleys for example, that have a high potential for producing economic mineral deposits will be avoided in the final site selection. The environmental surveys for subsequent tiered decisionmaking will include an investigation of mineral value to ensure that economically developable resources are identified.

Public comments expressed concern with impacts of M-X facilities on individual claims and leases and that mitigations expressed in the DEIS did not address the potential impact on mineral deposits yet to be discovered. Also concern

Table 4.3.2.4-1. Areas of significant mineral resource value in Nevada and Utah valleys potentially affected by M-X.

Resource Area	Resource	Location	Comments
Railroad Valley	Oil	Entire valley	West central part has Nevada's only two producing oil fields. Entire valley has been heavily explored.
Hot Creek and Reveille Valleys	Geothermal	T.7 & 8N, R.5051E	
Big Smoky Valley	Geothermal, Minerals	Entire valley	Geothermal potential, heavy claim activity.
Lake Valley	Minerals	T.1N, R67E	Heavy claim activity
Cave Valley	Minerals	T.5.N.R.6.3E	227 claims
Coal Valley	Minerals	T.2N, R.61E T.3N, R.61E	312 claims 93 claims
Hot Creek Valley	Minerals	T.7N, R.50E	115 claims adjacent to Tybo mining district
Steptoe Valley	Minerals	T.14N, R.63E	153 claims
Tonopah Area	Minerals	South end of Big Smoky Valley	Molybdenum; several active mines along valley flanks
Escalante Desert	Geothermal	South of T.255, east of R.10W	High geothermal potential
Black Rock Desert	Geothermal		
Sevier Desert	Minerals	Key Mountains, Sheeprock Mountain	Uranium, base and precious metals
Dugway Valley	Minerals		Beryllium, fluorite, uranium
Fish Springs Flat	Minerals, Geothermal	T.13S, R.11W T.12 & 13S, R.12 & 13W	
Sevier Lake Valley	Minerals	R.11W, T.20-22S	

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T = Township; R = Range

was expressed over access for exploration and the types of exploration which would be allowed.

Proposed Air Force policy tries to avoid preventing access to any known or high potential mineral deposits. The policy is currently (August, 1981) being negotiated with BLM before being finalized. It should be stressed that the M-X system analyzed for mining impacts will not necessarily be the final M-X system design. This proposed policy, released subsequent to the DEIS, contains the following elements:

a. Avoidance: The Air Force is committed to not siting components of the M-X system on active mining claims or in areas of "High Potential Minerals" as defined in the Mineral Survey for the Great Basin deployment region (Ertec Mineral Resources Survey, January 1981 and June 1981).

b. Relocation of Facilities: The Air Force is willing to move facilities or buy out interests for future mineral discoveries. When future incompatible proposed uses are identified, as a part of the case-by-case decisions, the Air Force will determine whether funds should be programmed to purchase the incompatible use and acquire the necessary land rights or whether the affected shelter(s) should be abandoned or replaced elsewhere in the deployment area.

c. Joint Use Activities: This concerns mining activities that are permissible on lands in the M-X deployment region which are not specifically withdrawn for M-X. Certain activities such as mineral prospecting, mining, and mineral extraction (including blasting and overflights, if coordinated in advance with the Air Force) are allowable nonrestrictive activities which can occur on lands adjacent to M-X shelter sites.

d. Joint Siting Review: As a part of the siting review process, site plans for each valley will be jointly reviewed by the states, BLM, and other parties. During this review, it would be expected that case-by-case mining conflicts would be resolved prior to release of land to the Air Force.

PROPOSED ACTION (4.3.2.4.2)

DDA Impacts

Mining development is a long-term resource commitment. From the date of discovery of a mineral deposit to the start of production may take ten years or more. The economic life of a mining operation may extend up to 50 years. Mining and mineral recovery is the most important economic activity within the M-X deployment area, second only to gaming in the state of Nevada. The present mining boom was caused by an increase in the prices for minerals and by advances in exploration and recovery techniques. Because the deployment of M-X components could interact with mining operations at some locations, the economic development near these locations could be impacted.

No difference is apparent between the potentials for impacts at the OB site and in the DDA. Potential constraints are locational in nature and will be resolved during subsequent decisionmaking.

Withdrawal of land presently held in mineral claims could have the potential of limiting immediate economically viable mineral development in the deployment area. Some undiscovered ore deposits located under the valleyfill could not be developed during the useful life of the M-X components. This situation would be especially true for ores requiring open-pit mining. In addition to proven claims that could indicate large-scale mineral deposits, many claims are held by individuals and are worked on a part-time basis. Impact to these claims could affect the livelihood of the holders.

The drawdown on sand, gravel, and cement materials would be substantial during the construction phase of the M-X program. It would be miniscule during the operations phase. Only the minerals used in building the M-X facilities would be irretrievably committed.

Any adverse impacts on the building-materials industries could be mitigated through appropriate planning. Valid mining claims occupied by M-X components will require that the holder of the claim be compensated. Most economically viable claims could be avoided by careful siting of the M-X components. Tables 4.3.2.4-2 indicates the level of impact as calculated by the previously described technique expected in each hydrologic subunit.

Coyote Spring Valley OB Impacts

The Coyote Spring OB would be located in an area of little mining activity and few mining claims. The nearest mining is gypsum, silica, and sand and gravel. The OB is not expected to impact these concerns except perhaps to increase the development of sand and gravel sites.

Milford OB Impacts

The Milford OB site is located near the south end of the Star Range. Farther north in the Star Range is the Star Mining district. There are many patented and unpatented claims throughout the area. The OB site avoids the largest concentrations of claims. The mineral occurrence is associated with intrusive rocks. A geologic assessment of the area would be needed as part of subsequent tiered decisionmaking to ensure that the OB site does not conflict with developable mineral deposits.

ALTERNATIVE 1 (4.3.2.4.3)

The DDA for Alternative 1 would be the same as that for the Proposed Action; there would be no difference in the impacts. The Coyote Spring Valley OB would be the same as that for the Proposed Action. The Delta OB would be located away from any active mining areas although there is a concentration of unpatented claims surrounding Sevier Lake to the south. The Delta OB site would not be expected to disrupt any future mining activity.

ALTERNATIVE 2 (4.3.2.4.4)

The DDA for Alternative 2 would be the same as that for the Proposed Action. The Coyote Spring Valley OB would be the same as that for the Proposed Action. The Beryl OB site is not located near any active mining areas nor any major

Table 4.3.2.4-2. Potential impact to known mining and mineral recovery activity in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Hydrologic Subunit Name	Number of Known Claims Within Geotechnically Suitable Area: Unpatented	Number of Known Claims Within Geotechnically Suitable Area: Patented	Short Term Impact[1,3]	Long Term Impact[1,3]
	Subunits with M-X Clusters and DTN				
4	Snake, Nev./Utah	169	--	*	*
5	Pine, Utah	406	--	***	***
6	White, Utah	500	7	***	***
7	Fish Springs, Utah	2,614	--	***	***
8	Dugway, Utah	1,766	--	***	***
9	Government Creek, Utah	115	--	*	*
46	Sevier Desert, Utah	1,795	2	***	***
46A	Sevier Desert-Dry Lake, Utah[2]	300	--	***	***
54	Wah Wah, Utah	43	2	***	***
137A	Big Smoky-Tonopah Flat, Nev.	4,678	285	*****	*****
139	Kobeh, Nev.	146	2	***	***
140A	Monitor-North, Nev.	2,663	34	***	***
140B	Monitor-South, Nev.			***	***
141	Ralston, Nev.	--	--	***	***
142	Alkali Spring, Nev.	--	--	*	*
148	Cactus Flat, Nev.	--	--	*	*
149	Stone Cabin, Nev.[2]	--	--	***	***
151	Antelope, Nev.	--	--	***	***
154	Newark, Nev.[2]	233	0	***	***
155A	Little Smoky-North, Nev.	7	--	***	***
155C	Little Smoky-South, Nev.	5	--	*	*
156	Hot Creek, Nev.	149	1	***	***
170	Penoyer, Nev.	91	1	***	***
171	Coal, Nev.	331	--	***	***
172	Garden, Nev.	86	--	*	*
173A	Railroad-South, Nev.	5	--	*	*
173B	Railroad-North, Nev.	69	--	***	***
174	Jakes, Nev.	159	0	***	***
175	Long, Nev.	234	0	***	***
178B	Butte-South, Nev.	71	20	***	***
179	Steptoe, Nev.	131	--	***	***
180	Cave, Nev.	227	--	*****	*****
181	Dry Lake, Nev.[2]	5	--	***	***
182	Delamar, Nev.	13	17	***	***
183	Lake, Nev.	479	167	***	***
184	Spring, Nev.	43	20	***	***
196	Hamlin, Nev./Utah	11	--	***	***
202	Patterson, Nev.[4]	N/D	N/D	*****	*****
207	White River, Nev.[2]	35	--	*	*
208	Pahroc, Nev.	7	--	*	*
209	Pahranagat, Nev.	--	--	*	*
	Overall DDA Impact			***	***

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[1] - = No impact.
* = Low impact. Minor claim activity and low mineral potential of land withdrawn.
*** = Moderate impact. Moderate claim activity or location in potential mineralized belt.
***** = High impact. System located in area of heavy claim activity with high mineral potential previously recommended for exclusion.

[2] Conceptual location of Area Support Centers (ASCs).

[3] Impacts are caused by potential withdrawal of land presently held in mineral claims.

[4] Location of Pioche Mining District.

N/D = No data.

concentration of mining claims. No significant impacts would be expected at this site.

ALTERNATIVE 3 (4.3.2.4.5)

The DDA for Alternative 3 would be the same as that for the Proposed Action and the impacts would be the same. The system in Railroad Valley could indirectly impact the Trap Springs oil field because of temporary heavy construction traffic. The Beryl OB site is discussed under Alternative 1. The Ely OB site would be located south of the Ward mining district in southern Steptoe Valley. Some of the peripheral functions of the OB might conflict slightly with future expansion of the Ward District if mineral values were found beneath the valley alluvium. There exists some potential for additional discoveries in the mountains of the Egan Range and in the valleyfill along the front of the range.

ALTERNATIVE 4 (4.3.2.4.6)

The DDA for Alternative 4 would be the same as that for the Proposed Action. The Beryl OB site is discussed under Alternative 1. The Coyote Spring Valley OB site is discussed under the Proposed Action.

ALTERNATIVE 5 (4.3.2.4.7)

The DDA for Alternative 5 is the same as that for the Proposed Action. The Milford OB site is discussed under the Proposed Action. The Ely OB site is discussed under Alternative 3.

ALTERNATIVE 6 (4.3.2.4.8)

The DDA for Alternative 6 would be the same as that for the Proposed Action. The Milford and the Coyote Spring Valley OB sites are discussed under the Proposed Action.

ALTERNATIVE 7 (4.3.2.4.9)

The DDA for Alternative 7 would be located on the surface of the High Plains in Texas and New Mexico. There is little mining activity in the area and no significant impacts would be expected. There may be some minor location conflicts with a new carbon dioxide gas field and pipeline distribution system in Union, Harding, and Quay counties but these should be avoidable. The Clovis OB site is not located near any mining or potential mining activity. No impacts other than an increased use of sand and gravel would be expected.

The Dalhart OB site is not located near any mining or potential mining activity. It is 15 to 20 mi west of the Hugoton gas field but no conflicts would be expected. Increased demand for sand and gravel would accompany the OB construction. See Table 4.3.2.4-3 for a comparison of impact potential by county.

ALTERNATIVE 8 (4.3.2.4.10)

The DDA for Alternative 8 would be split between Nevada/Utah and Texas/New Mexico. In Nevada/Utah, the reduced deployment would avoid the

Table 4.3.2.4-3. Potential impact to known mining and mineral recovery activity in Texas/New Mexico DDA for Alternative 7.

County	Oil and Gas Potential	Short Term Impact[1,3]	Long Term Impact[1,3]
Counties with M-X Clusters and DTN			
Bailey, Tex.	Low	-	-
Castro, Tex.		-	-
Cochran, Tex.	Moderate	-	-
Dallam, Tex.	Moderate	-	-
Deaf Smith, Tex.[2]	Low	-	-
Hartley, Tex.[2]	Moderate	-	-
Hockley, Tex.		-	-
Lamb, Tex.		-	-
Oldham, Tex.	High	-	-
Parmer, Tex.	Low	-	-
Randall, Tex.		-	-
Sherman, Tex.	Moderate	-	-
Swisher, Tex.		-	-
Chaves, N. Mex.	Moderate	-	-
Curry, N. Mex.	Low	-	-
DeBaca, N. Mex.	Low	-	-
Guadalupe, N. Mex.		-	-
Harding, N. Mex.[4]	Low	*	*
Lea, N. Mex.		-	-
Quay, N. Mex.	Low	-	-
Roosevelt, N. Mex.[2]		-	-
Union, N. Mex.[4]	Moderate	*	*
Overall DDA Impact		-	-

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[1]- = No impact.
* = Low impact. Minor claim activity and low mineral potential of land withdrawn.
*** = Moderate impact. Moderate claim activity or location in potential mineralized belt.
***** = High impact. System located in area of heavy claim activity with high mineral potential previously recommended for exclusion.

[2]Conceptual location of Area Support Centers (ASCs).

[3]Impacts are caused by potential withdrawal of land presently held in mineral claims.

[4]Location of carbon dioxide field.

potential mineral areas to the west, around Tonopah, and to the north in White Pine County. The potential impacts to mining and mining claims would be substantially reduced. The ratings for the valleys retained in the layout are the same as for the Proposed Action. The Coyote Spring Valley OB would be the same as for the Proposed Action. The Clovis OB would be the same as Alternative 7. Table 4.3.2.4-4 indicates the potential impact by hydrological subunit.

MITIGATIONS (4.3.2.4.11)

During the siting of M-X facilities, areas of known high value mineral deposits will be identified and avoided. The Air Force will coordinate and cooperate with local mine operators to minimize disruption of mining operations. Where it is not practical to totally avoid a claim, impacted claim holders will be compensated in accordance with law. These mining conflicts will be negotiated on a case-by-case basis.

After the construction of shelters is completed, if a high value mineral resource is discovered and recovery is economically justified, the Air Force will advocate that Congress consider the abandonment or dismantling of affected shelter sites if it is necessary for mineral recovery.

Further details on mining and mineral mitigations are included in ETR-38 (Mitigations) and ETR-11 (Mining and Geology).

The M-X system will not directly preempt any working mine. The most significant impact upon mining, especially smaller mining operations, will probably be the competition for local labor. This operation is near Moapa.

Table 4.3.2.4-4. Potential impact to known mining and mineral recovery activity in Nevada/Utah and Texas/New Mexico DDAs for Alternative 8.

Hydrologic Subunit No.	Hydrologic Subunit Name	Number of Known Claims Within Geotechnically Suitable Area: Unpatented	Patented	Short Term Impact[1,3]	Long Term Impact[1,3]
	Subunits or Counties with M-X Clusters and DTN				
4	Snake, Nev./Utah[2]	169	--	*	*
5	Pine, Utah	406	--	***	***
6	White, Utah	500	7	***	***
7	Fish Springs, Utah	2,614	--	***	***
46	Sevier Desert, Utah	1,795	2	***	***
46A	Sevier Desert-Dry Lake, Utah[2]	300	--	***	***
54	Wah Wah, Utah	43	2	***	***
155C	Little Smoky-South, Nev.	5	--	*	*
156	Hot Creek, Nev.	149	1	***	***
170	Penoyer, Nev.	91	1	***	***
171	Coal, Nev.[2]	331	--	***	***
172	Garden, Nev.	86	--	*	*
173A	Railroad-South, Nev.	5	--	*	*
173B	Railroad-North, Nev.	69	--	***	***
180	Cave, Nev.	227	--	*****	*****
181	Dry Lake, Nev.[2]	5	--	***	***
182	Delamar, Nev.	13	17	***	***
183	Lake, Nev.	479	167	***	***
184	Spring, Nev.	43	20	***	***
196	Hamlin, Nev./Utah	11	--	***	***
202	Patterson, Nev.[4]	--	--	*****	*****
207	White River, Nev.	35	--	*	*
	Oil and Gas Potential				
	Bailey, Tex.	Low		-	-
	Cochran, Tex.	Moderate		-	-
	Dallam, Tex.	Moderate		-	-
	Deaf Smith, Tex.	Low		-	-
	Hartley, Tex.	Moderate		-	-
	Hockley, Tex.			-	-
	Lamb, Tex.			-	-
	Oldham, Tex.	High		-	-
	Parmer, Tex.	Low		-	-
	Chaves, N. Mex.	Moderate		-	-
	Curry, N. Mex.	Low		-	-
	DeBaca, N. Mex.	Low		-	-
	Guadalupe, N. Mex.			-	-
	Harding, N. Mex.	Low		*	*
	Lea, N. Mex.			-	-
	Quay, N. Mex.	Low		-	-
	Roosevelt, N. Mex.	Moderate-Low		-	
	Union, N. Mex.			*	*

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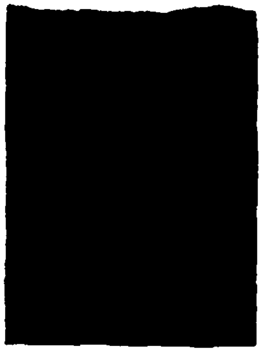
[1] - = No impact.
* = Low impact. Minor claim activity and low mineral potential of land withdrawn.
*** = Moderate impact. Moderate claim activity or location in potential mineralized belt.
***** = High impact. System located in area of heavy claim activity with high mineral potential previously recommended for exclusion.

[2] Conceptual location of Area Support Centers (ASCs).

[3] Impacts are caused by potential withdrawal of land presently held in mineral claims.

[4] Location of Pioche Mining District.

Native Vegetation



NATIVE VEGETATION

INTRODUCTION (4.3.2.5.1)

The native vegetation in the study area forms the base of a diverse community of plants and animals, coadapted to harsh environments. Few nonnative species (particularly in portions of the Nevada/Utah project area) can provide long-term stability in these areas, since they lack the beneficial attributes of the native vegetation. The existing native vegetation has many functions. It is at the base of the food chain, provides a habitat for wildlife, and is the basic resource of the livestock industry. Vegetation protects the soil from erosion, minimizes sediment loss from wind and water erosion, and greatly reduces the occurrence and magnitude of floods (Colman, 1953). Vegetation also aids infiltration of precipitation to groundwater storage, builds desirable soil characteristics, and provides an aesthetic environment for recreation.

Once the native vegetation is removed, natural recovery in many Nevada/Utah study area locations is projected to take from a few decades to over a century. The time for recovery depends largely upon the nature of the community, the soil, and the rainfall patterns. For example, sagebrush in well-drained areas of high rainfall will recover much faster than shadscale in poorly drained saline areas of low rainfall. After the removal of vegetation during construction, plants and animals that previously dominated will be replaced by species which thrive in disturbed areas. Where vegetative cover is removed and the soil disturbed, substantial rehabilitation is required to restore it.

Although the vegetation types in the Nevada/Utah study area are rather uniform over wide areas, this uniformity masks substantial local differentiation. For example, sagebrush vegetation may be dominated by one or more of five species or subspecies, each of which exhibits substantial variation, depending on geographic location and site characteristics. In addition, the group of species associated with the dominant species also changes markedly from place to place. Existing within areas which support widespread vegetation types are many unique kinds of vegetation, such as relict populations and species hybridizations, and possibly undiscovered species or subspecies.

The impact to natural vegetation was analyzed by comparing the project layout to the known distribution of vegetation types in the area. The data base for vegetation distribution included a compilation of Bureau of Land Management and Soil Conservation Service vegetation maps, Landsat imagery field studies conducted for this report, and vegetation distributions recorded in the literature. The impact analysis also relies heavily, especially regarding the prediction of indirect impacts, on literature reviews of studies on the disturbance and subsequent recovery of native vegetation in Great Basin and Mojave Desert vegetation types. Criteria for establishment of impact significance are detailed in Section 2.1.1 of ETR-14.

Vegetation was mapped and sampled on 10 wetland sites, five in Snake Valley, Utah and five in White River Valley, Nevada. Analysis of data and similarity indices between wetland sites is presented in ETR-14 (Native Vegetation). Wetland vegetation in each valley is shown to be distinctive in species composition; this may be primarily due to disturbance and alteration of these wetlands by man (e.g., physical alteration and grazing). Some differences in diversity may be due to climatic and elevational variation (e.g., different rainfall patterns).

PROPOSED ACTION (4.3.2.5.2)

DDA Impacts

Approximately 139,500 acres of vegetation would be removed for construction of roads, shelters, and other structures in Nevada/Utah as a result of the Proposed Action. Additional acreage of vegetation would be removed for energy facilities and other project elements not accounted for in the above figure. Including the OB sites, over 168,000 acres of vegetation would be removed. Shadscale, Great Basin sagebrush, and pinyon-juniper woodland, which cover most of the bajadas and valley bottoms in the proposed DDA, would be the vegetation types most affected. Other bajada and valley-bottom vegetation types, including alkali sink scrub, desert marsh and spring vegetation, riparian woodland, creosote bush scrub, and wash and arroyo vegetation would also be affected by vegetation clearing. A simplified vegetation type map for the proposed project area with the full deployment project layout is shown in Figure 4.3.2.5-1.

There is considerable public concern that deployment of the M-X system will create havoc and totally destroy Great Basin ecosystems. Examples of this concern are contained in the following comments.

PUBLIC COMMENTS ON THE DRAFT EIS:

"There will be havoc during construction. The destruction of this fragile desert ecology system will inevitably occur with your plans for pouring rivers of concrete, and digging up areas where plant life cannot be restored for decades, if ever."

"The ecosystems in the Great Basin are, for the most part, fragile and easily disrupted. If vegetation is removed on the bajadas and valley floors, including the edges of playas for example, the disturbed area is very slow to heal, often taking many years to revegetate."

The Air Force recognizes that ecosystem restoration involves more than just vegetation, and must include integrated procedures for erosion control as well as wildlife and grazing management. The Air Force is also committed to adopt conservative, careful construction practice and to minimize the disturbed area at all sites. In most Great Basin areas, suitable revegetation within the lifetime of the project may only be possible with the aid of a comprehensive reclamation plan. This plan should integrate accepted practices of seeding, irrigation, protection, erosion control, and monitoring. The fragility and slowness to heal of desert ecosystems is discussed more fully in ETR-14 (Native Vegetation).

Indirect impacts to vegetation would result from accelerated wind and water erosion, sedimentation, soil compaction, deposition of excavated material, altered patterns of surface-water flow, groundwater drawdown, and increased fugitive dust. The most significant of these impacts will be near cleared areas. However, indirect impacts from recreation, such as from ORV use, may occur at a considerable distance from cleared locations. The large number of cleared areas within many of the hydrologic subunits will create the potential for extensive impacts. Soil erosion from disturbed land would increase sedimentation of perennial water sources and decrease water absorption and retention in eroded areas. The reduction in available water to eroded areas probably would cause a decline in vegetative cover and changes in vegetative composition. Since indirect impacts to vegetation are related to site-specific factors, such as slope, the total area impacted cannot be estimated until detailed siting has been performed.

The spread of weedy species occurs whenever vegetation is disturbed or removed. One alien annual, halogeton (Halogeton glomeratus), is of particular concern. It quickly becomes established after disturbance, and it can be poisonous to sheep feeding exclusively on it along the trails, and has reduced range quality in some areas in the Great Basin. The clearing of vegetation would accelerate the spread of halogeton, a trend that could be partly reversed by revegetation procedures. Long-term establishment of halogeton, which would occur in repeatedly disturbed areas, could prevent reestablishment of native vegetation, and irretrievably degrade the value of the land for future wildlife and livestock use. The reestablishment of perennial vegetation is thought to be the only reasonable method of control of this species. After light disturbance, halogeton may be gradually replaced by native shrubs, but under severe or repeated disturbance, halogeton may alter soil chemistry to the point that native vegetation is excluded (Eckert and Kinsinger, 1960). Soil modification by halogeton may prevent the re-establishment of native species for at least 30 years. The state of Nevada recognizes that the spread of halogeton can only be mitigated by a comprehensive revegetation program.

An example of a reclamation plan designed to mitigate the spread of halogeton is presented in ETR-14 (Native Vegetation).

The Eastern Plains Council of Governments commented that prairie ecosystems of the Texas/New Mexico DDA will require a longer period of succession than desert ecosystems in Nevada and Utah.

VEGETATION TYPES

LEGEND

WESTERN FORESTS

DOUGLAS FIR FOREST
(Pseudotsuga)

WESTERN SPRUCE FIR FOREST
(Picea-Abies)

PINE-DOUGLAS FIR FOREST
(Pinus-Pseudotsuga)

ARIZONA PINE FOREST
(Pinus)

SPRUCE-FIR DOUGLAS FIR FOREST
(Picea-Abies-Pseudotsuga)

GREAT BASIN PINE FOREST
(Pinus)

JUNIPER-PINYON WOODLAND
(Juniperus-Pinus)

JUNIPER STEPPE WOODLAND
(Juniperus-Artemisia-Agropyron)

WESTERN SHRUB AND GRASSLAND

MOUNTAIN MAHOGANY-OAK SCRUB
(Cercocarpus-Quercus)

GREAT BASIN SAGEBRUSH
(Artemisia)

BLACKBRUSH
(Coleogyne)

SALTBUSH-GREASEWOOD
(Atriplex-Sarcobatus)

CREOSOTE BUSH
(Larrea)

DESERT: VEGETATION
LARGELY ABSENT

■ *Yucca brevifolia* (JOSHUA TREE)

▼ *Juniperus spp.* (JUNIPER, RED CEDAR)

TULE MARSHES
(Scirpus-Typha)

WHEATGRASS-BLUEGRASS
(Agropyron-Poa)

ALPINE MEADOWS AND BARREN
(Agrostis, Carex, Festuca, Poa)

SAGEBRUSH STEPPE
(Artemisia-Agropyron)

GALLETA-THREE AWN SHRUBSTEPPE
(Hilaria-Aristida)

3198-B-1

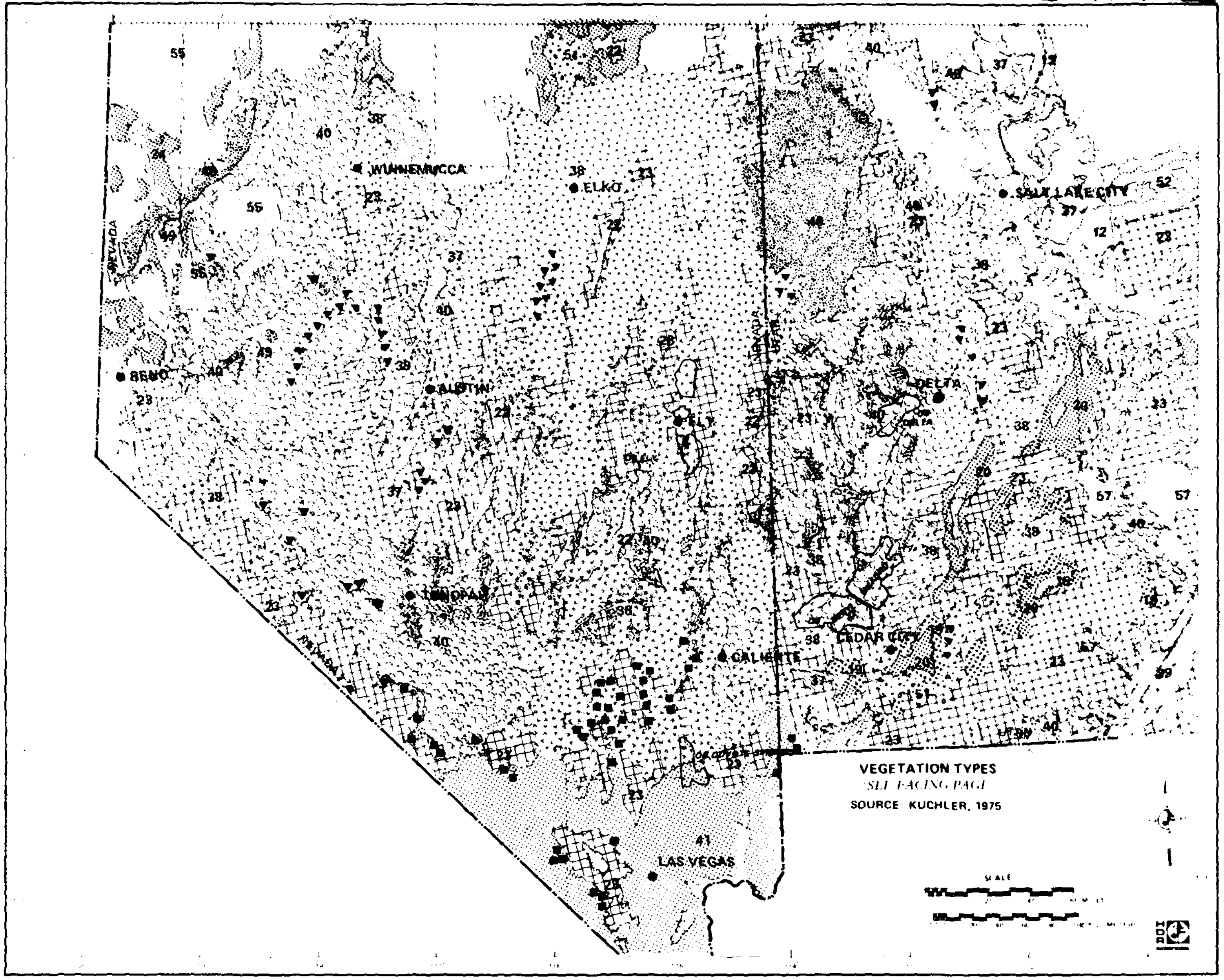


Figure 4.3.2.5-1. Natural vegetation of the Nevada/Utah study area and the Proposed Action conceptual project layout.

PUBLIC COMMENT ON THE DRAFT EIS:

"The analysis on native vegetation makes no distinction whatsoever with regard to vegetative quality within or between the two DDAs, i.e., the analysis states that natural processes will adequately revegetate disturbed areas in mixed prairie ecosystems. This assertion is not correct. Secondary succession processes will require a very long period of time to restore vegetative species of acceptable quality and suitable population. Secondary succession in desert vs. prairie ecosystems are not comparable in terms of time period required to restore vegetation of suitable quality. The facts are that prairie ecosystems of the New Mexico DDA will require a longer period of secondary succession than the desert ecosystem of the proposed action area. Desert vegetation is better adapted to environmental stress and, therefore, is better able to quickly respond after even total disturbance. On the other hand, prairie ecosystems require distinct periods of secondary succession to create a suitable environment for suitable species to become established in absence of further disturbance. As a result, impacts to mixed prairie natural vegetation are grossly underestimated."

Precipitation is higher in the Texas/New Mexico study area (15 to 20 in./yr rainfall) than in the Nevada/Utah (less than 8 in./yr over much of the area), and the amount of top soil and organic matter is much greater. For these and other reasons discussed in ETR-14 (Native Vegetation) natural revegetation is expected to take much longer in Nevada/Utah, up to a century or more.

The amount of area cleared of vegetation would increase throughout construction. Additional areas will be disturbed for some time beyond construction, as a result of erosion and off-road vehicle use. In areas not infested by halogeton, cleared areas without roads or structures will have the potential for being slowly revegetated. The rate of natural revegetation depends upon such factors as the annual rate and seasonal distribution of precipitation, the substrate characteristics, the intensity of erosive forces, and the response of reestablishing species to disturbed conditions. Natural revegetation will be inhibited if the soil has been compacted or covered with overburden materials unsuitable for plant growth, or if the surface soil is removed, exposing toxic subsoil, hard soil layers or bedrock.

Construction and operation of the system would reduce the usefulness of the cleared areas and their surroundings for livestock forage, wildlife habitat, and recreation. Many individuals of common animal species which rely on the vegetation would be lost. A more detailed discussion of ecosystem dependence on vegetation is presented in ETR-14 (Native Vegetation). Although cleared areas may be less than 2 percent of any hydrologic subunit, these areas would be subject to erosion, an impact which is particularly critical when dust, sediment, and flooding from the cleared areas impact nearby streams or rivers, farming operations, or population centers.

The clearing of a large number of areas in many of the hydrologic subunits will have a greater impact than would the clearing of only a few areas. The opportunity for viewing undisturbed areas would be curtailed. As the number of disturbed areas increases, so does the amount of vegetation at the perimeter of the cleared areas which will be subject to erosion and flooding. Indirectly impacted areas would also be subject to invasion by toxic weeds. The proportion of the watershed which lies within 0.5 mi of a disturbance provides a rough index to the frequency of vegetation clearing and the associated indirect impacts. This index is referred to as the index of off-site disturbance (IOSD). It is estimated that this 0.5 mi distance would include much of the area between closely spaced cluster roads subject to unauthorized disturbance and, therefore, to localized degradation. Most of the zone, however, will probably not be significantly affected. A detailed discussion of the impact of vegetation loss on grazing is presented in ETR-40 (Grazing).

Based on planimetry from 1:250,000 scale maps of the project layout, it was determined that three hydrologic subunits would have over 50 percent of their area within 0.5 mi of disturbance, and that an additional 18 hydrologic subunits would have over 25 percent of their area within 0.5 mi of disturbance. If five clusters are sited in the Alkali Spring hydrologic subunit as shown on the conceptual layout, 59 percent of the valley area would lie within 0.5 mi of disturbance. Several comments expressed concern that the figures presented as Index to off-site disturbance (IOSD) represented the actual area disturbed by the project. For example, the Council on Environmental Quality made the following comment.

PUBLIC COMMENT ON THE DRAFT EIS:

"A serious deficiency in the Draft EIS is its failure to discuss in a way useful to decisionmakers and the public the magnitude of direct and indirect environmental effects of M-X deployment. To illustrate this point, the Council's review reveals that the Draft EIS misrepresents the total direct impacts on native vegetation of deploying the M-X in the Nevada/Utah region. The Draft EIS states for example that approximately 142,900 acres of vegetation would be removed for roads, shelters and other structures in the 38 valleys designated in the Nevada/Utah region. Because the designated Nevada/Utah deployment area totals 22,611,400 acres, the decisionmaker is led to conclude that less than 1 percent of the designated deployment area will suffer loss of native vegetation. Draft EIS, Vol IV, p. 4-98. But using other data in the Draft EIS, dealing with anticipated "off-site disturbance", it is apparent that potential impacts of M-X deployment on native vegetation in the Nevada/Utah region are of a much greater order of magnitude. The "index to off-site disturbance" shown in the Draft EIS is the percentage of each "hydrologic subunit" within 0.5 mi of disturbance, and assumes that native vegetation within 0.5 mi of shelter sites and other development will be disturbed by construction and related activities. Applying the index to off-site disturbance to each of the 38 "hydrologic subunits" in the Nevada/Utah designated deployment area, it is evident that approximately 5,780,000 acres of native vegetation will be adversely affected or destroyed by M-X deployment in that region. Draft EIS, Vol IV, p. 4-98. This figure represents about 25% of the total designated deployment area." (B0086-7-002)

The assumption that native vegetation within 0.5 mi of the project will be disturbed is incorrect. The area within 0.5 mi of the project has the potential for localized disturbance, and much of the area will remain undisturbed. The Index of off-site disturbance (IOSD) was a measure of the pervasiveness of the project in the affected watersheds, not an estimate of the area actually disturbed directly or indirectly by the project. The larger the Index, the larger is the proportion of the hydrologic subunit that is close to project features and that could be subject to subtle offsite effects which are difficult to quantify.

The variable and limited effects of disturbances from construction of roads were indicated in the results of a field study (conducted from June to July of 1980 in Nevada and Utah to determine the effect of road construction on plant species composition and abundance). The construction of roads on slopes was found to have a variable impact on downslope vegetation. The effects of construction were not observable more than 200 m (about 0.1 mi) from the road. Halogeton was abundant within 10 m of the road, but declined to very low abundance beyond 10 m. The construction of roads on level areas had an impact only where the soil was mechanically disturbed by road building operations and water erosion due to runoff from the road surface. At both sites, the ratios and abundances of plant species were altered in a consistent pattern near the road.

Table 4.3.2.5-1 shows the potential direct loss of vegetation due to clearing for project facilities and the percentage of each hydrologic subunit within 0.5 mi of construction. The loss of vegetation is unavoidable if the system is constructed as proposed. However, the cleared area can be kept to a minimum and many of the potential adverse impacts in the 0.5-mi zone can be reduced or avoided through implementation of the mitigation measures discussed below. Without mitigation, the significant adverse impacts of vegetation clearing would range from long term to permanent.

Table 4.3.2.5-2 indicates the potential direct impact in acres impact to native vegetation types for the Proposed Action. Nearly 75 percent of the proposed cleared area is located in shadscale and sagebrush types.

Coyote Spring Valley OB Impacts

The Coyote Spring OB would permanently remove approximately 8,300 acres of native vegetation, mainly creosote bush scrub and Joshua tree woodland (see Figure 4.3.2.5-2), with some desert marsh and spring vegetation, as well as wash and arroyo vegetation. Additional areas may also be cleared by construction. Presently, the vegetation of Coyote Spring Valley is relatively undisturbed. The greatest impacts to native vegetation from the M-X project would occur near the close of the construction period. Indirect impacts are expected to continue to increase throughout the life of the project.

The vegetation in areas that are not permanently covered by the project may begin to recover at the end of construction, provided that soil conditions and water availability are suitable for plant growth. The natural recovery rate for creosote bush scrub is slow, although the rate has not been precisely determined. A study on the recovery of this community in the northern Mojave Desert showed that 33 years after disturbance, less than 20 percent of the shrub species had reached predisturbance levels of density and frequency (Wells, 1961). This study and others suggest that vegetation will not recover substantially within the lifetime of the M-X project. Complete natural recovery is likely to require at least 100 years.

Table 4.3.2.5-1. Potential impacts to native vegetation in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6, and 8.

Hydrologic Subunit No.	Hydrologic Subunit Name	Total Hydrologic Subunit Area (Acres)	Potential Native Vegetation Removed[5] (Acres)	Index to Off-Site Disturbance[6] (IOSD)	Impact[1]
	Subunits with M-X Clusters and DTN				
4	Snake, Nev./Utah[2]	1,728,000	10,544	23	*****
5	Pine, Utah[2]	467,200	4,003	28	***
6	White, Utah[2]	601,600	4,784	32	***
7	Fish Springs, Utah[2]	256,000	2,050	33	***
8	Dugway, Utah	207,200	1,953	27	***
9	Government Creek, Utah[2]	362,400	586	8	*
46	Sevier Desert, Utah[2]	1,920,000	5,663	14	*****
46A	Sevier Desert-Dry Lake, Utah[2,3]	620,800	7,908	24	*****
54	Wah Wah, Utah[2]	384,000	5,663	51	*****
137A	Big Smoky-Tonopah Flat, Nev.	1,025,900	3,222	22	***
139	Kobeh, Nev.	555,500	4,882	38	*****
140	Monitor-North and South, Nev.	664,300	3,905	20	***
141	Ralston, Nev.	586,900	6,248	38	*****
142	Alkali Spring, Nev.	200,300	3,222	59	*****
148	Cactus Flat, Nev.[3]	see Stone Cabin	--	--	
149	Stone Cabin, Nev.[3]	630,400	4,490	28	***
151	Antelope, Nev.[3]	284,200	4,296	44	*****
154	Newark, Nev.	512,600	2,343	33	***
155	Little Smoky-North and South, Nev.[2]	741,100	4,882	11	*
156	Hot Creek, Nev.[2]	663,000	4,589	28	***
170	Penoyer, Nev.[2]	448,000	3,808	29	***
171	Coal, Nev.[2,4]	294,400	3,710	43	*****
172	Garden, Nev.[2]	315,500	3,318	40	*****
173	Railroad-North and South, Nev.[2]	1,716,300	10,836	20	*****
174	Jakes, Nev.	270,100	3,027	35	***
175	Long, Nev.	416,600	1,268	2	*
178B	Butte-South, Nev.	646,400	3,319	18	***
179	Steptoe, Nev.[2]	1,242,900	488	1	*
180	Cave, Nev.[2]	231,700	1,953	28	***
181	Dry Lake, Nev.[2,3]	564,500	6,638	42	*****
182	Delamar, Nev.[2]	245,100	1,953	36	*****
183	Lake, Nev.[2]	369,300	3,027	35	***
184	Spring, Nev.[2]	1,063,000	1,367	5	*
196	Hamlin, Nev./Utah[2]	264,300	4,003	56	*****
202	Patterson, Nev.[2]	266,200	586	15	*
207	White River, Nev.[2]	1,036,800	4,101	17	***
208	Pahroc, Nev.	305,900	293	7	*
209	Pahranagat, Nev.	503,000	586	4	*
	Overall DDA	27,781,200	139,515	--	*****[7]
	Overall DDA for Alternative 8 (Nevada/Utah)	14,196,800	70,100	--	***[7]

T3874/10-2-81

[1] - = No impact. (No vegetation removed.)

* = Low relative impact. (Less than 1,000 acres of vegetation removed and an IOSD of 15 or less.)

*** = Moderate relative impact. (1,000-5,000 acres of vegetation removed and an IOSD between 15 and 35 percent.)

***** = High relative impact. (Over 5,000 acres of vegetation removed or an IOSD over 35.)

[2] Affected hydrologic subunits under Alternative 8.

[3] Conceptual location of Area Support Centers (ASCs) for the Proposed Action and Alternatives 1-6.

[4] Conceptual location of Area Support Centers (ASCs) for Alternative 8.

[5] Includes area for DTN, cluster roads, shelters, construction camps, and concrete plants. Additional areas, not included in the above figures, may be cleared of vegetation.

[6] Index to off-site disturbance (IOSD) equals the percent of the hydrologic subunit within 0.5 mi of disturbance.

[7] Impact rating for "Overall DDA" and "Overall DDA in Nevada/Utah for Alternative 8" are rated relative to each other.

Table 4.3.2.5-2. Potential direct impact to native vegetation types for the Proposed Action[1,2]

No.	Hydrologic Subunit Name	Alk. Sink Scrub	Shad	Shad-J.Tree	Ag-TR	Sage	PJ	MB	B	ND	Misc	Total
4	Snake, Nev./Utah	743	3,742	0	1,765	1,086	217	0	0	2,940	0	10,493
5	Pine, Utah	142	2,759	0	0	956	142	0	0	0	0	3,999
6	White, Utah	232	2,923	0	830	199	0	0	232	332	0	4,748
7	Fish Springs, Utah	339	1,581	0	0	0	0	0	0	0	142	2,062
8	Dugway, Utah	0	797	0	0	0	0	0	0	285	854	1,936
9	Government Creek, Utah	0	88	0	0	53	53	0	0	351	18	563
46	Sevier Desert, Utah	0	914	0	47	562	0	0	0	4,099	0	5,622
46A	Sevier Desert, Utah	0	7,579	0	213	142	0	0	0	0	0	7,934
54	Wah Wah, Utah	0	4,492	0	0	408	220	0	157	346	0	5,623
137A	Big Smoky Tonopah Flat, Nev.	1,943	888	111	139	27	0	0	83	0	56	3,247
139	Kobeh, Nev.	54	0	0	189	4,326	270	0	0	0	27	4,866
104	Monitor, Nev.	97	225	0	97	3,516	0	0	0	0	0	3,935
141	Ralston, Nev.	637	4302	0	128	1,083	0	0	0	0	96	6,246
142	Alkali Spring, Nev.	1,863	932	395	0	0	0	0	57	0	0	3,247
148	Cactus Flat, Nev.				See	Stone Cabin						
149	Stone Cabin, Nev.	32	1,811	0	130	2,232	32	0	0	194	97	4,528
151	Antelope, Nev.	154	1,848	0	31	2,275	0	0	0	0	0	4,308
154	Newark, Nev.	165	165	0	0	1,574	470	0	0	0	0	2,374
155	Little Smoky, Nev.	58	1,634	0	0	2,422	672	0	59	0	0	4,875
156	Hot Creek, Nev.	238	3,144	0	158	1,057	26	0	0	0	0	4,623
170	Penover, Nev.	0	3,054	0	0	756	0	26	0	0	0	3,836
171	Coal, Nev.	226	1,066			1,628	97			646		3.663
172	Garden, Nev.		467			2,258	324			252		3,301
173A	Railroad South, Nev.	209	3,046			747				30		4,032
173B	Railroad North, Nev.	2,186	3,590		65	653	228				32	6,754
174	Jakes, Nev.	37	590	0	37	1,991	221	0	0	184	0	3,060
175	Long, Nev.	21	339	0	0	910	42	0	0	0	0	1,312
178B	Butte, Nev.	291	130	0	64	2,272	551	0	0	0	0	3,308
179	Steptoe, Nev.	0	0	0	148	74	223	0	0	0	0	445
180	Cave, Nev.	242	91	0	121	1,060	485	0	0	0	0	1,999
181	Dry Lake, Nev.	0	3,797	94	31	1,788	816	0	159	0	0	6,685
182	Delamar, Nev.	0	492	1,017	0	427	0	0	0	0	0	1,936
183	Lake, Nev.	0	28	0	226	1,669	1,018	57	0	0	0	2,998
184	Spring, Nev.	0	180	0	209	836	149	0	0	0	0	1,374
196	Hamlin, Nev./Utah	0	1,380	0	0	2,186	403	28	0	0	0	3,997
202	Patterson, Nev.	0	0	0	107	0	484	0	0	0	0	591
207	White River, Nev.	0	432	0	0	2,698	814	51	0	0	127	4,122
208	Pahroc, Nev.	0	0	0	0	250	0	0	0	0	0	250
209	Pahranagat, Nev.	0	379	0	0	244	0	0	0	0	0	623
Project Total		9,939	58,885	1,617	4,735	44,365	7,957	162	747	9,659	1,449	139,515[1]

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Alk. Sink Scrub	= Alkali Sink Scrub	PJ	= Pinyon-Juniper Woodland
Shad	= Shadscale	MB	= Montane Brush
Shad-J. Tree	= Shadscale-Joshua Tree Woodland	B	= Barren
Ag-TR	= Agriculture-Treated Rangeland	ND	= Insufficient Data
Sage	= Great Basin Sagebrush	Misc	= Uncategorized Non-BLM Land

[1] Acres disturbed for DTN (17,671), cluster roads (75,144), shelters (46,000), construction camps (500) and concrete plants (200). OB facilities, OBTS sites, and airfields are not included in these calculations. Values were calculated as follows:

Step A) A 1:250,000 scale overlay of the conceptual project layout was placed over the modofied BLM vegetation maps. (Modification of BLM maps consisted of an aggregation of similiar cover type codes into more general categories and addition of new field data where available.)

Step B) The number of shelters lying in each vegetation type was tallied for each hydrologic subunit.

Step C) An average value for the acres cleared within each hydrologic subunit, expressed on a per shelter basis, was calculated by dividing the area disturbed (including DTN, cluster roads, shelters, constuction camps and concrete plants) by the total number of shelters within the subunit.

Step D) Acres impacted per vegetation type per hydrologic subunit were determined by multiplying the number of shelters in a given vegetation type by the average acres cleared per shelter.

[2] Acreage for riparian habitat was not available for this analysis, but will be considered in subsequent tiered decision-making analyses.

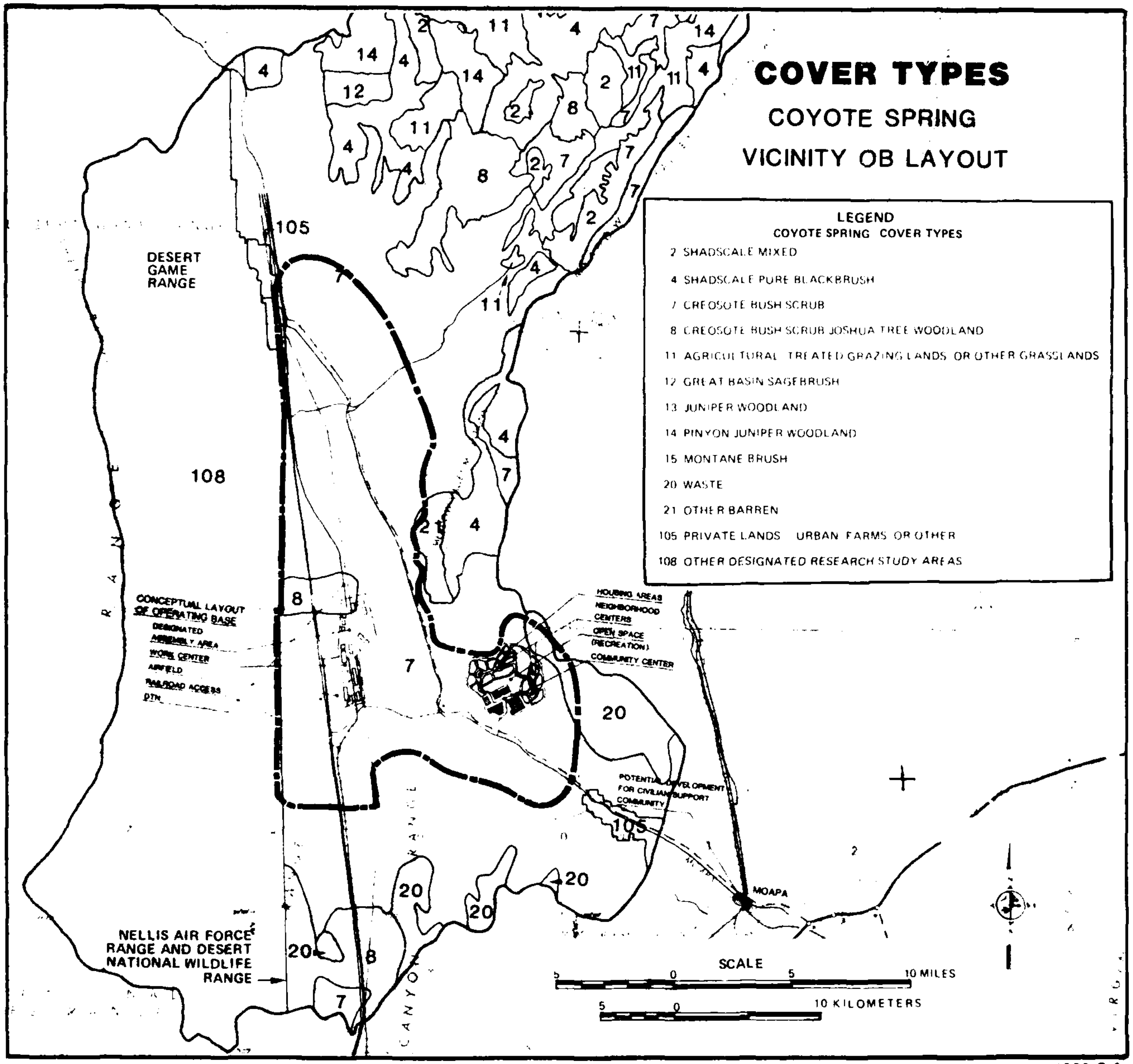

Figure 4.3.2.5-2. Vegetation cover types in the vicinity of the Coyote Spring OB.

The indirect impacts in Coyote Spring Valley would include the degradation of vegetation from fugitive dust, groundwater drawdown, increased collection of certain plant species for commercial purposes, and increased ORV use and other recreational activities. The area of vegetation that may be lost or degraded could be significant. The indirect impacts from the recreational activities of the M-X-related population are expected to extend to Pahranagat, Meadow Valley Wash, Las Vegas, Lower Moapa, Virgin River, Black Mountains, and California Wash hydrologic subunits.

The impacts will not vary greatly if the location of the base is shifted within the suitability zone. However, the proportion of each vegetation type affected may change, and this could cause significant differences in impacts to moisture-requiring vegetation types, including desert marsh and spring vegetation, and wash and arroyo vegetation.

Additional impacts to Coyote Spring Valley and nearby hydrologic subunits may result from the Harry Allen Energy System near Garnet, approximately 10 mi southeast of the proposed OB site. Personnel from that project are expected to use Coyote Spring Valley and nearby hydrologic subunits for recreation, resulting in indirect impacts similar to those for M-X.

The loss of native vegetation during the construction and operations phases of the project is unavoidable if the system is constructed as proposed. The amount lost could be reduced by the use of mitigation measures comparable to those discussed for DDA impacts. The overall impacts on Coyote Spring Valley are determined to be relatively high.

Milford OB Impacts

A second OB near Milford would permanently remove approximately 4,200 acres of native vegetation, mainly Great Basin sagebrush, pinyon-juniper woodland, shadscale scrub, and alkali sink scrub (see Figure 4.3.2.5-3). Additional acreage of vegetation would be removed as a result of clearing for drainage diversion, construction marshalling, borrow pit sites, and so forth. The native vegetation of the Milford area has already been affected by livestock grazing and recreational activities.

The indirect impacts to vegetation would include the loss or degradation of Great Basin sagebrush, shadscale scrub, alkali sink scrub, and possibly pinyon-juniper woodland and other vegetation types. Another potentially significant adverse impact is the invasion of halogeton (Halogeton glomeratus), as a result of vegetation clearing. Indirect impacts from the recreational activities of the M-X-related population are expected to extend to surrounding hydrologic subunits with greatest concentration in the Pine, Beaver, Sevier Desert, Parowan, and Beryl-Enterprise District hydrologic subunits, and in the area south of the Beryl-Enterprise District. Additional indirect impacts to the Milford area and other nearby watersheds may result from a planned alunite plant about 30 mi southwest of Milford. Construction and operation of the mine and processing plant would increase air pollution and damage soil, vegetation, and land productivity.

The impacts to vegetation would not vary greatly if the location of the base were shifted within the suitability zone. However, the proportion of each affected

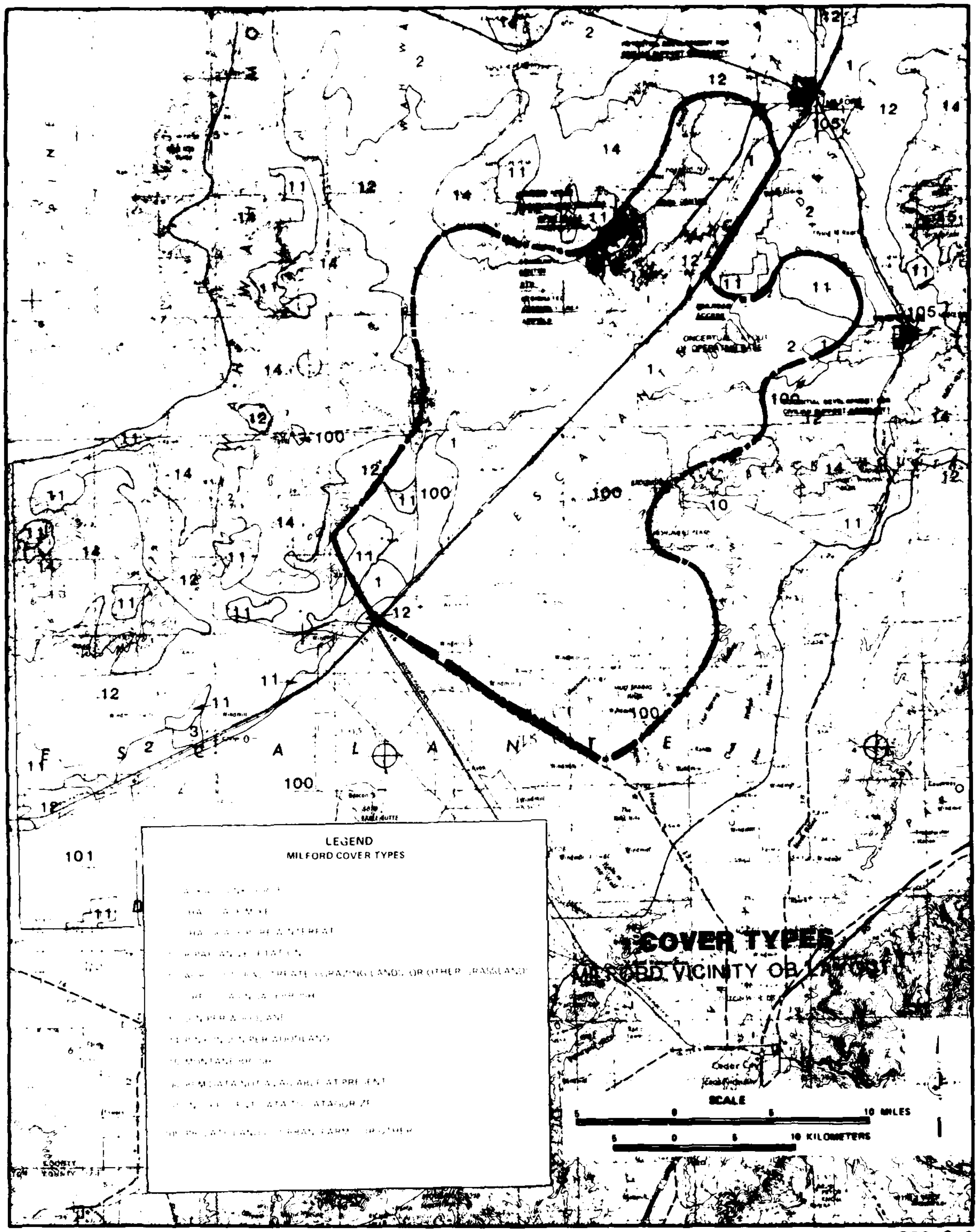

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Figure 4.3.2.5-3. Vegetation cover types in the vicinity of the Milford OB.

vegetation type may change. For vegetation types of limited occurrence, such as riparian woodland, the amount removed could vary greatly, depending upon the base location selected.

The greatest impact to vegetation would occur before the close of the construction period, although additional impacts are expected after this. The long-term and irretrievable loss of native vegetation would be similar to the loss at the Coyote Spring site. The direct and indirect loss of native vegetation is unavoidable if the system is constructed as proposed, although the amount of vegetation lost could be reduced by the mitigation measures discussed for the DDA. The overall impacts for the Milford OB site are determined to be moderate.

ALTERNATIVE 1 (4.3.2.5.3)

The impacts in the DDA and at the Coyote Spring OB would be the same as those for the Proposed Action. The second OB near Beryl would remove approximately 4,200 acres of native vegetation, mainly Great Basin sagebrush, shadscale scrub, alkali sink scrub, and pinyon-juniper woodland (see Figure 4.3.2.5-4). A similar amount of native vegetation would be permanently lost at Beryl as at Milford, although the proportion of types lost would differ between the two sites. The overall impact for the Beryl OB site is determined to be moderate.

The indirect impacts resulting from the recreational activities of the M-X-related population are expected to extend to Pine, Cedar City, Parowan, Spring, and Eagle hydrologic subunits and the area south of the Beryl-Enterprise District.

The impacts will not vary greatly if the location of the base is shifted within the suitability zone, although the proportion of each affected vegetation type may change. For vegetation types of limited area, such as pure winterfat stands, the amount lost within the suitability zone could vary greatly, depending on the location selected.

ALTERNATIVE 2 (4.3.2.5.4)

The impacts in the DDA and at the Coyote Spring OB would be the same as those for the Proposed Action. The second OB near Delta would remove approximately 4,200 acres of native vegetation, mainly shadscale scrub and some alkali sink scrub (Figure 4.3.2.5-5). This amount of vegetation lost is not significantly different from that expected from the Milford OB. Temporary and indirect impacts are also expected to be similar to those of the Proposed Action, although the loss of shadscale scrub may be greater at Delta than at Milford, since larger areas of this vegetation type are found at Delta. The impacts will not vary greatly if the location of the base is shifted within the suitability zone.

The indirect impacts resulting from the recreational activities of the M-X-related population are expected to be concentrated in Beaver, Fish Springs, Government Creek, and Rush hydrologic subunits, and in the area east of the Sevier Desert.

Additional impacts to the native vegetation of the Delta area and other nearby watersheds may result from the construction of the Intermountain Power Project near Lynndyl, 15 mi northeast of Delta. Impacts from this project include the

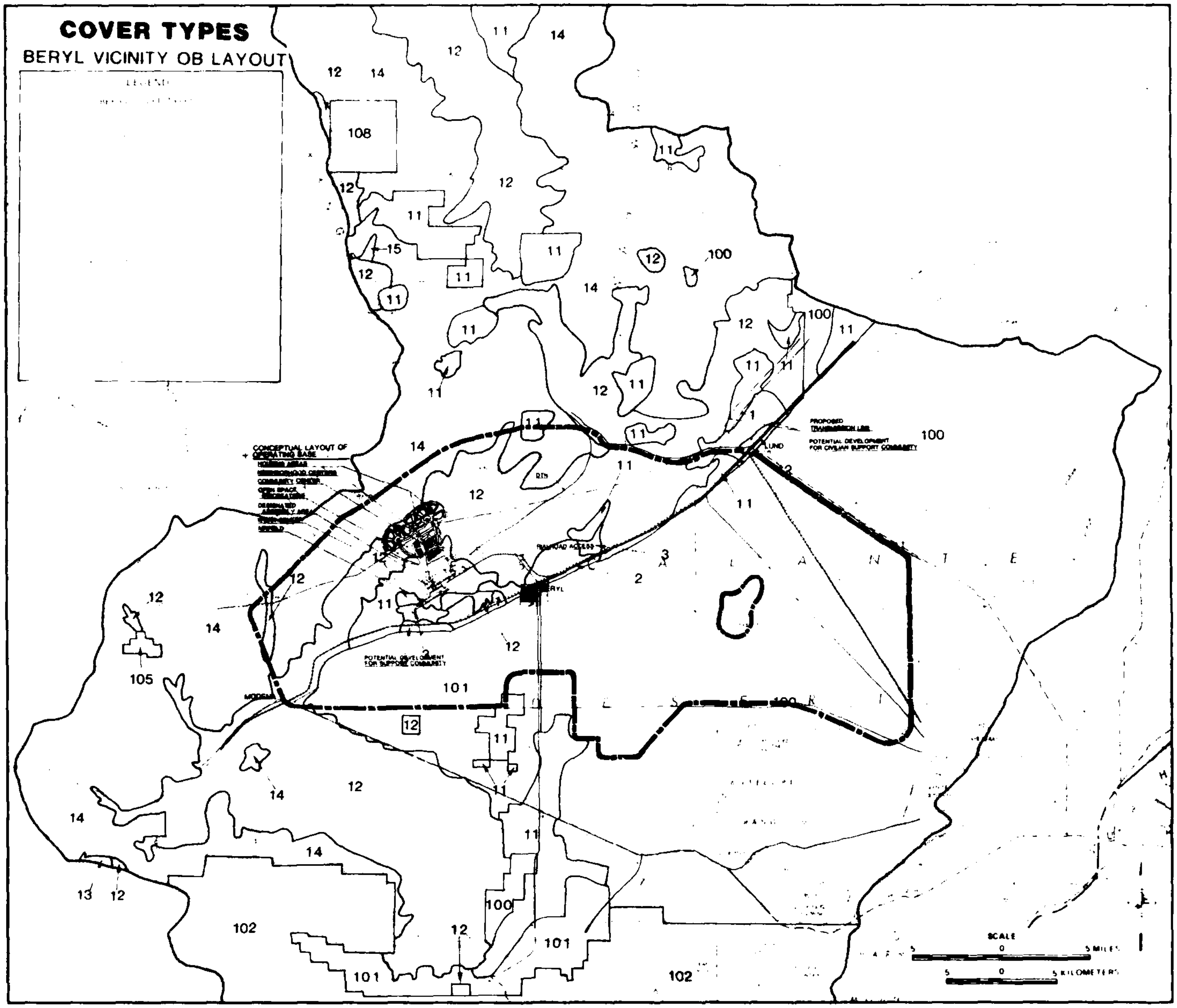


Figure 4.3.2.5-4. Vegetation cover types in the vicinity of the Beryl OB.

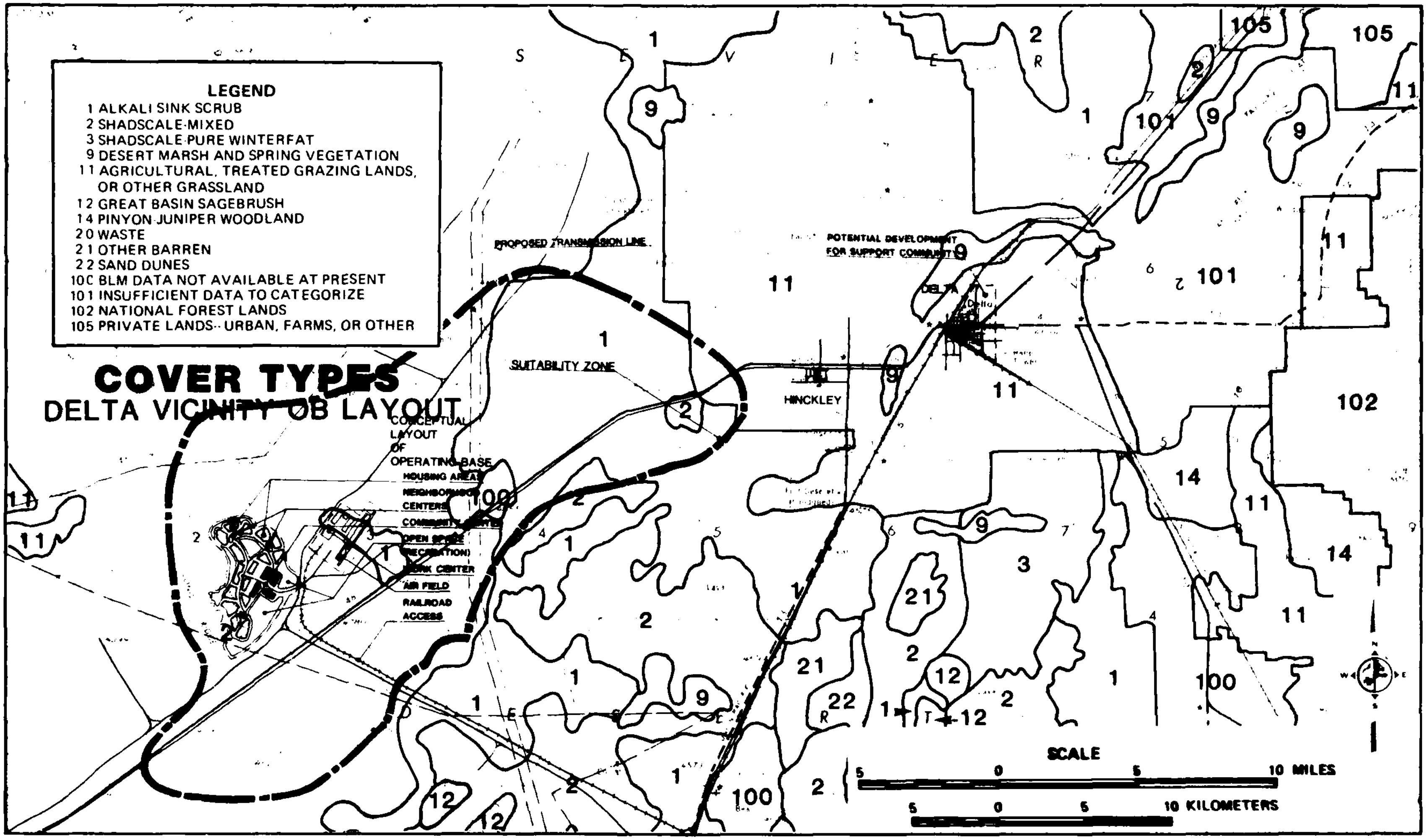


Figure 4.3.2.5-5. Vegetation cover types in the vicinity of the Delta OB.

permanent removal of 2,650 acres of vegetation and the temporary removal of an addditional 8,320 acres. Indirect impacts to vegetation are also expected from the project.

The changes in impact over time, the long-term and irretrievable losses of native vegetation, the significance of the impacts, and the recommended mitigation measures are similar to those discussed for the Milford OB under the Proposed Action.

ALTERNATIVE 3 (4.3.2.5.5)

The impacts in the DDA would be similar to those for the Proposed Action. The Beryl OB would have the same impacts as those discussed under Alternative 1, except that an additional 4,000 acres of vegetation would be removed, because under Alternative 3, Beryl is a first OB. In addition, indirect impacts would be greater, since there will be a larger M-X-related population at a first base than at a second base.

Siting the second OB near Ely would result in the direct removal of approximately 4,200 acres of native vegetation, mainly Great Basin sagebrush and pinyon-juniper woodland (Figure 4.3.2.5-6). The amount of vegetation lost is not significantly different from that expected as a result of siting a second OB near Milford under the Proposed Action. Indirect impacts to vegetation are expected to be similar to those of the Proposed Action. If the location of the base were shifted within the suitability zone, additional vegetation types including shadscale scrub and riparian woodland, could be impacted.

The indirect impacts resulting from the recreational activities of the M-X-related population are expected to be concentrated in Spring, White River, Ruby, Jakes, and Snake hydrologic subunits.

Additional impacts to the native vegetation of the Ely area and nearby hydrologic subunits are expected from the planned reopening of the Kennecott Copper Mine, north of Ely, and the construction and operation of the White Pine County Power Plant. Expected impacts on vegetation from the reopening of the Kennecott Copper Mine include those resulting from an increased local population. The potential sites for the White Pine County Power Plant include one in Jakes Valley, west of Ely, and another near McGill in northern Steptoe Valley; both are near the OB site south of Ely. The power plant is expected to result in some permanent loss of native vegetation, and additional indirect impacts. The change in impact over time, the long-term and irretrievable losses of native vegetation, the significance of the impact, and the recommended mitigations are similar to those discussed for the Milford OB under the Proposed Action.

ALTERNATIVE 4 (4.3.2.5.6)

The impacts in the DDA would be the same as for the Proposed Action; the impacts at the Beryl OB would be the same as those for Alternative 3. The impacts at the Coyote Spring OB would be similar to those discussed under the Proposed Action, except 4,000 fewer acres of vegetation would be removed, and indirect impacts would be less extensive.

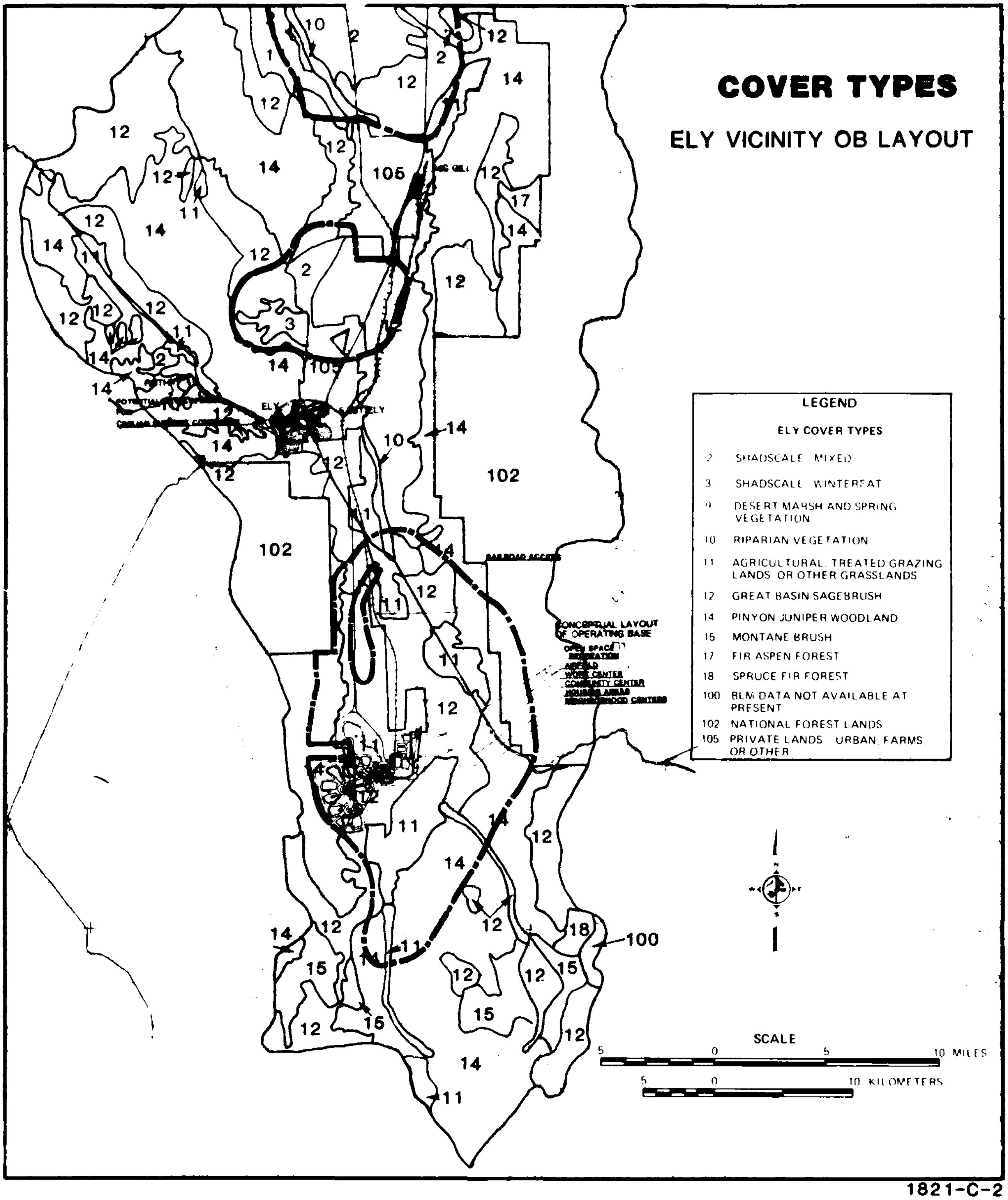


Figure 4.3.2.5-6. Vegetation cover types in the vicinity of the Ely OB.

ALTERNATIVE 5 (4.3.2.5.7)

The impacts in the DDA would be the same as those for the Proposed Action; the impacts at the Milford OB would be similar to those discussed for the Proposed Action, except approximately 4,000 more acres of native vegetation would be removed. Indirect impacts would be greater, since there would be more people associated with the base. The impacts at the Ely OB would be the same as those for Alternative 3.

ALTERNATIVE 6 (4.3.2.5.8)

The impacts in the DDA would be the same as those for the Proposed Action; the impacts at the Milford OB would be the same as those for Alternative 5; and the impacts at the Coyote Spring OB would be the same as those for Alternative 4.

ALTERNATIVE 7 (4.3.2.5.9)

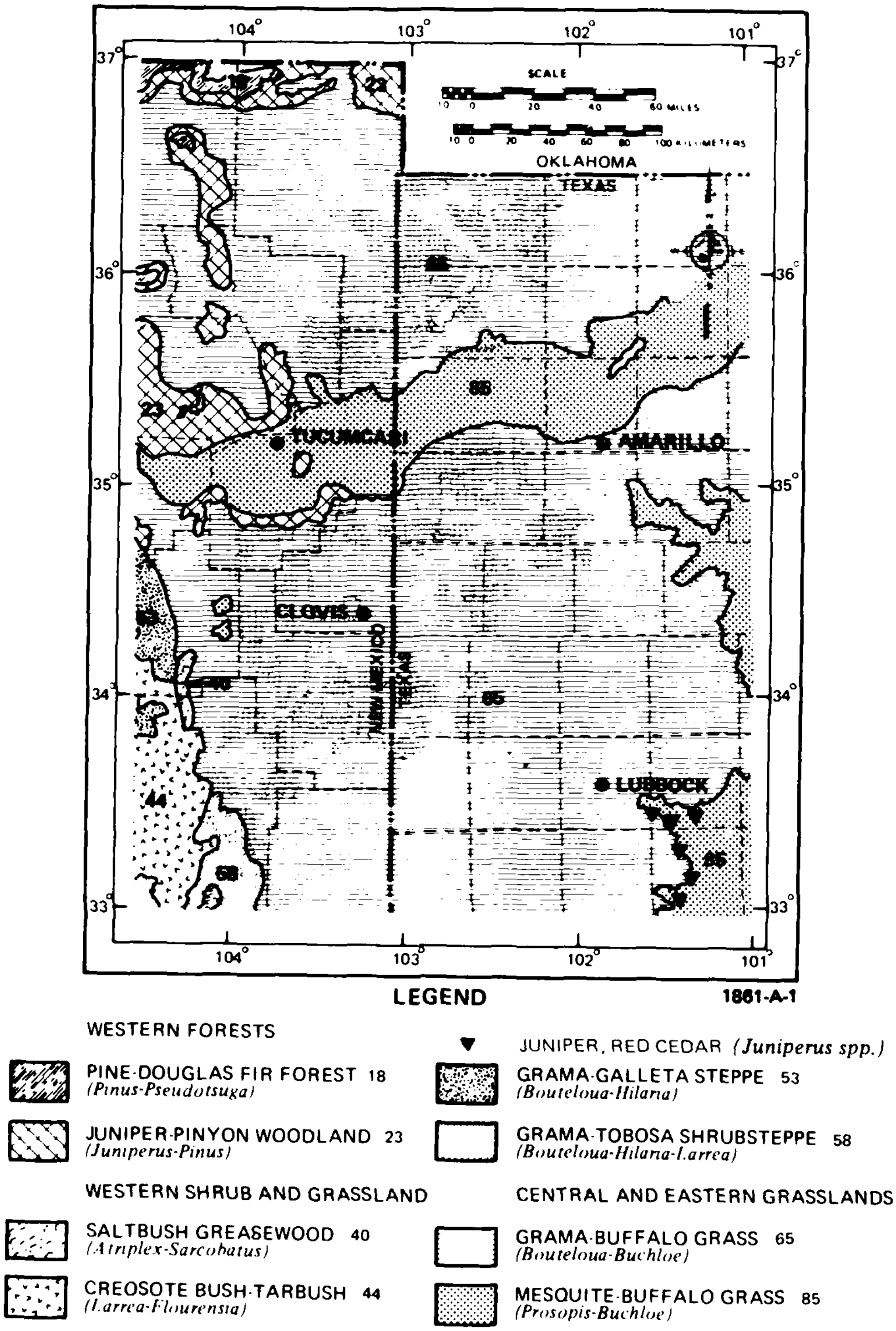
Full deployment in Texas/New Mexico would primarily affect cropland and intensively grazed native rangeland. It is estimated that 71,800 acres of native vegetation used as rangeland would be removed. Grama, bluestem, and mesquite grasslands would be the most extensively impacted vegetation types (see Figure 4.3.2.5-7). Since a lower percentage of land in Texas/New Mexico is covered with native vegetation, indirect impacts would be less.

Areas used for roads and structures would be permanently lost; other cleared areas have the potential for being revegetated. The rate of natural revegetation depends on such factors as the annual rate and seasonal distribution of the precipitation, the substrate characteristics, the intensity of erosive forces, and the response of reestablishing species to disturbed conditions. Natural revegetation will be inhibited if the soil has been compacted or covered with overburden materials unsuitable for plant growth, or if the surface soil is removed. If a suitable substrate remains after construction, partial vegetation recovery can probably be expected from natural processes within 2 to 5 years.

The usefulness of the cleared areas and their surroundings for livestock forage, wildlife habitat, and recreation would be reduced. Many species of common animals which rely on vegetation would be lost. The disturbed areas would be subject to wind and water erosion, an effect which is particularly critical when dust, sediment, and flooding impact nearby streams or rivers, farming operations, and population centers.

The area of native vegetation cleared would be significantly less than for the Proposed Action (because less native vegetation remains within the Texas/New Mexico site) and the recovery of the native vegetation would proceed more rapidly. Table 4.3.2.5-3 lists the directly impacted counties and the estimated acreage of native vegetation which would be removed.

Vegetation removal is unavoidable if the system is to be constructed. However, the cleared area can be kept to a minimum, and some of the adverse impacts of vegetation removal could be avoided through mitigation. Without mitigation, the adverse impacts from vegetation removal would range from short term to permanent.



SOURCE: KUCHLER, 1975

Figure 4.3.2.5-7. Simplified vegetation map of the Texas/New Mexico study area with Alternative 7 conceptual layout.

Table 4.3.2.5-3. Potential direct impact to native vegetation in Texas/New Mexico for Alternatives 7 and 8.

County	County Area (acres)	Area Which Would Be Disturbed (acres)[5]	Potential Native Vegetation Removed[5] (acres)	Impact[1]
Counties with M-X Clusters and DTN				
Bailey, Tex.[2]	534,400	3,396	485	*
Castro, Tex.[2]	563,200	3,784	194	*
Cochran, Tex.[2]	500,800	2,329	485	*
Dallam, Tex.	945,200	19,406	6,598	*****
Deaf Smith, Tex.[2,3]	966,400	15,913	3,784	***
Hartley, Tex.[2,3]	952,300	10,382	7,956	*****
Hockley, Tex.[2]	See Lamb County			
Lamb, Tex.[2]	654,100	2,135	0	-
Oldham, Tex.[2]	945,300	1,748	97	*
Parmer, Tex.[2]	549,800	6,972	582	*
Randall, Tex.	584,000	1,261	582	*
Sherman, Tex.	586,200	679	291	*
Swisher, Tex.	See Castro County			
Chaves, N. Mex.[2]	389,400	13,293	13,196	*****
Curry, N. Mex.[2,3]	897,900	7,568	2,718	***
DeBaca, N. Mex.[2]	1,507,800	1,261	1,261	***
Guadalupe, N. Mex.[2]	See Quay County			
Harding, N. Mex.[2]	1,365,400	4,754	4,657	***
Lea, N. Mex.[2]	2,811,200	873	679	*
Quay, N. Mex.[2,4]	1,840,000	14,069	9,994	*****
Roosevelt, N. Mex.[2,3,4]	1,570,800	17,950	13,778	*****
Union, N. Mex.[2]	2,442,200	6,307	4,463	***
Overall DDA for Alternative 7		133,900	71,800	*[6]
Overall DDA (Tex./N. Mex.) for Alternative 8		70,000	66,650	*[6]

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[1] - = No impact (no vegetation removed).
* = Low relative impact (less than 1,000 acres vegetation removed).
*** = Moderate relative impact (between 1,000 and 5,000 acres vegetation removed).
***** = High relative impact (greater than 5,000 acres vegetation removed).

[2] Affected counties under Alternative 8.

[3] Conceptual location of Area Support Centers (ASCs) for Alternative 7.

[4] Conceptual location of Area Support Centers (ASCs) for Alternative 8.

[5] Includes area for DTN, cluster roads, shelters, construction camps and concrete plants and is based on LANDSAT analysis.

[6] Rating relative to "overall DDA" for the Proposed Action.

The overall impacts to the Clovis and Dalhart OB sites are determined to be relatively low.

No native vegetation will be removed directly as a result of a first OB near Clovis. Landsat imagery shows that virtually all the land in the vicinity of Clovis is agricultural. The nearest extensive area of native vegetation is located 25 mi north, in the Canadian Breaks area. There may be some indirect impacts on Canadian Breaks vegetation, due to ORV-related crushing of vegetation and rut formation in soils. Such vegetation and soil damage is expected to increase the incidence and magnitude of soil erosion by wind and water. Landsat imagery shows that much of the land in the vicinity of Dalhart is agricultural, with smaller areas of rangeland; therefore, cropland, and to a lesser degree, native vegetation will be removed directly as a result of siting the second operating base in Dalhart. Some wetland vegetation could be impacted if the base were shifted to the southern portion of the suitability zone.

A comprehensive revegetation program for the Texas/New Mexico full deployment alternative would cost significantly less and would require less irrigation water than would a corresponding program for the Proposed Action. The more favorable environment in Texas/New Mexico enables one to use a less intensive revegetation program and to rely more heavily on natural precipitation.

ALTERNATIVE 8 (4.3.2.5.10)

Split basing would remove native vegetation from approximately 96,600 acres in the Nevada/Utah project area (see Figure 4.3.2.5-8) and 56,800 acres in the Texas/New Mexico project area (see Figure 4.3.2.5-9). The impacts to native vegetation in the Nevada/Utah project area would be reduced roughly 50 percent compared to the Proposed Action. In Nevada, a proportionately greater amount of the shadscale scrub vegetation type would be cleared due to the elimination of clusters within hydrologic subunits, including Kobeh and Antelope valleys, which are predominantly covered by sagebrush. In Utah, some hydrologic subunits which are predominantly covered by alkali sink scrub and shadscale scrub vegetation types, including Fish Springs and White valleys, would be eliminated from the project by this alternative.

This split-basing alternative shifts one-half of the project layout away from relatively undisturbed native vegetation (in Nevada and Utah) and into rangeland and cropland and more heavily disturbed native rangeland in Texas and New Mexico. Therefore, a less significant impact to undisturbed native vegetation would occur from this split-basing alternative than from the Proposed Action. Due to the higher levels of precipitation and the generally more favorable soil conditions in Texas and New Mexico, natural revegetation would proceed more rapidly for this half of the project layout. Revegetation of the Texas/New Mexico portion of the split-basing layout would be less expensive and would require less irrigation water than the Nevada/Utah portion.

Impacts at the Coyote Spring OB would be the same as those discussed for the Proposed Action; those at the Clovis OB would be the same as for Alternative 7.

MITIGATIONS (4.3.2.5.11)

The Air Force will implement a revegetation program in cooperation with appropriate federal and state agencies. Procedures which will be considered for incorporation into the revegetation program include characterization of existing vegetation communities, minimization of disturbed areas, characterizations of the distribution and nature of soils, development of effective soils-handling procedures, development of a seeding and transplanting program, irrigation of disturbed areas where applicable, protection of planted areas and monitoring of revegetated areas, and providing for vegetation valuable for specific wildlife. The Air Force will provide programs to minimize the spread of noxious vegetation and for the control of erosion and dust. The Air Force will also implement education programs for workers and their dependents. Additional discussion of mitigations is contained in ETR-14 (Native Vegetation) and ETR-38 (Mitigations).

VEGETATION TYPES

LEGEND

WESTERN FORESTS

DOUGLAS FIR FOREST
(Pseudotsuga)

WESTERN SPRUCE-FIR FOREST
(Picea-Abies)

PINE-DOUGLAS FIR FOREST
(Pinus-Pseudotsuga)

ARIZONA PINE FOREST
(Pinus)

SPRUCE-FIR-DOUGLAS FIR FOREST
(Picea-Abies-Pseudotsuga)

GREAT BASIN PINE FOREST
(Pinus)

JUNIPER-PINYON WOODLAND
(Juniperus-Pinus)

JUNIPER STEPPE WOODLAND
(Juniperus-Artemisia-Agropyron)

WESTERN SHRUB AND GRASSLAND

MOUNTAIN MAHOGANY-OAK SCRUB
(Cercocarpus-Quercus)

GREAT BASIN SAGEBRUSH
(Artemisia)

BLACKBRUSH
(Coleogyne)

SALTBUSH-GREASEWOOD
(Atriplex-Sarcobatus)

CREOSOTE BUSH
(Larrea)

DESERT: VEGETATION LARGELY ABSENT

■ *Yucca brevifolia* (JOSHUA TREE)

▼ *Juniperus spp.* (JUNIPER, RED CEDAR)

TULE MARSHES
(Scirpus-Typha)

WHEATGRASS-BLUEGRASS
(Agropyron-Poa)

ALPINE MEADOWS AND BARREN
(Agrostis, Carex, Festuca, Poa)

SAGEBRUSH STEPPE
(Artemisia-Agropyron)

GALLETA-THREE AWN SHRUBSTEPPE
(Hilaria-Aristida)

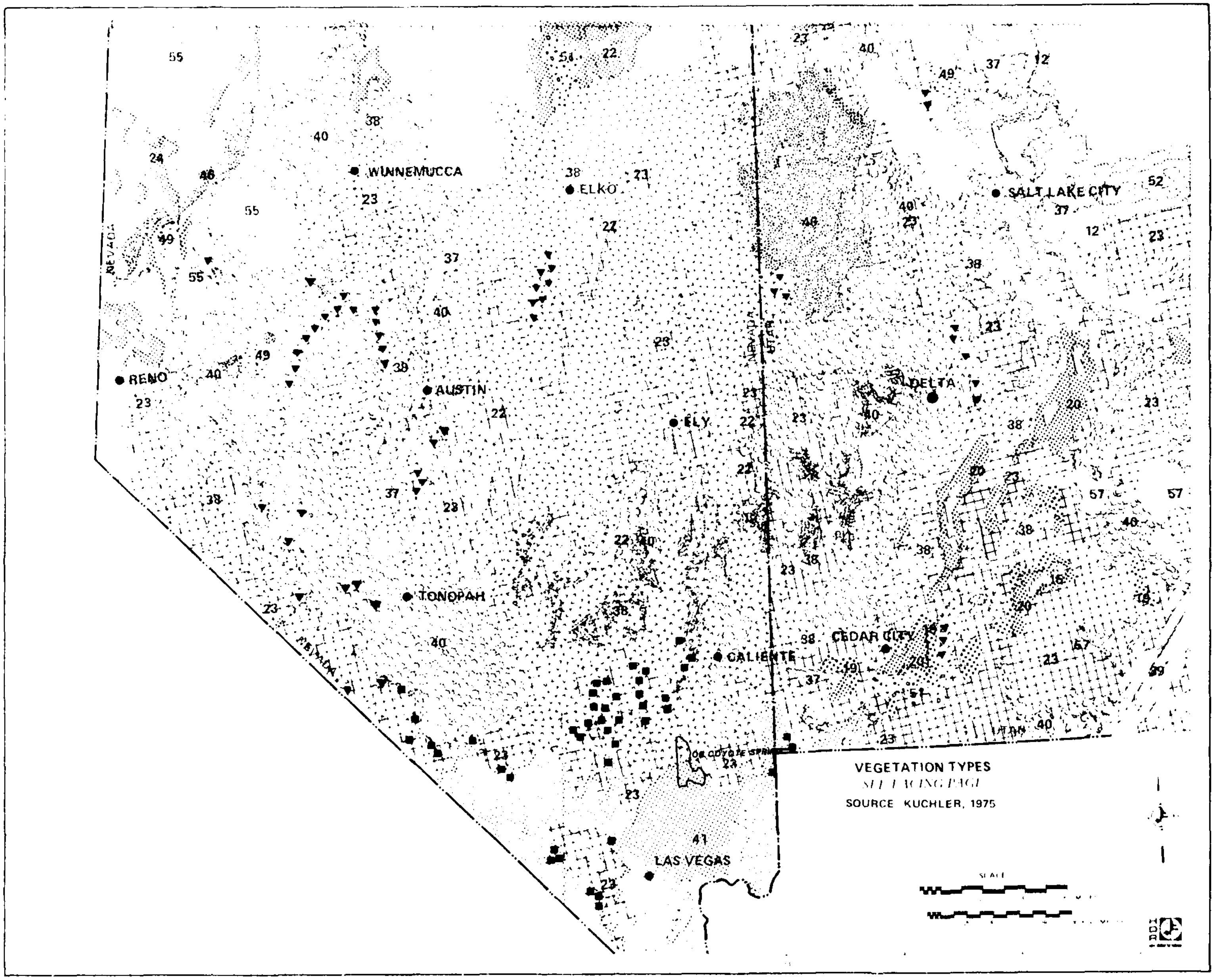
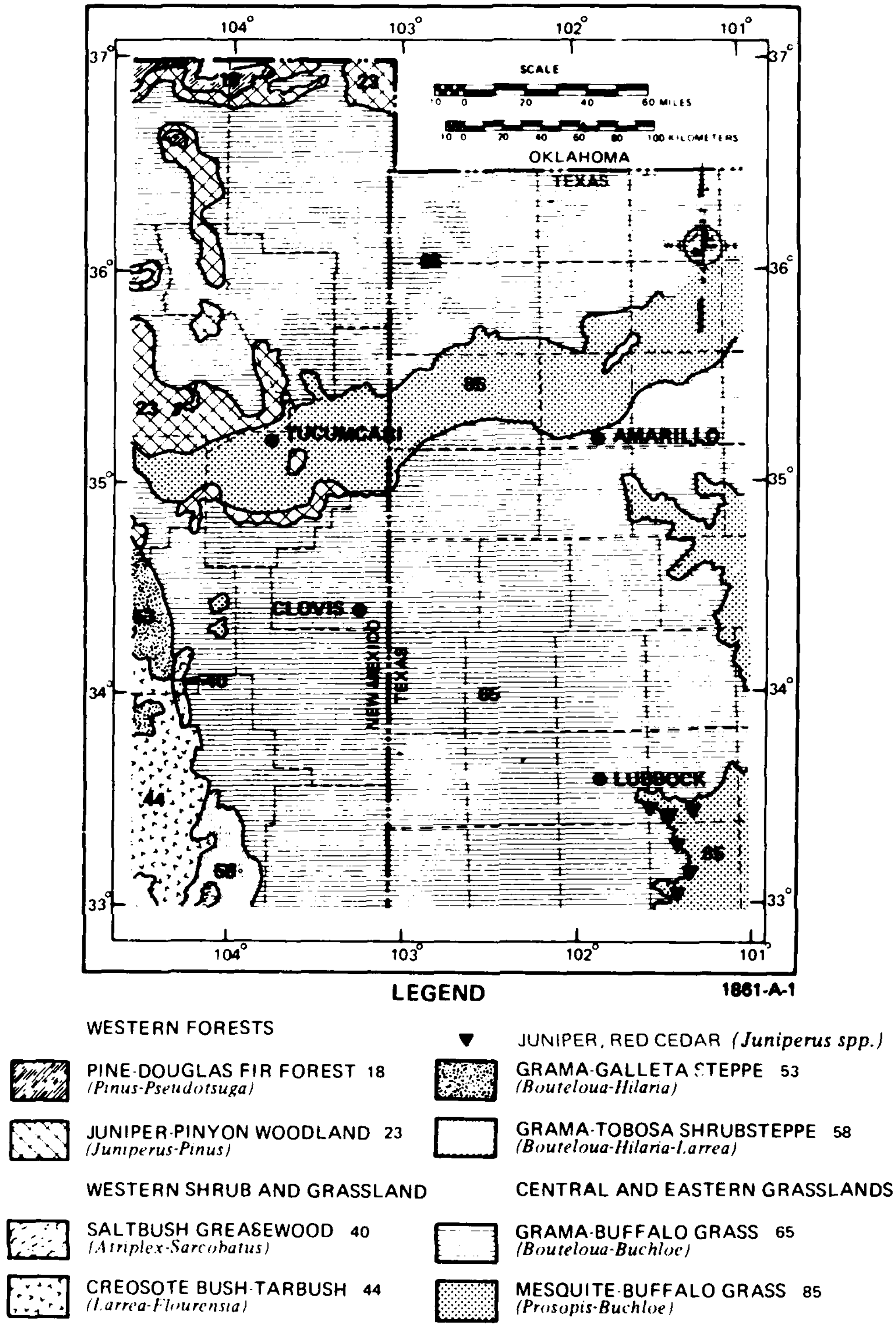


Figure 4.3.2.5-8. Natural vegetation types of the Nevada/Utah study area with Alternative 8 conceptual layout.



SOURCE: KUCHLER, 1975

Figure 4.3.2.5-9. Simplified vegetation map of the Texas/New Mexico study area with Alternative 8 conceptual layout.

Pronghorn

PRONGHORN

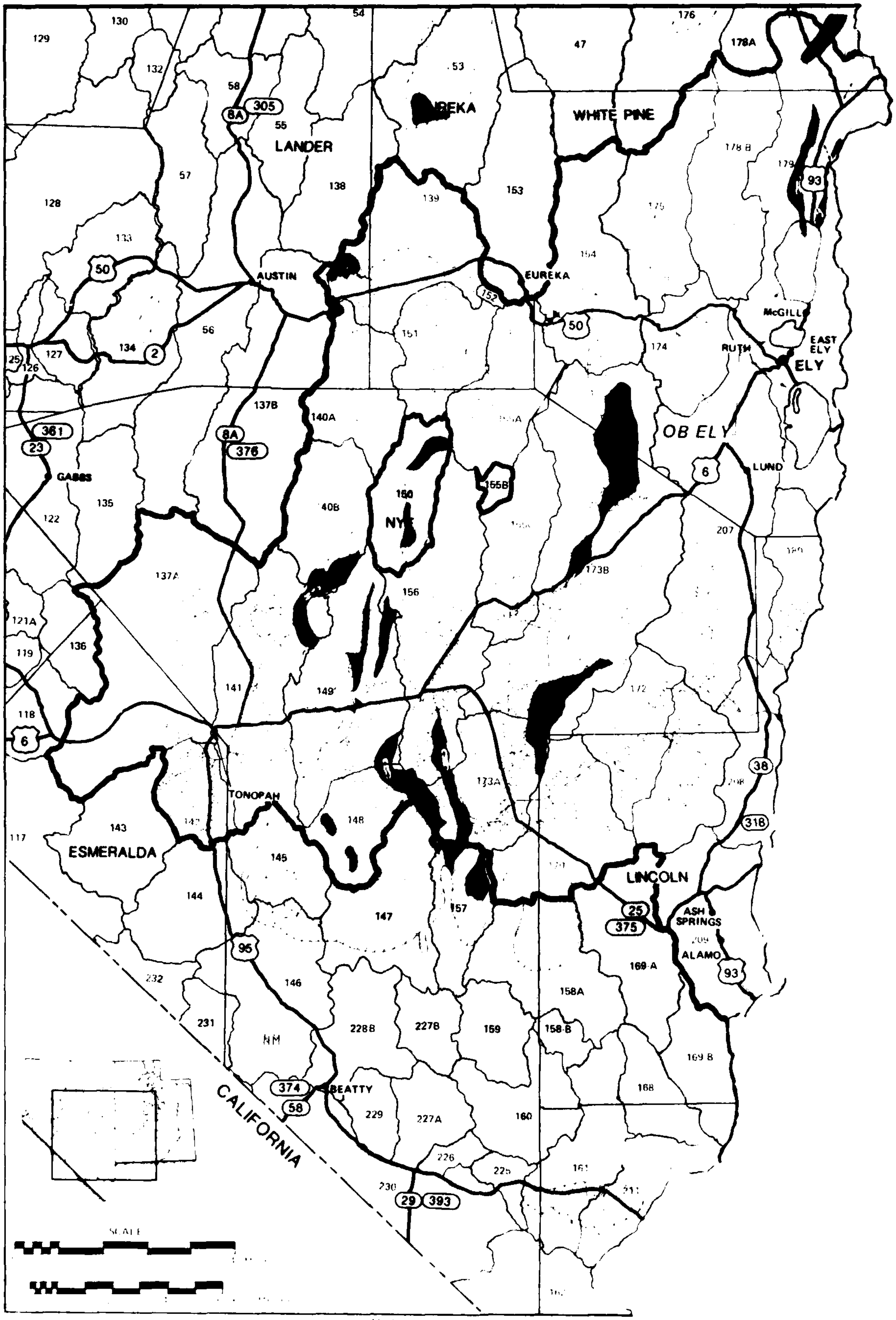
INTRODUCTION (4.3.2.6.1)

Pronghorn are a particularly valuable wildlife resource because they are a prized game animal and have a high aesthetic value. For the 1978 hunting season, 5,163 people applied for the 320 available tags in Utah while 2,625 applied for the 391 available tags in Nevada (Jense and Burruss, 1979; Tsukamoto, 1979). Their abundance and range were greatly reduced in the late 1800s and early 1900s, but present management is assisting population recovery in some areas of the Great Basin. Impact analysis was performed in three steps: (1) a description of project effects on pronghorn, (2) an assessment of the impact (all effects combined) to pronghorn, and (3) a determination of the significance of the impact. Effects were determined by combining baseline information presented in Chapter 3 and ETR-15 with project information. These effects result primarily from construction activities, water use, and recreation activities of project-related people. It was assumed that impacts to pronghorn populations would occur wherever habitat was lost, even if only temporarily (on the order of one year). Since field observations and discussions with wildlife managers indicate that pronghorn will avoid areas up to a distance of about 1 mi from sites under construction, short-term habitat loss was calculated for both the area directly involved in construction and the area within one mile of construction. Long-term habitat loss was calculated for only that area which would be directly involved in construction (where vegetation is lost).

Indirect impacts are more difficult to quantify than are direct impacts. An index of indirect effects was determined in the vicinity of the operating bases. Short-term, indirect impacts in the DDA were also ranked using construction camp location and size, but the values did not change the general levels of impact determined for direct effects. Long-term indirect impacts attributable to project activities in the DDA, excluding operating base effects, are expected to be low because few project personnel would be present in the DDA (except at the ASCs).

PROPOSED ACTION (4.3.2.6.2)

Figure 4.3.2.6-1 shows the relationship between pronghorn range and conceptual project configuration. Since pronghorn do not range throughout the potential



LANDER
EUREKA
WHITE PINE
AUSTIN
McGILL
EAST ELY
RUTH
ELY
LUND
GABBS
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
SCALE

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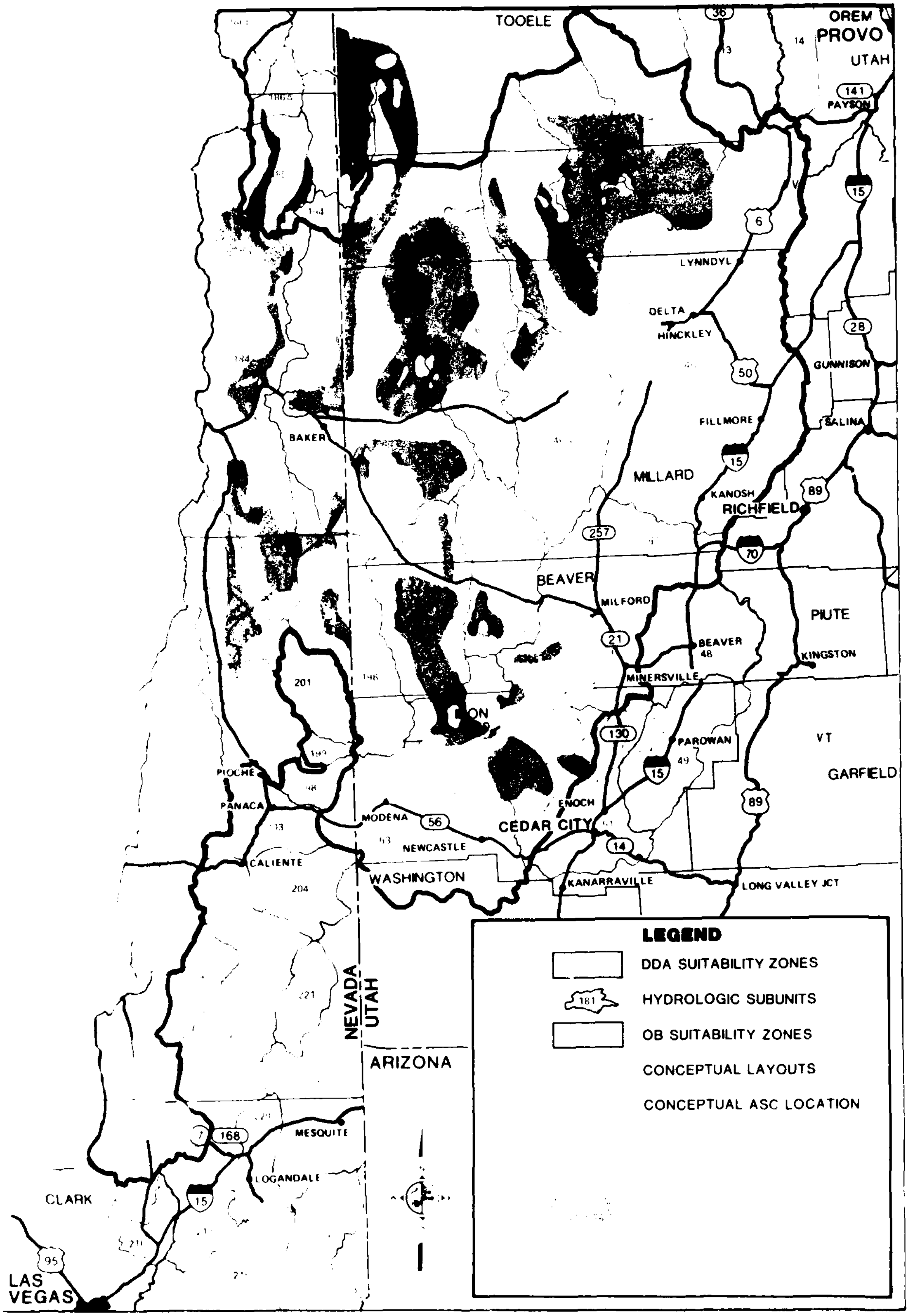

Figure 4.3.2.6-1. Pronghorn distribution and the Proposed Action conceptual layout. 4168-D

deployment area, direct project effects would be limited to the areas where overlap occurs, the greatest effect occurring where key habitat is disturbed. Key habitat is defined by the Nevada Department of Wildlife as areas where pronghorn are most frequently found, and includes water sources important for pronghorn survival, particularly during summer, and kidding areas. The conceptual project configuration for the Proposed Action would have construction activities dispersed throughout much of the key habitat in Lake, Railroad, Hot Creek, and Hamlin valleys in Nevada and in Pine and Tule (White) valleys in western Utah. The project would also intersect large portions of pronghorn range in Fish Creek, Wah Wah, Ralston, Patterson Wash, Lake, Railroad, Hot Creek, Little Smoky, Antelope, Stone Cabin, and Kobeh valleys. Thus, the potential for direct effects from project deployment would be greatest in these areas. Impacts may also be high in other valleys where a smaller percentage of the habitat is affected, such as Snake Valley.

The noise and visual effects of construction activities would occur over an area considerably larger than that actually disturbed during construction. Pronghorn have an acute sense of sight and are not accustomed to construction. The large and dispersed nature of the M-X project coincides with much of the known pronghorn range in the potential deployment area, often dissecting their habitat into small segments which would not provide refuge from construction activities.

PUBLIC COMMENT ON THE DRAFT EIS:

> "It should be noted that key habitats (winter range, fawning areas, etc.) have not been totally or precisely identified so their losses may not be noted until populations decline. Antelope are a mobile species that adapt to small changes in habitat conditions. Storm patterns in the West Desert can cause greatly different forage conditions in one segment of a drainage area compared to another. The antelope will move to the improved range areas if no barrier exists. Thus, because of periodic lack of precipitation in one year, antelope may be absent from one part of their range."

Water use for project construction would cause localized reductions in water table level in the vicinity of source wells which could affect nearby spring-fed pronghorn water sources. Pronghorn are dependent upon key water sources within their range, especially during summer when vegetation moisture content is relatively low (Beale and Smith, 1970). Water table depression could seriously threaten some of these key water sources. Well locations have not been determined at this time, and consequently, potential for impact to specific pronghorn water sources cannot presently be determined.

Indirect effects resulting from recreational activities of construction workers and operations personnel would occur in areas where the project overlaps pronghorn range, as well as in the vicinity of construction camps or operating bases (OBs). Impacts of siting OBs in regions inhabited by pronghorn are primarily associated with increased human population. Water effects would be the same as described above for construction effects, but would be long term. In addition, an increase in human population would result in an increase in hunters, fishermen, picnickers, and ORV enthusiasts. Pronghorn are nervous animals that are easily disturbed by human activity. The HDR pronghorn field study (details in ETR-15) has documented avoidance of vehicles, interruption of normal behavior patterns, and increased foraging effort associated with vehicular disturbance to Great Basin pronghorn. Thus, ORV use and travel through key pronghorn habitat could be expected to significantly affect pronghorn populations by increasing foraging stress and escape efforts to the point of energy imbalance and declining reproductive rates. Increased human population would also increase poaching of pronghorn in areas surrounding population centers. Illegal hunting is extremely difficult to measure, and may be as large or greater than the legal harvest (Pursley, 1977). For conservative estimates, present illegal hunting of pronghorn was assumed to be 75 percent of the legal harvest and would increase 50 percent with a 100 percent increase in human population. For worst-case estimates, illegal hunting was assumed to be 150 percent of the legal harvest and to increase 100 percent with 100 percent increase in human population. These increases were assumed to affect pronghorn populations within 50 mi of OB locations; therefore, calculations were based on 1978 legal harvest figures (Tsukamoto, 1979; Jense and Burruss, 1979) for pronghorn management units within 50 mi of OB locations.

DDA Impacts

As noted above, the project could affect pronghorn through construction activities, water use, and off-duty activities of construction personnel. Placement of facilities would result in habitat loss through removal of vegetation and pronghorn avoidance of construction activities. A further loss of habitat would occur if project activity restricted movement or access to water. Consumption of water during construction might cause a loss of surface water in springs. If this occurred, the carrying capacity of the existing pronghorn range could be reduced. Such effects, however, could be mitigated as discussed below and in ETR-38. Increased human activity, including poaching, harassment, habitat degradation and increased highway mortality, would also affect pronghorn.

Implementation of other projects such as the Anaconda Molybdenum project near Tonopah, White Pine Power Project (WPPP) in White Pine County, Pine Grove Molybdenum project (Pine Valley), Allen-Warner project in Dry Lake Valley, Alunite mine in Wah Wah Valley, and Intermountain Power Project (IPP) near Delta would compete for resources (e.g., water) and cause additional land disturbances and population growth. However, the effects of construction activities associated with these projects would be small compared to that for M-X, the exception being water use. The cumulative effects of water use, especially in areas where water availability is limited, could be measurable. For example, water use for the IPP could compound the effect of M-X water use in the Delta area. Cumulative effects of water consumption on pronghorn in the vicinity of other projects would depend upon amount of water used, water availability, aquifer properties, and timing of use by M-X and other projects. As for the combined indirect effects on pronghorn caused by human population growth, the incremental increase resulting from construction and operation of the other projects would be small compared to that for M-X, except in the case of IPP near Delta where population increases will be similar to those anticipated for M-X.

M-X would have the greatest affect on pronghorn during the construction phase, since this is when intense activity would be widespread in their habitat. Mortality resulting from habitat loss and poaching would decrease herd size during this time. After completion of construction, pronghorn would likely repopulate the remaining suitable habitat, either from contiguous undisturbed areas or through transplants made by wildlife departments. Pronghorn population levels would be expected to stabilize at new lower levels. Levels would depend upon the amount and type of habitat permanently lost (e.g., marginal range versus key habitat), the rate of recovery (revegetation) of temporarily disturbed areas, and behavioral responses to the presence and operation of the facilities. The time required for population recovery would be site specific, determined by habitat quality and climatic factors. Recovery should occur, but it could take approximately 10 to 20 years, assuming intensive management and no unusually severe climatic conditions (e.g., drought).

The effects of M-X construction would reduce pronghorn abundances in the short-term where project activity occurs in substantial portions of their range or any key habitat. The absolute level of this reduction cannot be reasonably estimated, but a worst case would be direct extirpation or eventual complete loss in some areas through depression of numbers to below the level necessary for maintenance, possibly in Hamlin, Wah Wah, Pine, Dugway, Kobeh, or Lake valleys. Where pronghorn numbers are not reduced below this threshold, long-term pronghorn abundance, however, would be reduced very little since mitigation and management should bring pronghorn populations back to near preproject levels. The reduction in long-term abundance, as compared to future predictions without M-X, would be related to amount of habitat lost.

PUBLIC COMMENTS ON THE DRAFT EIS:

> "It is doubtful to the Fauna Review Team that the mitigation and management can, in fact, restore antelope populations back to pre-project level. Who will fund such mitigation and management? What are the mitigations and management strategies that are referred to?"
>
> "The state is not as optimistic as the Air Force and its consultants that drastically reduced antelope herds will be restored to preproject levels in the long-term. Documentation should be provided or it should be deleted in the FEIS."
>
> "Because of marginal habitat, destruction of this habitat, harassment and poaching, pronghorn populations probably cannot survive the M-X. We see extirpation for most populations, and the EIS ought to mention this."

The small amount of pronghorn habitat which would be permanently lost represents an irreversible and irretrievable commitment of resources. On the other hand, loss of pronghorn attributed to this habitat loss could be recovered through mitigation measures (see below and ETR-38).

The consequences of the previously discussed effects on pronghorn would be a reduction of their numbers. The greatest reduction would occur during construction in valleys where key habitat was lost, followed by recovery to new levels. This in turn would reduce recreational opportunities such as hunting, photography, and observation. Since pronghorn are a prized game animal with limited numbers in the potential deployment area, any measureable decrease in number is likely to be perceived as a significant impact, even if only short term. Such perceived impacts would occur primarily in those valleys where project activities were extensively dispersed throughout pronghorn range or in any key habitat.

The effects from construction activities are generally unavoidable because they result largely from pronghorn behavior, which cannot be easily modified. Pronghorn are known to habituate to some types of human disturbances, but this requires a longer period of time than that for project construction and often requires intensive management. The effects from people and water use are largely avoidable and can be mitigated.

Predicted effect levels are summarized in Table 4.3.2.6-1 for each hydrologic subunit in which project elements would be deployed for the Proposed Action. Indirect effects could occur in subunits with no project elements as a result of recreation by construction workers, but these were assumed to be insignificant for this level of analysis. From the table, it can be seen that signficant (high) short-term impacts would likely occur in 21 of the 41 subunits. Of the remaining 20 hydrologic subunits, 15 are not inhabited by pronghorn and no significant impacts would occur in the other 5. The presence of project elements within key habitat was the major reason for the determination of significant impact (in 18 of 21 hydrologic subunits). The short-term key habitat loss, including the 1 mi avoidance factor, ranged from zero to 95 percent (Hot Creek Valley) with the majority exceeding 40 percent. The loss of range, other than key habitat, exceeded 50 percent of that present in 11 hydrologic subunits. Kobeh, Antelope, and Little Smoky valleys were the only ones in which this occurred with no loss of key habitat. Long-term impacts to pronghorn were predicted to be much lower than those predicted for the short-term. The actual habitat disturbed during construction was calculated to be less than 5 percent of the available habitat in all hydrologic subunits (Table 4.3.2.6-1). Other factors, however, could act to increase the area of habitat loss through behavioral responses of pronghorn to the presence and operation of the various facilities. Loss of even a small amount of key habitat could impact pronghorn populations, particularly if the kidding areas were affected, but loss of small amounts of range would not be likely to have any measureable long-term impact on pronghorn.

In response to the Draft EIS, the state of Nevada commented that estimated numbers of pronghorn should have been used to describe the populations and potential impacts. An adequate analysis of impacts, in their estimation, would require specific data for each herd unit or valley using more detailed maps than presented in the EIS, and the impacts should be presented by herd unit, not just for the entire study area. This detailed impact anlaysis was not performed in preparing this EIS because it is not necessary for comparison of the alternatives presented; this EIS is for selection of a deployment area. More detailed analyses would be necessary for siting within the deployment area, when it is chosen.

PUBLIC COMMENT ON THE DRAFT EIS:

"The sum of direct and indirect impacts on antelope populations within the DDA will result in a loss in excess of 50 percent of the

Table 4.3.2.6-1. Potential direct impacts to pronghorn in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Hydrologic Subunit Name	Habitat Type Present	Short-Term Habitat Loss (Percent)[2] Range	Short-Term Habitat Loss (Percent)[2] Key	Short-Term Impact[1,3]	Long-Term Habitat Loss (Percent) Range	Long-Term Habitat Loss (Percent) Key	Long-Term Impact[1,3]
	Subunits with M-X clusters and DTN							
4	Snake, Nev./Utah	Key	35	45	*****	1	1	***
5	Pine, Utah	Key	25	65	*****	1	2	***
6	White, Utah	Key	20	90	*****	0	2	***
7	Fish Springs, Utah	Key	85	15	*****	1	1	***
8	Dugway, Utah	Key	10	55	*****	0	1	***
9	Government Creek, Utah	Key	25	30	*****	1	1	***
46	Sevier Desert, Utah	Key	16	50	*****	1	2	***
46A	Sevier Desert-Dry Lake, Utah[4]	Key	35	25	*****	1	1	***
54	Wah Wah, Utah	Key	95	50	*****	2	1	***
137A	Big Smoky-Tonopah Flat, Nev.	None	0	0	-	0	0	-
139	Kobeh, Nev.	Key	55	0	*****	1	0	*
140A	Monitor-North, Nev.	Range	0	0	-	0	0	-
140B	Monitor-South, Nev.	Key	0	0	-	0	0	-
141	Ralston, Nev.	Key	80	35	*****	2	2	***
142	Alkali Spring, Nev.	None	0	0	-	0	0	-
148	Cactus Flat, Nev.	Key	6	0	-	0	0	-
149	Stone Cabin, Nev.	Key	55	30	*****	1	1	***
151	Antelope, Nev.[4]	Range	75	0	*****	5	0	*
154	Newark, Nev.	None	0	0	-	0	0	-
155A	Little Smoky-North, Nev.	None	0	0	-	0	0	-
155C	Little Smoky-South, Nev.[4]	Range	65	0	*****	2	0	*
156	Hot Creek, Nev.	Key	65	95	*****	2	1	***
170	Penoyer, Nev.	Range	0	0	-	0	0	-
171	Coal, Nev.	None	0	0	-	0	0	-
172	Garden, Nev.	None	0	0	-	0	0	-
173A	Railroad-South, Nev.	Key	72	74	*****	2	2	***
173B	Railroad-North, Nev.	Key	45	63	*****	1	1	***
174	Jakes, Nev.	None	0	0	-	0	0	-
175	Long, Nev.	None	0	0	-	0	0	-
178B	Butte-South, Nev.	None	0	0	-	0	0	-
179	Steptoe, Nev.	Key	0	0	-	0	0	-
180	Cave, Nev.	None	0	0	-	0	0	-
181	Dry Lake, Nev.[4]	None	0	0	-	0	0	-
182	Delamar, Nev.	None	0	0	-	0	0	-
183	Lake, Nev.	Key	85	85	*****	1	1	***
184	Spring, Nev.	Key	2	10	*****	1	1	***
196	Hamlin, Nev./Utah	Key	40	80	*****	1	2	***
202	Patterson, Nev.	Key	80	45	*****	1	1	***
207	White River, Nev.	None	0	0	-	0	0	-
208	Pahroc, Nev.	None	0	0	-	0	0	-
209	Pahranagat, Nev.	None	0	0	-	0	0	-
	DDA Impact		40	45	*****	1	1	***

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Habitat loss during construction, including a 1 mi avoidance effect zone around all construction activities.

[3] Loss of any key habitat or more than 25 percent of range in hydrologic subunit or county is considered high impact. Loss of 25 percent or less of range is considered moderate to low impact. Any key habitat loss remaining after construction could cause a moderate impact, and any long-term loss of range could cause a low impact.

[4] Conceptual location of Area Support Center (ASC).

population depending upon actual locations of human activity, shelters, roads and fences in relation to overall herd parameters and behavior. ETR-15 indicates a short-term key habitat disturbance of 45 percent. We believe this impact will be long-term to the antelope resource and this coupled with indirect impacts could be expected to cause a population decline probably exceeding 50 percent (NDOW and Fauna Review Team members). These impacts could be short and long-term in effect depending upon the ability of individual herds to recover or respond."

Coyote Spring Valley OB Impacts

Pronghorn do not inhabit the southern Nevada area near Coyote Spring Valley and, thus, would not be affected by location of an Operating Base in that vicinity.

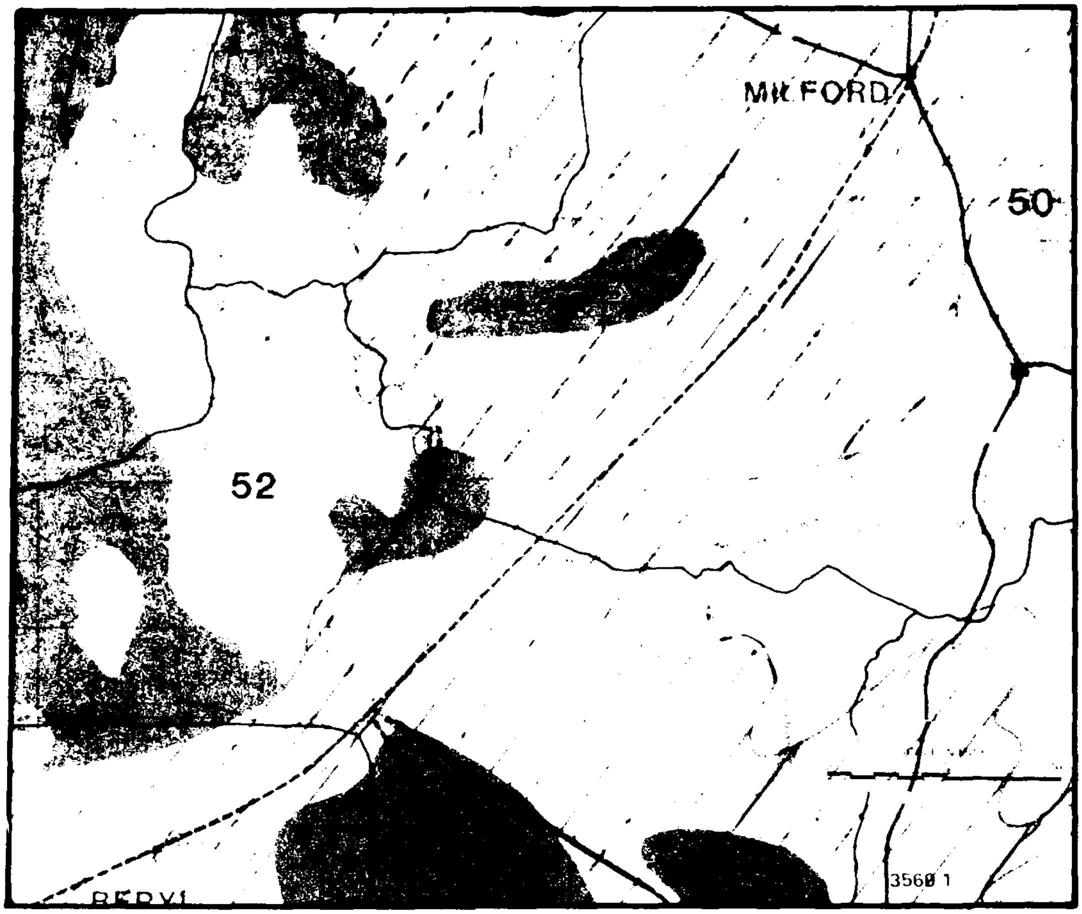
Milford OB Impacts

Figure 4.3.2.6-2 shows the relationship between pronghorn distribution and the operating base suitability zone around Milford. The OB suitability zone at Milford is located within pronghorn habitat in the Escalante Desert and encompasses four patches of key pronghorn habitat including the area along the southern base of Topache Peak, the Shauntie Hills and White Mountain, and the area along the eastern and southern slopes of the southeast end of the Wah Wah Mountains. Construction of the Milford OB would eliminate up to 4,500 acres of key habitat. OB construction and subsequent human activity in the OB vicinity would also substantially affect pronghorn use of key habitats; extirpation of pronghorn in these areas would be likely. Water consumption could further impact these habitats by destroying key water sources as discussed for the DDA. Avoiding key habitat by locating the OB southeast of the Union Pacific railroad tracks and north of Lund should reduce these effects.

An influx of an estimated 15,400 permanent residents to the Milford area would affect other pronghorn populations in Pine Valley, Hamlin Valley, Wah Wah Valley, Snake Valley, Tule Valley (White Valley hydrologic subunit), Parowan Valley, and the Sevier and Escalante deserts (Milford, Cedar City, Lund, and Beryl-Enterprise hydrologic subunits). Off-road vehicle use in the Escalante Desert would probably be high, and would threaten the already low pronghorn population in the Milford area and in key habitat south of Lund. ORV use in Pine, Hamlin, and Wah Wah valleys would also increase to a much lesser extent.

The 1978 legal harvest in the two Utah herd units within 50 mi of Milford (see Section 3.2.3.8 for Utah Game Management area locations) was 34 pronghorn (Jense and Burruss, 1979); a conservative estimate of illegal hunting loss resulting from the 230 percent population increase in Beaver County is 30 pronghorn; a worst case estimate is 115 animals. The combined effect of ORV use and illegal hunting would undoubtedly impact populations in the Sevier Desert, Hamlin, Pine, and Wah Wah valleys, and might affect populations in Snake, Parowan, and Tule valleys, as well. Other projects in the area are not expected to change these effects.

The impact of locating an OB near Milford would persist throughout the lifetime of the M-X system. Pronghorn populations in the region would not recover until M-X personnel left the area, due to the continued effect of the activities of



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LEGEND

PRONGHORN DISTRIBUTION
IN THE VICINITY OF MILFORD OPERATING BASE

RANGE

KEY HABITAT

Figure 4.3.2.6-2. Pronghorn distribution and the Milford OB vicinity.

15,400 people. During the peak construction period, the impacts would be slightly greater because of higher population levels in the Milford area. The impact of this large human population growth would be largely unavoidable. Pronghorn abundance would decline in this area, with an associated decline in both consumptive (e.g., hunting) and nonconsumptive use (e.g., photography and animal observation). Undoubtedly, some Milford residents would experience a reduction in their aesthetic enjoyment of the region because of decrease or extirpation of pronghorn populations. This would be perceived as significant to some proportion of the area's population.

Certain measures might effectively mitigate impacts to pronghorn in the Milford area. These include locating the OB so as to avoid key habitat within the OB suitability zone, and constructing artificial water sources outside of key areas where water table depression is identified, through further project planning and environmental analysis, to be a serious threat. Restricting ORV use in key habitats and increasing law enforcement activities in pronghorn range to reduce illegal hunting might also be helpful.

A summary of potential impact to pronghorn due to OB locations for the Proposed Action is presented in Table 4.3.2.6-2.

ALTERNATIVE 1 (4.3.2.6.3)

DDA Impacts

The DDA configuration for Alternative 1 is the same as that for the Proposed Action, and the DDA impacts are the same.

Coyote Spring Valley OB Impacts

Pronghorn do not inhabit the region around Coyote Spring Valley and would not be affected by locating an OB in that area.

Beryl OB Impacts

Figure 4.3.2.6-3 shows the relationship between pronghorn distribution and the operating base suitability area around Beryl. The OB suitability zone near Beryl occupies pronghorn range in the Escalante Desert. Approximately 100 sq mi of key habitat is located around Table Butte 10 mi east of Beryl. The removal of 4,500 acres of pronghorn range for construction of the OB would have a significant impact on pronghorn if the OB were located in the Table Butte key habitat. Recreation use and poaching by M-X personnel could also significantly affect pronghorn populations in the region as discussed previously for the Milford OB in the Proposed Action.

Pronghorn in Hamlin Valley, Pine Valley, Wah Wah Valley and the Escalante Desert (Milford, Cedar City, Lund, and Beryl-Enterprise hydrologic subunits) would most likely suffer to some extent from an estimated permanent human population increase of 14,400. Pronghorn populations in Parowan, Patterson, and Lake Valleys could potentially be affected, and the impact to the Table Butte animals would likely be significant even if the OB is not located in the Table Butte area. Increased human activity with no mitigation could eliminate pronghorn from Table Butte key habitat, but some effort to reduce ORV and poaching effects could hold losses to a

Table 4.3.2.6-2. Potential overall impact to pronghorn resulting from construction and operation of M-X operating bases for the Proposed Action, Alternatives 1-6, and the Nevada/Utah portion of Alternative 8.

No.	Hydrologic Subunit Name	Habitat Type Present	Impact[1] Proposed Action Coyote Spring/ Milford	Alt. 1 Coyote Spring/ Beryl	Alt. 2 Coyote Spring/ Delta	Alt. 3 Beryl/ Ely	Alt. 4 Beryl/ Coyote Spring	Alt. 5 Milford/ Ely	Alt. 6 Milford/ Coyote Spring	Alt. 8 Coyote Spring/ Clovis
	Subunits within OB Suitability Zone									
46	Sevier Desert, Utah	Key	-	-	*****	-	-	-	-	-
46A	Sevier Desert-Dry Lake, Utah[2,3]	Key	*****	-	*****	-	-	*****	*****	-
50	Milford, Utah	Key	*****	*****	-	*****	*****	*****	*****	-
52	Lund District, Utah	Key	*****	*****	-	*****	*****	*****	*****	-
53	Beryl-Enterprise, Utah	Key	*****	*****	-	*****	*****	*****	*****	-
179	Steptoe, Nev.	Key	-	-	-	*****	-	*****	-	
210	Coyote Spring, Nev.	None	-	-	-	-	-	-	-	-
219	Muddy River Springs, Nev.	None	-	-	-	-	-	-	-	-
	Other Affected Subunits									
4	Snake, Nev./Utah	Key	-	-	*****	*****	-	*****	-	-
5	Pine, Utah[3]	Key	*****	*****	*****	*****	*****	*****	*****	-
6	White, Utah	Key	-	-	*****	-	-	-	-	-
7	Fish Springs, Utah	Key	-	-	*****	-	-	-	-	-
8	Dugway, Utah	Key	-	-	*****	-	-	-	-	-
9	Government Creek, Utah	Key	-	-	*****	-	-	-	-	-
49	Parowan, Utah	Range	***	***	-	***	***	***	***	-
51	Cedar Spring, Utah	Key	*****	*****	-	*****	*****	*****	*****	-
54	Wah Wah, Utah	Key	*****	*****	*****	*****	*****	*****	*****	-
155	Little Smoky-North and South, Nev.	Range	-	-	-	***	-	***	-	-
183	Lake, Nev.	Key	-	*****	-	*****	*****	*****	-	-
184	Spring, Nev.	Key	-	-	-	*****	-	*****	-	-
185	Tippett, Nev.	Key	-	-	-	*****	-	*****	-	-
196	Hamlin, Nev./Utah	Key	*****	*****	-	*****	*****	*****	*****	-
202	Patterson, Nev.	Key	-	*****	-	*****	*****	-	-	-
	Alternative Impact		*****	*****	*****	*****	*****	*****	*****	-

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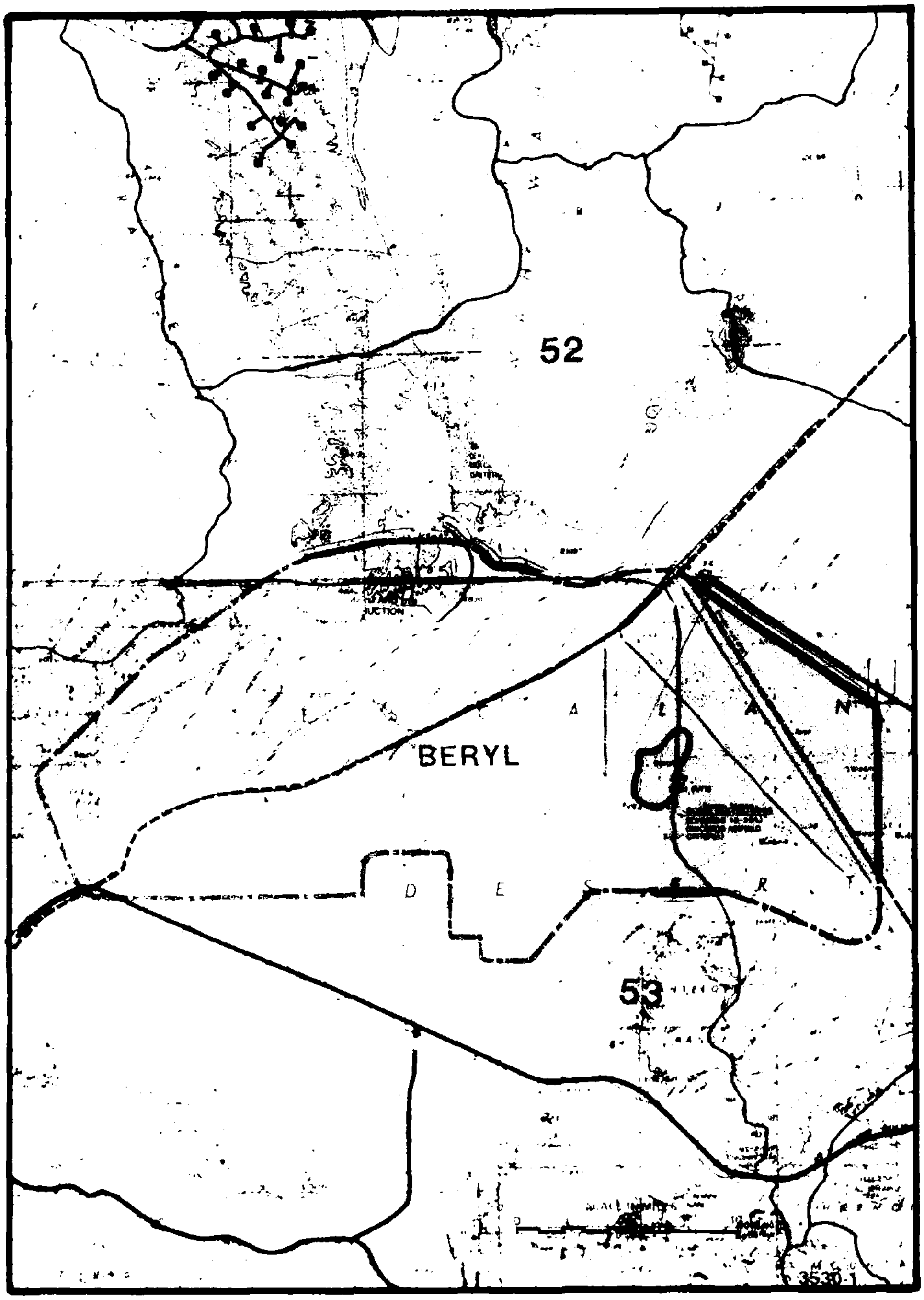
[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.
No impacts are expected for Alternative 7 or the Clovis DB for Alternative 8.

[2] Conceptual location of Area Support Centers (ASCs) for Proposed Action and Alternatives 1-6.

[3] Conceptual location of Area Support Centers (ASCs) for Alternative 8.



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LEGEND

PRONGHORN DISTRIBUTION
IN THE VICINITY OF BERYL OPERATING BASE

RANGE

KEY HABITAT

Figure 4.3.2.6-3. Pronghorn distribution and the Beryl OB vicinity.

moderate reduction in population. Water consumption by 14,400 residents could threaten important pronghorn water sources near Table Butte. If water table depression were great enough to dry up key water sources, pronghorn would be displaced from the area. Proposed developments other than M-X in the Beryl vicinity are not expected to significantly affect pronghorn.

The impact of an OB site at Beryl would persist throughout the lifetime of the M-X project. No significant recovery of the pronghorn resource would occur until M-X personnel vacated Beryl. During the peak construction period, impacts would be slightly greater because of higher population levels in the Beryl area. Because pronghorn are a highly valued resource for both consumptive and nonconsumptive use, the decline in Escalante Desert pronghorn would be perceived as a significant negative impact by many area residents, especially if the effects were unmitigated.

Some impact to the Table Butte pronghorn would be unavoidable if an OB were situated at Beryl. However, the magnitude of the impact could be reduced through some mitigation measures such as locating the OB in the western part of the suitability zone, restricting ORV use, and providing artificial water sources.

A summary of potential impact to pronghorn due to OB locations for Alternative 1 is presented in Table 4.3.2.6-2.

ALTERNATIVE 2 (4.3.2.6.4)

DDA Impacts

DDA impacts are the same as those discussed for the Proposed Action.

Coyote Spring Valley OB Impacts

Pronghorn do not inhabit the region around Coyote Spring Valley and would not be affected by locating an OB in that area.

Delta OB Impacts

The proposed OB at Delta, Utah is situated on the edge of pronghorn range in the Sevier Desert. The removal of 4,500 acres of potential pronghorn range to construct the OB should have no significant effect on pronghorn populations (see Figure 4.3.2.6-4). The most serious threat to Sevier Desert pronghorn posed by a Delta OB would be harassment by recreationists and poaching, especially in the Desert Mountain area 25 mi north of Delta. Harassment by ORV users could potentially decrease use of this key habitat by pronghorn, but the presence of a great deal of suitable ORV use area closer to Delta should render these effects insignificant. The 1978 legal harvest in the three management areas within 50 mi of Delta was 53 pronghorn (Jense and Burruss, 1979). A conservative estimate of illegal hunting loss resulting from the 114 percent population increase in Millard County is 25 pronghorn; a worst-case estimate is 90 animals (see Proposed Action for method of calculation). This could affect important pronghorn populations in the Sevier Desert, Tule Valley (White Valley hydrologic subunit), Wah Wah Valley, Pine Valley, and Snake Valley. Pronghorn in Fish Springs, Dugway, and Government Creek valleys could also suffer impacts, but losses should not be significant. Any impacts due to OB siting in Delta would persist for the duration of the M-X project. During

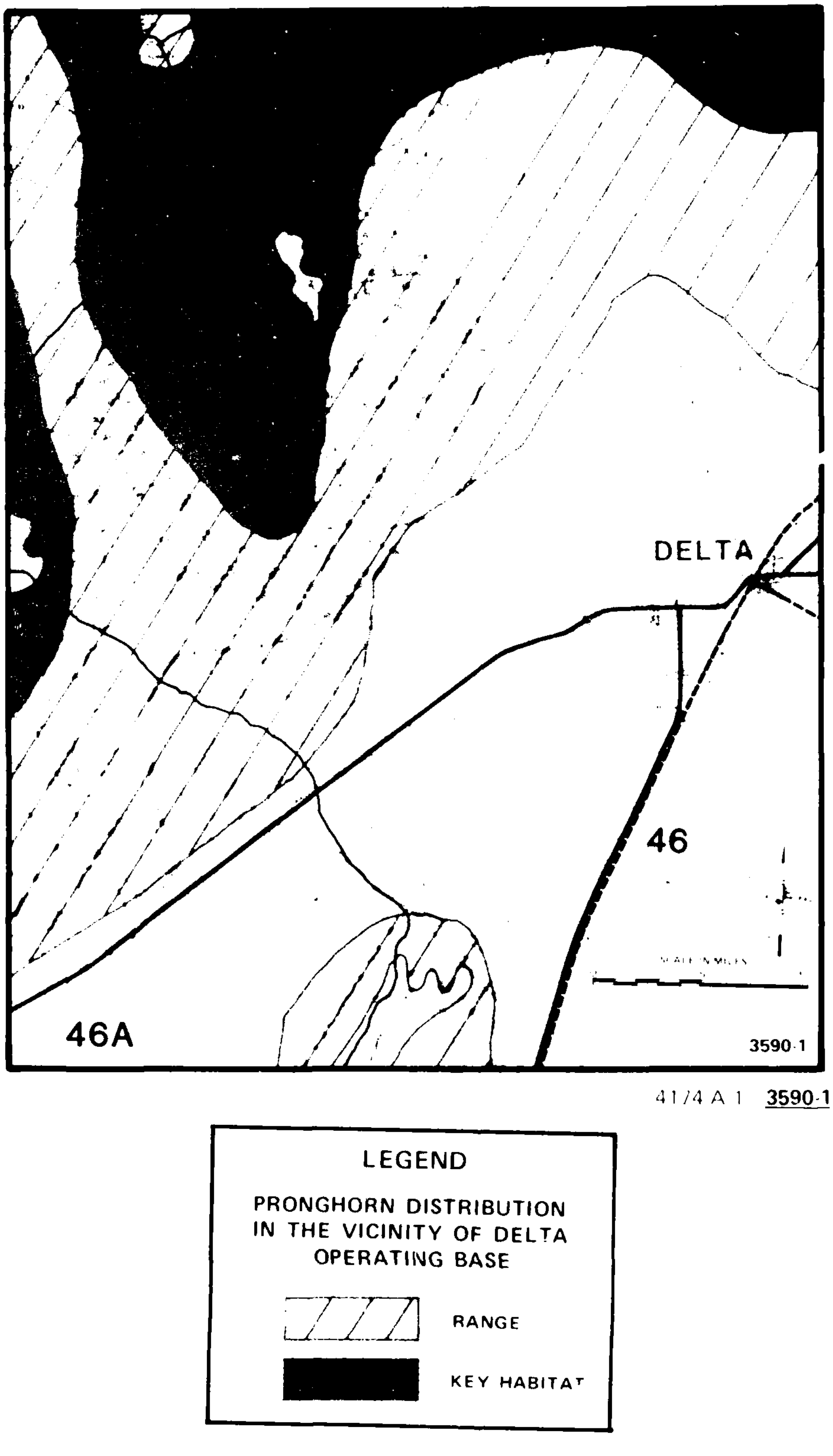

Figure 4.3.2.6-4. Pronghorn distribution and the Delta OB vicinity.

the peak construction period, impacts would be slightly greater because of higher population levels in the Delta area. Mitigation possibilities include restricting ORV use and increased patrolling of pronghorn key habitat. A summary of potential impact to pronghorn due to OB locations for Alternative 2 is presented in Table 4.3.2.6-2.

ALTERNATIVE 3 (4.3.2.6.5)

DDA Impacts

In Alternative 3, the DDA remains the same as for the Proposed Action with the same potential impacts.

Beryl OB Impacts

Impacts of an OB located near Beryl, Utah are discussed under Alternative 1. Having Beryl as a primary base would remove an estimated 8,000 acres of pronghorn habitat in the Beryl area and would add approximately 19,870 permanent residents. These figures differ from those in Alternative 1, and the greater number of residents would proportionally increase the indirect effects of Alternative 3.

Ely OB Impacts

The proposed OB location near Ely, Nevada would not eliminate any key pronghorn habitat unless it were located in the extreme northern end of the suitability zone near Warm Springs (see Figure 4.3.2.6-5). If located north of Warm Springs, OB construction would eliminate 4,500 acres of pronghorn habitat and up to 600 acres of key habitat. This might not significantly impact pronghorn populations, but construction and subsequent human activity in these areas would pose a major threat to Steptoe Valley pronghorn. Additional impacts of an OB near Ely would stem from the indirect effects of the movements and recreational activities of an estimated 15,400 additional permanent residents in the Ely region. Spring Valley, northern Steptoe Valley, Snake Valley, and Tippett Valley support some of the largest pronghorn populations in the potential M-X deployment area and include large areas of key habitat. Increased recreation pressure from fishermen, hunters, campers and ORV enthusiasts in the key habitat areas would affect pronghorn to some extent. The effects of increased vehicular travel through key habitats to favored fishing, hunting, and camping spots in the Schell Creek Range could greatly impact pronghorn populations if not properly controlled. Pronghorn in Lake Valley could also be affected. The 1978 legal harvest in the 4 management areas within 50 mi of Ely was 37 pronghorn (Tsukamoto, 1979). Pronghorn losses due to illegal hunting in Spring and Steptoe valleys would increase by an estimated 25 to 95 animals as a result of an estimated 174 percent human population increase in White Pine County. Some impact to pronghorn resources would be inevitable, but the magnitude and significance of the impact is speculative. It is reasonable to predict a reversal in the present increasing population trend, but the extent of this might not be significant. Because these effects would result from increased human population levels associated with an Ely OB, they would persist throughout the lifetime of the M-X project. During the peak construction period, impacts would be slightly greater because of higher population levels in the Ely area. Measures that could mitigate the impact of an Ely OB include restricting vehicular access to key pronghorn habitats and increased patrolling to reduce illegal hunting.

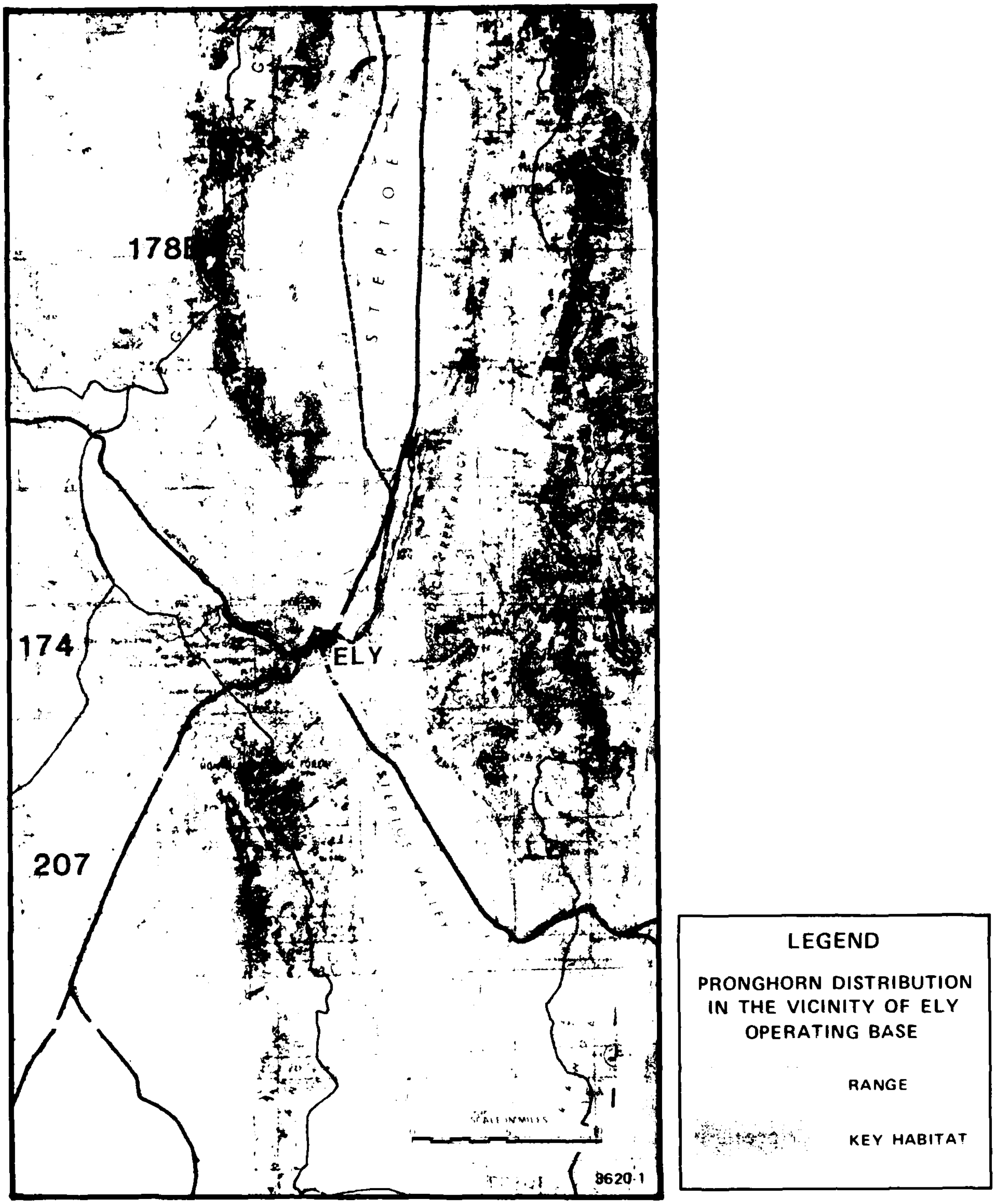

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Figure 4.3.2.6-5. Pronghorn distribution and the Ely OB vicinity.

A summary of potential impact to pronghorn due to OB locations for Alternative 3 is presented in Table 4.3.2.6-2.

ALTERNATIVE 4 (4.3.2.6.6)

DDA Impacts

The DDA in Alternative 4 is the same as that for the Proposed Action; the potential impacts would be identical to those described for it.

Beryl OB Impacts

Impacts for the proposed OB location at Beryl are discussed under Alternatives 1 and 3.

Coyote Spring Valley OB Impacts

Pronghorn do not inhabit the region around Coyote Spring Valley and would not be affected by locating an OB in that area.

A summary of potential impact to pronghorn due to OB locations for Alternative 4 is presented in Table 4.3.2.6-2.

ALTERNATIVE 5 (4.3.2.6.7)

DDA Impacts

Impacts for Alternative 5 are the same as for the Proposed Action.

Milford OB Impacts

Using Milford as the primary operating base would remove an estimated 8,000 acres of pronghorn habitat in the Milford area and add approximately 21,350 permanent residents. These figures differ from those in the Proposed Action, and the greater number of residents would proportionally increase the indirect effects of Alternative 5.

Ely OB Impacts

Impacts for the proposed OB location at Ely are discussed under Alternative 3.

A summary of potential impacts to pronghorn due to OB locations for Alternative 5 is presented in Table 4.3.2.6-2.

ALTERNATIVE 6 (4.3.2.6.8)

DDA Impacts

For Alternative 6, the DDA potential impacts would be the same as for the Proposed Action.

Milford OB Impacts

Impacts for the proposed OB location at Milford are discussed under the Proposed Action and Alternative 5.

Coyote Spring Valley OB Impacts

Pronghorn do not inhabit the region around Coyote Spring Valley and would not be affected by locating an OB in that area.

A summary of potential impacts to pronghorn due to OB locations for Alternative 6 is presented in Table 4.3.2.6-2.

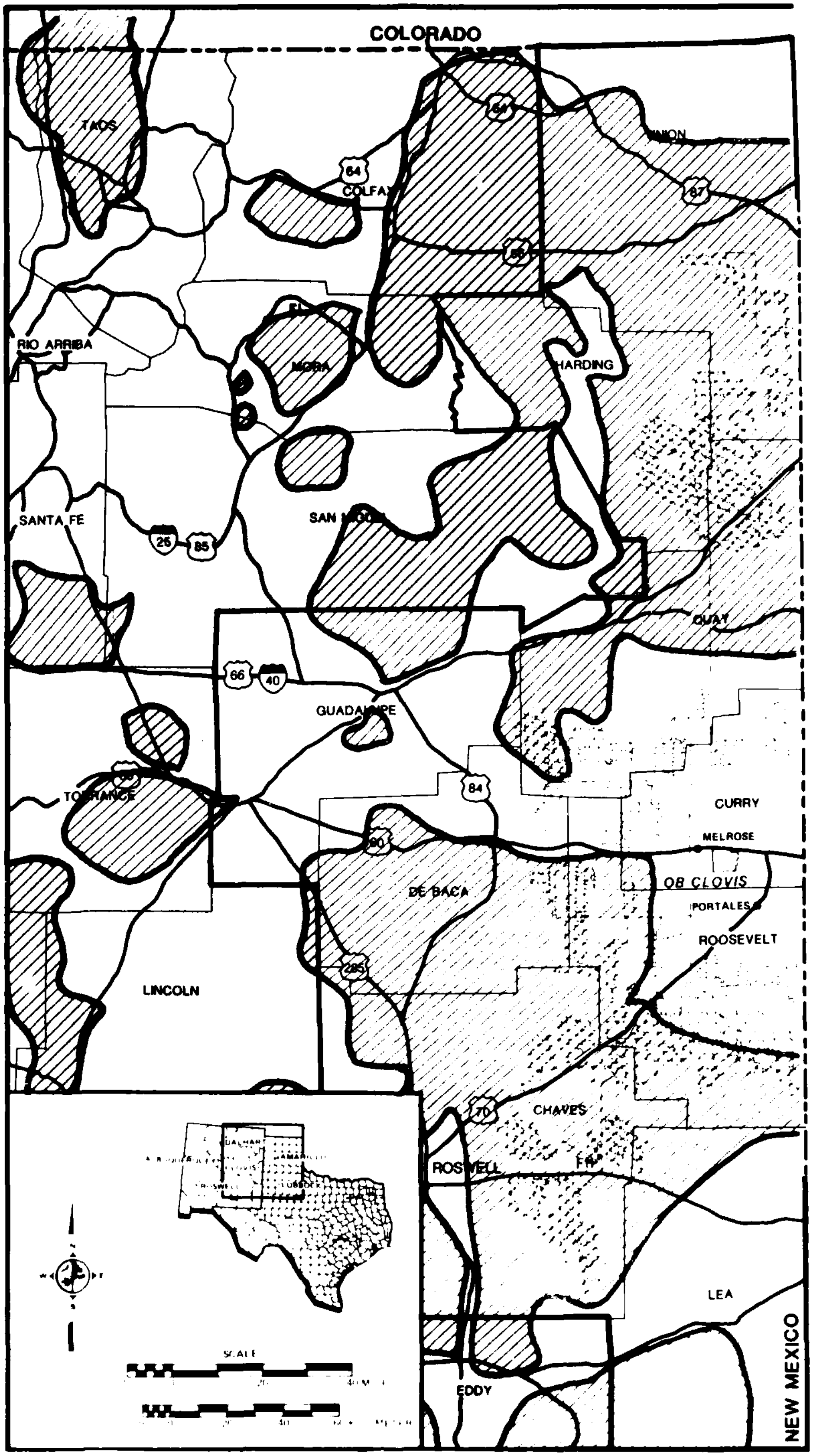
ALTERNATIVE 7 (4.3.2.6.9)

Figure 4.3.2.6-6 shows the relationship between pronghorn distribution and configuration of this alternative. Direct project effects would be limited to areas of overlap in rangeland in 4 counties in Texas and 7 counties in New Mexico. Key habitat data comparable to those from Nevada and Utah were not available for the Texas/New Mexico High Plains. Indirect effects resulting from increased use by construction workers would occur in areas where the project overlaps pronghorn range as well as in areas near construction camps which contain no project features. The operating base at Clovis is not in pronghorn range. The Dalhart site is in pronghorn range, but abundances are relatively low. There are no other large-scale projects planned which might compete with M-X in the region, although there are carbon dioxide pipelines planned in New Mexico.

DDA Impacts

As noted above, the project could affect pronghorn through construction activities and recreation activities of construction personnel. Water use is not an issue here, as surface water features are not linked with the water source for the project, the Ogallala aquifer. Emplacement of facilities will result in short-term habitat loss through removal of vegetation and pronghorn avoidance of construction activities. This avoidance could result in a further loss of habitat if it restricted movement over and above the restrictions already imposed by fencing of range and farmland. Long-term effects would be related to permanent habitat loss. Increased human activity, primarily recreation, would affect pronghorn through poaching, harassment, and habitat degradation. However, as much of the pronghorn range is privately held, these effects would be minimized through owner intervention. In Texas, pronghorn herds are managed for hunting, for which the individual landowner receives a fee of $500 to $2,000 from each hunter for each animal.

M-X would have the greatest effect on pronghorn during the construction phase since this is when intense activity would be widespread in their habitat. Mortality resulting from habitat loss and poaching could decrease herd size during this time. After construction was completed, pronghorn would likely repopulate the suitable habitat remaining, either from contiguous undisturbed areas or through transplants by wildlife departments. Population levels would stabilize at new levels. Whether these levels would be the same as for populations before M-X would depend upon the amount of habitat permanently lost, the rate of recovery (revegetation) of temporarily disturbed areas, and behavioral responses to the presence and operation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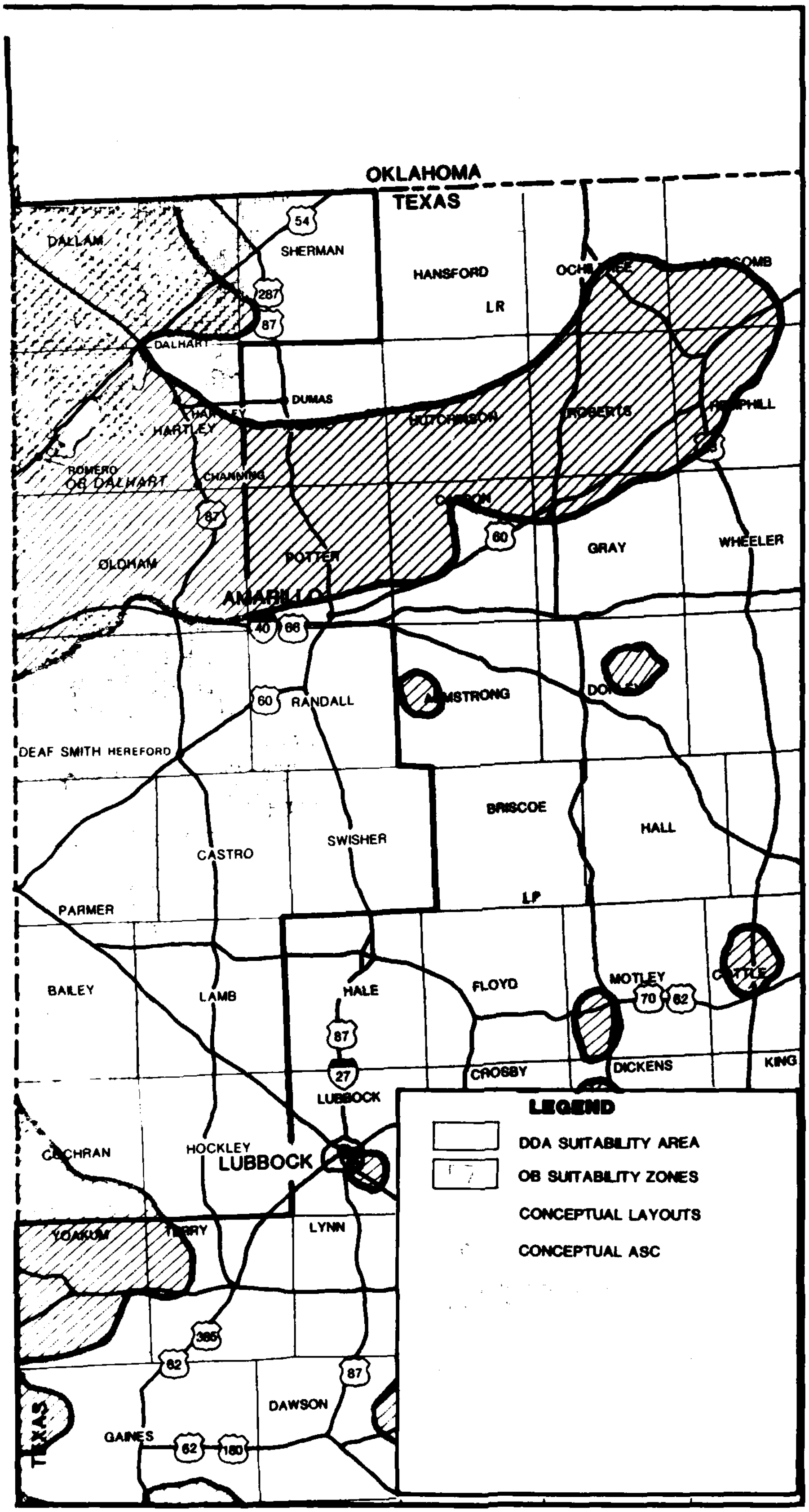

Figure 4.3.2.6-6. Distribution of pronghorn and the conceptual layout for Alternative 7.

of the facilities. Habitat quality in Texas/New Mexico is superior to that in Nevada/Utah, AUM values being five times as high in the first as in the second. Due to the higher level of human disturbance already present in Texas and New Mexico, pronghorn tolerance to human activity would likely be greater than in Nevada/Utah, reducing the effect to the level where the impact could be considered not significant. See Table 4.3.2.6-3 for impact summary.

The effects of construction would reduce short-term productivity by removal of forage areas, but local extirpation would be unlikely. Although long-term productivity is expected to be slightly reduced, employing game management techniques could bring abundances back to near preproject levels. The reduction in long-term productivity, as compared to future predictions without M-X, would be related to amount of habitat lost. Due to the income derived from hunters, there might be considerable effort by landowners to restore abundances.

The small amount of pronghorn habitat permanently lost, roughly 1 percent of the total, would represent an irreversible and irretrievable commitment of resources. Loss of animals, on the other hand, could be reduced through mitigation measures (see Section 4.3.2.6.11 and ETR-38).

The consequences of the previously discussed effects on pronghorn would be to reduce their abundance. The greatest reduction would be during construction. This in turn would reduce recreational opportunities such as hunting and nonconsumptive uses (e.g., photography and observation) in a similar manner. Since pronghorn are a game animal and source of income in the potential deployment area, any measureable decrease in abundance would likely be perceived by many people as a significant impact, even if it is of short duration.

The effects of construction activities are generally unavoidable because they result largely from pronghorn behavior, which cannot be easily modified. Pronghorn have habituated to some types of human disturbances, but the increase due to project construction could exceed the existing tolerances. The effects of people on pronghorn are largely avoidable or could be mitigated by the actions described below and in ETR-38.

Predicted impacts and their significance are summarized in Table 4.3.2.6-3 for each county in which project elements would be deployed for this option. This shows that impacts would likely occur in 12 of the 19 counties, but they would not be significant.

Several mitigation measures could be taken to reduce or compensate for the adverse impacts described above. These are discussed in detail in ETR-38, and in Section 4.3.2.6.11 of this chapter.

Clovis OB Impacts

The Clovis operating base is not in pronghorn range.

Dalhart OB Impacts

The Dalhart OB (Figure 4.3.2.6-7) is in pronghorn range, and near the Canadian Breaks, where significant pronghorn populations occur in the extensive rangeland.

Table 4.3.2.6-3. Potential impact to pronghorn in Texas/New Mexico DDA for Alternative 7.

County	Habitat Type Present	Short-Term Range Loss (Percent)	Short-Term Impact[1,3]	Long-Term Range Loss (Percent)	Long-Term Impact[1,3]
Counties with M-X Clusters and DTN					
Bailey, Tex.	None	0	-	0	-
Castro, Tex.	None	0	-	0	-
Cochran, Tex.	Range	6	***	1	*
Dallam, Tex.	Range	25	***	3	*
Deaf Smith, Tex.	Range	20	***	6	*
Hartley, Tex.[2]	Range	15	***	2	*
Hockley, Tex.	None	0	-	0	-
Lamb, Tex.	None	0	-	0	-
Oldham, Tex.[2]	Range	4	***	1	*
Parmer, Tex.[2]	None	0	-	0	-
Randall, Tex.	None	0	-	0	-
Sherman, Tex.	None	0	-	0	-
Swisher, Tex.	None	0	-	0	-
Chaves, N. Mex.[2]	Range	7	***	1	*
Curry, N. Mex.	Range	20	***	7	*
DeBaca, N. Mex.	Range	4	***	1	*
Guadalupe, N. Mex.	None	0	-	0	-
Harding, N. Mex.	Range	15	***	1	*
Lea, N. Mex.	None	0	-	0	-
Quay, N. Mex.	Range	9	***	1	*
Roosevelt, N. Mex.	Range	25	***	2	*
Union, N. Mex.	Range	9	***	1	*
DDA Impact		10	***	1	*

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[1]- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2]Conceptual location of Area Support Center (ASC).

[3]Loss of any key habitat or more than 25 percent of range in county is considered high impact. Loss of 25 percent or less of range in a county is considered moderate to low for short term impacts. Any loss of range could cause a low impact for the long term.

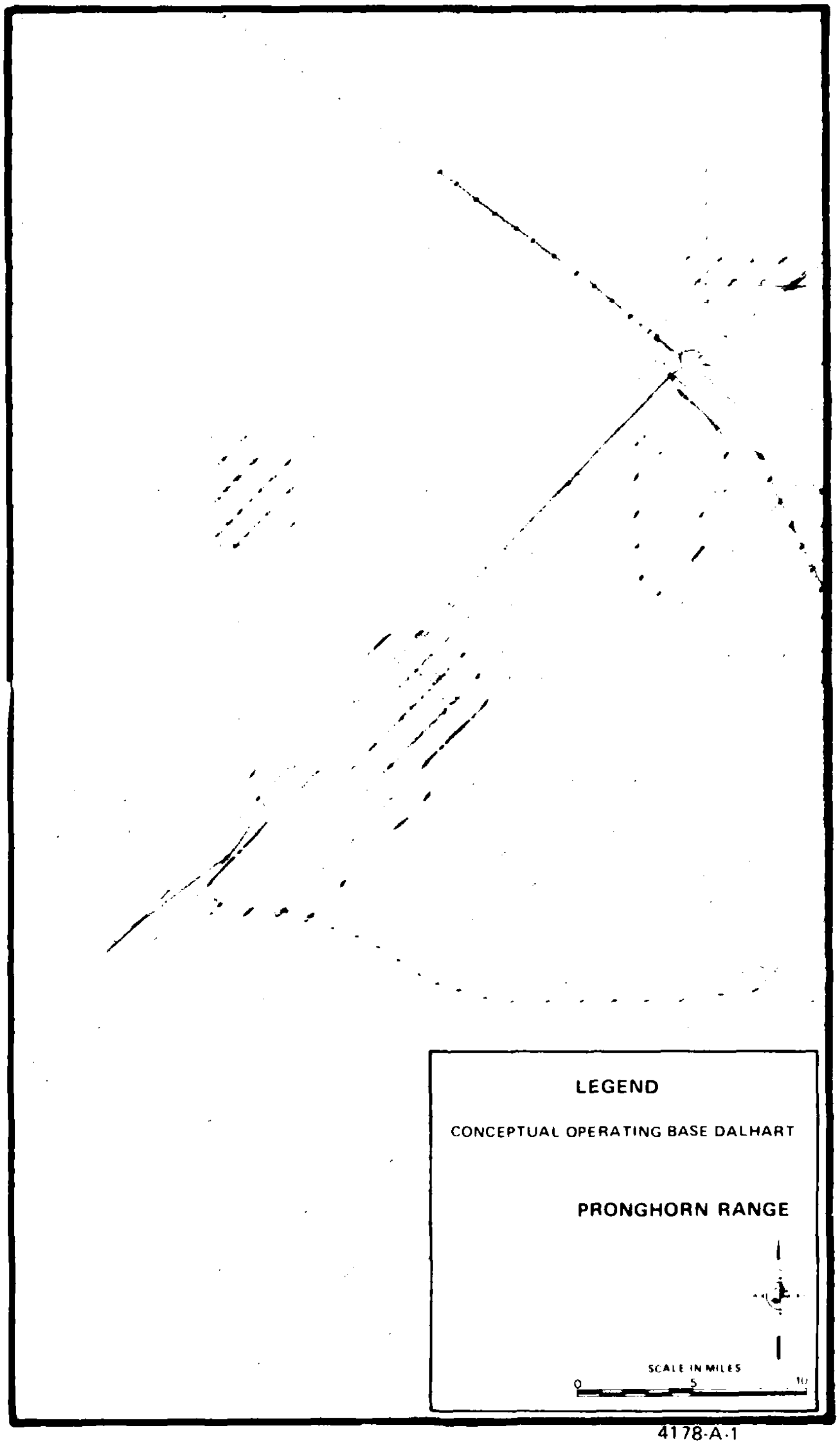


Figure 4.3.2.6-7. Pronghorn distribution in the vicinity of Dalhart, Alternative 7.

However, the land dedicated to the OB is primarily farmland, and no pronghorn are expected in the immediate vicinity, so no significant direct effects would occur. Similarly, as the surrounding lands are privately held and hunting is strictly regulated, no significant indirect effects would occur (Table 4.3.2.6-2).

ALTERNATIVE 8 (4.3.2.6.10)

Alternative 8 and pronghorn distribution are shown in Figures 4.3.2.6-8 and 4.3.2.6-9. Only one OB would be necessary in each basing area for this alternative, at Coyote Spring and Clovis. Deploying half the project in Nevada and Utah would reduce the number of hydrologic subunits containing project elements approximately 40 percent. The subunits with highest pronghorn abundance (Snake, Pine, Spring, and Hamlin valleys) are still within the project area, while 8 of the 24 hydrologic subunits used in split basing are not inhabited by pronghorn. The direct and indirect effects of project deployment would be the same as described above for the Proposed Action.

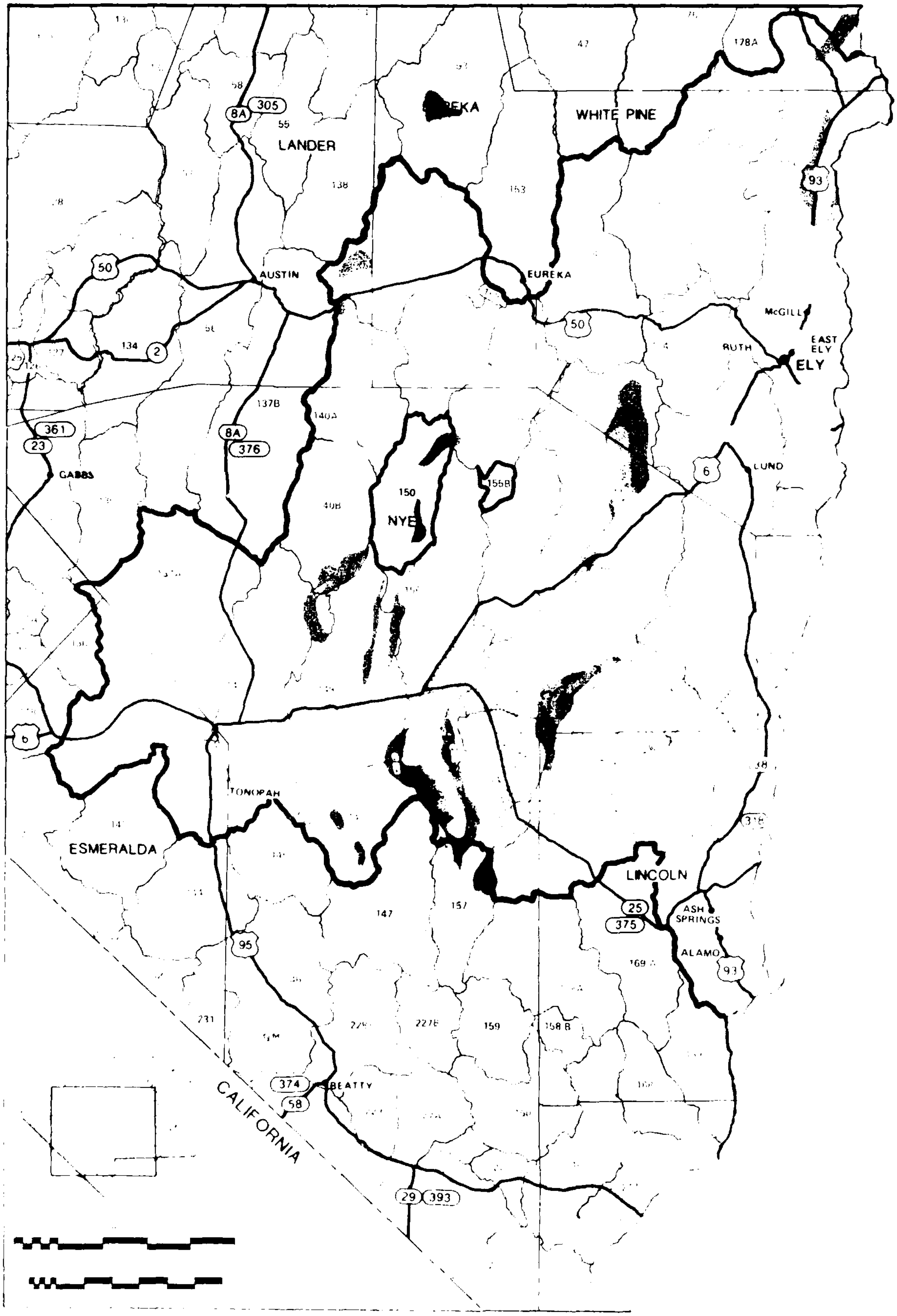
In Texas and New Mexico, the overall project area is also reduced by about half, but the split-basing deployment concentrates clusters in rangeland. Thus, 79 of the 100 clusters are placed in pronghorn range in Dallam, Hartley, Oldham, Deaf Smith, and Cochran counties, Texas, and Union, Harding, Quay, Roosevelt, Curry and Chaves counties, New Mexico, the same counties involved in full basing.

DDA Impacts

Deployment of the DDA necessary for basing half the project in Nevada and Utah and half in Texas and New Mexico could affect pronghorn through construction activities, water use (Nevada/Utah only), and recreation activities of construction workers as discussed for the Proposed Action and Alternative 7. The potential for combined effects of M-X and other projects planned for the Nevada/Utah study area would be reduced since the Anaconda Molybdenum project and all but the northern White River Valley potential site for WPPP would be outside the deployment area. Interactions with Alunite, Pine Grove Molybdenum, IPP, and Allen-Warner could still occur. No other significant projects are planned for the Texas and New Mexico area.

Time dependent effects of project implementation on pronghorn would be the same as described for the Proposed Action and Alternative 7.

The effects of M-X construction on short-term productivity of pronghorn would be similar to that described under the Proposed Action and Alternative 7. In Nevada and Utah, the reduction in productivity would occur in fewer valleys, thus reducing overall impacts to pronghorn. Areas that would likely have measureable reductions in short-term productivity for full basing but not for split basing include Antelope, Stone Cabin, Kobeh, Fish Springs, and Dugway valleys (hydrologic subunits). Populations in Snake and White Valley subunits would be affected in both basing options but to a lesser degree in split basing. Other hydrologic subunits in which the potential for impact would be reduced in split basing are Fish Springs, Sevier, Sevier Desert-Dry Lake, Little Smoky-South, Railroad, and Lake. In Texas and New Mexico, due to the concentration of clusters in pronghorn range, the effects would be similar to those discussed in Alternative 7 in both quality and quantity in all but Cochran and Dallam counties, where there would be less population reduction.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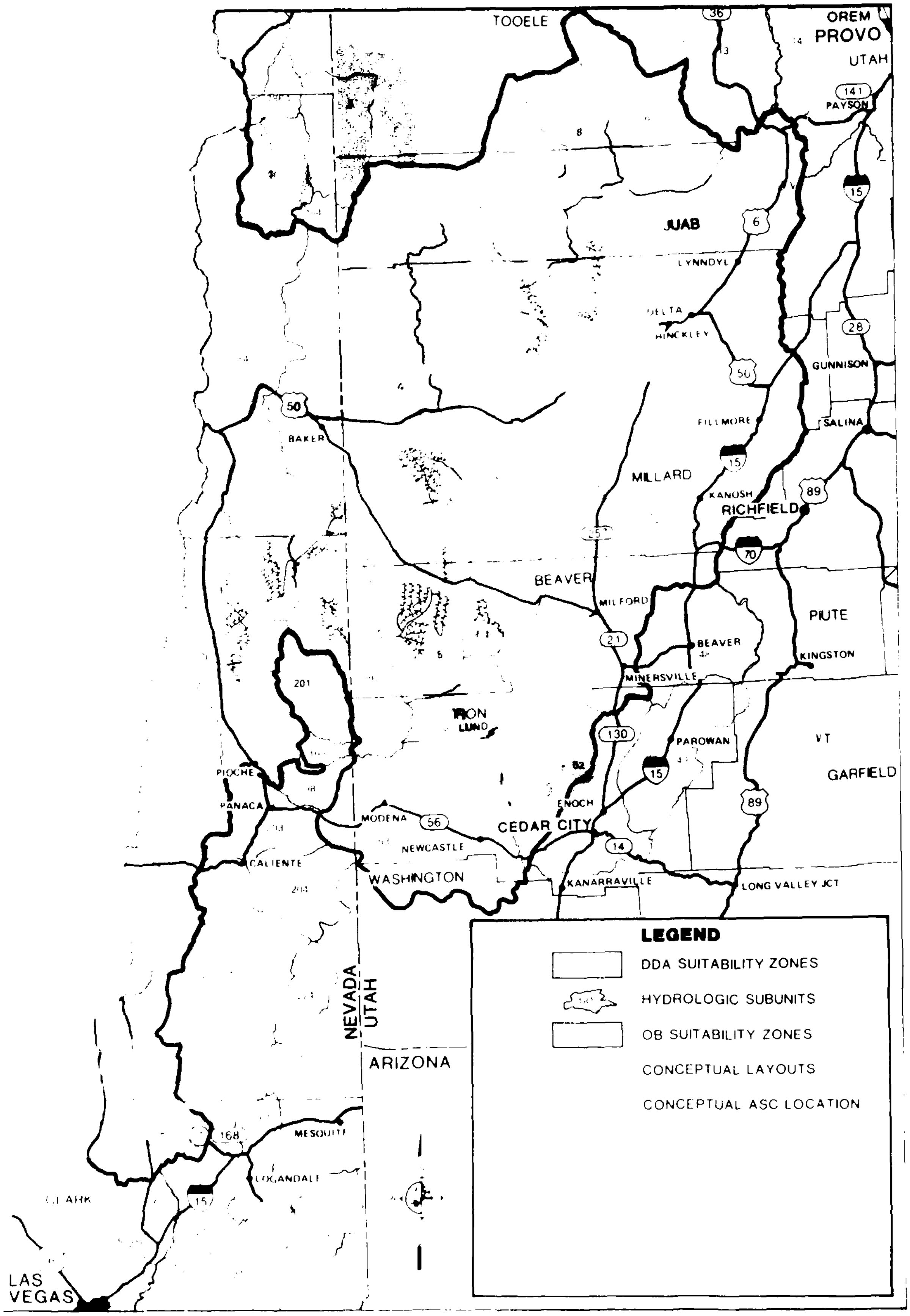
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NEWCASTLE
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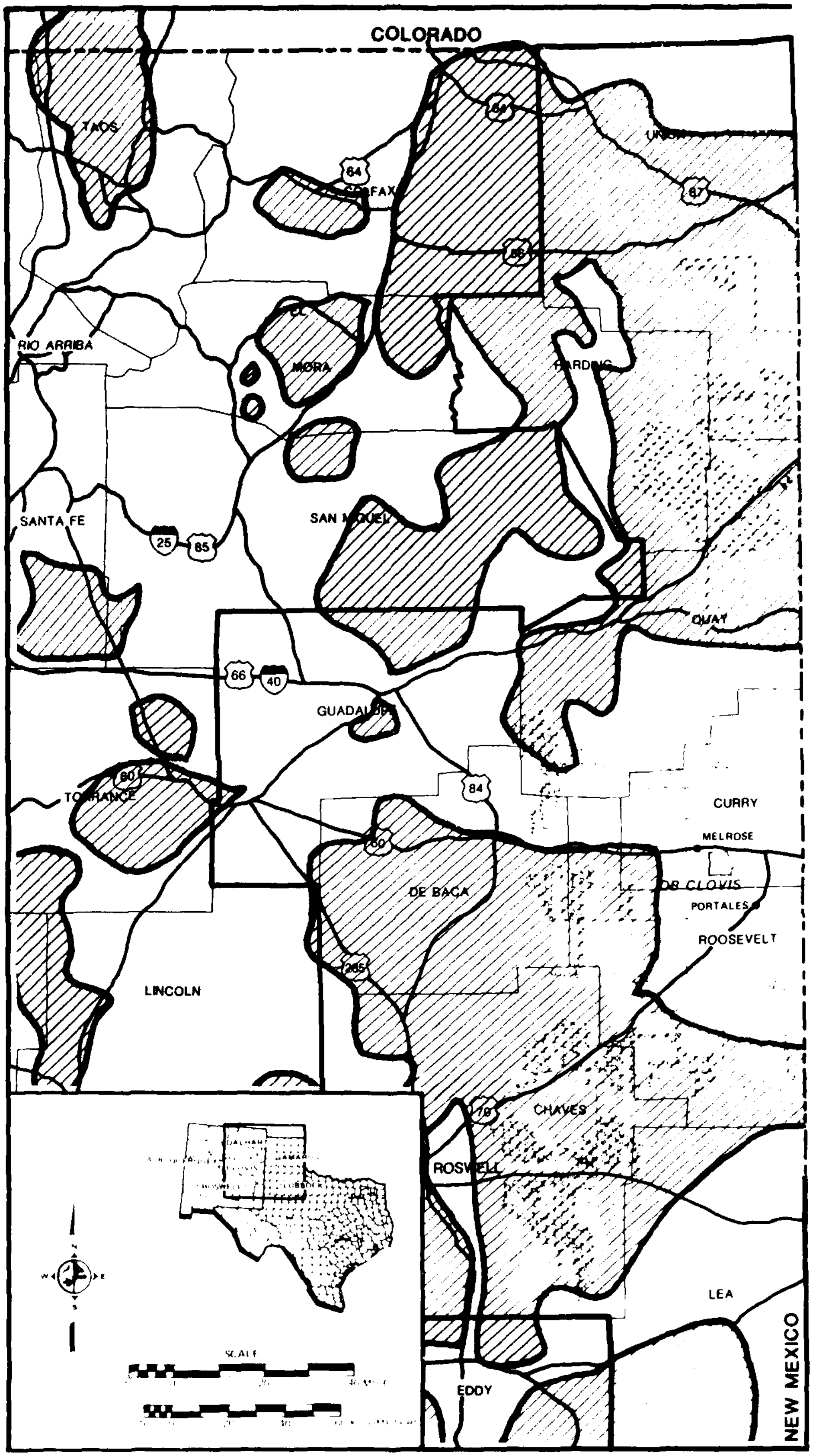
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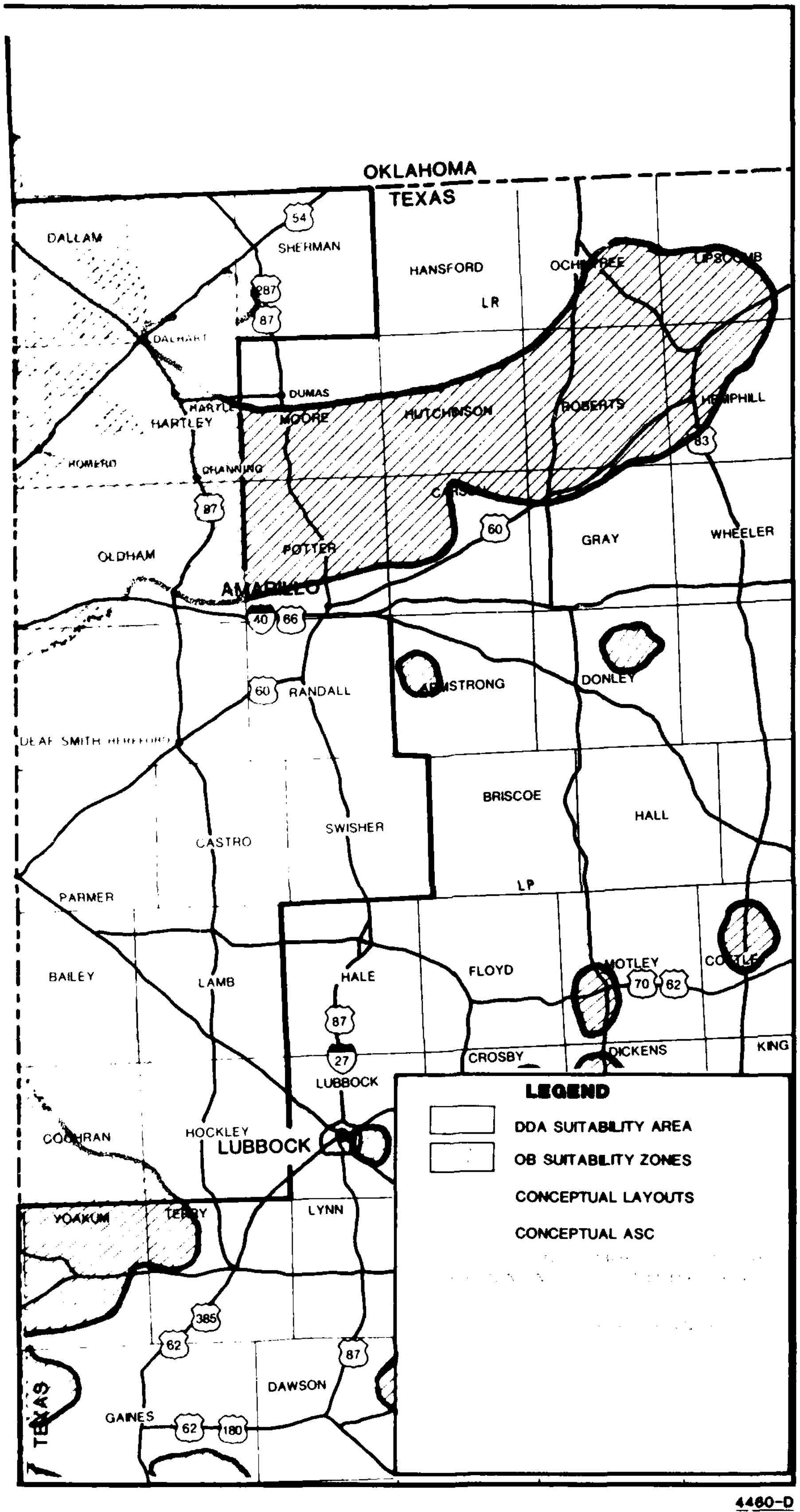

Figure 4.3.2.6-9. Distribution of pronghorn and the conceptual layout, Alternative 8, Texas/New Mexico.

The small amount of pronghorn habitat permanently lost would represent an irreversible and irretrievable commitment of resources. Loss of animals on the other hand could be replaced through mitigation measures.

The consequences of project-related effects on pronghorn are the same as those described for the Proposed Action and Alternative 7.

Predicted impacts and their significance are summarized in Table 4.3.2.6-4 for each hydrologic subunit or county in which project elements would be deployed for split basing. In Nevada/Utah, significant impacts are predicted for 14 of the 24 hydrologic subunits containing project elements. Eight of the ten remaining hydrologic subunits are not inhabited by pronghorn, and no significant impacts would occur in Penoyer and Little Smoky valleys (170 and 155c). Loss of key habitat was the reason for significant impact in all subunits. Long-term effects are the same as discussed for full basing. In Texas/New Mexico, all the counties affected by full basing would also be affected in split basing, with indirect effects reduced in Cochran and Dallam counties only. Otherwise, both indirect and direct effects would be as described in Alternative 7.

OB Impacts

Potential impacts to pronghorn in the vicinity of the Coyote Spring and Clovis OB sites would be the same as discussed for the Proposed Action and Alternative 7. These are summarized in Table 4.3.2.6-2.

PUBLIC COMMENT ON THE DRAFT EIS:

"Pronghorn populations, nor impacts are described using estimated numbers of animals. Specific data by herd unit and/or valley are needed to adequately assess impacts to this species. More detailed maps are needed to accomplish this. The direct and indirect impacts anticipated for this species are also addressed in a general fashion. Specific impacts are needed by herd unit - not for the entire Utah/Nevada antelope.

MITIGATIONS (4.3.2.6.11)

Mitigation measures for pronghorn need to be directed toward the preservation of habitats for these animals and minimization of disturbance. The Air Force will institute cooperative programs with appropriate federal and state agencies for wildlife management. The Air Force would assist in identifying, monitoring, and managing species to counteract project impacts. These programs would include all or part of the following, as appropriate: avoid important habitats, if possible; schedule activities to avoid critical periods; fence selected construction areas; provide supplemental or replacement water and/or food sources; restrict domestic pets in life support communities; suppress adverse noise impacts; assist enforcement and management agencies; transplant wildlife; and provide additional habitat or improve other habitats to offset impacts.

In addition, the Air Force will restrict weapons in life support camps and at job sites, restrict off-road travel, accomplish a revegetation program in cooperation

Table 4.3.2.6-4. Potential impact to pronghorn in Nevada/Utah and Texas/New Mexico DDAs for Alternative 8.

No.	Hydrologic Subunit or County Name	Habitat Type Present	Short-Term Habitat Loss (Percent)[4] Range	Short-Term Habitat Loss (Percent)[4] Key	Short-Term Impact[1,3]	Long-Term Habitat Loss (Percent) Range	Long-Term Habitat Loss (Percent) Key	Long-Term Impact[1,3]
	Subunits or counties with M-X clusters and DTN							
4	Snake, Nev.[2]/Utah	Key	10	15	*****	1	1	***
5	Pine, Utah[2]	Key	25	65	*****	1	2	***
6	White, Utah	Key	10	0	***	1	0	*
7	Fish Springs, Utah	Key	0	4	*****	0	1	***
46	Sevier Desert, Utah	Key	7	20	*****	1	1	***
46A	Sevier Desert-Dry Lake, Utah[2]	Key	25	25	*****	1	1	***
54	Wah Wah, Utah	Key	95	50	*****	2	1	***
155C	Little Smoky-South, Nev.	Range	4	0	***	1	0	*
156	Hot Creek, Nev.	Key	60	95	*****	2	1	***
170	Penoyer, Nev.	Range	0	0	-	0	0	-
171	Coal, Nev.	None	0	0	-	0	0	-
172	Garden, Nev.[2]	None	0	0	-	0	0	-
173A	Railroad-South, Nev.	Key	60	55	*****	1	1	***
173B	Railroad-North, Nev.	Key	10	25	*****	1	1	***
180	Cave, Nev.	None	0	0	-	0	0	-
181	Dry Lake[2], Nev.	None	0	0	-	0	0	-
182	Delamar, Nev.	None	0	0	-	0	0	-
183	Lake, Nev.	Key	60	85	*****	1	1	***
184	Spring, Nev.	Key	2	10	*****	1	1	***
196	Hamlin, Nev./Utah	Key	40	80	*****	1	2	***
202	Patterson, Nev.	Key	80	45	*****	1	1	***
207	White River, Nev.	None	0	0	-	0	0	-
208	Pahroc, Nev.	None	0	0	-	0	0	-
209	Pahranagat, Nev.	None	0	0	-	0	0	-
	Bailey, Tex.	None	0	0	-	0	0	-
	Cochran, Tex.	Range	4	0	***	1	0	*
	Dallam, Tex.	Range	20	0	***	2	0	*
	Deaf Smith, Tex.	Range	20	0	***	6	0	*
	Hartley, Tex.	Range	15	0	***	2	0	*
	Hockley, Tex.	None	0	0	-	0	0	-
	Lamb, Tex.	None	0	0	-	0	0	-
	Oldham, Tex.	Range	4	0	***	1	0	*
	Parmer, Tex.	None	0	0	-	0	0	-
	Chaves, N. Mex.	Range	7	0	***	1	0	*
	Curry, N. Mex.	Range	20	0	***	[illegible]	0	*
	DeBaca, N. Mex.	Range	3	0	***	1	0	*
	Guadalupe, N. Mex.	None	0	0	-	0	0	-
	Harding, N. Mex.	Range	15	0	***	1	0	*
	Lea, N. Mex.	None	0	0	-	0	0	-
	Quay, N. Mex.[2]	Range	9	0	***	1	0	*
	Roosevelt, N. Mex.[2]	Range	25	0	***	2	0	*
	Union, N. Mex.	Range	9	0	***	1	0	*
	Nev./Utah DDA Impact		15	21	*****	1	1	***
	Tex./N. Mex. DDA Impact		10	0	***	1	0	*
	Alternative 8 DDA Impact				*****			***

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Center (ASC).

[3] Loss of any key habitat or more than 25 percent of range in hydrologic subunit or county is considered high impact. Loss of 25 percent or less of range is considered moderate. Any key habitat loss remaining after construction could cause a moderate impact, and any long-term loss of range could cause a low impact.

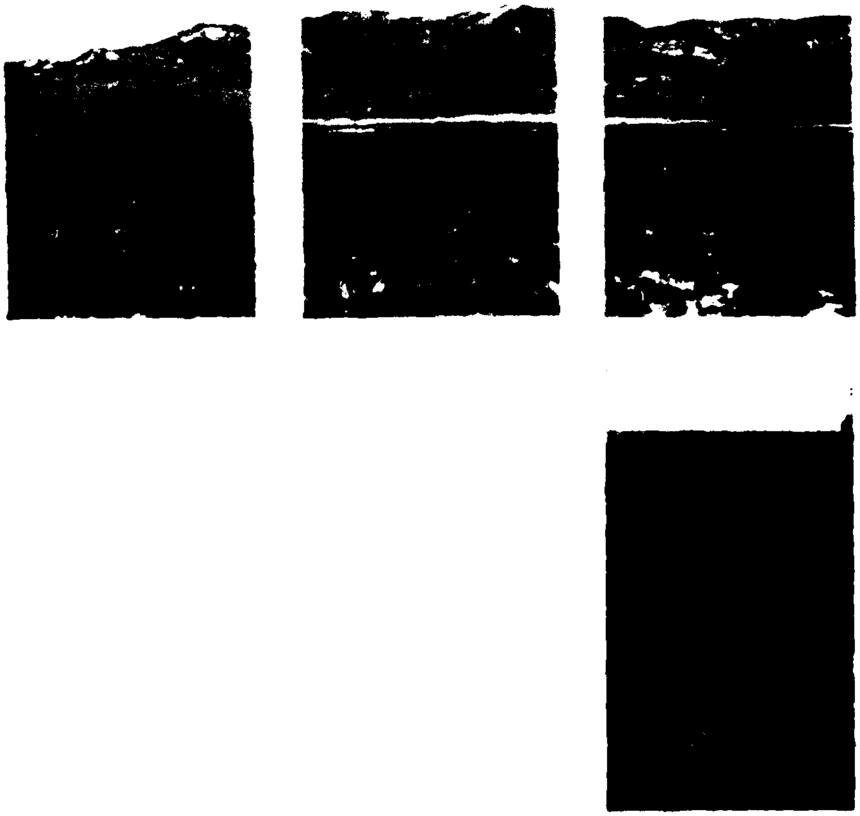
[4] Habitat loss during construction. This includes a 1-mi (1.6 km) avoidance zone around all construction activities.

with appropriate federal and state agencies, and provide conservation education programs for workers and their dependents. A program to manage groundwater withdrawal as it affects surface water and an erosion control program will be instituted by the Air Force. The Air Force will advocate funding additional fish and wildlife personnel.

In order to prevent the spread of noxious vegetation and the inadvertent introduction of new species, the Air Force will survey noxious vegetation and introduced species and monitor infestation levels. Eradication of unwanted vegetation caused by M-X activities will be accomplished in conjunction with the revegetation program.

Additional details on mitigations for pronghorn are included in ETR-15 (Wildlife) and ETR-38 (Mitigations).

SAGE GROUSE/
LESSER PRAIRIE CHICKEN



SAGE GROUSE / LESSER PRAIRIE CHICKEN

INTRODUCTION (4.3.2.7.1)

The sage grouse (Centrocercus urophasiamus) is distributed throughout the western United States. It is distinguished by its dependence upon sagebrush vegetation and the congregation of males at strutting grounds (leks) during the breeding season to perform courtship displays. Much of the sage grouse key habitat (i.e., leks, brood use areas, and wintering grounds) in the study area is found in the valley bottoms and bajadas. The sage grouse is a highly valued game species whose range extensively overlaps the M-X suitability area. During the 1978 hunting season in Nevada, 6,647 hunters, approximately 1 percent of the state population, harvested 17,693 sage grouse. In past years, the number of hunters in the field has exceeded 9,000 (e.g., 9,180 in 1970 and 9,348 in 1974), with over 23,000 grouse harvested annually (Molini and Barngrover, 1979). In Utah, during 1979, 16,927 hunters (again 1 percent of the state population) harvested 28,280 sage grouse. Although the number of hunters and the total harvest have generally increased over the years in Utah, hunter success has declined (Leatham and Bunnell, 1979).

Lesser prairie chickens (Tympanuchus pallidcinctus) inhabit the eastern portion of the Great Plains, including parts of Colorado, Kansas, New Mexico, Oklahoma, and Texas. In the 1800s they occupied an area covering about 13,000 sq mi, but by 1980 this area decreased to 10,500 sq mi, 72 percent of the former range (Taylor and Guthery, 1980a). The widescale conversion of prairies to cropland is the single most important factor influencing the decline of prairie chickens on the Great Plains. Overgrazing by domestic livestock in preferred habitat also has resulted in local extirpation or lowered productivity. Current range of prairie chicken in New Mexico includes much of the southeastern portion of the state. Their population level has remained relatively stable for 20 years; no large-scale conversion of rangeland to cropland is anticipated so their future appears stable. Ongoing management of state-owned prairie chicken restoration areas may result in increasing populations in these areas. Their current range in Texas is limited to a narrow strip bordering New Mexico and an isolated area near Oklahoma. Habitat loss due to conversion of rangeland to cropland in Texas may continue because the water table is comparatively high, allowing further development of center pivot sprinkler systems.

Prairie chickens congregate at leks (strutting grounds) during the breeding season to perform courtship displays. They prefer skinnery oak-sandsage habitats but the location of key habitat, such as lek, nesting habitat or brood use areas is poorly known for the Texas/New Mexico study area due to restricted access onto private lands (J. LePlatt, pers. comm., Roswell BLM). Prairie chickens are managed as upland game birds in Texas and New Mexico. In New Mexico, between 900 and 2,000 birds are taken annually; 100 percent of this harvest is taken in counties containing M-X project elements. Comparable data were not available from Texas where 650 to 1,200 birds are taken statewide annually. The region that includes counties with proposed M-X elements accounts for 50 to 60 percent of the Texas annual harvest.

Potential significant project impacts were identified by combining sage grouse and lesser prairie chicken distribution information with project information.

PROPOSED ACTION (4.3.2.7.2)

DDA Impacts

Figure 4.3.2.7-1 shows the relationship between the project configuration and sage grouse range and key habitat. Key habitat is defined by Nevada DOW and Utah DWR as habitat which is necessary for the survival of sage grouse population, that is: strutting grounds, brood-use areas, and wintering grounds. Because many areas of the Great Basin have not been adequately surveyed for key habitat, the amount of key habitat listed in this discussion should be considered the minimum.

The effects of M-X deployment on sage grouse fall into three categories: loss of habitat, surface water depletion, and effects of increased human population. However, nearly all effects would ultimately result in a loss of habitat, a reduction of habitat quality, or a direct reduction in population. Habitat loss or reduction in quality eventually influences the size of vigor of the population through the reduction in carrying capacity. Habitat loss would consist of the direct loss of vegetation through scarification or through behavioral avoidance of areas of construction or recreation (e.g., ORV and camping areas). Sage grouse populations tend to be closely associated with one lek or a small cluster of leks--areas traditionally used for communal courtship and breeding. Very little movement occurs between leks or lek complexes (Molini, 1980). Therefore, if a lek or lek complex is removed or if sage grouse abandon a lek because of an adjacent disturbance, that population has a high likelihood of being lost. Through field observation and a knowledge of sage grouse behavior, the Department of Wildlife in Nevada has estimated that construction activities and the use of major roadways during construction would have an effect-radius of approximately 1 mi (line-of-sight) (Molini, 1980). Any key habitat within a 1 mi radius of construction or high human activity has a strong likelihood of being abandoned (Molini, 1980). Initially, noise, construction activity, and the presence of people would have a major negative effect, although some acclimation might occur with time.

Reduction or loss of surface water or groundwater would have a major effect on valleys where springs and wet meadows dried up as a result. Sage grouse depend upon these mesic areas for the successful rearing of their broods. The results of HDRs Sage Grouse Lek Characterization Study (1980) indicate a moderate correlation between sage grouse lek location and distance to water sources, with the distances to water being less than from non-lek sites included in the sample. Effects from increased human populations are increased hunting activity (primarily illegal) and the loss of habitat due to behavioral avoidance.

Sage grouse habitat quality fluctuates from year to year in the Great Basin due to variation in climatic conditions (e.g., precipitation, temperature) and such disturbances as livestock grazing and human activity. Therefore, the impacts of M-X could be compounded or lessened during a particular year depending upon climatic conditions or other non-M-X-related disturbances.

Other projects planned for, proposed, or approved in the region would affect sage grouse, but major effects of these projects are expected to be localized. Large-scale projects proposed for the region include the Intermountain Power Project (IPP), the White Pine Power Project (WPPP), the Pine Grove Molybdenum Mine, and the Anaconda Nevada Molybdenum Project. None of these projects are expected to have the overall widespread effects on sage grouse that M-X deployment would have, or to add significantly to the effects of M-X. The localized effects that would add to M-X effects would be scarification, construction activities, and the effects of an increased human population. Localized M-X effects would be less than those of the proposed Anaconda-Nevada Molybdenum mine. The intensity of scarification and human activity from this mine would be much greater (permanent loss of 2,600 acres of vegetation) than in an area where M-X construction would take place. However, the number of sage grouse populations in the M-X deployment area likely to be affected by this mine is small compared to sage grouse populations affected by M-X.

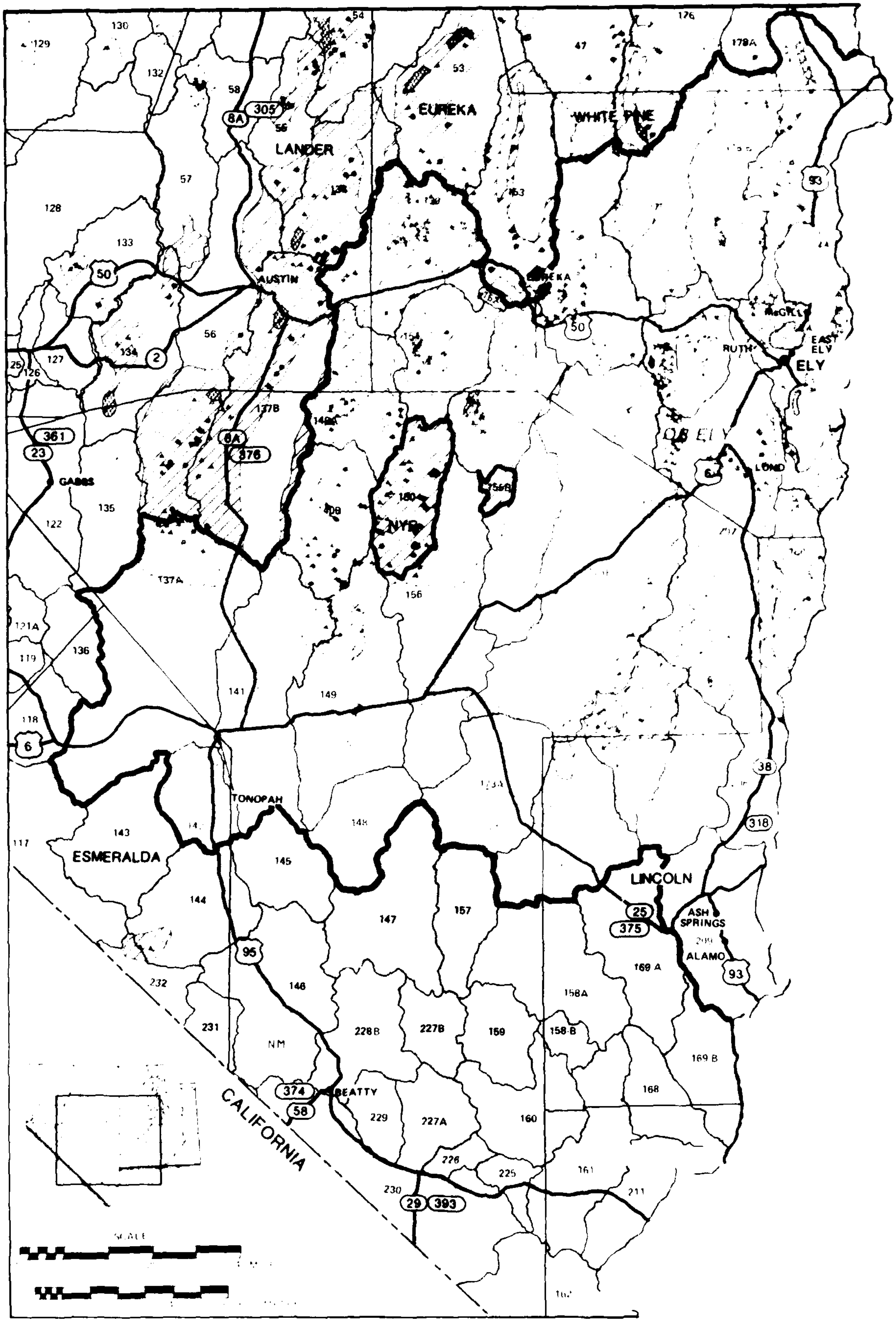
Direct impacts to known sage grouse habitats (Table 4.3.2.7-1) were estimated from the intersections of known sage grouse range and key habitat (leks, brood use areas, and wintering grounds) with project elements on 1:500,000 scale maps (1 in. = 4 mi). Data were obtained from the Nevada Department of Wildlife and Utah Division of Wildlife Resources.

Short-term (construction) effects would involve both direct habitat disturbances and the potential abandonment of key habitat up to 1 mi from construction sites. Because of the map scale used in this analysis, the size of both key habitat and construction sites is exaggerated, causing an overestimate of the numbers of known leks and brood use sites impacted. This allows for the short-term behavioral avoidance, but is probably an overestimate of direct impacts to known key habitat.

PUBLIC COMMENT ON THE DRAFT EIS:

> "This discussion is confusing in that it implies that the map scale is the cause of the problem (see sentence 2 of the previous paragraph). In actuality, since all sage grouse leks, nesting and brooding areas have not been defined, the amount of key habitat may be underestimated--not exaggerated. Direct impacts may well be underestimated. The discussion should be changed accordingly."

The map scale used in the impact analysis is likely to cause impacts to known key habitat to be overestimated, as noted in the text. The likelihood of undiscovered key habitat being impacted is noted. One would expect that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RUTH
McGILL
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GABBS
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
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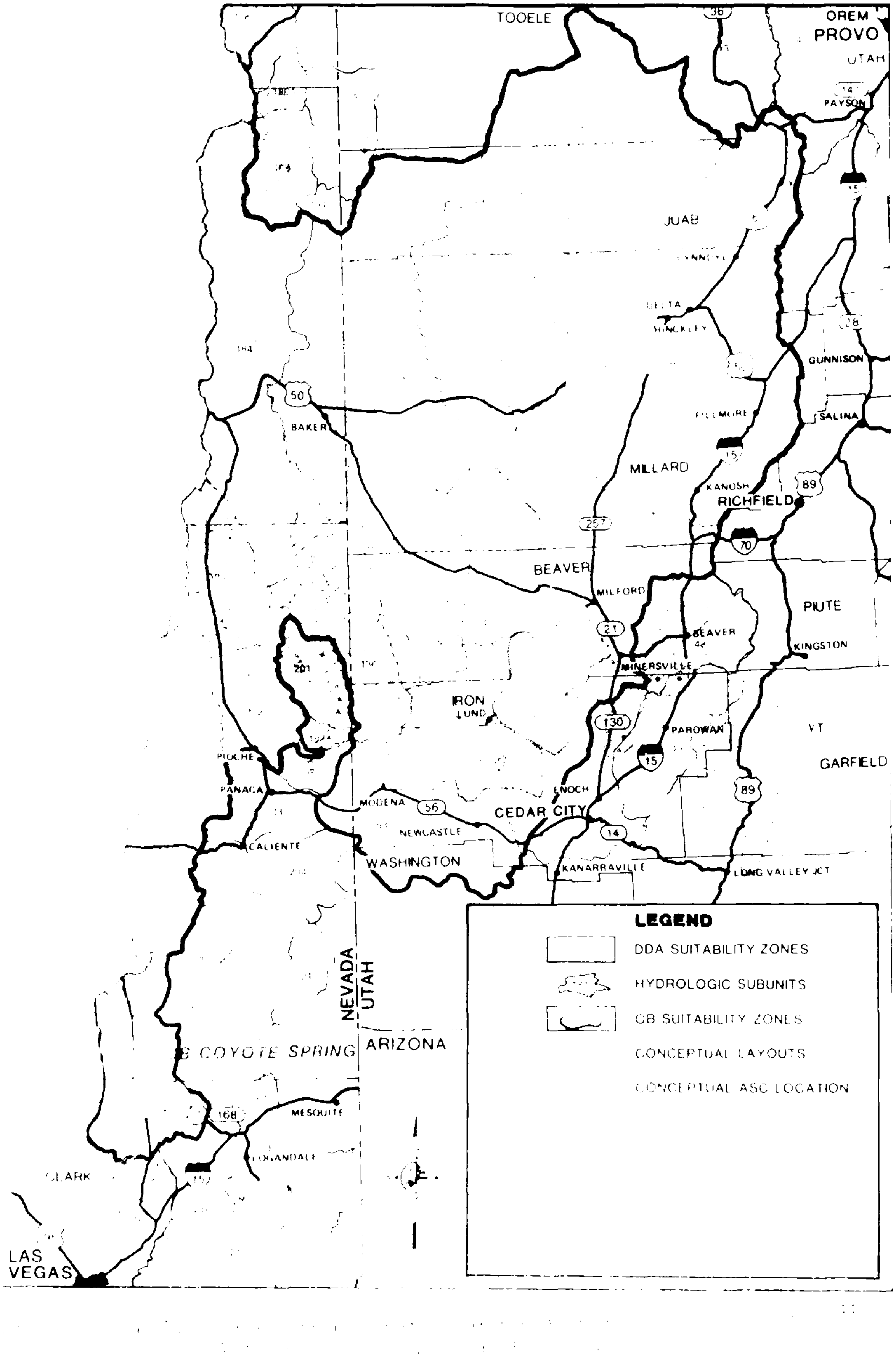

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JUAB
DELTA
HINCKLEY
GUNNISON
SALINA
FILLMORE
MILLARD
KANOSH
RICHFIELD
BEAVER
MILFORD
PIUTE
BEAVER
KINGSTON
MINERSVILLE
IRON
LUND
PAROWAN
GARFIELD
PIOCHE
PANACA
MODENA
ENOCH
CEDAR CITY
NEWCASTLE
CALIENTE
WASHINGTON
KANARRAVILLE
LONG VALLEY JCT
BAKER
NEVADA
UTAH
COYOTE SPRING
ARIZONA
MESQUITE
LOGANDALE
CLARK
LAS VEGAS
LEGEND
DDA SUITABILITY ZONES
HYDROLOGIC SUBUNITS
OB SUITABILITY ZONES
CONCEPTUAL LAYOUTS
CONCEPTUAL ASC LOCATION

Table 4.3.2.7-1. Minimum potential impact to known sage grouse range and key habitats in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6 and 8.

Hydrologic Subunit No.	Hydrologic Subunit Name	Habitat Type Present[6]	Percent of Hydro-Subunit Range Disturbed	Percent of Lek Sites Disturbed	Percent of Brood Use Areas Disturbed	Percent Area of Wintering Grounds Disturbed	Short and Long Term Impact[1,4]
	Subunits with M-X Clusters and DTN						
# 4	Snake, Nev./Utah	Range	0	0	0	0	-
# 5	Pine, Utah	Range	2	0	0	0	***
# 6	White, Utah	None	0	0	0	0	-
7	Fish Springs, Utah	None	0	0	0	0	-
8	Dugway, Utah	None	0	0	0	0	-
9	Government Creek, Utah	Range	0	0	0	0	-
# 46	Sevier Desert, Utah	None	0	0	0	0	-
# 46A	Sevier Desert-Dry Lake, Utah[2,3]	None	0	0	0	0	-
54	Wah Wah, Utah	None	0	0	0	0	-
137A	Big Smoky-Tonopah Flat, Nev.	Range	1	0	14	0	*****
139	Kobeh, Nev.	Key	1	45	28	2	*****
140A	Monitor-North, Nev.	Key	1	23	9	0	*****
140B	Monitor-South, Nev.	Key					*****
141	Ralston, Nev.	Range	0	0	0	0	-
142	Alkali Spring, Nev.	None	0	0	0	0	-
148	Cactus Flat, Nev.[2]	None	0	0	0	0	-
149	Stone Cabin, Nev.[2]	Range	1	0	0	0	***
151	Antelope, Nev.	Key	2	100	1	0	*****
154	Newark, Nev.[2]	Key	1	15	0	0	*****
# 155A	Little Smoky-North, Nev.	Key	0	0	0	0	-
# 155C	Little Smoky-South, Nev.	Key					-
# 156	Hot Creek, Nev.	Key	0	0	0	0	-
# 170	Penoyer, Nev.	Range	0	0	0	0	-
# 171	Coal, Nev.	None	0	0	0	0	-
# 172	Garden, Nev.	Key	1	0	67	0	*****
# 173A	Railroad-South, Nev.	Range	3	0	8	0	*****
# 173B	Railroad-North, Nev.	Range					*****
174	Jakes, Nev.	Key	1	33	0	0	*****
175	Long, Nev.	Key	1	100	0	0	*****
178B	Butte-South, Nev.	Key	1	50	0	1	*****
179	Steptoe, Nev.	Key	0	0	0	0	-
# 180	Cave, Nev.	Key	1	0	0	0	***
# 181	Dry Lake, Nev.[2]	Range	0	0	0	0	-
# 182	Delamar, Nev.	None	0	0	0	0	-
# 183	Lake, Nev.	Key	1	100	57	0	*****
# 184	Spring, Nev.	Key	1	0	0	0	***
# 196	Hamlin, Nev./Utah	Key	2	0	67	0	*****
# 202	Patterson, Nev.	Range	0	0	0	0	-
# 207	White River, Nev.[2]	Key	1	0	0	0	***
# 208	Pahroc, Nev.	None	0	0	0	0	-
# 209	Pahranagat, Nev.	None	0	0	0	0	-
	DDA Impact		1	22	7	1	*****[5]

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[1] - = No significant impact.
* = Low impact (not used).
*** = Moderate impact.
***** = High impact.

[2] Conceptual location of Area Support Centers (ASCs) for Alternatives 1-6.

[3] Conceptual location of Area Support Centers (ASCs) for Alternative 8.

[4] Long term impact is less than short term impact by an undetermined amount (see text). This is a worst-case analysis.

[5] DDA impact is deemed significant because of the loss of a minimum of 22 percent of known lek sites.

[6] Range = Sage grouse present but no key habitat known for this area.
Key = Sage grouse present and key haitat (leks, brood use areas, and/or wintering grounds) also found in this area.

#Hydrologic subunits used for Alternative 8 (split basing).

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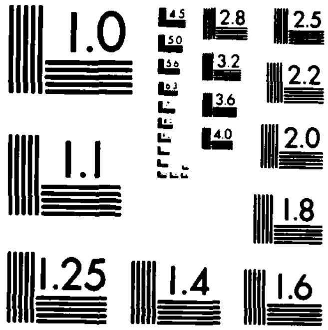

MICROCOPY RESOLUTION TEST CHART
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undiscovered key habitat would be impacted by the project in roughly the same proportion as known key habitat.

Long-term effects are assumed to be proportional to the key habitat area actually disturbed by the project and thus would be lower than for short-term effects in which behavioral avoidance is a factor. Because of the overestimates introduced by the analysis map scale, long-term effects must be considered a worst-case estimate.

Table 4.3.2.7-1 indicates sage grouse abundances and the potential impact significance for the 29 hydrologic subunits in the M-X deployment area known to contain sage grouse range. Of these, 19 would have direct loss of habitat due to the construction of shelters, roadways, and associated developments. The maximum percentage of total sage grouse habitat area directly removed in any hydrologic subunit is less than 4 percent, and most watersheds show less than 2 percent total habitat area lost. Key habitat would be lost in 14 watersheds. Because of the probable loss of 22 percent of known leks in the deployment area, DDA impacts to sage grouse would be significant.

PUBLIC COMMENT ON THE DRAFT EIS:

> "There is no discussion of high significant impacts to sage grouse in Pine and Hamlin valleys. The state provided Henningson, Durham & Richardson (HDR) with sage grouse strutting ground locations in a letter of August 25, 1980. This should be corrected in the FEIS."

Table 4.3.2.7-1 (pg. 4-149) in the DEIS indicates that sage grouse in Pine Valley would be moderately impacted and those in Hamlin Valley would be significantly impacted. The data supplied on August 25, 1980 was used in the impact analysis. A more detailed study will be done as part of the analyses used in subsequent tiered decisionmaking.

The Kobeh hydrologic subunit is the most heavily affected by M-X deployment in terms of loss of key habitat. It is used in this discussion to illustrate potential project-induced changes in sage grouse populations and productivity with time. During the construction phase of the project, 13 of 29 leks, 5 to 18 brood-use areas, and 163 acres of wintering grounds in the Kobeh hydrologic subunit would be directly removed by shelter and road construction. In addition, human activity in the area would increase by an estimated 1,752 people in 1988 due to the presence of a construction camp (#18). Behavioral avoidance of previously used habitat would be greatest during this time and could increase effective habitat loss several times over the area actually scarified.

Within the first two years of project construction and operation, sage grouse abundance in the Kobeh hydrologic subunit might be expected to decrease 30 to 50 percent because of the 45 percent reduction in lek sites and the 28 percent reduction in brood-use areas. Many shelters and roadways criss-cross the one wintering ground essential for winter survival, and the effective loss of this habitat for sage grouse might be greater than the 163 acres directly removed. After the first year of disturbance, sage grouse could recover slightly if behaviorally-avoided key habitat again became available. Sage grouse have been known to use leks adjacent to disturbed areas (Higby, 1969). Because of a large long-term loss of key habitat, however, sage grouse abundance might not recover in the foreseeable future above 50-60 percent of current abundance. Revegetation of scarified key habitat areas may take decades, and loss of scarified habitat for this time period would keep the sage grouse population at reduced levels.

Short-term productivity would likely be only 50-70 percent of current productivity because of the loss of key habitat and the presence of human activity associated with the construction camp. Long-term productivity would also likely be in the 50-70 percent range because most of the key habitat loss would be permanent.

Loss of key habitat due to scarification or intense human activity is, in most cases, an irretrievable loss of resources required by sage grouse for survival. In some cases, and with intensive management, key habitat might be retrievable. Much of the habitat lost because of behavioral intolerance of construction disturbances such as noise, traffic, and people could in many cases be recovered if managed properly.

Sage grouse are considered by state wildlife agencies within the Great Basin as a significant, highly specialized resource, very dependent upon sagebrush vegetation, and sensitive to environmental disturbance. The loss of any key habitat is considered a significant impact (Molini, 1980). Direct removal of key habitat in 14 hydrologic subunits would have significant impacts. Many key habitat sites are probably not currently mapped, and M-X construction could have significant impacts in other hydrologic subunits after more information is collected.

Operating Base (OB) Impacts

Figure 4.3.2.7-2 shows the relationship of sage grouse range and the Milford Operating Base area. None are present near the Coyote Spring OB site.

Coyote Spring Valley, Nevada Area

No sage grouse occur in the vicinity of the Coyote Spring OB, and no significant adverse impacts to sage grouse would result from OB construction or operation.

Milford, Utah Area

No direct loss of sage grouse habitat would result from construction of a base southwest of Milford (Figure 4.3.2.7-2). However, over 4,200 acres of habitat could be lost to sage grouse if the base were moved to the northeast part of the suitability zone. Increased exploitation (both legal and illegal) would likely affect the population of sage grouse located near Minersville, Utah. Because of a substantial increase in the human population in the area (estimated at approximately 14,700 people for the life of this project), sage grouse would be negatively affected by increased recreation, particularly ORV use.

Increased camping would also be likely in meadow and riparian habitats, thus impacting sage grouse brood-use areas. Many investigators have found that destruction of sagebrush near a strutting ground can severely reduce sage grouse use

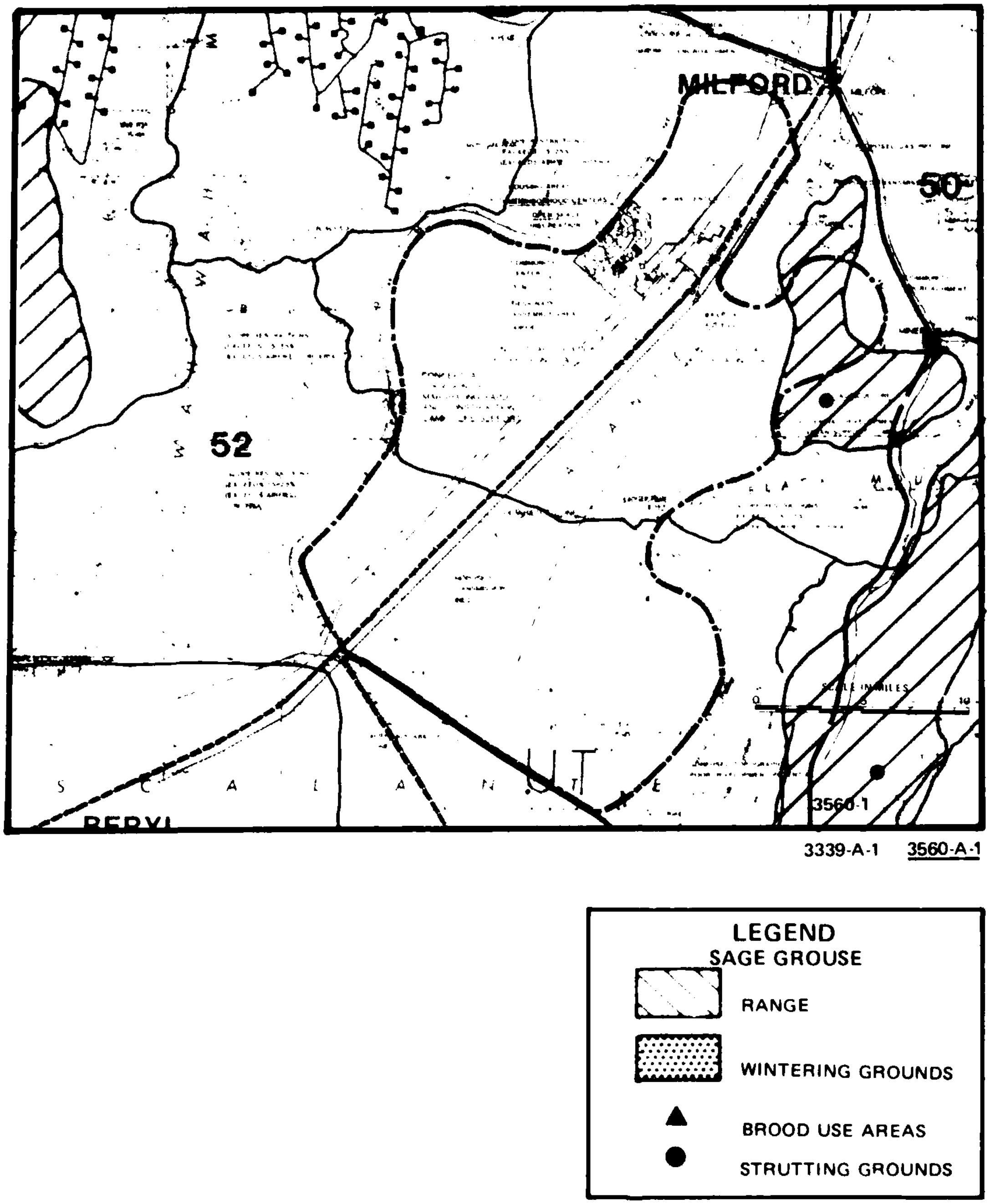

Figure 4.3.2.7-2. Distribution of sage grouse in the vicinity of the Milford OB.

of the strutting ground or cause its abandonment altogether. These effects would last throughout the operations phase of the project. ORV use could be expected to be very high within 3 mi of the base (Rajala, 1980) and would be particularly harmful to sage grouse if the base were located in the northeast part of the suitability zone, directly in sage grouse habitat. Productivity for this area would probably be lowered even after project decommissioning. Productivity of sage grouse is tied largely to the quality of the sagebrush habitat, and the recovery of sagebrush would probably take 50-100 years (see ETR-14, Natural Vegetation).

Direct impacts could be avoided if the base were not sited in the northeast part of the suitability zone. Both ORV and poaching impacts could be avoided. Areas known to have sage grouse could be posted to prohibit ORV activity and patrols could be started in sage grouse areas to monitor ORV use and poaching. Limitation of human activities in these areas during the months encompassing courtship, nesting, and brood rearing could help ensure reproductive success.

Table 4.3.2.7-2 shows the effects on sage grouse of the OBs for the Proposed Action. Milford would have significant indirect effects on sage grouse in four hydrologic subunits, while Coyote Spring would have minimal impacts. The overall indirect effect of the OBs for the Proposed Action would be high.

ALTERNATIVE 1 (4.3.2.7.3)

DDA Impacts

The impacts for the DDA of Alternative 1 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Figure 4.3.2.7-3 overlays sage grouse distribution in Nevada and Utah with the location of the Beryl OB location.

Coyote Spring Valley, Nevada Area

No significant adverse impacts to sage grouse will occur due to the location of the base at Coyote Spring Wash because no sage grouse occur in this area.

Beryl, Utah Area

Adverse indirect impacts to sage grouse are likely to occur if a base is located at Beryl, Utah, due to a significant increase in population in a presently sparsely populated area. The population in this area is expected to increase by approximately 14,500 people during the time the base is operational. Sage grouse occur in both southern Pine and Hamlin valleys to the north of this base and in areas of the Escalante Desert to the southeast (Figure 4.3.2.7-3). These areas would likely receive most of the increase in sage grouse hunting pressure (both legal and illegal) resulting from population increases at Beryl because of their closeness to the base (10-20 miles). This could lead to severe population reductions in these areas. These areas also may receive increases in other types of human recreation. These activities would serve to lower sage grouse numbers through direct mortality and habitat degradation mostly by ORV use. This lowering of sage grouse numbers would

Table 4.3.2.7-2. Potential overall indirect impact to sage grouse which could result from construction and operation of M-X operating bases for the Proposed Action and Alternatives 1-8.

			Impact[1]								
	Hydrologic Subunit or County	Habitat Type Present[5]	Proposed Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8
No.	Name		Coyote Spring/ Milford	Coyote Spring/ Beryl	Coyote Spring/ Delta	Beryl/ Ely	Beryl/ Coyote Spring	Milford/ Ely	Milford/ Coyote Spring	Clovis/ Dalhart	Coyote Spring/ Clovis
	Subunits or Counties within OB Suitability Zone										
46	Sevier Desert, Utah	None	-	-	-	-	-	-	-	-	-
50	Milford, Utah[2,4]	Key	*****	***	-	***	***	*****	*****	-	-
52	Lund District, Utah	None	-	-	-	-	-	-	-	-	-
53	Beryl-Enterprise, Utah	Key	***	*****	-	-	*****	-	-	-	-
179	Steptoe, Nev.	Key	-	-	-	*****	-	*****	-	-	-
210	Coyote Spring, Nev.	None	-	-	-	-	-	-	-	-	-
219	Muddy River Springs, Nev.	None	-	-	-	-	-	-	-	-	-
	Curry County, N. Mex.[3]	None	-	-	-	-	-	-	-	-	-
	Hartley County, Tex.[3]	None	-	-	-	-	-	-	-	-	-
	Other Affected Subunits or Counties										
4	Snake, Nev./Utah	Range	-	-	*****	***	-	***	-	-	-
5	Pine, Utah	Key	*****	*****	***	*****	*****	*****	***	-	-
9	Government Creek, Utah	Key	-	-	***	-	-	-	-	-	-
48	Beaver, Utah	Key	*****	*****	-	*****	*****	*****	*****	-	-
49	Parowan, Utah	Key	*****	*****	-	*****	*****	*****	*****	-	-
51	Cedar Spring, Utah[2]	Key	***	***	-	***	***	*****	*****	-	-
154	Newark, Nev.[2]	Key	-	-	-	***	-	***	-	-	-
155	Little Smoky-North and South, Nev.	Key	-	-	-	***	-	***	-	-	-
174	Jakes, Nev.	Key	-	-	-	*****	-	*****	-	-	-
175	Long, Nev.	Key	-	-	-	***	-	***	-	-	-
178	Butte, Nev.	Key	-	-	-	***	-	***	-	-	-
180	Cave, Nev.	Key	-	-	-	*****	-	*****	-	-	-
183	Lake, Nev.	Key	-	*****	-	*****	*****	*****	-	-	-
184	Spring, Nev.	Key	-	-	-	*****	-	*****	-	-	-
185	Tippett, Nev.	Range	-	-	-	-	-	***	-	-	-
196	Hamlin, Nev./Utah	Key	*****	*****	-	*****	*****	*****	*****	-	-
198	Dry, Nev.	Range	***	***	-	***	***	***	***	-	-
201	Spring, Nev.	Key	*****	*****	-	-	*****	*****	*****	-	-
202	Patterson, Nev.	Key	-	*****	-	-	-	-	-	-	-
207	White River, Nev.[2]	Key	-	-	-	*****	-	*****	-	-	-
	Overall Alternative Impact		***	***	-	*****	***	*****	***	-	-

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[1]- = No impact.
* = Low impact.
*** = Moderate impact--see ETR 15 for criteria.
***** = High impact--see ETR 15 for criteria.
Impact rankings based upon output from the Indirect Effects Module (Appendix D).

[2]Conceptual location of Area Support Centers (ASCs) for Proposed Action and Alternatives 1-6.

[3]Conceptual location of Area Support Centers (ASCs) for Alternative 7.

[4]Conceptual location of Area Support Centers (ASCs) for Alternative 8.

[5]Range = Sage grouse present but no key habitat known for this area.
Key = Sage grouse present and key habitat (leks, brood-use areas, and/or wintering grounds) also found in this area.

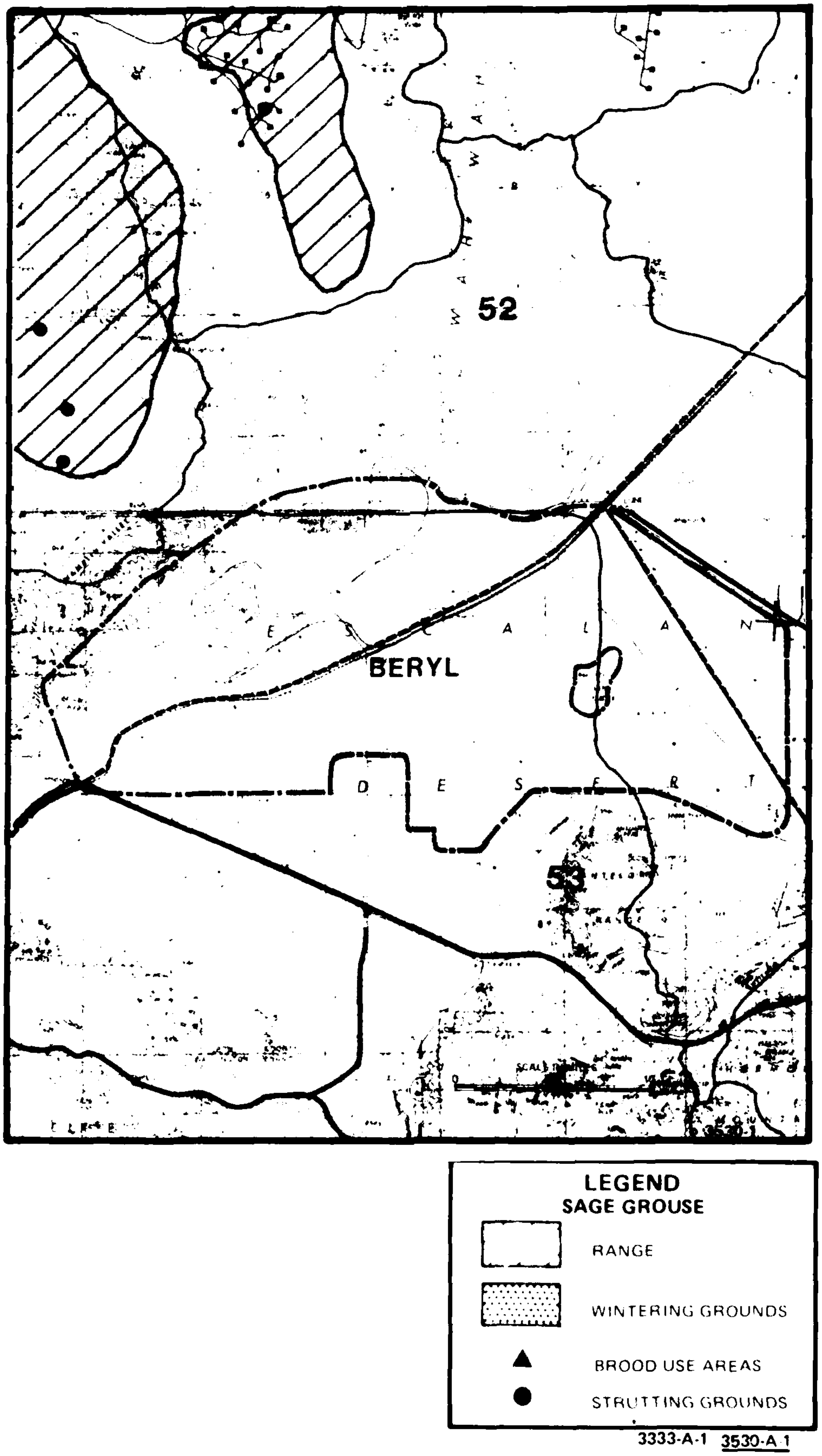

Figure 4.3.2.7-3. Distribution of sage grouse in the vicinity of the Beryl OB.

probably be substantial if ORV use is high. These effects would be long-term and should lower the productivity of the populations in Pine Valley and the Escalante Desert and perhaps in most of Hamlin Valley. This impact is significant for the Beryl OB. The impacts at this base are very similar to the Milford OB and the same mitigation measures would apply. Table 4.3.2.7-2 indicates that the Coyote Spring OB has minimal negative effects to sage grouse, but the Beryl OB would have signiificant negative impacts in 7 hydrologic subunits. The overall impact of the two OBs is high for Alternative 1.

ALTERNATIVE 2 (4.3.2.7.4)

DDA Impacts

The impacts for the DDA of Alternative 2 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Coyote, Spring Valley, Nevada Area

No significant impacts to sage grouse will occur due to a base located at Coyote Spring Wash because no sage grouse inhabit this area.

Delta, Utah Area

Few impacts to sage grouse are expected from a base at Delta. Sage grouse occur approximately 30 miles northwest of the base site in the Sheeprock Mountains and about 80 miles northwest in the Deep Creek Mountains. Hunting may increase in the Deep Creek Mountains because of their natural beauty and attractiveness, but this is not expected to be significant. Table 4.3.2.7-2 shows only the Snake hydrographic subunit being significantly impacted by people from the Delta OB and this is caused mostly by its inherent attractiveness. Overall impacts to sage grouse would be low in Alternative 2.

ALTERNATIVE 3 (4.3.2.7.5)

DDA Impacts

The impacts for the DDA in Alternative 3 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Figures 4.3.2.7-3 and 4.3.2.7-4 show the distribution of sage grouse in the vicinity of the Beryl and Ely OB sites.

Beryl, Utah Area

The discussion for the Beryl OB site can be found under Alternative 1.

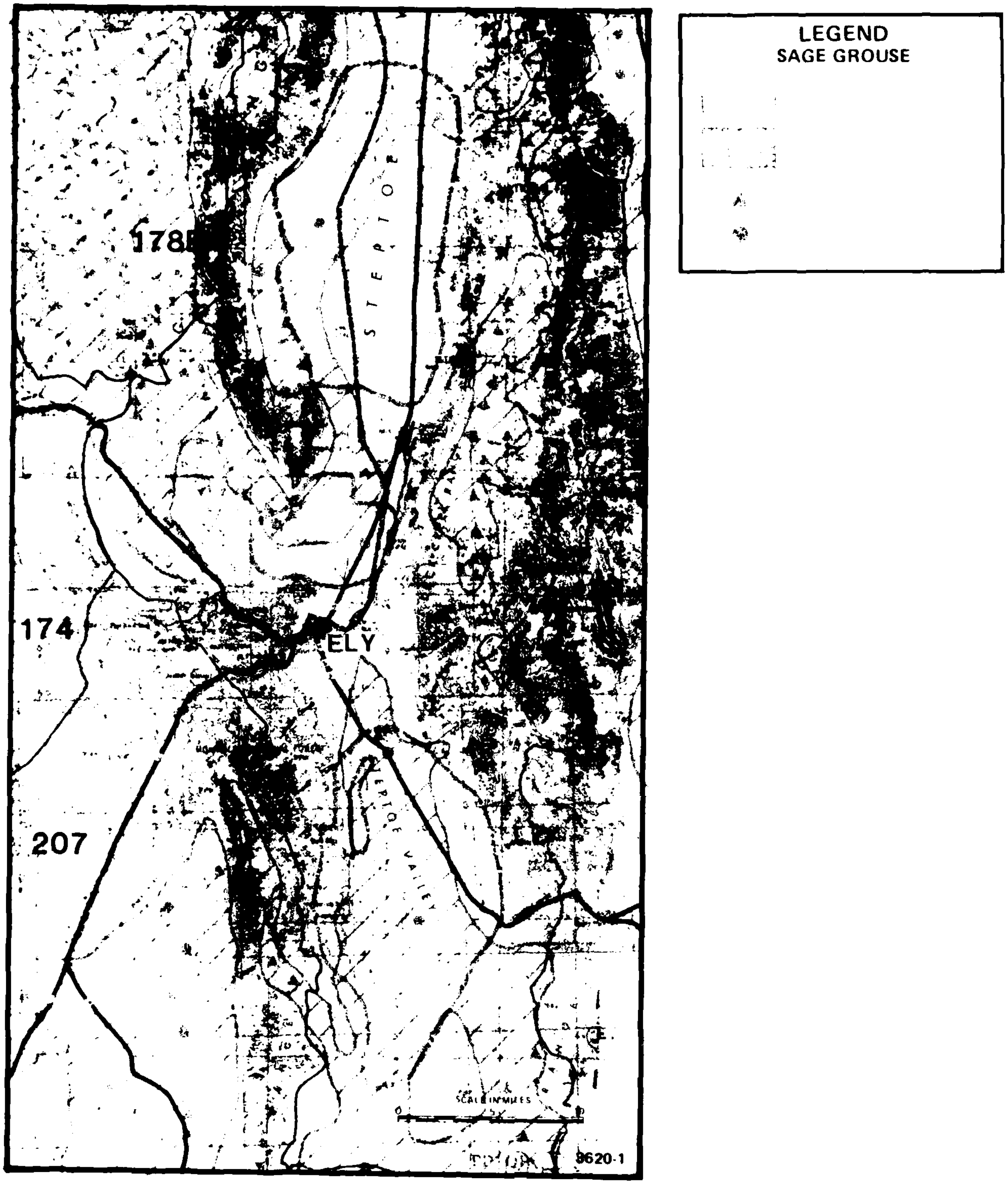

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Figure 4.3.2.7-4. Distribution of sage grouse in the vicinity of the Ely OB.

Ely, Nevada Area

The large suitability zone south of Ely and the other large zone north of McGill both have a high potential for direct impact to sage grouse habitat. On the other hand, the small zone just north of Ely has a very low potential for intersecting any sage grouse habitat. A base within the suitability zone to the south of Ely has a 90-100 percent probability of removing 4,500 acres of sage grouse habitat because sage grouse occur throughout most of this area (Figure 4.3.2.7-4). The present base location will remove 4,500 acres of sage habitat. There is approximately a 50 percent probability of removing this amount of habitat in the large northern zone because about 50 percent of this area contains sage grouse (Figure 4.3.2.7-4). Removal of sagebrush will reduce the carrying capacity of the area and will lead to a reduction of sage grouse numbers. Increased human population will also cause impacts to sage grouse, and these effects will be the same in both suitability zones. The large population increase, estimated to be 14,500 people in the Ely area (the present population of Ely is about 5,000), will lead to an increase in hunters. Areas 20 to 30 mi north and south of Ely which contain sage grouse are likely to be the most heavily exploited, both legally and illegally. This exploitation will lower sage grouse numbers and may lead to local extirpations. Another impact from the increased population would be an increase in ORV use. This recreational activity would also be heaviest locally (approximately 3 mi around a population center) and could lead to a severe degradation of the habitat (Rajala, 1980) which could also reduce sage grouse numbers. These impacts will be increased by the White Pine Power Project, which is expected to add approximately 800 more people to Ely.

Present population trends for sage grouse are decreasing in this area due partially to habitat deterioration in White Pine County (Molini and Barngrover, 1979). Installation of a base at Ely, with the attendant increased human population will continue this downward trend throughout the area and particularly so 10-30 mi around Ely. These can be expected to be long-term impacts. The effects of base personnel would continue for the 30-50 year life of the M-X project and beyond until the population of Ely is reduced and the land around the base and Ely is restored to its present condition. These are significant impacts because of the effects on local populations of sage grouse near Ely as the base will be large. Some of the impacts would be unavoidable if the base is placed directly in sage grouse habitat. The people-related impacts are avoidable if areas with sage grouse can be sufficiently monitored to limit ORV use and illegal exploitation. Additionally, hunting zones can be established to spread out the legal hunting, thus reducing the impacts in specific areas. Table 4.3.2.7-2 shows the potential effects of the Beryl and Ely OBs on sage grouse. Both of these bases will have significant indirect impacts caused by recreation concentrated in 10 hydrologic subunits (see Table 4.3.2.7-2). Ely will also have direct impacts. This alternative has the second highest impact (after Alternative 5) for sage grouse.

ALTERNATIVE 4 (4.3.2.7.6)

DDA Impacts

The impacts for the DDA in Alternative 4 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Figure 4.3.2.7-3 shows the range of sage grouse in the vicinity of the Beryl OB. Table 4.3.2.7-2 indicates that seven hydrologic subunits would be significantly impacted by the bases of Alternative 4. The overall impact to sage grouse from this alternative is high.

Beryl, Utah Area

The discussion for the Beryl base site can be found under Alternative 1.

Coyote Spring Valley, Nevada Area

No significant adverse impacts to sage grouse will result from a base at Coyote Spring Wash because no sage grouse occur in this area.

ALTERNATIVE 5 (4.3.2.7.7)

DDA Impacts

The impacts for the DDA of Alternative 5 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Figures 4.3.2.7-2 and 4.3.2.7.-4 show sage grouse range in the vicinity of the Milford and Ely OB sites. Table 4.3.2.7-2 shows that this alternative has a significant indirect impact on sage grouse.

Milford, Utah Area

The discussion for the Milford base site can be found under the Proposed Action.

Ely, Nevada Area

The discussion for the Ely base site can be found under Alternative 3.

ALTERNATIVE 6 (4.3.2.7.8)

DDA Impacts

The impacts for the DDA of Alternative 6 are the same as those discussed for the Proposed Action.

Operating Base (OB) Impacts

Figure 4.3.2.7-2 shows the distribution of sage grouse in the vicinity of the Milford OB site. None are present near the Coyote Spring site. Table 4.3.2.7-2 summarizes impacts to sage grouse from this alternative.

Milford, Utah Area

The main discussion for this base site can be found under the Proposed Action. Because the Milford OB is a first base in this alternative there is a greater potential for impacts to sage grouse than when it is a second base because the population increases to about 19,500 from 14,700.

Coyote Spring Valley, Nevada Area

No significant adverse impacts to sage grouse will occur due to a base at Coyote Spring Wash because no sage grouse occur in this area.

ALTERNATIVE 7 (4.3.2.7.9)

DDA Impacts

There will be no impacts to sage grouse due to the DDA because sage grouse do not occur in this basing region.

Figure 4.3.2.7-5 shows the relationship between M-X project configuration and lesser prairie chicken range. Locations of key habitat, including lek sites, brood use areas and feeding grounds, have not been identified in the Texas/New Mexico area.

The potential effects of M-X deployment on lesser prairie chickens fall into three broad categories: habitat loss, human disturbance and, to a lesser extent, surface water depletion. Habitat loss includes direct loss due to vegetation scarification and disturbance and indirect loss due to behavioral avoidance of construction and recreation sites. Prairie chickens remain close to lek sites throughout the year. Taylor and Guthery (1980b) found that 90 percent of the prairie chickens during months of low food abundance were within a 1.9 mi radius of lek sites, and virtually all were within 2.9 mi. Thus, a clearer understanding of lek distribution can lead to a more refined analysis of M-X deployment effects. This would be accomplished as part of analyses for subsequent tiered decisionmaking should Texas/New Mexico deployment be selected.

Any leks or brood use areas within a 0.5 mi radius of construction or high human activity have higher likelihood of abandonment; thus a 0.5 mi avoidance radius is recommended around such key habitat (R. Tully, Colorado Division of Wildlife). Noise, construction activity, and human presence initially could have a negative effect, although some acclimation is possible. This species shows little tolerance of disturbance during courtship displays.

Human population influx can result in indirect impacts to prairie chicken populations, primarily through ORV use and illegal hunting. Increased demand for legal hunting can be regulated by state agencies, but poaching presents a problem. Prairie chickens are conspicuous during courtship periods when they congregate. Their populations are especially vulnerable at that time. Birds may be hunted illegally, especially during the M-X construction phase. ORV use may result in gross vegetation and behavioral disturbance, which may then result in lowered prairie chicken productivity. Behavioral avoidance of areas frequented by ORVs may result in additional reduced productivity. However, ORV use will be limited in extent due to restricted access to private lands. Negative effects due to human population influx probably would be less than those resulting from direct habitat loss due to construction. However, it may also serve to further disrupt isolated populations in which case the impact could be compounded.

Surface water depletion through playa lake, stockpond, and/or natural spring depletion could have a detrimental effect on prairie chickens during critical time periods. For the most part, prairie chickens are not dependent on an immediate water source for survival because they derive moisture from food. However, Crawford and Bolen (1975) cited a number of instances of stock pond use by prairie chickens in spring and suggested they now may enhance survival during periods of spring drought.

Direct impacts were estimated from intersections of known rangeland within prairie chicken range and M-X project elements on 1:500,000 scale maps (1 in. = 4 mi). Data were obtained from New Mexico Department of Game and Fish, Texas Parks and Wildlife Department, United States Bureau of Land Management, and the Proceedings of the Prairie Grouse Symposium (1980). Because overall range (which includes areas not used by the species) rather than key habitat is used in this analysis, results represent an overestimate of the habitat area impacted. This has been compensated for to a degree by deducting the amount of cropland within the range that is impacted because this land-use largely precludes use by prairie chickens.

Short-term (construction) effects involve direct habitat disturbance and potential habitat loss within 0.5 mi of construction activity due to behavioral avoidance. Long-term effects include direct habitat loss alone because it is assumed that behavioral avoidance will end with termination of construction.

Table 4.3.2.7-3 summarizes lesser prairie chicken abundance based on county harvest records, prime habitat loss based on location of state restoration areas, percentage of range directly impacted, and the overall level of impact for each county in the M-X deployment area containing prairie chicken range. All eight New Mexico counties containing prairie chicken habitat would be impacted. No Texas counties containing prairie chickens are intersected by M-X project elements. Although the total acreage of rangeland lost directly is less than 3 percent in most counties, this does not include range lost due to behavioral avoidance of construction sites. Level of impact was judged high in six counties. As much as 8.4 percent of their range could be lost in Roosevelt County.

Short-term effects of M-X construction on lesser prairie chicken in New Mexico are summarized in Table 4.3.2.7-3. As much as 69 percent of potential prairie chicken habitat on rangeland may be lost due to vegetation loss or behavioral avoidance. Because this analysis assumes an even distribution of prairie chickens across the rangeland, it represents an overestimate of actual disturbance. However, Roosevelt County, New Mexico, contains some particularly important habitat in the form of state prairie chicken restoration areas, some of which are intersected by project elements. It also supports high harvest levels, which suggests high population levels. Although Chavez County has moderate harvest levels and a small percentage of range directly impacted, the level of impact is judged high because of the extensive disruption to large tracts of contiguous range in the southeastern portion of the state. The disjunct population found in a small part of Quay, Harding, and Union counties is intersected extensively by M-X elements. Because the

LEGEND

DISTRIBUTION OF THE LESSER PRAIRIE CHICKEN AND THE M-X CONCEPTUAL LAYOUT FOR TEXAS / NEW MEXICO

LESSER PRAIRIE CHICKEN RANGE IN AND NEAR THE TEXAS/NEW MEXICO M-X STUDY AREA.

RANGELAND WITHIN LESSER PRAIRIE CHICKEN RANGE.

COUNTIES WITH HIGH LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (MORE THAN 1 BIRD TAKEN PER HUNTER). [1]

COUNTIES WITH MODERATE LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (BETWEEN 0 AND 1 BIRD TAKEN PER HUNTER). [1]

LESSER PRAIRIE CHICKEN STATE RESTORATION AREA.

NOTES:

[1] COUNTIES WITH LOW LESSER PRAIRIE CHICKEN ABUNDANCE INDEX ARE NOT SHADED. TEXAS DATA ARE NOT AVAILABLE FOR EACH COUNTY.

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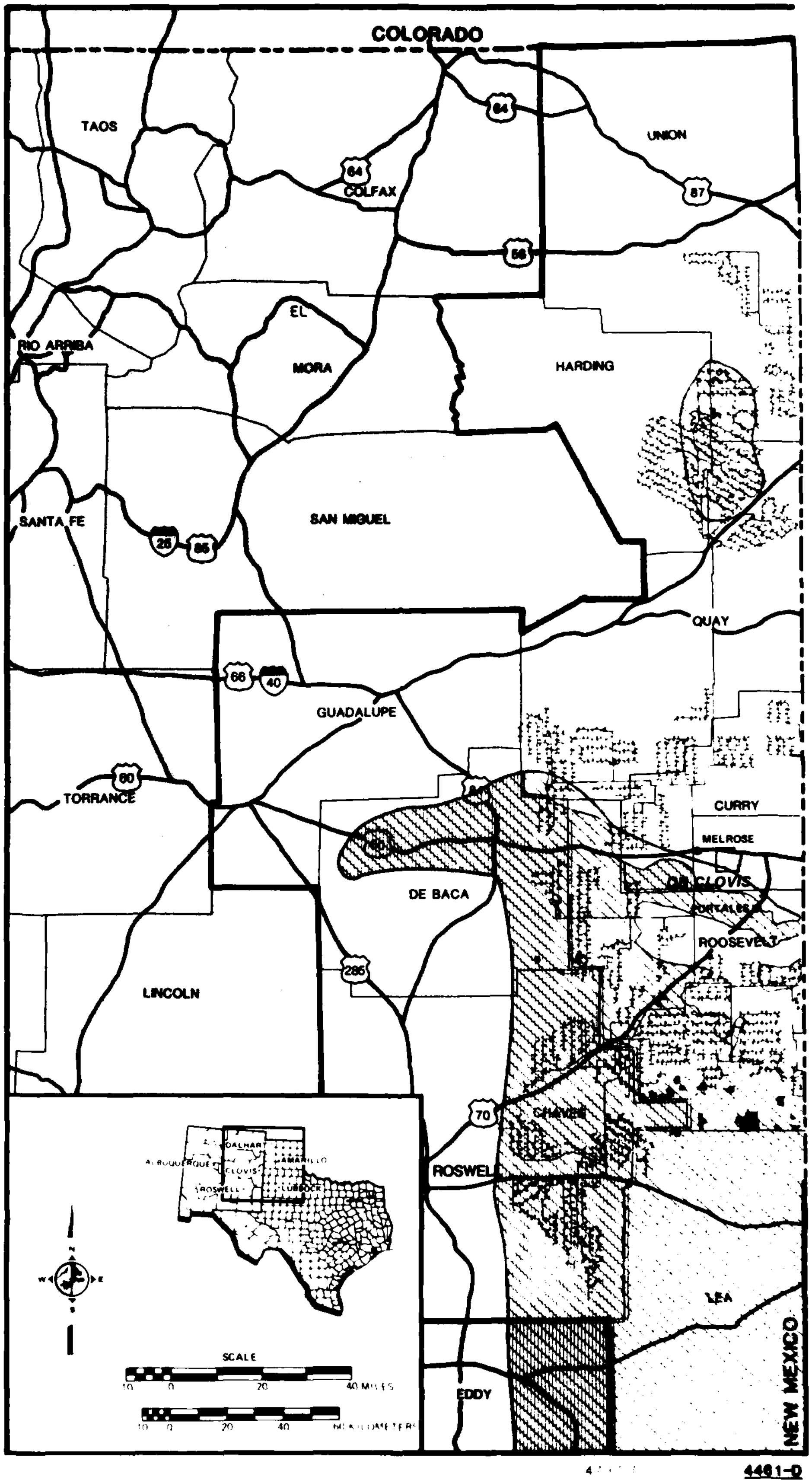
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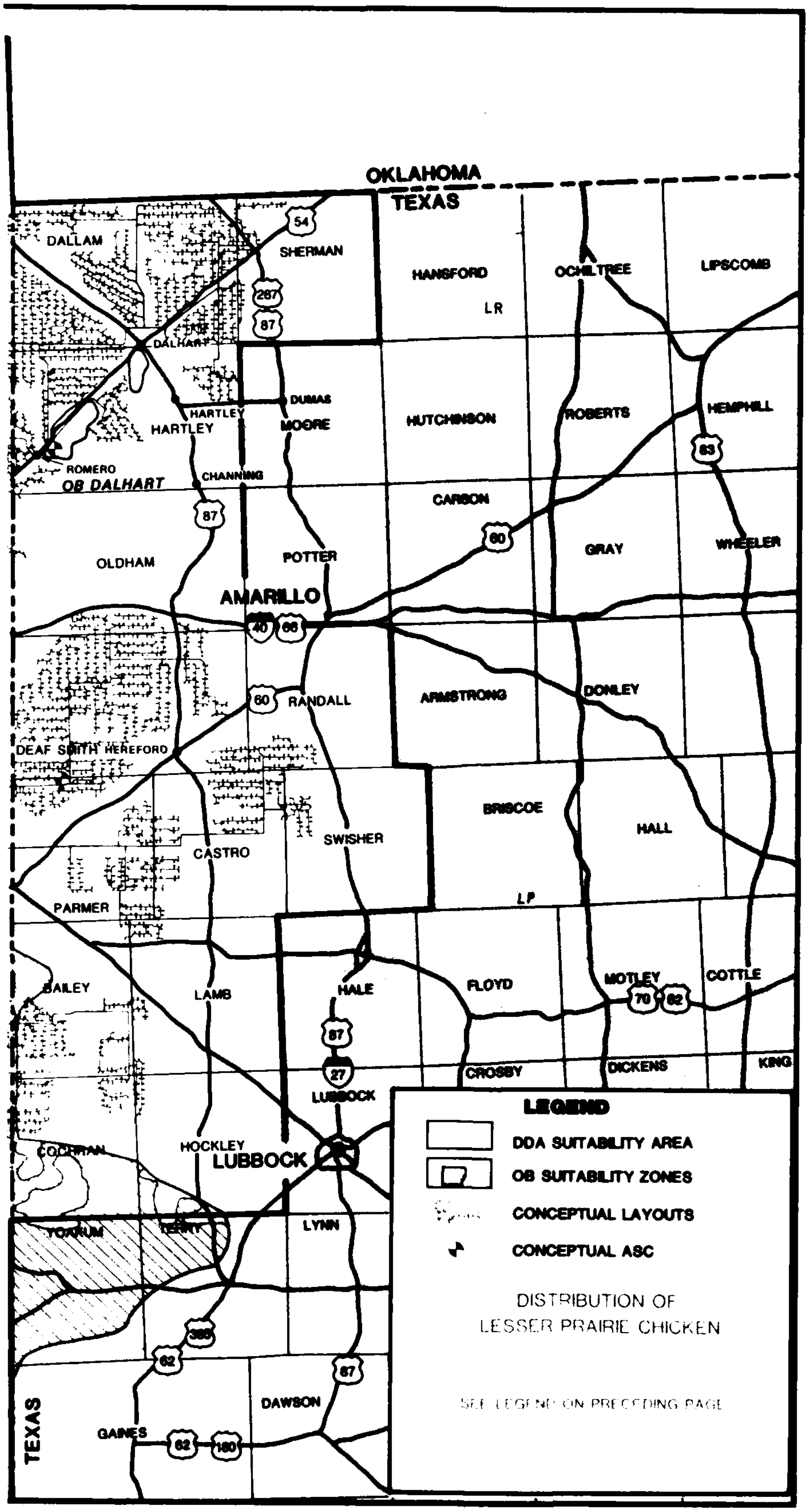

Figure 4.3.2.7-5. Distribution of lesser prairie chicken in the Texas/New Mexico study area and Alternative 7.

Table 4.3.2.7-3. Estimated DDA impact on lesser prairie chicken in Texas and New Mexico, Alternative 7.

County	Abundance Index[1]	Short-Term Impacts: Range Loss (Percent)	Short-Term Impacts: Level of Impact[2]	Long-Term Impacts: Range Loss (Percent)	Long-Term Impacts: Level of Impact[3]
Counties with M-X Clusters and DTN					
Bailey, Tex.	L	0	-	0	-
Castro, Tex.	-	0	-	0	-
Cochran, Tex.	L	0	-	0	-
Dallam, Tex.	-	0	-	0	-
Deaf Smith, Tex.	-	0	-	0	-
Hartley, Tex.	-	0	-	0	-
Hockley, Tex.	-	0	-	0	-
Lamb, Tex.	-	0	-	0	-
Oldham, Tex.	-	0	-	0	-
Parmer, Tex.	-	0	-	0	-
Randall, Tex.	-	0	-	0	-
Sherman, Tex.	-	0	-	0	-
Swisher, Tex.	-	0	-	0	-
Chaves, N. Mex.	M	40.0	*****	1.2	*****
Curry, N. Mex.	M	3.4	*	0.1	*
DeBaca, N. Mex.	M	18.0	*****	0.6	***
Guadalupe, N. Mex.	-	0	-	0	-
Harding, N. Mex.	L	69.0	*****	2.2	*****
Lea, N. Mex.	H	1.0	*	0.0	-
Quay, N. Mex.	L	65.0	*****	2.0	*****
Roosevelt, N. Mex.	H	30.4	*****	8.4	*****
Union, N. Mex.	L	64.0	*****	1.6	*****

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[1]Based on harvest data:
- - = No lesser prairie chickens present.
- L = Population present, none harvested.
- M = Low numbers harvested.
- H = High numbers harvested.

[2]Potential for short-term impact was determined using the abundance index, presence of state restoration areas, and percentage of range in rangeland disturbed, including 0.5 mi around all construction sites.
- - = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3]Potential for long-term impact was determined using the abundance index, presence of state restoration areas, and percentage of range in rangelands disturbed. Symbols same as above.

existing population level is low, any habitat loss or disruption could have serious impacts.

Deployment of M-X in the existing rangeland of Texas/New Mexico poses serious problems for the lesser prairie chicken. They are becoming increasingly rare in other states, but the New Mexico population appears to have stabilized. Without mitigation by avoidance, impacts due to construction may result in immediate and localized extirpation of some populations in part of the range or the creation of small, isolated pockets of suitable habitat containing small populations. Such isolated populations are more susceptible to population decline and extirpation than are populations in large tracts of suitable habitat (Wilson and Willis, 1975). The probability of being able to recolonize formerly occupied rangeland is lower when the potential source consists of fragmented units.

Two examples of what can result from habitat loss, population decline and isolation are Attwater's prairie chicken (T. cupido attwateri) and heath hen (T. c. cupido). Attwater's prairie chicken survives only in a small, closely managed refuge in southern Texas and the heath hen is extinct. They are subspecies of the closely related greater prairie chicken.

Operating Base (OB) Impacts

No sage grouse occur in Texas or New Mexico, so bases at Clovis and Dalhart would not have an impact on this resource.

Clovis, New Mexico Area

No direct loss of lesser prairie chicken habitat would result from construction of a base at Clovis or the immediate vicinity. Most land in the immediate vicinity is cropland, although prairie chicken leks are known in rangeland near Portales, 17 mi from the proposed OB. Only indirect effects from ORV use and poaching would be expected and these probably would be minimal.

Dalhart, Texas Area

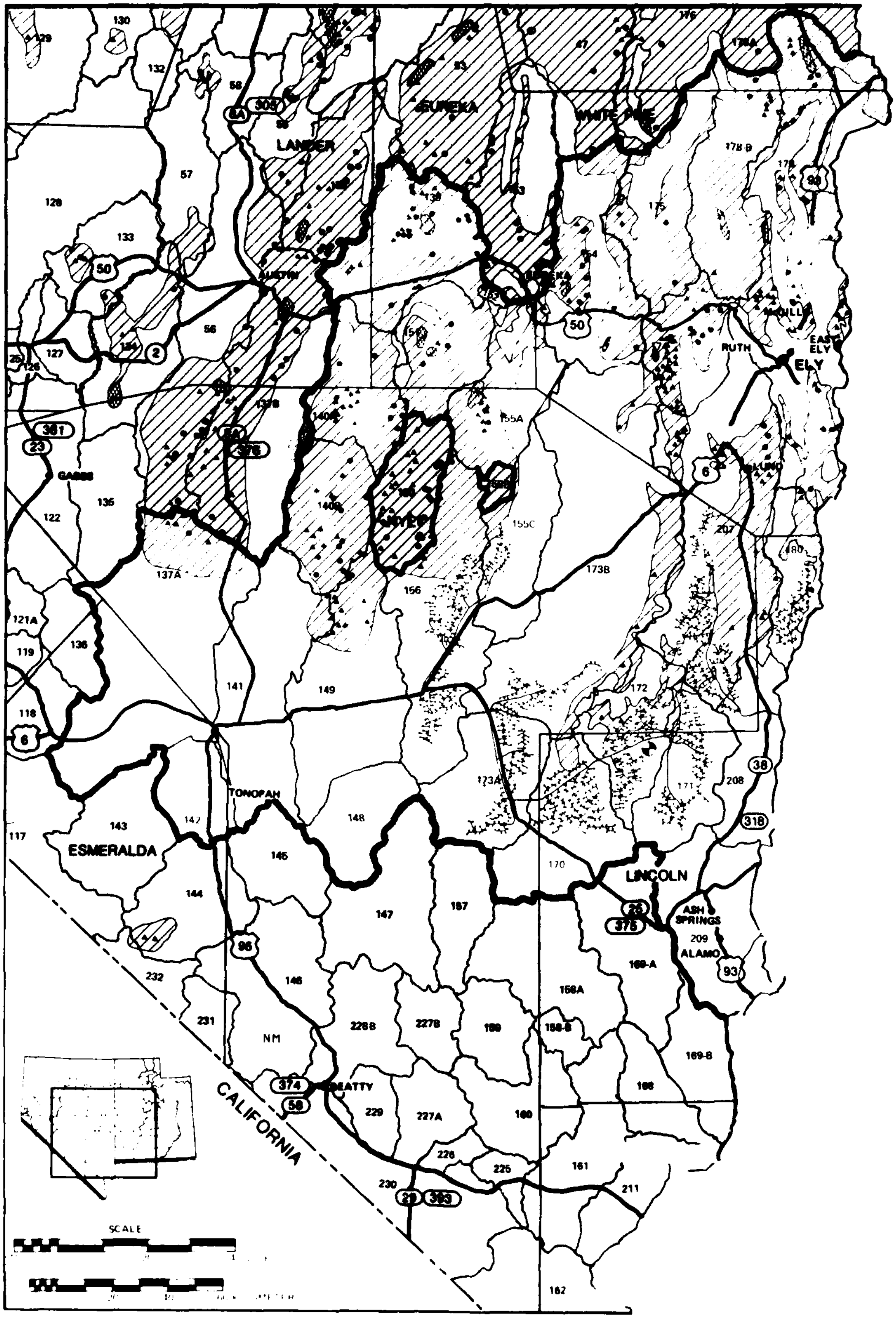
The overall impact lesser prairie chickens would be significant for Alternative 7 due to indirect effects and construction of DDA elements in prairie chicken habitat.

ALTERNATIVE 8 (4.3.2.7.10)

Fifty percent of the clusters (100) proposed for deployment under the Proposed Action are eliminated from the Nevada/Utah area and placed in the Texas/New Mexico deployment area. The remaining clusters are concentrated in the south-eastern half of the potential deployment area in Nevada/Utah. The kinds of impacts upon sage grouse are expected to be the same as for the Proposed Action (see Figure 4.2.3.4-6). Figure 4.2.3.4-7 shows the relationship between lesser prairie chicken range and project configuration in Texas/New Mexico.

DDA Impacts (Nevada/Utah)

The kinds of effects upon sage grouse from split-basing deployment are expected to be the same as under full deployment in Nevada/Utah. Other projects



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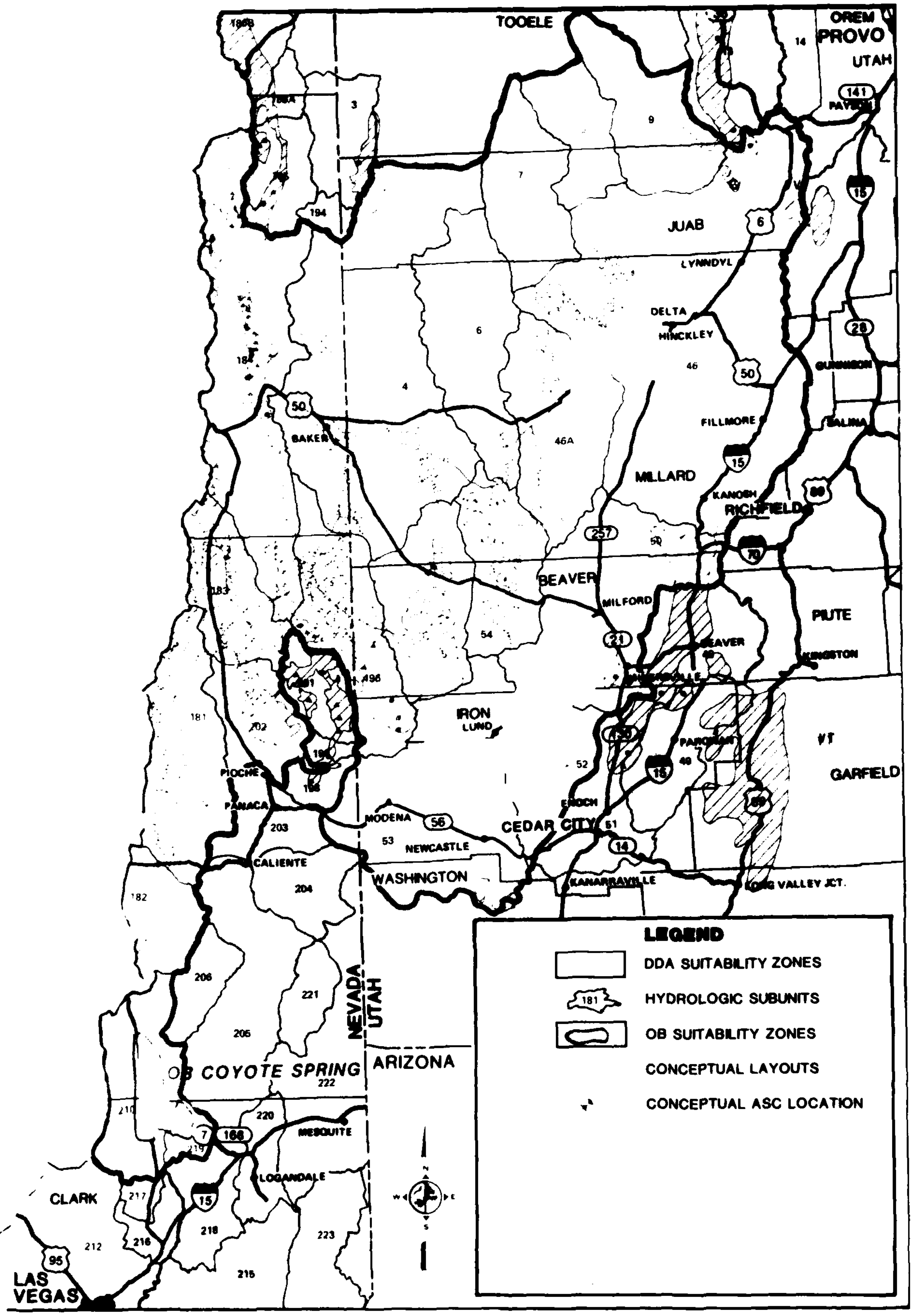

Figure 4.3.2.7-6. Sage grouse distribution and the Alternative 8 conceptual layout.

in the Great Basin that with M-X may have cumulative impact upon sage grouse are expected to produce the same impacts as those under full deployment in Nevada/Utah. The Anaconda-Nevada Molybdenum mine, however, will not have a cumulative effect with M-X because M-X will not utilize valleys in west-central Nevada under split basing.

Under split-basing deployment, 9 hydrologic subunits having sage grouse habitat would be disturbed (see Table 4.3.2.7-1) as compared to 19 subunits having sage grouse habitat directly affected under full deployment. Key habitat would be directly disturbed in only five subunits: Lake Valley (183) - one out of one known lek and four out of seven known brood-use ares; Hamlin Valley (196) - two out of three brood-use areas; Railroad Valley (173A and 173B)--1 out of 13 known brood-use areas; and Garden Valley (172) - two out of three brood-use areas. The maximum percentage of sage grouse range directly removed within any impacted subunit would be approximately 3 percent. The criterion for a significant effect upon sage grouse within a watershed is loss of key habitat. Therefore, only three subunits are significantly affected under split basing, while 14 subunits are significantly affected under the Proposed Action.

Lake Valley is the most heavily affected subunit in terms of key habitat loss to M-X split-basing deployment. The effect of key habitat loss and human activity would be greatest during the construction phase of deployment. Only one lek is known in Lake Valley, and it would be eliminated by M-X. If this is the only lek in the subunit, that sage grouse population would be permanently lost. However, it is possible that additional leks may exist, some of which may also be impacted by M-X. If other leks exist, some population recovery may occur in three to five years where key habitat was not destroyed but was behaviorally avoided by the birds during construction because of human activity. This assumes that animals avoiding project intersections with key habitat die or do not reproduce during their avoidance. A loss of four out of seven known brood-use areas would hamper recovery and perhaps keep abundance down to 40 to 50 percent of preproject levels.

Short-term and long-term productivity in Lake Valley would be expected to drop to zero if the one impacted lek is the only one present. If other leks exist long-term productivity would not be expected to increase above 40 to 50 percent of current levels because of the loss of broad-use areas, unless more of this key habitat is discovered there. In a comparison of impacts of the Proposed Action and split-basing deployment on sage grouse, split basing has a much smaller negative effect upon this species.

Table 4.3.2.7-1 lists the abundances and significance of impacts on sage grouse on a hydrologic subunit basis.

DDA Impacts (Texas/New Mexico)

Split basing will have the same types of effects on prairie chickens in Texas/New Mexico as discussed for Alternative 7. Long-term effects would impact 7 counties, compared to 8 under full deployment in Texas/New Mexico (Table 4.3.2.7-4). There is a slight decrease in the percentage of their range impacted in 4 counties. Similarly, short-term impacts would occur in 8 counties, with slight decreases in percentage of range affected when compared to full basing.

LEGEND

DISTRIBUTION OF THE LESSER PRAIRIE CHICKEN AND THE M-X CONCEPTUAL LAYOUT FOR TEXAS / NEW MEXICO

	LESSER PRAIRIE CHICKEN RANGE IN AND NEAR THE TEXAS/NEW MEXICO M-X STUDY AREA.
	RANGELAND WITHIN LESSER PRAIRIE CHICKEN RANGE.
	COUNTIES WITH HIGH LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (MORE THAN 1 BIRD TAKEN PER HUNTER). [1]
	COUNTIES WITH MODERATE LESSER PRAIRIE CHICKEN ABUNDANCE INDEX (BETWEEN 0 AND 1 BIRD TAKEN PER HUNTER). [1]
	LESSER PRAIRIE CHICKEN STATE RESTORATION AREA.

NOTES:

[1] COUNTIES WITH LOW LESSER PRAIRIE CHICKEN ABUNDANCE INDEX ARE NOT SHADED. TEXAS DATA ARE NOT AVAILABLE FOR EACH COUNTY.

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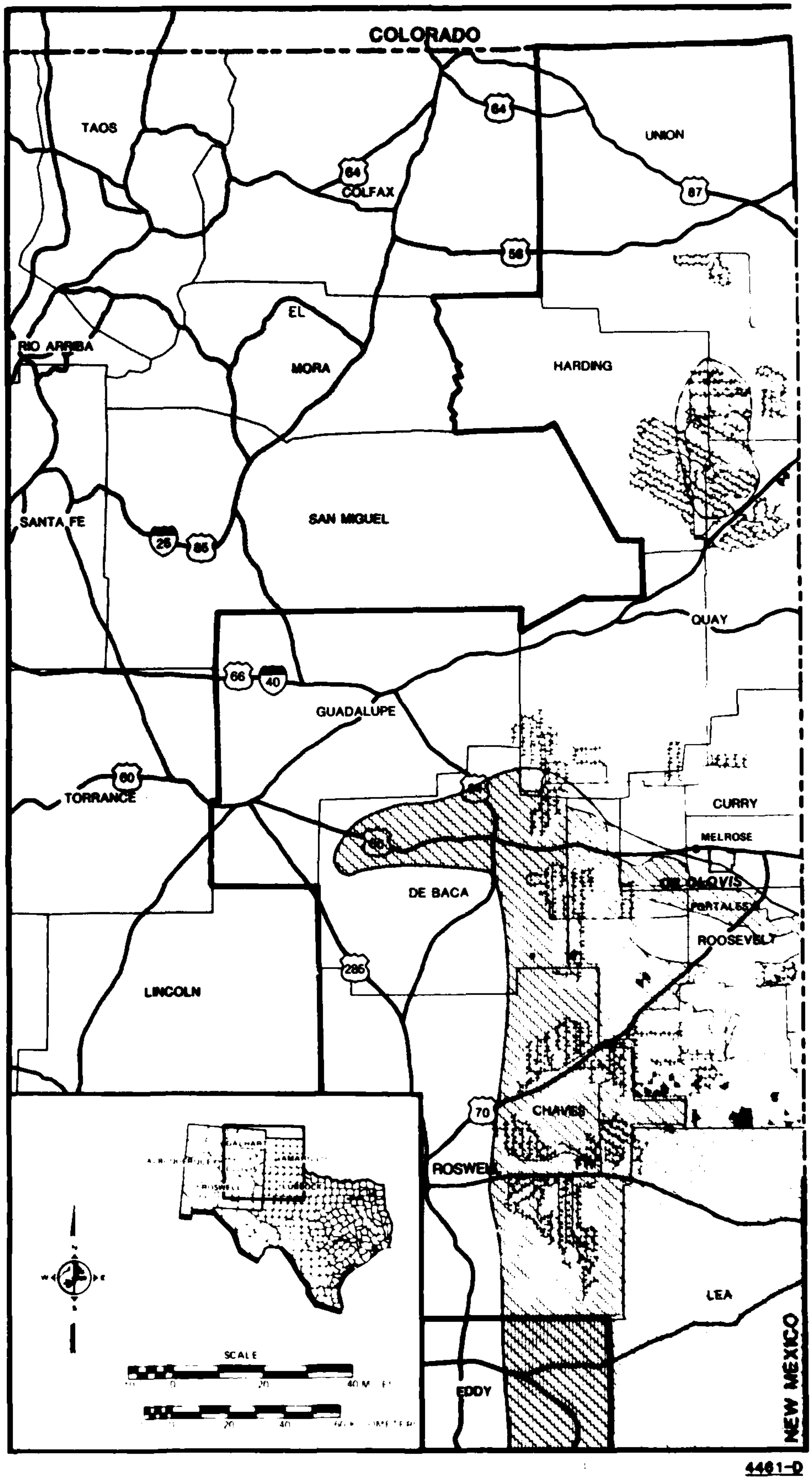
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CURRY
MELROSE
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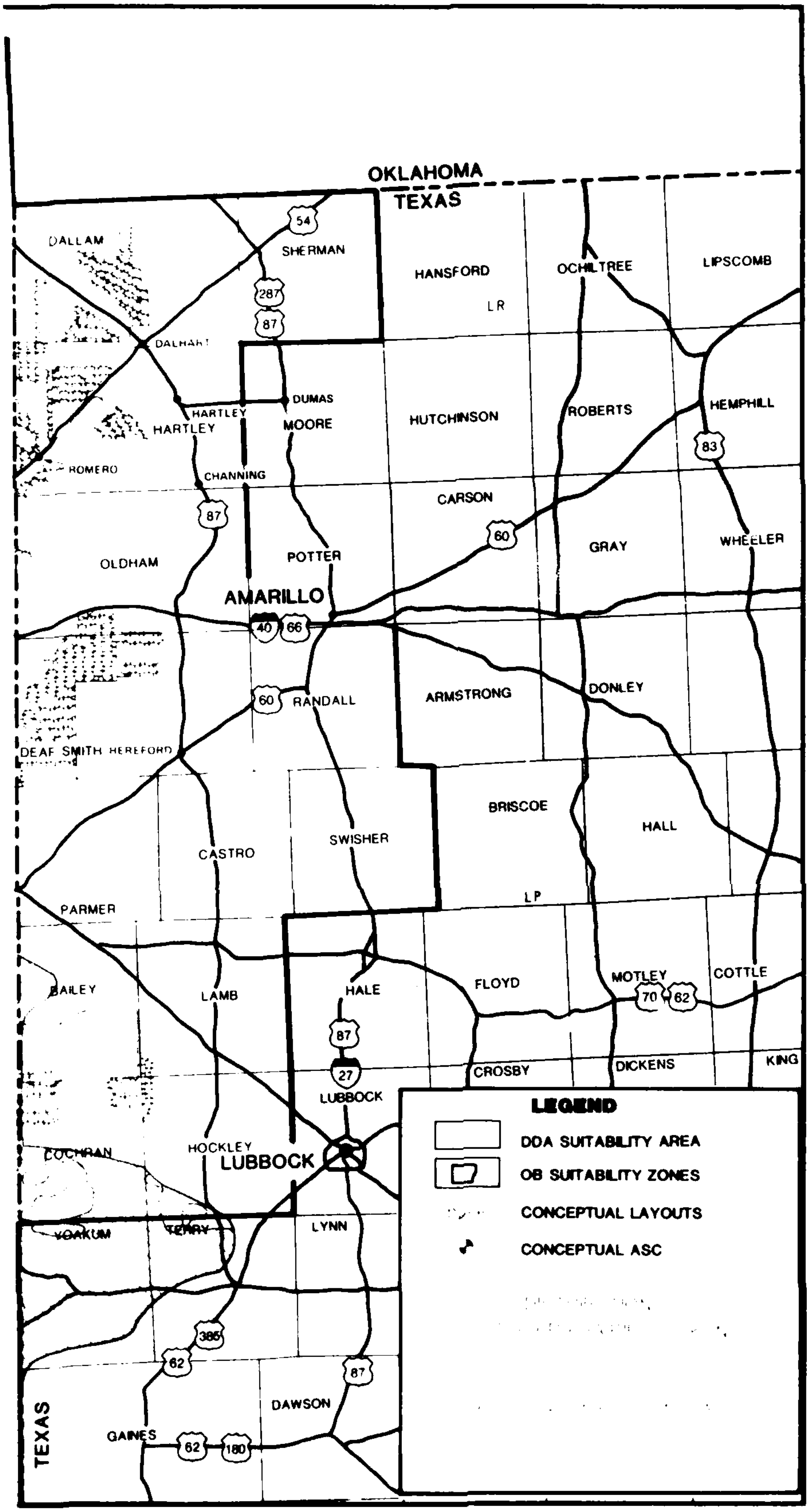

Figure 4.3.2.7-7. Distribution of lesser prairie chicken and the Alternative 8 layout.

Table 4.3.2.7-4. Estimated DDA impact on lesser prairie chicken in Texas and New Mexico, Alternative 8.

County	Abundance Index[1]	Short-Term Range Loss (Percent)	Short-Term Impact[2]	Long-Term Range Loss (Percent)	Long-Term Impact[3]
Counties with M-X Clusters and DTN					
Bailey, Tex.	L	0	-	0	-
Castro, Tex.	-	0	-	0	-
Cochran, Tex.	L	0	-	0	-
Dallam, Tex.	-	0	-	0	-
Deaf Smith, Tex.	-	0	-	0	-
Hartley, Tex.	-	0	-	0	-
Hockley, Tex.	-	0	-	0	-
Lamb, Tex.	-	0	-	0	-
Oldham, Tex.	-	0	-	0	-
Parmer, Tex.	-	0	-	0	-
Randall, Tex.	-	0	-	0	-
Sherman, Tex.	-	0	-	0	-
Swisher, Tex.	-	0	-	0	-
Chaves, N. Mex.	M	39	*****	1	*****
Curry, N. Mex.	M	3	*	1	*
DeBaca, N. Mex.	M	15	*****	1	***
Guadalupe, N. Mex.	-	0	-	0	-
Harding, N. Mex.	L	57	*****	2	*****
Lea, N. Mex.	H	1	*	0	-
Quay, N. Mex.	L	47	***	1	*
Roosevelt, N. Mex.	H	12	*****	3	*****
Union, N. Mex.	L	64	*****	2	*****
DDA Impact	L	18	*****	1	*****

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[1]Based on harvest data:
- \- = No lesser prairie chickens present.
- L = Population present, none harvested.
- M = Low numbers harvested.
- H = High numbers harvested.

[2]Potential for short-term impact was determined using the abundance index, presence of state restoration areas, and percentage of range in rangeland disturbed, including 0.5 mi around all construction sites.
- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3]Potential for long-term impact was determined using the abundance index, presence of state restoration areas, and percentage of range in rangelands disturbed. Symbols same as above.

The greatest difference is seen in Roosevelt county where percentage of range impacted in split basing is half that of full basing. Nevertheless, some lesser prairie chicken state restoration areas still would be impacted. This is one of the most important parts of their range in New Mexico. The disjunct population found in portions of Harding, Quay, and Union counties would be disrupted by project elements. This is a significant effect because any disruption to this isolated group would result in serious population decline or local extirpation.

Split-basing has a slightly smaller negative impact to lesser prairie chicken than does full basing in Texas/New Mexico.

Operating Base (OB) Impacts

Coyote Spring Valley, Nevada Area

No significant adverse impacts to sage grouse will occur due to a base at Coyote Spring Wash because no sage grouse occur in this area.

Clovis, New Mexico Area

No direct loss of habitat would result from construction of a base at Clovis or the immediate vicinity. Because prairie chickens are found near Clovis (at Portales), only indirect effects from ORV use and poaching would be expected. Compared to the total DDA effects these probably would be minimal.

MITIGATIONS (4.3.2.7.11)

Mitigation measures for sage grouse and lesser prairie chicken need to be directed toward the preservation of key habitats (e.g., leks, brood-use areas, and wintering grounds).

The Air Force will institute cooperative programs with appropriate federal and state agencies for fish and wildlife management. The Air Force would assist in identifying, monitoring, and managing species to counteract project impacts. These programs would include all or part of the following, as appropriate: avoid important habitats, if possible, schedule activities to avoid critical periods, fence selected construction areas, provide supplemental or replacement water and/or food sources, restrict worker pets in life support communities, suppress adverse noise impacts, assist enforcement and management agencies, transplant fish and wildlife, and provide additional habitat or alter other habitats to offset impacts.

In addition, the Air Force will restrict firearms in life support camps and at job sites, restrict off-road travel, accomplish a revegetation program in cooperation with appropriate federal and state agencies, and provide conservation education programs for workers and their dependents. A program to manage groundwater withdrawal as it affects surface water and an erosion control program will be instituted by the Air Force.

Additional details on mitigations for sage grouse and prairie chicken are included in ETR-15 (Wildlife) and ETR-38 (Mitigations).

Bighorn Sheep

BIGHORN SHEEP

INTRODUCTION (4.3.2.8.1)

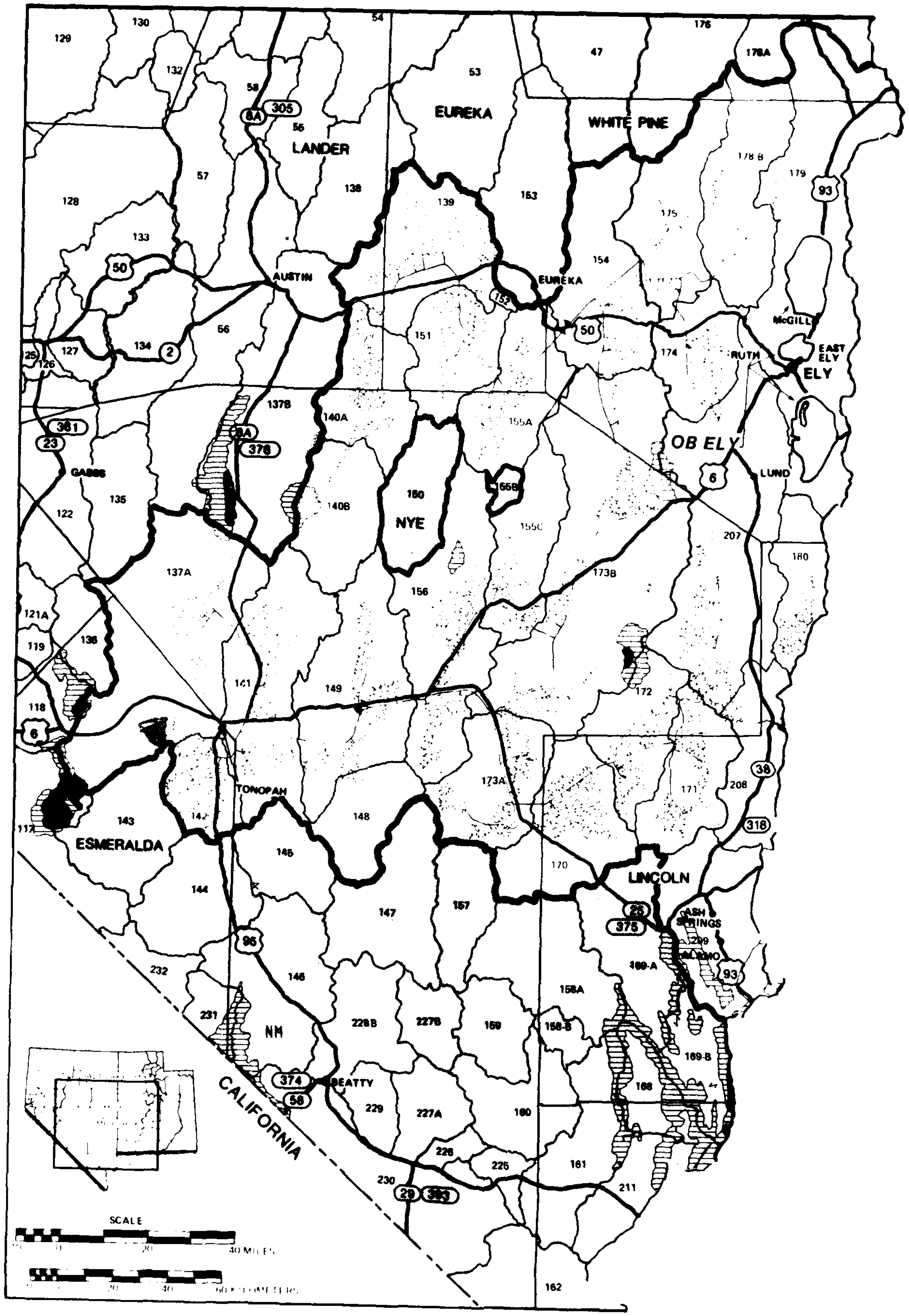
Bighorn sheep are a trophy big game species in Nevada and Utah for which hunter demand far exceeds the supply (1,469 applicants for 81 Nevada permits in 1979). The species also has a high aesthetic appeal. Bighorn sheep once inhabited most of the mountain ranges in Nevada and several in southwestern Utah. Their current distribution within the study area is limited primarily to southern Nevada, where several migration routes between mountain ranges have been identified.

Impacts were determined by combining information about bighorn sheep range, abundance, habitat requirements, and the project. Direct effects were assumed where construction would intersect range or migration routes, and indirect effects were assumed whenever substantial population growth would occur close to habitats. Short-term impacts in the DDA were defined as significant if habitat were lost, i. migration routes were crossed, or if project-related people would be living within 25 mi of bighorn sheep habitat. Direct impacts resulting from the operating bases were assumed to be significant if any habitat would be lost or any migration routes would be crossed. Short- and long-term indirect impacts from human activity in the vicinity of the OBs were determined using the abundance of bighorn sheep and an indirect effect index developed by a computer model that describes the distribution of people around the OBs. A distance of 35 mi from the OB was used to delimit the area that would be affected. The impact analysis methodology is discussed in greater detail in ETR-15 (Wildlife).

PROPOSED ACTION (4.3.2.8.2)

DDA Impacts

Figure 4.3.2.8-1 shows the relationship of bighorn sheep range to the conceptual project configuration. Because of their limited distribution and preference for rugged terrain, bighorn sheep are not likely to be directly affected by M-X in the DDA. Nevertheless, considerable public concern was expressed about the effects of project water use.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EUREKA
McGILL
EAST ELY
RUTH
ELY
OB ELY
LUND
GABBS
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
NM
BEATTY
CALIFORNIA
SCALE
40 MILES

4459-D

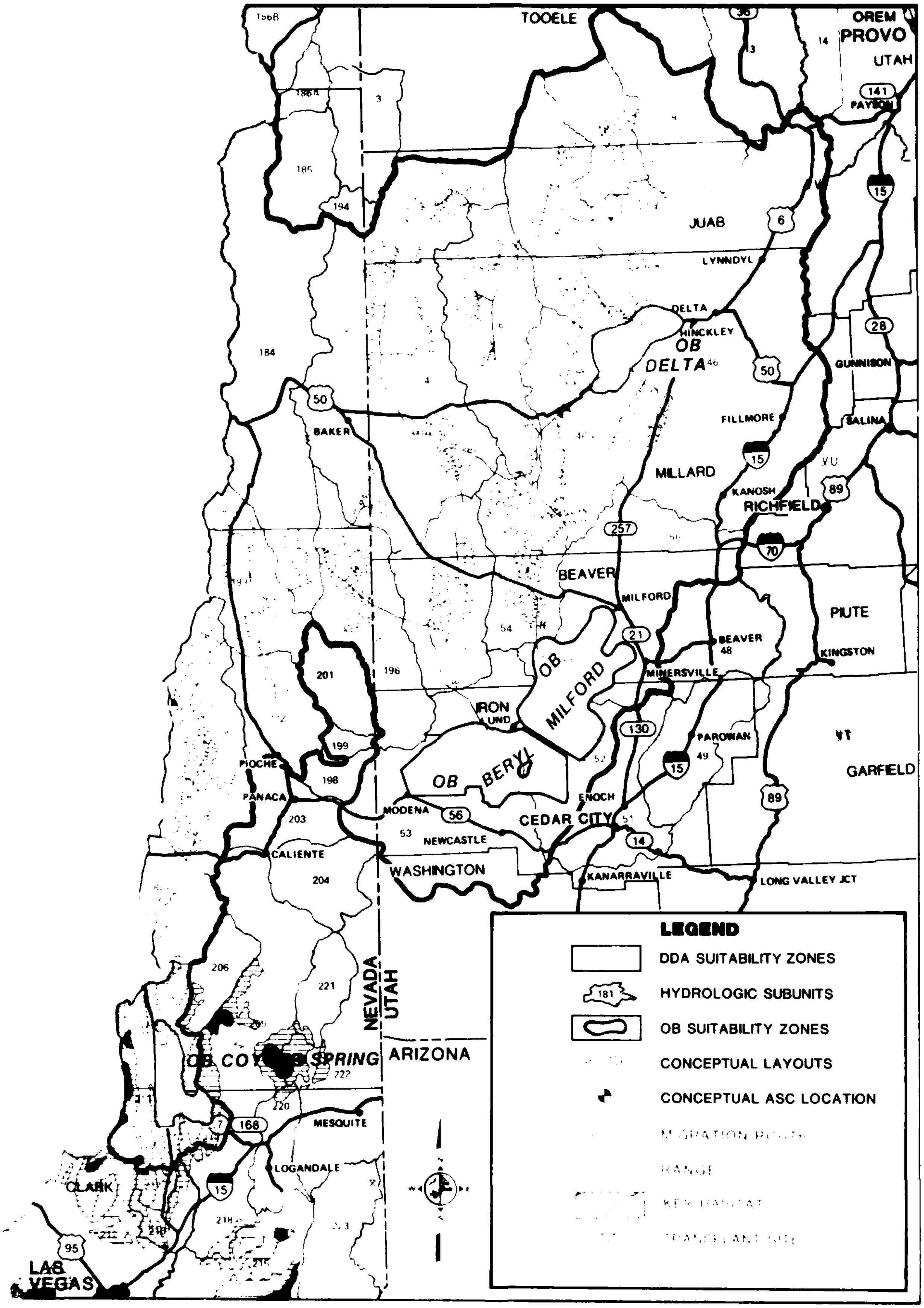

Figure 1.3.2.8-1. Bighorn sheep range and habitat and the Proposed Action conceptual project layout.

PUBLIC COMMENT ON THE DRAFT EIS:

> "Although bighorn sheep do not occur in the Utah segment, the following comment warrants consideration in areas where they occur. The loss of any surface springs and seeps due to insufficient groundwater recharge would have a significant negative impact on desert bighorn sheep, causing them to cease using these portions of their range. Habitat use is learned behavior by lambs from the ewes. Ewe avoidance of areas results in long-term nonuse of this portion of their home range. For this reason, the pioneering by sheep into these areas after DDA disturbance (water use and human activity) would be slow in recovery to preoperational population and density levels. This should be incorporated into the discussion."

Short-term indirect effects, however, could result from the recreational activities of construction workers and their families. Bighorn sheep are tolerant of some human activity within their habitat, but such activity at water sites during the dry summer months, when bighorn sheep are concentrated within about 2 mi of permanent water sources (Leslie and Douglas, 1979), could reduce their number. Studies of the use of a summer water site by bighorn sheep and humans (Jorgensen, 1974) have shown that bighorn sheep use of the site decreased approximately 50 percent on days when vehicle traffic (1-5 vehicles per day) was present. One of the major causes of death in Nevada desert bighorn sheep is pneumonia produced by the bacteria Pasteurella hemolytica (Taylor, 1976). When bighorn sheep are stressed, their resistance to this organism is lowered, increasing their susceptibility to pneumonia (McQuivey, 1978). Thus, increased human activity at bighorn sheep summer watering sites resulting from M-X induced population growth could reduce the bighorn sheep populations in southern Nevada. Poaching would also affect bighorn sheep populations. Other projects in the study area are not expected to increase the potential for M-X impact upon bighorn sheep in the DDA because of the distance of these projects from bighorn sheep populations.

Indirect effects to bighorn sheep in the DDA are expected to occur only during construction, when a large number of people would be present. Construction camps in Ralston, Dry Lake, Snake, Garden, and Railroad valleys would be within 25 mi of bighorn sheep habitat at Lone Mountain (146 sheep), in the Grant Range (100 sheep), in the White Pine Range (50 sheep), in the Delamar Mountains (50 sheep), and in the Snake Range (Rocky Mountain bighorn sheep transplant sites). Construction camps would be within 50 mi of the bighorn sheep population in the Pahranagat Range. Once construction is completed, few project-related people would be present in the DDA, thus reducing the potential for additional long-term effects on bighorn sheep to a very low level. Improved road access, however, may encourage off-duty personnel and people other than project personnel to use these areas. In addition, both states plan to reintroduce bighorn sheep to a number of mountain ranges in the potential deployment area which could be impacted by indirect project effects. For example:

PUBLIC COMMENT ON THE DRAFT EIS:

"Based on the Utah Division of Wildlife Resources October 1979 Big Game Transplant Schedule, Rocky Mountain bighorn sheep are scheduled for reintroduction onto some of the desert mountain ranges in Utah, with the Deep Creek Mountain Range at the top of the priority list. Desert bighorn sheep are also proposed for reintroduction onto the Pine Valley Mountains, Wah Wah Mountains, San Francisco Mountains, Mineral Mountains, House Range, Confusion Range, Sheeprock Mountains, Dugway Range, Stansbury Island, Lakeside Mountains and Silver Island Range in 1987-89. The increased human activity associated with M-X could create significant negative impacts to the reestablishment of the species in the form of poaching, ORV use, hiking and other recreational activities. The Utah transplant program must be addressed in the FEIS."

Short-term abundance of bighorn sheep could be reduced in the Grant Range, Delamar Mountains, Snake Range, and at Lone Mountain as a result of recreational activities and illegal hunting by construction workers, but the level of reduction cannot be reasonably estimated. Long-term effects are expected to be moderate in these areas. No irreversible or irretrievable commitment of bighorn sheep resources in the DDA is anticipated.

The effect of recreational activities and illegal hunting on bighorn sheep would be to reduce their numbers, which would then reduce other recreational opportunities, such as legal hunting and observation. Any decrease in population size for this valued species would be perceived as a significant impact by many people. Such effects are predicted to occur over a short time and at only a few locations in the DDA, and could be reduced by implementing the mitigation measures described below.

Table 4.3.2.8-1 summarizes the potential impact to bighorn sheep in the Nevada/Utah potential deployment area by hydrologic subunit. The estimate of significant impact is a worst case prediction since much of the preferred habitat of bighorn sheep is often inaccessible to humans or in areas with no other recreation attractions, such as fishable streams or campgrounds. The effects are expected to be short-term. Based on the demographic characteristics of bighorn sheep in the study area and depending upon the level of population reduction, bighorn sheep population recovery from these short-term effects would require approximately five years or longer or may not occur without intensive management effort.

The Health Care M-X DEIS Review Team questioned the impact analysis in the DEIS in which short-term impacts were listed as high and long-term impacts were low because the desert environment and bighorn sheep are slow to recover from disruptive influences. The analysis presented in Table 4.3.2.8-1 has been changed for the FEIS to indicate that long-term impacts may be moderate.

Coyote Spring Valley OB Impacts

The Coyote Spring OB suitability zone overlaps bighorn sheep habitat in the Delamar Mountains, Arrow Canyon Range, Las Vegas Range, and Meadow Valley

Table 4.3.2.8-1. Potential impact to bighorn sheep in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Name	Abundance[1]	Short-Term Impacts[2]	Long-Term Impacts[2]
	Subunits with M-X Clusters and DTN			
4	Snake, Nev./Utah	M/L	*****	***
5	Pine, Utah	-	-	-
6	White, Utah	-	-	-
7	Fish Springs, Utah	-	-	-
8	Dugway, Utah	-	-	-
9	Government Creek, Utah	-	-	-
46	Sevier Desert, Utah	-	-	-
46A	Sevier Desert-Dry Lake, Utah[3]	-	-	-
54	Wah Wah, Utah	-	-	-
137A	Big Smoky-Tonopah Flat, Nev.	H	*****	***
139	Kobeh, Nev.	-	-	-
140A	Monitor-North, Nev.	-	-	-
140B	Monitor-South, Nev.	-	-	-
141	Ralston, Nev.	-	-	-
142	Alkali Spring, Nev.	-	-	-
148	Cactus Flat, Nev.	-	-	-
149	Stone Cabin, Nev.	-	-	-
151	Antelope, Nev.	-	-	-
154	Newark, Nev.[3]	-	-	-
155A	Little Smoky-North, Nev.	-	-	-
155C	Little Smoky-South, Nev.	-	-	-
156	Hot Creek, Nev.[3]	-	-	-
170	Penoyer, Nev.	-	-	-
171	Coal, Nev.	-	-	-
172	Garden, Nev.	M/L	*****	***
173A	Railroad-South, Nev.	-	-	-
173B	Railroad-North, Nev.	M/L	*****	***
174	Jakes, Nev.	-	-	-
175	Long, Nev.	-	-	-
178B	Butte-South, Nev.	-	-	-
179	Steptoe, Nev.	-	-	-
180	Cave, Nev.	-	-	-
181	Dry Lake, Nev.[3]	-	-	-
182	Delamar, Nev.	M/L	*****	***
183	Lake, Nev.	-	-	-
184	Spring, Nev.	M/L	*****	***
196	Hamlin, Nev./Utah	-	-	-
202	Patterson, Nev.	-	-	-
207	White River, Nev.	-	-	-
208	Pahroc, Nev.	-	-	-
209	Pahranagat, Nev.	M/L	***	*
	Overall DDA Impact		*****	***

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[1]- = No bighorn sheep present.
M/L = Moderate to low abundance (less than 150 sheep).
H = High abundance (more than 150 sheep).

[2]- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

Potential for impact was determined using the abundance of bighorn sheep and presence of a construction camp within 25 mi (high) or 26-50 mi (moderate) of bighorn habitat.

[3]Conceptual location of Area Support Centers (ASCs).

Mountains (Figure 4.3.2.8-2). The road from Highway 93 to Moapa crosses a bighorn sheep migration route between the Meadow Valley Mountains and the Arrow Canyon Range. Other migration routes are crossed by Highway 93 south and north of the OB site. Increased traffic on these roads could be expected to increase the incidence of bighorn sheep road-kills, probably in proportion to the increase in traffic volume. Increased traffic and human encroachment could reduce or even stop bighorn sheep movements along these historic migration corridors over the course of several years. For example, Leslie and Douglas (1979) report that bighorn sheep migrations to the River Mountains at Railroad Pass and near Boulder City, Nevada, was curtailed over a period of 20 years as a result of human encroachment (roads, housing, etc.) in their historic movement pathways. Similar human encroachment in Coyote Spring Valley would effectively remove bighorn sheep from the Arrow Canyon Range because of the lack of permanent water there, thus decreasing habitat carrying capacity.

PUBLIC COMMENT ON THE DRAFT EIS:

> "It cannot be stressed too much that the cumulative effects of industrial, agricultural, and recreational development have historically been the nemesis of bighorn sheep populations and the underlying reason for their decline throughout the western United States (Welles, 1961; Blong, 1967; Wilson, 1968; Gallizioli, 1977; McQuivey, 1978). We have no reason to believe that the M-X and other proposed developments within the Coyote Spring Valley will be an exception to the rule. The United States Fish and Wildlife Service (USFWS), with the corroboration of the Nevada Department of Wildlife (NDOW), is developing a research project designed to provide information on sheep movements and population dynamics throughout the Desert National Wildlife Range (DNWR) and the surrounding mountain ranges. Data collected from this endeavor may be available by early 1983 and should give a better insight into the potential impacts of the M-X and possibly provide information and direction to aid the Air Force in siting and development of facilities not only in the Coyote Spring Valley but throughout the state of Nevada."

While the conceptual location of the OB within the suitability zone would not cause any direct loss of bighorn sheep habitat, the proposed support community would. In addition, substantial indirect effects would occur, since bighorn sheep inhabit all of the surrounding mountain ranges. The area of highest abundance of bighorn sheep in the state, the Sheep Range, is within 10 mi of the proposed OB site, but road access is limited. An estimated 730 animals inhabit this range with another 280 in the adjacent Las Vegas Range (McQuivey, 1978). On the other hand, road access to the Delamar, Meadow Valley, and Arrow Canyon mountains is fairly good, and it should be expected that construction workers, operations personnel, and their dependents would visit these areas. If, as a result, lactating ewes cannot get adequate water, lamb survival rate would decrease and the bighorn sheep population would be reduced. Present data are insufficient to make reasonable estimates of poaching, but this is another potential source of impact.

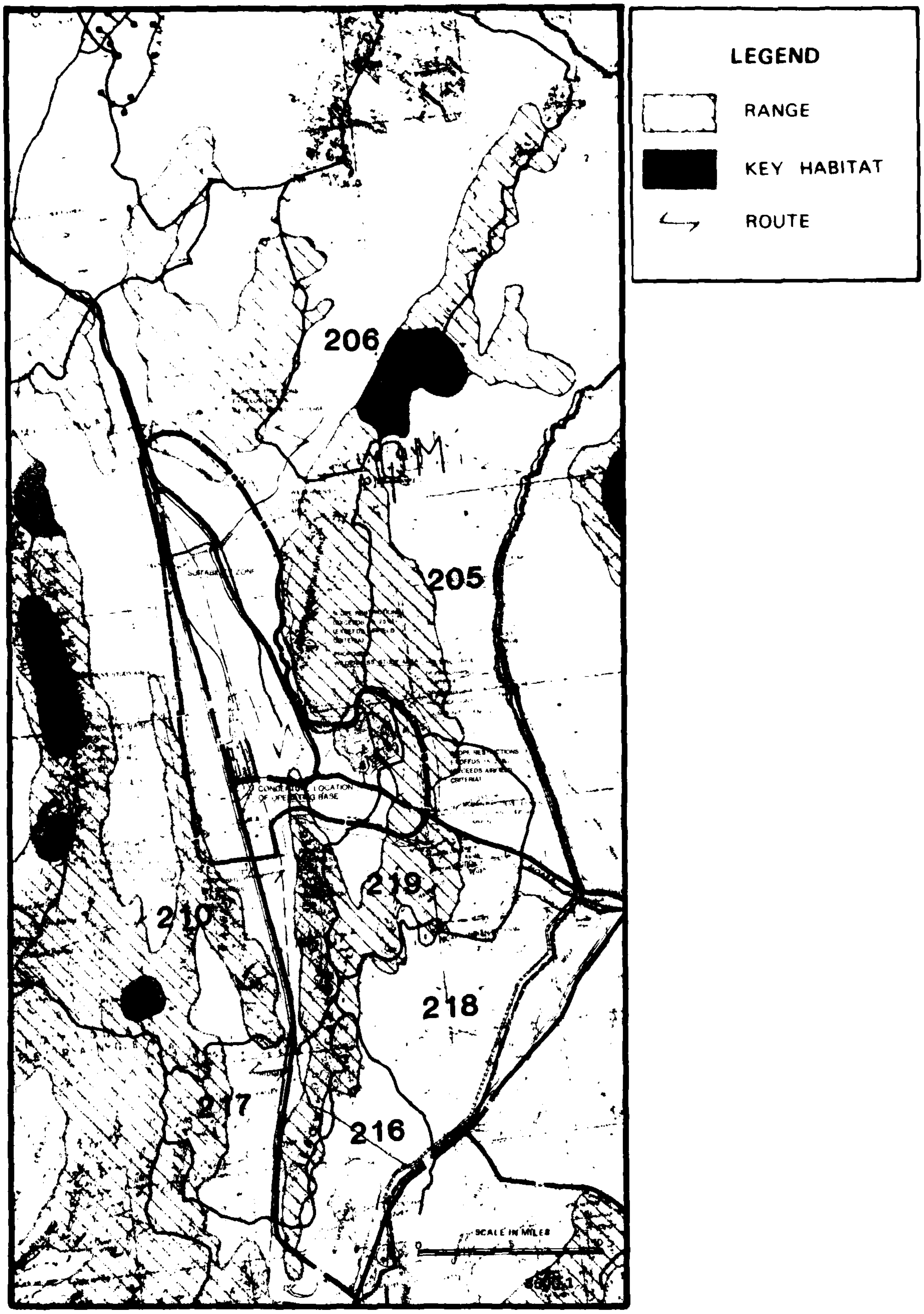

Figure 4.3.2.8-2. Relationship between bighorn sheep range and the Coyote Spring OB.

PUBLIC COMMENT ON THE DRAFT EIS:

"Increased human activity at watering sites and increased illegal hunting are by no means the only major causes of impacts. The suitable envelope for the Coyote Spring OB parallels 50 mi of the Sheep Mountain Range, which provides over 200 sq mi of key habitat for over 700 bighorn sheep. This highly mobile animal not only migrates from one mountain range to another but also forages at different elevations throughout the year. Consequently, the close proximity of the Coyote Spring OB with its associated work force, support facilities, and housing will likely impact, through attendant human disturbance, as much as 50 percent of the sheep habitat in the surrounding mountain ranges."

The indirect effects resulting from population growth in the Coyote Spring area are expected to peak during construction, when the maximum number of people (approximately 48,000) would be present in the area, and then decline in proportion to the fewer number of people (18,370) who will be present during operations. Some of these people might live in Las Vegas, which is about 40 mi south of the base site and would seek recreation either in Las Vegas or at Lake Mead 35 to 40 mi to the southeast or south. Some, however, would choose to visit the nearby mountains. Currently, pressure from recreation and development in bighorn sheep habitat, as well as competition with domestic livestock, is limiting expansion of bighorn sheep populations. The large influx of people resulting from M-X deployment would increase these pressures and could change the current stable population trend to a decline.

The only other large project planned concurrently with M-X in this area is the Harry Allen power plant in Dry Lake Valley (Garnet hydrologic subunit) approximately 25 mi south of the proposed OB. The peak number of people associated with this project would be 8,000, but this project is unlikely to increase the potential for impact to bighorn sheep in the Las Vegas and Arrow Canyon ranges because of its proximity to Lake Mead, a more attractive recreation area.

Siting an OB in Coyote Spring Valley would be expected to reduce the numbers of bighorn sheep in areas used for recreation by project-related people. The duration of this effect would depend upon the number of people remaining after decommissioning of the project.

Irreversible or irretrievable committment of resources is anticipated if any base facilities or the support community are build in bighorn sheep habitat or on a migration route.

Table 4.3.2.8-2 summarizes the potential indirect impacts to bighorn sheep in the vicinity of the operating bases for the Proposed Action and Alternatives 1-8. Significant impact to bighorn sheep is predicted in four of the seven hydrologic subunits containing bighorn sheep within 35 mi of the OB. Moderate impact is predicted for the other three subunits. Several mitigation measures that could reduce the potential impacts to bighorn sheep are listed in Section 4.3.2.8.11, Mitigations, and are further discussed in ETR-38 (Mitigations).

Table 4.3.2.8-2. Potential impact to bighorn sheep resulting from construction and operation of M-X operating bases for the Proposed Action, Alternatives 1-6, and the Nevada/Utah portion of Alternative 8.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance[1]	Impact[2,3] Proposed Action Coyote Spring/ Milford	Alt. 1 Coyote Spring/ Beryl	Alt. 2 Coyote Spring/ Delta	Alt. 3 Beryl/ Ely	Alt. 4 Beryl/ Coyote Spring	Alt. 5 Milford/ Ely	Alt. 6 Milford/ Coyote Spring	Alt. 8 Coyote Spring/ Clovis
	Subunits within OB Suitability Area									
46	Sevier Desert, Utah	-			-					
46A	Sevier Desert-Dry Lake, Utah[4]	-			-					
50	Milford, Utah	-	-					-	-	
52	Lund District, Utah	-	-	-		-	-	-	-	
53	Beryl-Enterprise, Utah	-		-		-	-			
179	Steptoe, Nev.	-				-		-		
210	Coyote Spring, Nev.	H	*****	*****	*****		*****		*****	*****
219	Muddy River Springs, Nev.	M/L	***	***	***		***		***	***
	Other Affected Subunits									
169B	Tikaboo, Nev.	H	*****	*****	*****		*****		*****	*****
206	Kane Spring, Nev.	M/L	***	***	***		***		***	***
216	Garnet, Nev.	H	*****	*****	*****		*****		*****	*****
217	Hidden Valley, Nev.	H	*****	*****	*****		*****		*****	*****
218	California Wash, Nev.	M/L	***	***	***		***		***	***
	Alternative Impact		*****	*****	*****	-	*****	-	*****	*****

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[1] - - No bighorn sheep present.
M/L - Moderate to low abundance (less than 150 sheep).
H - High abundance (more than 150 sheep).

[2] - - No impact.
* - Low impact.
*** - Moderate impact.
***** - High impact.

[3] Potential for impact was determined using the abundance of bighorn sheep and the indirect effect index described in Appendix D.

[4] Conceptual location of Area Support Centers (ASCs).

Milford OB Impacts

Bighorn sheep do not inhabit any of the mountains near the Milford area, although the Utah Division of Wildlife Resources has scheduled reintroductions to several nearby ranges in 1987-1989 as previously noted. Some bighorn sheep have been transplanted into Zion National Park, but no significant impacts resulting from M-X are anticipated.

ALTERNATIVE 1 (4.3.2.8.3)

Impacts in the DDA and at the Coyote Spring OB are the same as those for the Proposed Action. No bighorn sheep inhabit the area near the proposed Beryl OB site, although reintroductions are scheduled for several nearby mountain ranges, as previously noted. Some have been transplanted into Zion National Park but no significant effects resulting from M-X are expected.

ALTERNATIVE 2 (4.3.2.8.4)

Impacts in the DDA and at the Coyote Spring OB are the same as those for the Proposed Action. No bighorn sheep are present near the Delta OB site, although reintroductions are scheduled for several nearby mountain ranges, as previously noted. No significant impacts are predicted.

ALTERNATIVE 3 (4.3.2.8.5)

Impacts in the DDA are the same as those for the Proposed Action. No bighorn sheep currently inhabit the area near the proposed Beryl OB site, although reintroductions are scheduled for several nearby mountain ranges. Some sheep have been transplanted to Zion National Park, but no significant impacts from M-X are expected. No bighorn sheep inhabit the mountains near the proposed Ely OB site.

ALTERNATIVE 4 (4.3.2.8.6)

Impacts in the DDA and at the Coyote Spring OB are the same as those for the Proposed Action. No bighorn sheep inhabit the area near the proposed Beryl OB site, although reintroductions are scheduled for several nearby mountain ranges. Some sheep have been transplanted to Zion National Park, but no significant impacts from M-X are expected.

ALTERNATIVE 5 (4.3.2.8.7)

Impacts in the DDA are the same as those for the Proposed Action. No bighorn sheep occur near the proposed Ely OB sites, so no impacts are predicted. Some bighorn sheep have been reintroduced into Zion National Park, and further transplants are scheduled for mountain ranges near Milford, but no significant impacts from M-X are expected.

ALTERNATIVE 6 (4.3.2.8.8)

Impacts in the DDA and at the Coyote Spring OB are the same as those for the Proposed Action. Since bighorn sheep do not inhabit the mountains near the proposed Milford OB site, no impacts are predicted. However, reintroductions are scheduled for several nearby mountain ranges, as previously noted.

ALTERNATIVE 7 (4.3.2.8.9)

Bighorn sheep are not present in the Texas/New Mexico study area, so project deployment would have no impacts on this species.

ALTERNATIVE 8 (4.3.2.8.10)

Figure 4.3.2.8-3 shows the project configuration in relationship to bighorn sheep range in Nevada and Utah. Potential impacts to bighorn sheep resulting from DDA construction would be the same as those described for the Proposed Action, except that significant impacts would be expected for bighorn sheep only in the southern portion of the Grant Range and in the Delamar Mountains (Table 4.3.2.8-3) Project elements would occur in Snake Valley, and the construction camp would be within 50 mi of the Snake Range, which could result in moderate impacts to bighorn sheep. Impacts at the Coyote Spring OB are the same as those for the Proposed Action. (No bighorn sheep occur in the Texas/New Mexico study area.)

MITIGATIONS (4.3.2.8.11)

Mitigation measures for bighorn sheep should be directed toward protecting existing populations from disturbances due to construction and recreation as well as preserving their habitat and migration routes.

The Air Force will institute cooperative programs with appropriate federal and state agencies for fish and wildlife management. The Air Force would assist in identifying, monitoring, and managing species to counteract project impacts. These programs would include all or part of the following, as appropriate: avoid important habitats if possible; schedule activities to avoid critical periods; fence selected construction areas; provide supplemental or replacement water and/or food sources; restrict worker pets in life support communities; suppress adverse noise impacts; assist enforcement and management agencies; transplant fish and wildlife; and provide additional habitat or improve other habitats to offset impacts.

In addition, the Air Force will restrict weapons in life support camps and at job sites, restrict off-road travel, accomplish a revegetation program in cooperation with appropriate federal and state agencies, and provide conservation education programs for workers and their dependents. A program to manage groundwater withdrawal as it affects surface water and an erosion control program will be instituted by the Air Force. The Air Force will advocate funding additional fish and wildlife personnel.

In order to prevent the spread of noxious vegetation and the inadvertent introduction of new species, the Air Force will survey noxious vegetation and introduced species and monitor infestation levels. Eradication of unwanted vegetation caused by M-X activities will be accomplished in conjunction with the revegetation program.

Additional details on mitigations for bighorn sheep are included in ETR-15 (Wildlife) and ETR-38 (Mitigations).

Table 4.3.2.8-3. Potential impact to bighorn sheep in Nevada/Utah and Texas/New Mexico DDAs for Alternative 8.

Hydrologic Subunit No.	Name	Abundance[1]	Short-Term Impacts[2]	Long-Term Impacts[2]
	Subunits or Counties with M-X Clusters and DTN			
4	Snake, Nev./Utah	M/L	***	*
5	Pine, Utah[3]	-	-	-
6	White, Utah	-	-	-
7	Fish Springs, Utah	-	-	-
8	Dugway, Utah	-	-	-
46	Sevier Desert, Utah	-	-	-
46A	Sevier Desert-Dry Lake, Utah[3]	-	-	-
54	Wah Wah, Utah	-	-	-
155C	Little Smoky-South, Nev.	-	-	-
156	Hot Creek, Nev.	-	-	-
170	Penoyer, Nev.	-	-	-
171	Coal, Nev.	-	-	-
172	Garden, Nev.[3]	M/L	*****	***
173A	Railroad-South, Nev.	-	-	-
173B	Railroad-North, Nev.	M/L	*****	***
180	Cave, Nev.	-	-	-
181	Dry Lake, Nev.	-	-	-
182	Delamar, Nev.	M/L	*****	***
183	Lake, Nev.	-	-	-
184	Spring, Nev.	M/L	*****	***
196	Hamlin, Nev./Utah	-	-	-
202	Patterson, Nev.	-	-	-
207	White River, Nev.	-	-	-
208	Pahroc, Nev.	-	-	-
209	Pahranagat, Nev.	M/L	***	*
	Bailey, Tex.	-	-	-
	Cochran, Tex.	-	-	-
	Dallam, Tex.	-	-	-
	Deaf Smith, Tex.	-	-	-
	Hartley, Tex.	-	-	-
	Hockley, Tex.	-	-	-
	Lamb, Tex.	-	-	-
	Oldham, Tex.	-	-	-
	Parmer, Tex.	-	-	-
	Chaves, N. Mex.	-	-	-
	Curry, N. Mex.	-	-	-
	DeBaca, N. Mex.	-	-	-
	Guadalupe, N. Mex.	-	-	-
	Harding, N. Mex.	-	-	-
	Lea, N. Mex.	-	-	-
	Quay, N. Mex.[3]	-	-	-
	Roosevelt, N. Mex.[3]	-	-	-
	Union, N. Mex.	-	-	-
	DDA Impact		*****	***

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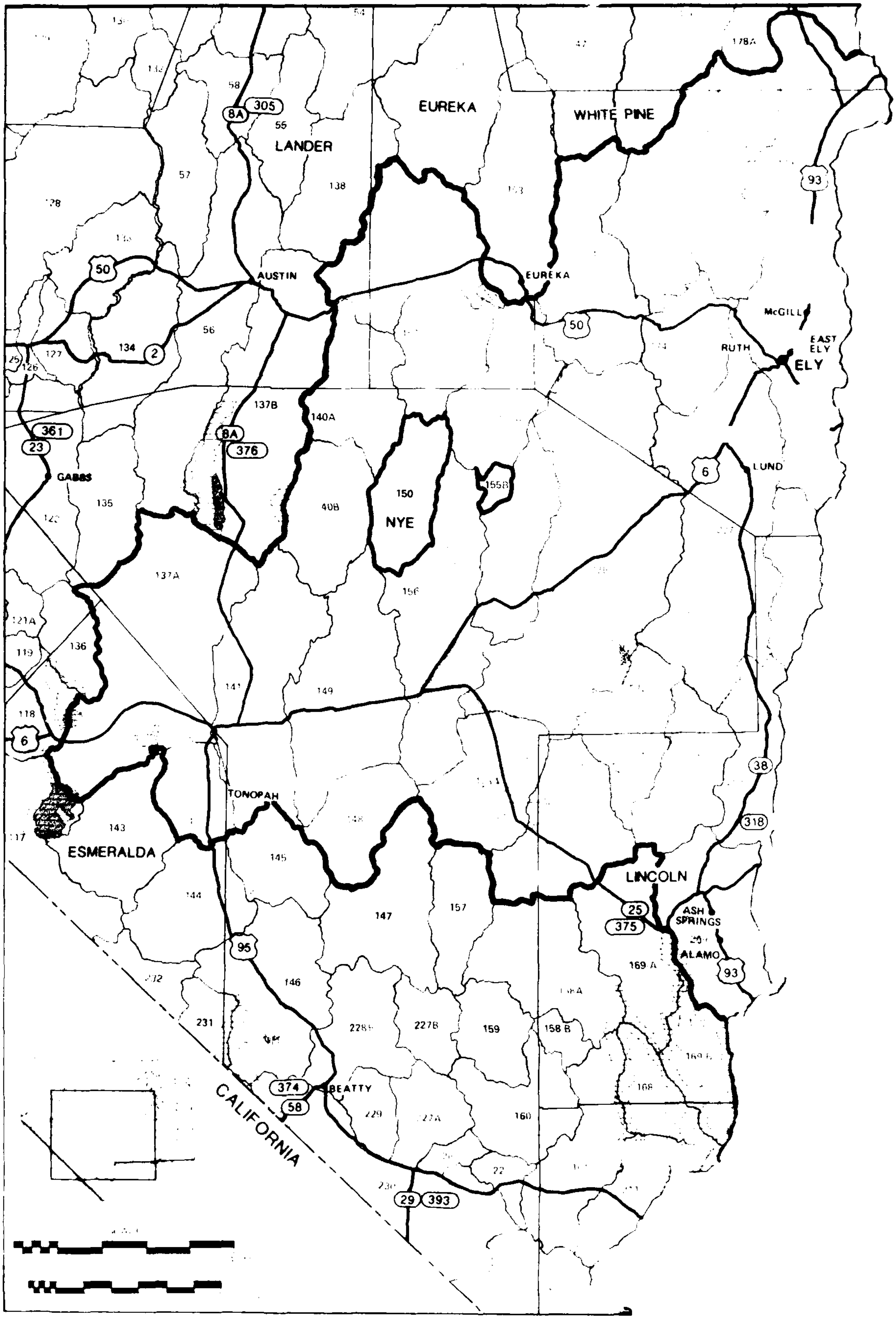
[1] - = No bighorn sheep present.
M/L = Moderate to low abundance (less than 150 sheep).
H = High abundance (more than 150 sheep).

[2] - = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

Potential for impact was determined using the abundance of bighorn sheep and presence of a construction camp within 25 mi (high) or 26-50 mi (moderate) of bighorn habitat.

[3] Conceptual location of Area Support Centers (ASCs).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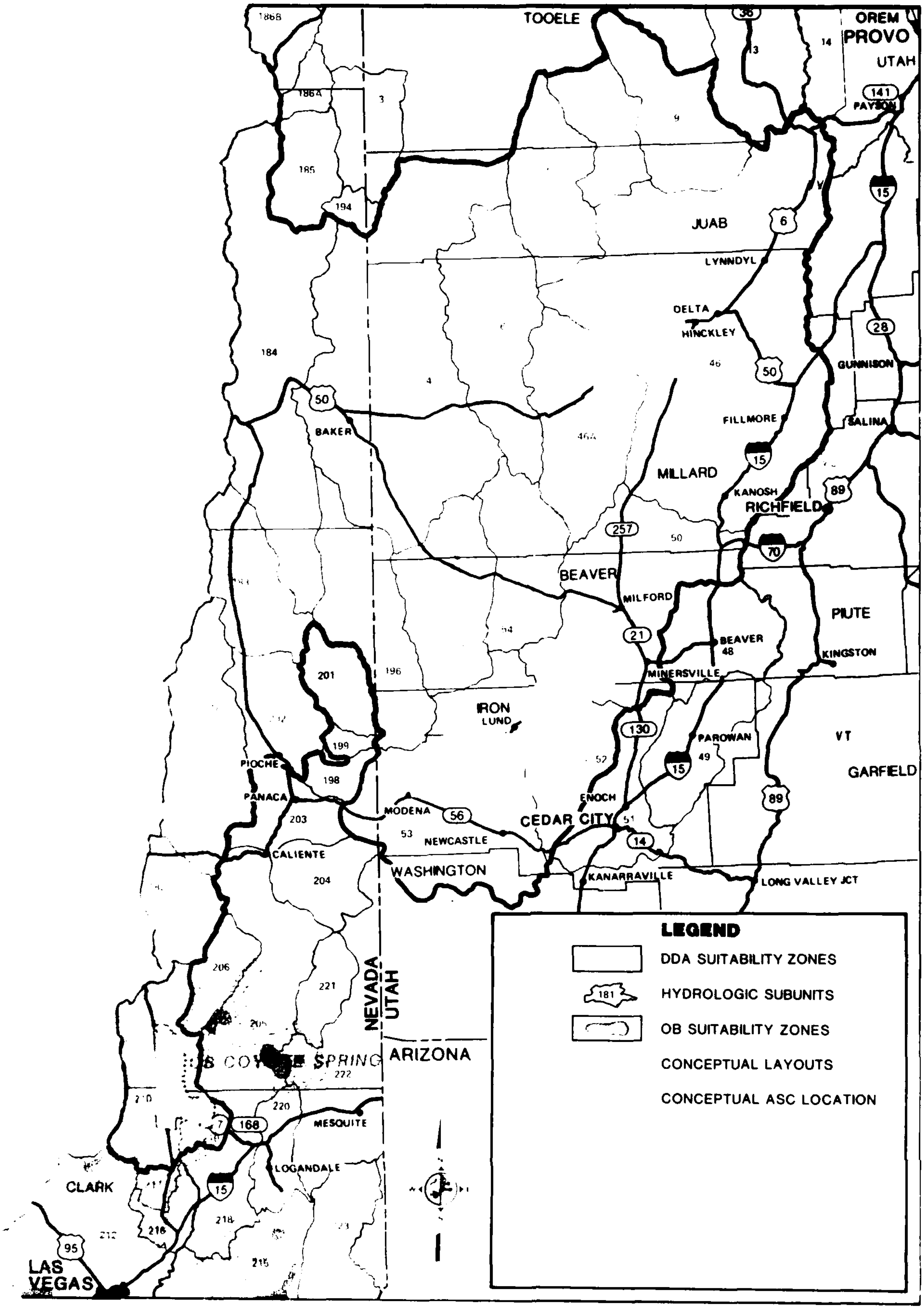
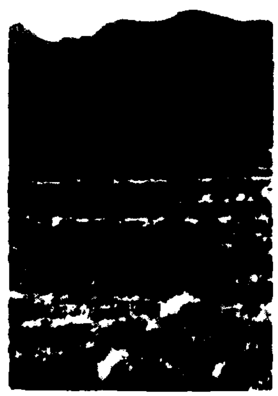


Figure 4.3.2.8-3. Bighorn sheep range and habitat and the Alternative 8, Nevada/Utah.

Protected Species



PROTECTED SPECIES

The protected species addressed in this section include desert tortoise, Utah prairie dog, rare plants, and protected aquatic species.

Desert Tortoise

DESERT TORTOISE

INTRODUCTION (4.3.2.9.1.1)

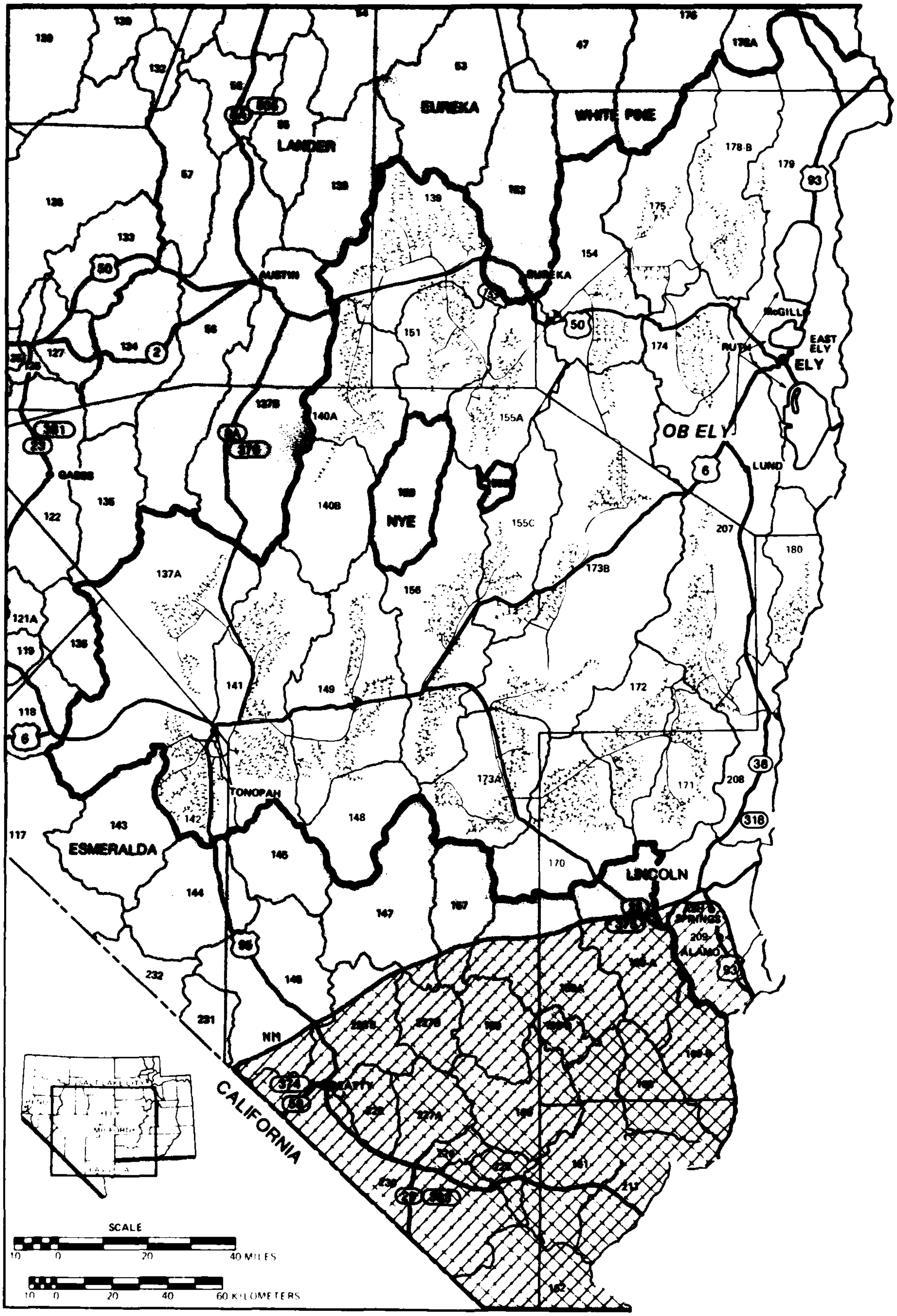
The desert tortoise is a large, herbivorous reptile that inhabits the Mojave and Sonoran desert habitat in southern Nevada, southwestern Utah, southeastern California, western Arizona, and south into Mexico. There are indications that the desert tortoise is declining throughout its range and that most of this decline can be attributed to human disturbances. These declines have led to the protection of the desert tortoise in the four states in which it occurs and to the federal designation of threatened status, with designation of critical habitat in the Beaver Dam Slope of southwestern Utah. In addition, throughout its range the desert tortoise is now under review for federal protection (FR 45:163). Human activity constitutes the major threat to the desert tortoise as may be seen in the following quotation.

> "The chief threats to the tortoise include habitat destruction through development for residential and agricultural use, overgrazing (Berry, 1978), geothermal development, taking as pets (now largely controlled by individual states), malicious killing, from being run over on roads, and from competition with grazing or feral animals. Natural predation may or may not be a significant factor in the decline of this species, depending on age class involved." (FR 45:163)

PROPOSED ACTION (4.3.2.9.1.2)

DDA Impacts. Figure 4.3.2.9-1 shows the M-X DDA in Nevada and Utah in relation to desert tortoise distribution. No adverse impacts would be expected to occur to desert tortoises from the construction of clusters and DTN in the valleys of Nevada/Utah because these structures are not located in desert tortoise range.

Coyote Spring Valley OB Impacts. Figure 4.3.2.9-2 shows the conceptual Coyote Spring operating base suitability zone and desert tortoise distribution. A base in Coyote Spring Valley would adversely impact desert tortoises by direct habitat destruction and indirectly through human actions. This base would directly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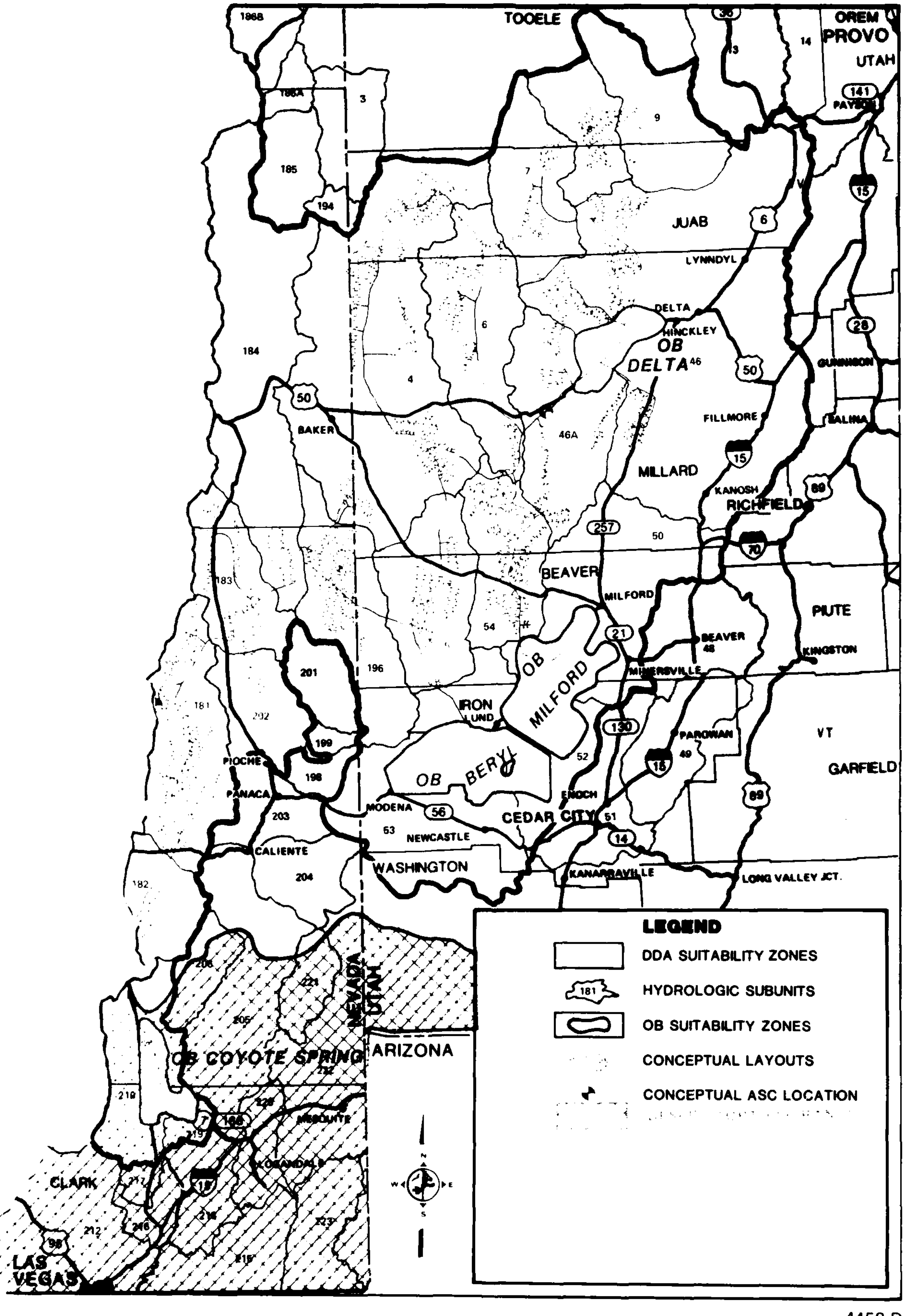

Figure 4.3.2.9-1. Desert tortoise distribution and the Proposed Action conceptual project layout.

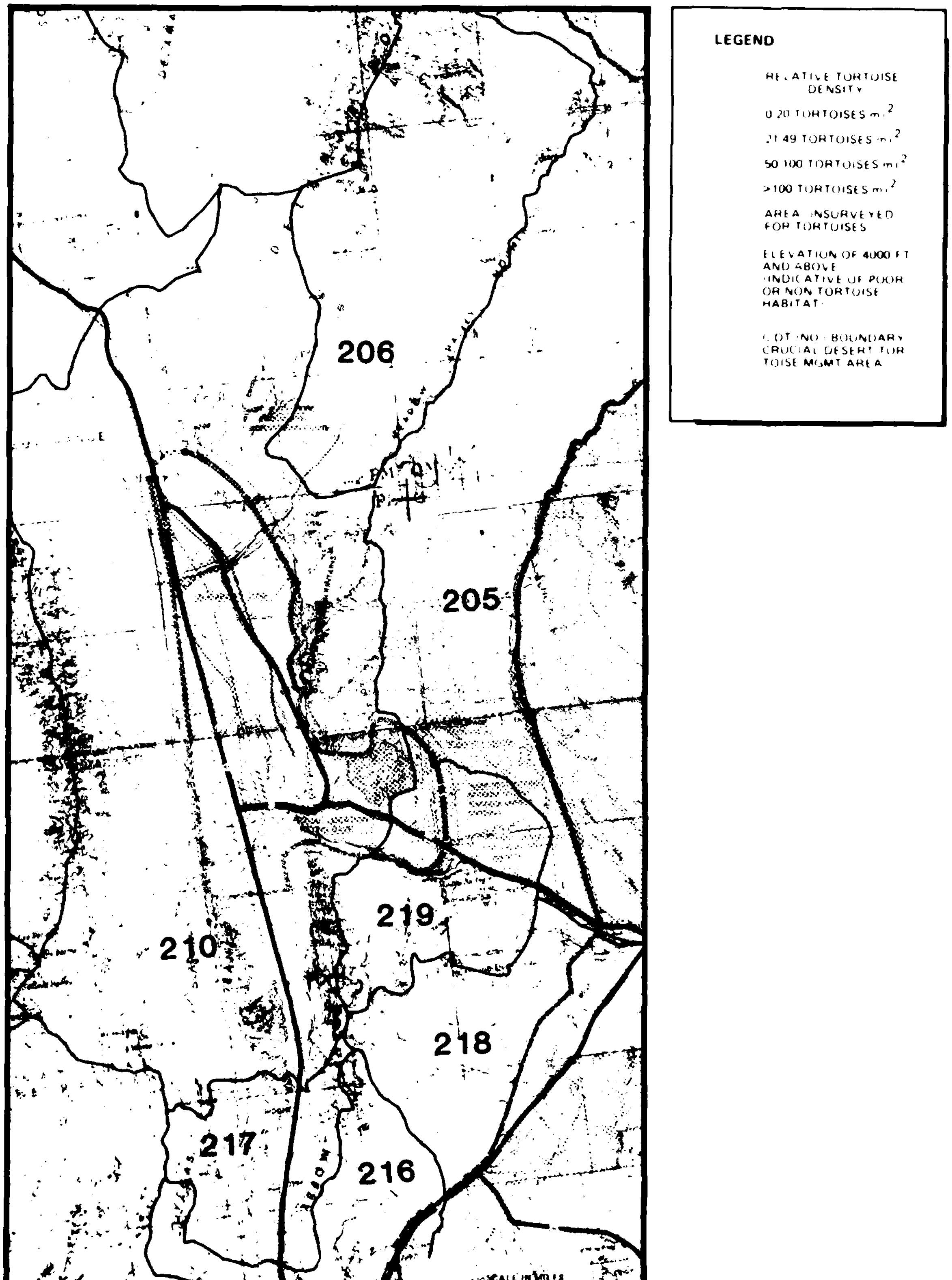

Figure 4.3.2.9-2. Intersection of desert tortoise distribution and the Coyote Spring OB vicinity.

eliminate approximately 8,000 acres of desert tortoise habitat, which has an estimated density of 117 tortoises per sq mi (Enriquez, 1977). More recent estimates by BLM indicate that 90 percent of this valley has medium- to-high tortoise densities (50-200 tortoises per sq mi). Indications are that this area contains some of the highest tortoise densities in all of Nevada (Karl, 1981). The proposed operating base suitability zone covers a large portion of high density (50-100 tortoises per sq mi) tortoise habitat from north to south and a large area of very high tortoise density (more than 100 tortoises per sq mi) in the northern part of this zone. The figure shows the conceptual location of base facilities with the technical facilities located in a medium tortoise density area and the base community in a high tortoise density area. The OB vicinity zone however includes one of the few very high tortoise density areas in Nevada and alternative configurations of project elements within the vicinity zone could result in extensive losses of very high quality habitat. The railroad spur running from the Union Pacific Railroad up Coyote Spring from the south would also destroy desert tortoise habitat. Given that the disturbed roadbed is approximately 30 ft wide and the spur will be about 25 mi long, approximately 40 more acres would be permanently lost to tortoises; more acres will be disturbed to build the line, and potential expansion of Route 93 could remove an additional 300 acres. Using a conservative estimate of 100 tortoises per sq mi, based upon the large amount of high and very high tortoise density habitat in this zone, and a disturbed area figure of 8,340 acres of desert tortoise habitat, approximately 1,300 tortoises would be lost. Depending upon their location the OBTS and borrow pits could considerably increase this figure. Depending upon the precise location of facilities within the vicinity upwards of 2,000 desert tortoises could be eliminated through direct construction effects.

In addition to direct habitat destruction due to the construction of base facilities and rail line, approximately 16,000 people will inhabit this area. Collection of tortoises for pets has depleted tortoise populations near cities. Collection can significantly change age-class ratios because the adults are the most conspicuous and most often taken. This leads to lower reproduction in a population (Berry, 1976). An increase in use of secondary roads is expected due to this population influx, which would also result in increased tortoise collecting (Luckenbach, 1975 cited in Steven, 1976). Besides the detrimental effect of people collecting tortoises, new roads and increased traffic on existing roads (particularly to and from Las Vegas) will result in additional tortoise deaths. Nicholson (1978) found that roads have a measurable detrimental effect on tortoise populations up to one kilometer due both to collecting and to deliberate and inadvertent vehicular impact.

Besides the actual habitat lost due to the construction of facilities, habitat destruction due to ORV activity can be severe. Near Barstow, California, estimated tortoise biomass was 3.4 kg/ha in non-ORV-use areas versus 0.5 kg/ha in the ORV-use area (Bury, 1978). Bury (1978) found that ORVs collapse burrows, destroy vegetation, and cause indirect mortality of tortoises, besides direct mortality from collisions. Heavy use around the base at Coyote Spring would probably be concentrated within a 3-mi radius (Rajala, 1980) and diminish with increasing distance. These impacts would be long term and would persist for at least the life of the project. Long-term productivity would continue to decline and, given the large number of people introduced to the area, the possibility exists that densities of tortoises in this hydrologic subunit could drop below the point where they could sustain their viability.

Due to its rare and protected status, any negative impacts to the desert tortoise are significant. If an operating base is located in Coyote Spring, most of these impacts are unavoidable. The habitat lost to base construction and a new rail line would not be recovered. It might be possible to relocate some portion of the tortoise population, but without almost total cessation of cattle and sheep grazing and ORV activity in nearby areas, the remaining habitat might not be able to support these displaced tortoises. A study done on tortoises removed from a highway right-of-way and transplanted to another area showed that most tortoises left the new area. The tortoises had been tagged when released and many of these animals were found dead in the following years (Berry, 1981). Apparently, resident animals drove out those that had been introduced. Indirect impacts could be reduced if off-road vehicle activity is strictly prohibited. Also, collecting of tortoises, which is prohibited by state law, should be strictly monitored as should harassment. Table 4.3.2.9-1 compares the effects to desert tortoises by the Coyote Spring OB and the hydrologic subunits which surround this site. Only the Coyote Spring OB would cause significant negative impacts to desert tortoises. This would be true for any alternative which includes the Coyote Spring OB.

Milford OB Impacts. No tortoises occur near Milford and no significant adverse impacts are expected. Some impacts may occur to tortoises south of the base if areas such as the Beaver Dam Slope attract recreationists, but to date there are no indications that this is a particularly attractive recreation area.

Desert tortoises do not occur within the area of any other OB. In Alternatives 4 and 6 the Coyote Spring Valley OB is a second base. The impacts to desert tortoises would be similar to, but possibly less than, impacts from those alternatives where Coyote Spring OB is a first base. Impacts, though, will still be significant. Instead of 8,000 acres of habitat disturbed, approximately 4,300 would be disturbed for a second base. Also, instead of a long-term population of about 17,000 people, a second base at Coyote Spring Valley would have about 13,000. These reductions would not be expected to change the overall effects on tortoises appreciably, so that use of Coyote Spring Valley as the site of a second OB would still cause significant impacts.

ALTERNATIVE 1 (4.3.2.9.1.3)

Impacts would be the same as for the Proposed Action.

ALTERNATIVE 2 (4.3.2.9.1.4)

Impacts would be the same as for the Proposed Action.

ALTERNATIVE 3 (4.3.2.9.1.5)

Some impacts may occur to tortoises south of the Beryl OB, but these impacts are not expected to be significant because as with the Milford OB recreationists are not expected to be attracted to the southern desert areas where tortoises exist. Instead they will likely be drawn to Zion and Bryce National Parks and the mountains of the Wasatch Front.

ALTERNATIVE 4 (4.3.2.9.1.6)

Impacts would be similar to those for the Proposed Action but reduced somewhat. This reduction occurs because the second base would be smaller (about

Table 4.3.2.9-1. Potential indirect impact to desert tortoises in Nevada and Utah within 70 mi of the proposed operating base at Coyote Spring[1].

Hydrologic Subunit No.	Hydrologic Subunit Name	Relative Abundance[2]	Potential Indirect Impact[3]
	Subunits within OB Suitability Zone		
210	Coyote Spring, Nev.	Present	*****
219	Muddy River Springs, Nev.	Present	*****
	Other Affected Subunits		
161	Indian Spring, Nev.	Present	*
169B	Tikaboo-South, Nev.	Present	*****
205	Meadow Valley Wash, Nev.	Present	*****
206	Kane Springs, Nev.	Present	*****
209	Panranagat Valley, Nev.	Present	*****
211	Three Lake, Nev.	Present	*
212	Las Vegas, Nev.	Present	*
215	Black Mountains, Nev.	Present	*
216	Garnet, Nev.	Present	*****
217	Hidden Valley-North, Nev.	Present	*****
218	California Wash, Nev.	Present	***
220	Lower Moapa, Nev.	Present	*****
221	Tule Desert, Nev.	Present	***
222	Virgin River, Nev.	Present	***
223	Gold Butte, Nev.	Present	*
	Impact[4]	Present	*****

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[1]Note: Desert tortoises would not be impacted in any other OB location. Also, construction of a DDA in Nevada/Utah or Texas/New Mexico would not impact the desert tortoise.

[2]Abundances are not known for every hydrologic subunit in which they occur and in those in which they occur, abundances vary within the subunit.

[3]- = No impact (not used).
* = Low impact.
*** = Moderate impact.
***** = High impact.

Significance of impact was estimated for each hydrologic subunit by comparing the abundance index, indirect effect index (see Appendix C of ETR 17), and road access from the OB site. The nearness of a hydrologic subunit to Las Vegas was also considered, because recreational activities from Las Vegas already may be heavily impacting the desert tortoise. The presence of an OB at Coyote Spring Valley would not significantly add to the impacts from Las Vegas in certain subunits.

[4]The overall impact was judged significant because approximately 45 percent of the affected hydrologic subunits would be significantly impacted, and the desert tortoise is protected by Nevada and Utah state law as a threatened species, the population in Utah is federally protected as threatened with critical habitat, and is under review throughout its range for federal protection under the Endangered Species Act.

4,300 acres versus 8,000 acres) and the operating population would be less. These reductions do not significantly reduce the level of the impacts below that for the Proposed Action.

ALTERNATIVE 5 (4.3.2.9.1.7)

Impacts are the same as those described for the Milford OB in the Proposed Action.

ALTERNATIVE 6 (4.3.2.9.1.8)

Impacts would be the same as for Alternative 4.

ALTERNATIVE 7 (4.3.2.9.1.9)

No impacts.

ALTERNATIVE 8 (4.3.2.9.1.10)

Impacts would be the same as for the Proposed Action.

MITIGATIONS (4.3.2.9.1.11)

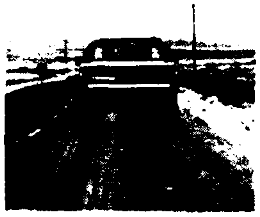
Mitigation measures for the desert tortoise should be directed toward preserving existing habitats and minimizing human disturbance to these animals.

To protect rare, threatened, and endangered species the Air Force will institute cooperative programs with federal and state management agencies. The Air Force will identify the critical habitat of rare, threatened, or endangered species and will monitor populations. Sensitive habitats will be avoided and construction activities will be scheduled to minimize disturbance insofar as possible. Additional measures to minimize impacts will include restricting construciton off-road travel and restricting firearms in life support camps and at job sites. When the avoidance of habitats is not possible, the Air Force will determine suitable replacement habitats and will relocate species as required.

In addition, the Air Force will accomplish a revegetation program in cooperation with appropriate federal and state agencies, and provide conservation education programs for workers and their dependents. A program to manage groundwater withdrawal as it affects surface water and an erosion control program will be instituted by the Air Force. The Air Force will advocate funding additional fish and wildlife personnel.

Additional details on mitigations for desert tortoise are included in ETR-17 (Protected Species) and ETR-38 (Mitigations).

Utah Prairie Dog



UTAH PRAIRIE DOG

INTRODUCTION (4.3.2.9.2.1)

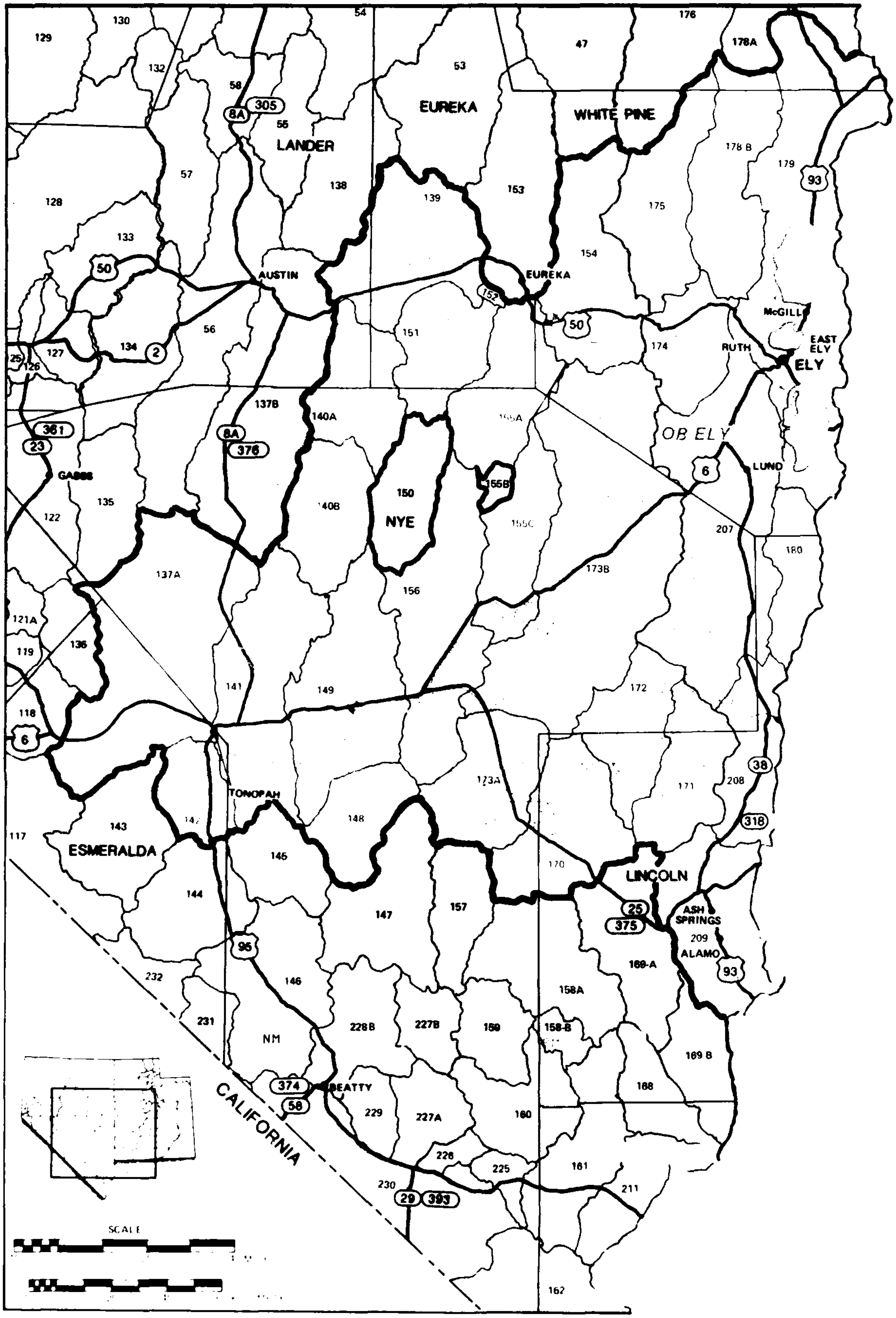
The Utah prairie dog (Cynomys parvidens) is a medium-sized colonial rodent that lives in large burrow complexes called towns. This species inhabits low, generally level, grassy areas and is dependent upon succulent forbs and grasses for food. The range of this species is the most restricted of all prairie dogs in the United States. It is currently found only in southern Utah, an area about half the size of its former range (Collier and Spillett, 1975). This range reduction resulted from a change in climate, causing a drying trend, from loss of habitat to agriculture and urbanization, and from poisoning of prairie dogs by ranchers and farmers (Collier and Spillett, 1975). Because of its highly constricted range, the Utah prairie dog was federally listed (June, 1973) as an endangered species. Recently, the state of Utah petitioned the U.S. Fish and Wildlife Service to revise the status of the Utah prairie dog from endangered to threatened in order to allow the Utah Division of Wildlife Resources greater opportunities for recovery efforts.

PROPOSED ACTION (4.3.2.9.2.2)

DDA Impacts

Figure 4.3.2.9.2-1 illustrates the M-X DDA in Nevada/Utah and the Utah prairie dog distribution. The Utah prairie dog would not be directly affected by the Proposed Action. No habitat would be lost because of construction activities. The only effects anticipated from DDA construction and operation are indirect effects from human activity in Pine Valley, Utah, the only valley within the deployment area supporting this species. Eight small transplant colonies, totaling approximately 100 prairie dogs, currently exist in Pine Valley (Ball, 1981) (see Figure 4.3.2.9.2-2). Indirect impacts are discussed in greater detail under Alternative 3 because the largest human concentration (as well as the greatest potential for direct impacts) occurs with that alternative.

Human activity would be greatest during the construction phase of M-X, with an estimated population increase of 2,200. Most of these people would be located in



EUREKA
WHITE PINE
LANDER
NYE
ESMERALDA
LINCOLN
CALIFORNIA
AUSTIN
EUREKA
McGILL
EAST ELY
ELY
RUTH
LUND
GABBS
TONOPAH
ASH SPRINGS
ALAMO
BEATTY
NM
SCALE

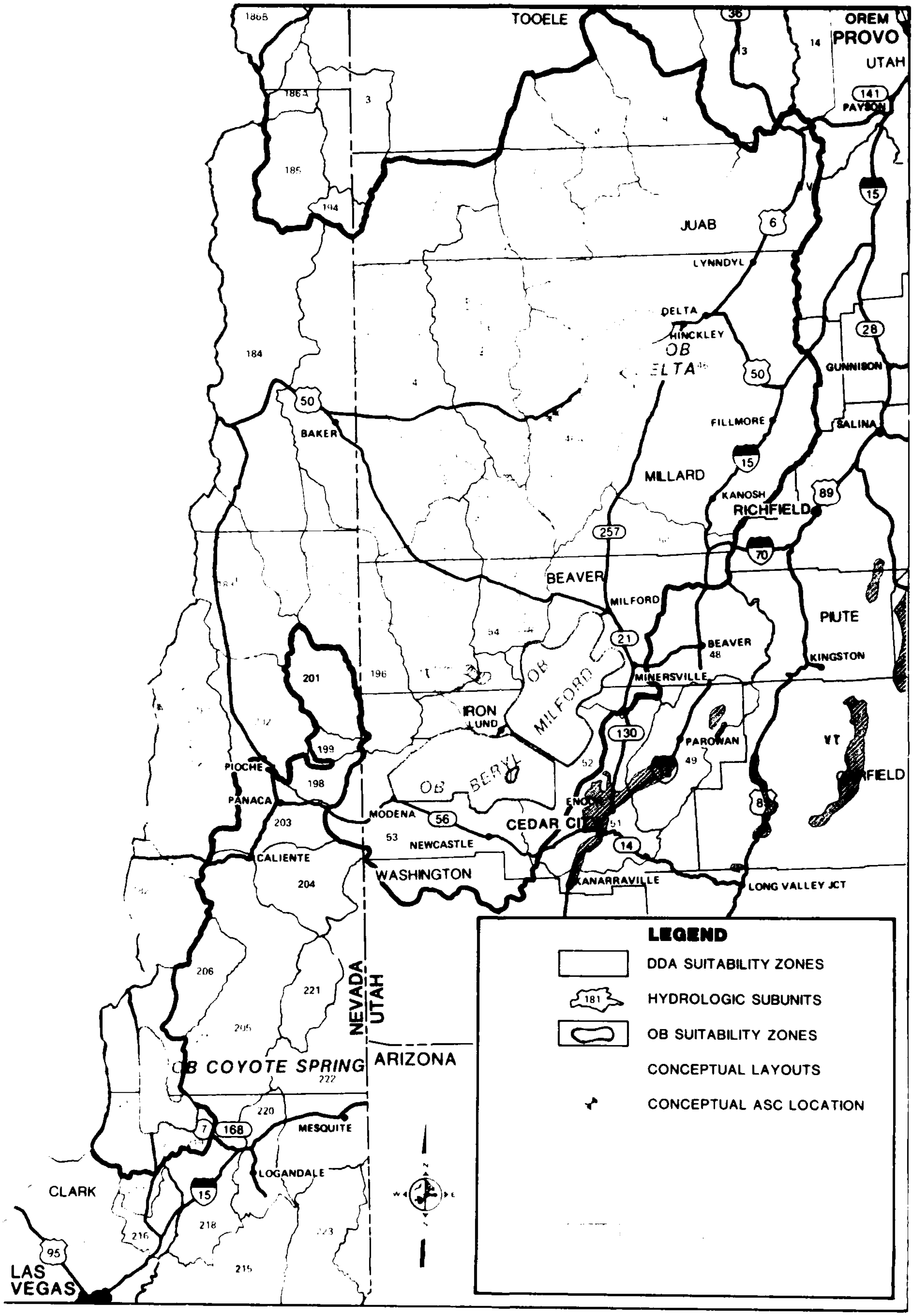


Figure 4.3.2.9.2-1. Prairie dog distribution and the Proposed Action conceptual project layout.

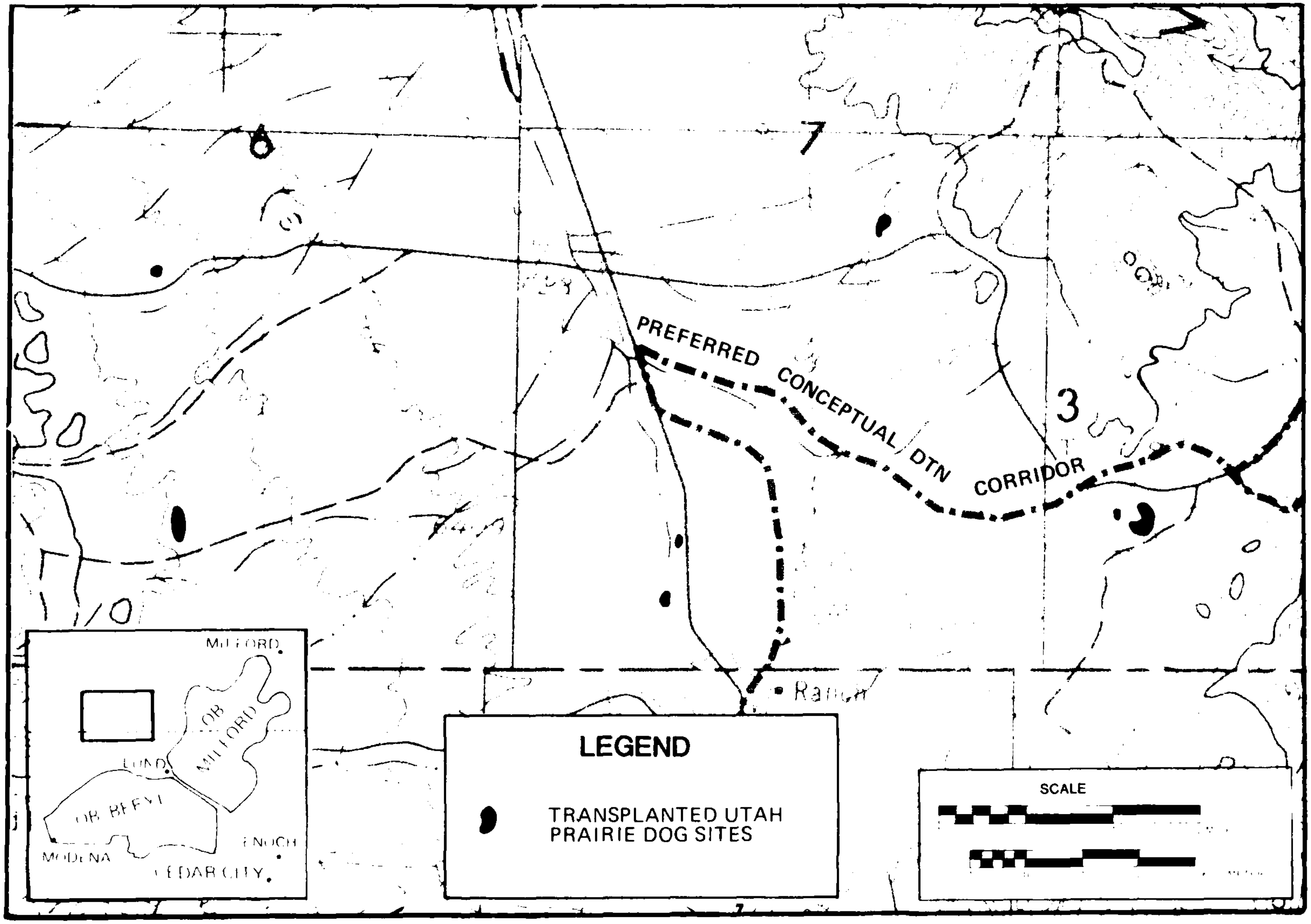


Figure 4.3.2.9.2-2. Utah prairie dog transplant colonies in Pine Valley (boxed area in inset).

a construction camp in central Pine Valley, 15 to 20 mi north of the prairie dog colonies. A dirt road runs down the middle of Pine Valley and provides access to the prairie dog towns. As a result of this construction camp, indirect effects such as shooting, and ORV use would impact Utah prairie dogs in Pine Valley. The Pine Valley prairie dog population is one of the most important populations on public lands. It is free of land use conflicts common to populations on private land and the colonies have the potential to substantially increase in size. Shooting, which would mostly occur close to roads and perhaps up to 1 mi away, could eliminate entire prairie dog towns. Camping may not influence prairie dogs in that their habitat holds little attraction for campers. ORV activity could significantly impact Utah prairie dog habitats in southern Pine Valley through loss of vegetation, soil disturbance, and noise. Most ORV activity is expected to occur within three mi of the camp (Rajala 1980). Currently the Pine Valley construction camp is to be approximately 20 mi north of the prairie dog populations. Despite this distance and the temporary nature of the camp, the impacts to prairie dogs are expected to be significant. Because these prairie dog colonies are small in size and few in number they are extremely susceptible to complete destruction by ORVs, and from shooting.

The Proposed Action should not produce any irretrievable commitment of resources. However, although indirect effects from the Proposed Action are not expected to extirpate populations, the Utah prairie dog is a federally listed endangered species, and because of this, potential reductions in populations must be considered significant. The indirect effects could be reduced by prohibition of firearms in the Pine Valley construction camp and by restricting camping, and ORV activity. Mitigations are discussed in more detail in ETR-17 and ETR-38.

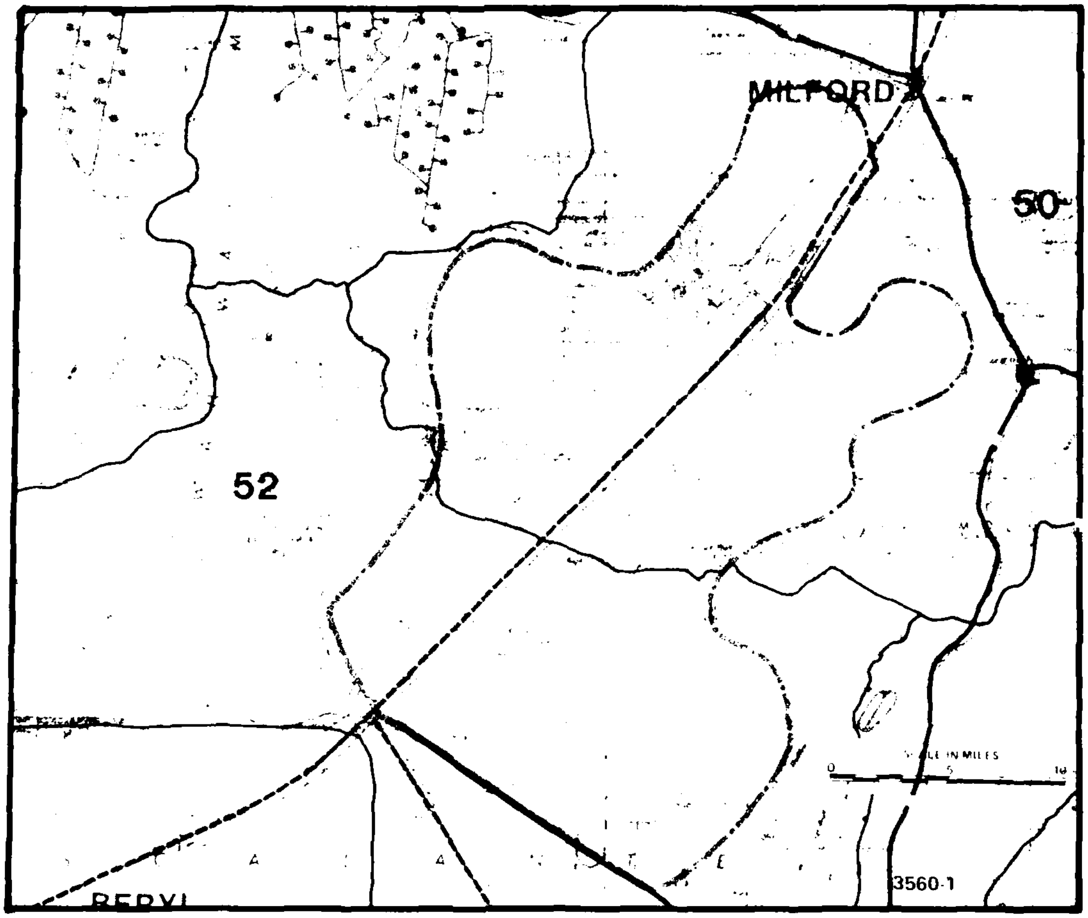
Coyote Spring Valley OB Impacts

No direct impacts and no significant indirect impacts on Utah prairie dogs from an OB at Coyote Spring Valley are anticipated.

Milford OB Impacts

A second OB at Milford (Figure 4.3.2.9.2-3) is expected to have a peak of 17,700 people during construction, and a long-term population of 13,100. Should the operating base be placed in the northern half of the OB suitability zone, no direct impacts are anticipated from construction of the OB. However, indirect effects could result from human activity in Parowan and Pine valleys and in the vicinity of Cedar City. Campgrounds in the mountains to the east of Parowan valley, and other recreation areas east of Milford, would draw people through Parowan Valley and Cedar City, increasing opportunities for human interference with the species. However, camping, ORV activity, and shooting are not expected to be high in Cedar City and Parowan Valley, as prairie dog habitat is on private lands and access is likely to be restricted. Short-term and long-term effects would not differ significantly. Indirect effects upon the Utah prairie dog might cause a slight reduction in their population in these areas if access is not restricted. Any reductions in population size would likely be limited to populations within 1 mile of a major roadway due to shooting and roadkills. Indirect impacts may be greater in Pine Valley, because the small transplant populations are on public land where access is virtually unlimited. These populations are very sensitive to disturbance.

Short- and long-term productivity could decrease, but the operating base should not produce any irretrievable commitments of resources. An OB in the



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LEGEND

UTAH PRAIRIE DOG RANGE

Figure 4.3.2.9.2-3. Distribution of the Utah prairie dog in the vicinity of the Milford OB.

Table 4.3.2.9.2-1. Potential indirect impact to the Utah prairie dog around operating bases (OBs) for the Proposed Action and Alternatives 1-8.

Hydrologic Subunit or County		Relative Abundance	Short and Long Term Impact[1]								
			Proposed Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8
No.	Name		Coyote Spring/ Milford	Coyote Spring/ Beryl	Coyote Spring/ Delta	Beryl/ Ely	Beryl/ Coyote Spring	Milford/ Ely	Milford/ Coyote Spring	Clovis/ Dalhart	Coyote Spring/ Clovis
	Subunits or Counties within OB Suitability Zone										
46	Sevier Desert, Utah	Not present			-			-	-	-	-
46A	Sevier Desert-Dry Lake, Utah[2]	Not present		-			-	-	-	-	
50	Milford, Utah	Not present	-					-	-	-	-
52	Lund District, Utah	Present	*****	*****		*****	*****	*****	*****	-	-
53	Beryl-Enterprise, Utah	Not present		-		-	-	-	-	-	-
179	Steptoe, Nev.	Not present				-		-	-	-	-
210	Coyote Spring, Nev.	Not present	-	-	-		-	-	-	-	-
219	Muddy River Springs, Nev.	Not present	-	-	-		-	-	-	-	-
	Curry County, N. Mex.[2]	Not present								-	-
	Hartley County, Tex.[2]	Not present								-	-
	Other Affected Subunits or Counties										
5	Pine, Utah	Present	*****	*****	-	*****	*****	*****	*****	-	-
49	Parowan, Utah	Present	*****	*****	-	*****	*****	*****	*****	-	-
51	Cedar City, Utah	Present	*****	*****	-	*****	*****	*****	*****	-	-
	Overall Alternative Impact	Not present	*****	*****	-	*****	*****	*****	*****	-	-

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[1] - = No impact.
* = Low impact.
*** = Moderate impact.
***** - High impact (any adverse impact to the Utah prairie dog is considered significant).

[2] Conceptual location of Area Support Centers (ASCs).

Milford suitability zone could reduce productivity slightly in Parowan Valley and around Cedar City, with greater potential impacts in Pine Valley. Because the Utah prairie dog is a federally listed endangered species, the impact potential is considered significant.

Table 4.3.2.9.2-1 indicates the occurrence of Utah prairie dog habitats and significant impacts to the habitats. Although predicted indirect effects may be small, perhaps unmeasurable, the possibility exists that some populations could be reduced or eliminated.

Mitigations might be difficult in Parowan Valley and around Cedar City because much of the land is privately owned. Fencing and posting of "no shooting" signs might help reduce human harassment. A conservation education program could be given to construction workers, operations personnel, and their dependents as an effective means of reducing impacts. Transplanting of prairie dogs from sites of likely human impact to areas of good habitat within their historic range under state or federal jurisdiction, would partially mitigate the project effects.

PUBLIC COMMENT ON THE DRAFT EIS:

> "There would be high significant direct impacts to the transplanted Utah prairie dog colonies in the Pine Valley area resulting from an OB at Milford."

Should the operating base be placed in the southern half of the Milford OB suitability zone, then either the DTN, or a major service road connecting the OB with the DDA, would likely pass through Pine Valley instead of Wah Wah Valley directly impact prairie dog colonies and habitats. If this scenario should occur then the direct impacts to Utah prairie dogs would be significant. Both direct and indirect impacts would be significant and the same as those discussed for an OB at Beryl under Alternative 3. The U.S. Air Force has agreed to avoid active Utah prairie dog colonies in Pine Valley during siting of this DTN segment. This would minimize direct impacts, but not indirect impacts.

ALTERNATIVE 1 (4.3.2.9.2.3)

DDA Impacts

DDA effects are the same as those for the Proposed Action.

Coyote Spring Valley OB Impacts

Impacts from the Coyote Spring OB are identical to those under the Proposed Action.

Beryl OB Impacts

Impacts from the second OB at Beryl would consist solely of indirect effects from human activity (see Figure 4.3.2.9.2-4). The second OB site at Beryl would have a peak human population of 17,400 and a long-term population of 12,800. No direct loss of prairie dog habitat would occur as a result of OB construction.

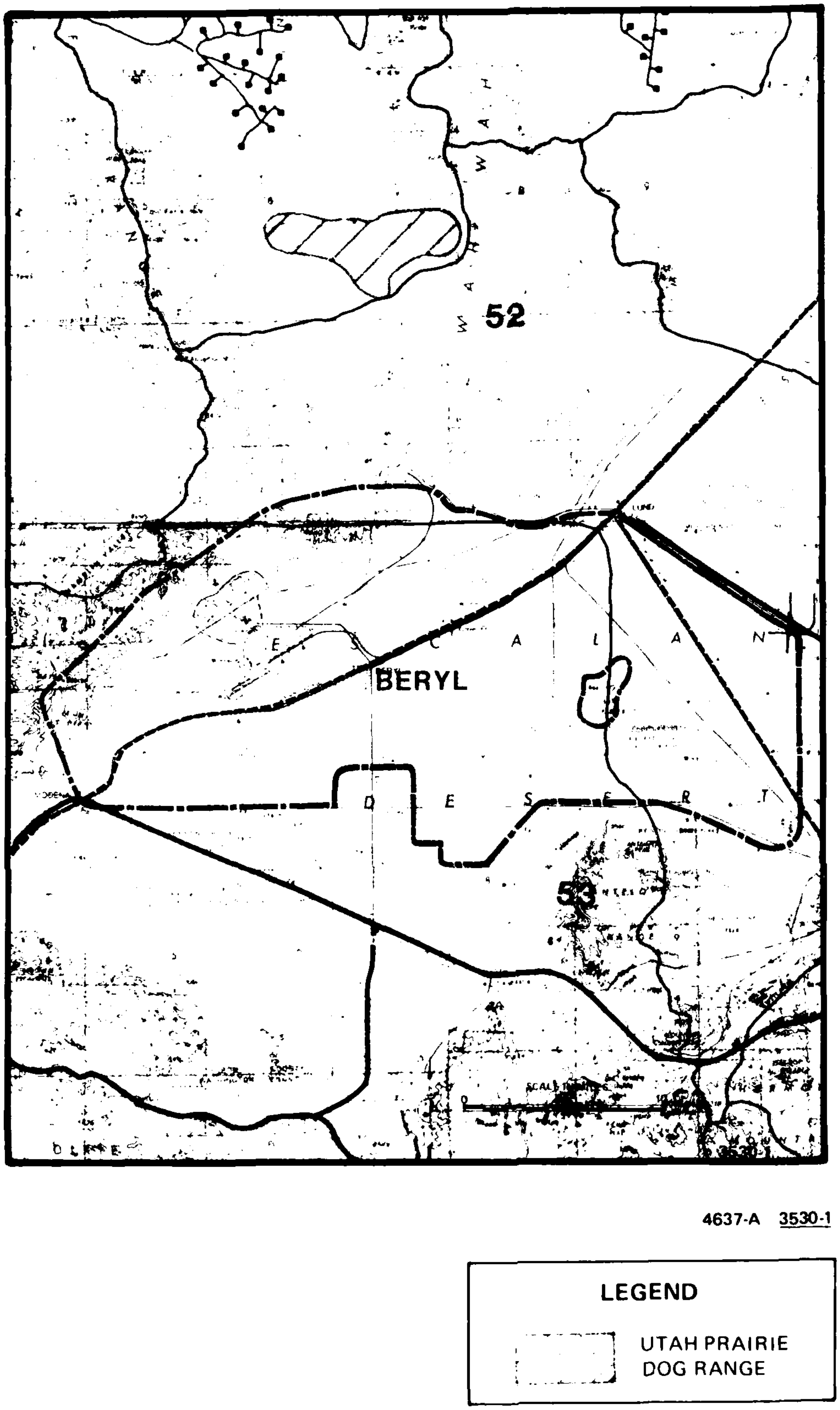

Figure 4.3.2.9.2-4. Distribution of the Utah prairie dog in the vicinity of the Beryl OB.

However, this OB site is the only one close enough to the Utah prairie dog range in southern Pine Valley (15 to 20 mi away) to potentially impact this species significantly. Currently a dirt road runs from the Beryl OB site into southern Pine Valley. ORV activity in Pine Valley could disrupt the prairie dog habitat through the loss of vegetation, collapsing of burrows, and generating of noise. Unlike Parowan Valley, where recreation is restricted because of the high proportion of private lands, Pine Valley is readily accessible, and use is virtually unrestricted. Although most recreation would be confined to areas closer to the Beryl OB, some effects from ORVs and shooting would be likely in Pine Valley, and prairie dogs and their habitat could be impacted. Also, unlike Parowan, Pine Valley is near an OB site, where long-term human activity would be concentrated. Although the magnitude of the indirect effects may not be great, the fact that this species is federally listed as endangered, and that it is highly susceptible to adverse impacts, makes the potential impacts significant.

Table 4.3.2.9.2-1 indicates the occurrence and significant impact upon the Utah prairie dog under Alternative 1.

ALTERNATIVE 2 (4.3.2.9.2.4)

DDA effects and Coyote Spring OB effects are the same as for the Proposed Action. The Utah prairie dog would not be significantly affected by the OB site at Delta.

ALTERNATIVE 3 (4.3.2.9.2.5)

DDA effects are the same as for the Proposed Action.

Figure 4.3.2.9.2-4 overlays onto a distribution map of the Utah prairie dog the Beryl OB site with that portion of the DTN passing through Pine Valley, Utah, to Beryl.

Effects upon the Utah prairie dog from M-X deployment would fall into two categories: direct loss of habitat and indirect effects from the presence of humans. Within the M-X deployment area, Utah prairie dogs are currently found only in southern Pine Valley, Utah. Under Alternative 3 the first OB would be located at Beryl, Utah and a portion of the DTN would be extended from Beryl through Pine Valley to connect with clusters in that hydrological subunit. This stretch of the DTN would bisect the prairie dog habitat. The DTN is estimated to remove 100 ft of suitable habitat along its length, resulting in a direct loss of 18 to 20 acres of Utah prairie dog habitat. Total potential prairie dog range in Pine Valley is estimated at 26,300 acres, which means that only 0.07 percent of the total potential habitat would be removed. However, prairie dogs inhabit only a small portion of this habitat, existing in small, scattered colonies. Therefore, the exact alignment of the DTN is of critical importance to this species. Scarification of prairie dog colonies would likely result in the elimination of all prairie dogs in those colonies. When disturbed, prairie dogs retreat to their burrows instead of escaping to the surrounding habitat. The elimination of a few colonies could reduce the Utah prairie dog population in Pine Valley by 50 percent, and since the loss of these colonies would be permanent, no recovery to the current population level would likely occur. However, alignment of the DTN to avoid colonies will reduce the impact to minimum levels. The U.S. Air Force has agreed to this mitigation. The placement of the

OBTS is also likely to directly impact several prairie dog colonies in southern Pine Valley. The Air Force has also agreed to mitigate this impact through avoidance, otherwise direct impacts would be significant.

Indirect effects from human activity would be greatest under Alternative 3, since Beryl is a first OB site with a projected peak population of approximately 17,400, and a long-term population of approximately 12,800. The DTN from Beryl into Pine Valley would provide a convenient corridor for the flow of recreationists into this valley. A major attraction of Pine Valley could be its use as an ORV area. Also, increased road traffic would be likely to increase prairie dog road kills in dog towns immediately adjacent to the road. No information currently exists on the significance of road kills on prairie dog populations. Shooting of prairie dogs has the potential to be a severe impact, because this species is an easy target and lives relatively close to several roads.

Indirect effects upon prairie dogs such as those discussed above are difficult to quantify. The increase in road kills would depend upon the exact alignment of the DTN. If a road bisects a prairie dog town, road kills are likely to be higher than if the road is aligned between two dog towns. Prairie dogs, other than dispersing juveniles, do not normally travel from town to town, and so would not cross the road in great numbers. ORV activity has a high potential to significantly impact Utah prairie dog habitat. The Beryl OB would be located 15 to 20 mi from Utah prairie dog habitats, and consequently, ORV activity is not anticipated to be great.

However, because the prairie dog lives in small, scattered colonies, the species is very susceptible to ORV impacts, especially since several of the colonies are near current roadways. The colonies in Pine Valley are small in size and population. Shooting, therefore, presents a potentially serious threat because one person with a firearm could eliminate or seriously reduce entire populations. Because of the nearness of the Beryl OB and the susceptibility of prairie dogs to ORV activity and shooting, impacts to this species from indirect effects are expected to be significant.

In summary, Utah prairie dog productivity could decrease up to 50 percent in Pine Valley in the short term due to the loss of habitat, depending upon DTN alignment. The Air Force has agreed to mitigate the direct effects by aligning the DTN to avoid active prairie dog colonies. Indirect effects would compound any direct impacts and further reduce productivity, perhaps eliminating the prairie dog from Pine Valley. However, indirect impacts alone may not eliminate the prairie dog from Pine Valley unless a large percentage (40-50 percent) of the current colonies are directly removed by the DTN first. Long-term reduction in productivity would probably remain about the same as the short-term reduction in productivity.

The loss of 18 to 20 acres of prairie dog habitat in Pine Valley would be an irretrievable commitment of resources.

The direct loss of habitat from the DTN could be mitigated by shifting the proposed DTN route through WahWah Valley to avoid the Utah prairie dog habitat in Pine Valley. This mitigation could also help reduce indirect effects by removing a major roadway that would encourage recreationists to move into Pine Valley. Other mitigations have been discussed previously.

Table 4.3.2.9.2-1 indicates the occurrence and significance of impact on the Utah prairie dog.

ALTERNATIVE 4 (4.3.2.9.2.6)

DDA effects are the same as for the Proposed Action.

Impacts from the Beryl OB site are identical to those discussed under Alternative 3. Coyote Spring OB site impacts are comparable to those discussed under the Proposed Action.

PUBLIC COMMENT ON THE DRAFT EIS:

"The newly established range of the Utah prairie dog would not be avoided by Alternatives 1, 3 or 4. With a Beryl OB, the OBTS would impact directly on transplanted Utah prairie dog colonies numbers 12A and 12B at the southwestern edge of their range southeast of the Indian Peak Wildlife Management Area (WMA) (Figure 4.3.1.9-5, page 4-191, and described on page 4-192, para. 4). Efforts to avoid the Utah prairie dog by shifting the DTN six miles west would only complicate matters. This discussion should be corrected in the FEIS." (B0122-0-176).

ALTERNATIVE 5 (4.3.2.9.2.7)

DDA effects are the same as for the Proposed Action.

The Ely OB site would not significantly impact the Utah prairie dog. With a first OB at Milford, the peak human population is projected to be 24,200, with a long-term population of 17,200. Effects upon prairie dogs may be slightly higher than were estimated under the Proposed Action because of the greater human population at the Milford OB. Impacts are expected to be significant.

Table 4.3.1.9.2-1 indicates the occurrence and significance of impact upon Utah prairie dogs under Alternative 5.

ALTERNATIVE 6 (4.3.2.9.2.8)

DDA effects are the same as for the Proposed Action.

Utah prairie dogs would not be significantly impacted by placing a second OB at Coyote Spring Valley. Impacts from the first OB at Milford are identical to those for Alternative 5.

ALTERNATIVE 7 (4.3.2.9.2.9)

Utah prairie dogs do not occur in Texas or New Mexico.

ALTERNATIVE 8 (4.3.2.9.2.10)

DDA effects are the same as for the Proposed Action. Utah prairie dogs would not be significantly affected by an OB site at Coyote Spring Valley. Utah prairie dogs do not occur in Texas or New Mexico.

MITIGATIONS (4.3.2.9.2.11)

Mitigation measures for Utah prairie dogs need to be directed toward preservation of existing habitats and minimization of human disturbance to these animals.

To protect rare, threatened, and endangered species, the Air Force will institute cooperative programs with federal and state management agencies. The Air Force will identify the critical habitat of rare, threatened, or endangered species and will monitor populations. Sensitive habitats will be avoided and construction activities will be scheduled to minimize disturbance insofar as possible. Additional measures to minimize impacts will include restricting construction off-road travel and restricting firearms in life support camps and at job sites. When the avoidance of habitats is not possible, the Air Force will determine suitable replacement habitats and will relocate species as required.

In addition, the Air Force will accomplish a revegetation program in cooperation with appropriate federal and state agencies, provide conservation education programs for workers and their dependents. A program to manage groundwater withdrawal as it affects surface water and an erosion control program will be instituted by the Air Force. The Air Force will advocate funding additional fish and wildlife personnel.

Rare Plants

RARE PLANTS

INTRODUCTION (4.3.2.9.3.1)

A paraphrased public comment presents the major concerns of many people regarding rare plants: In the Great Basin, the main factor responsible for the survival of rare plants is their inaccessibility. Some rare plant species would lose some of this inherent protection with the construction of the M-X project.

A rare plant as treated here is a species known to have, or thought to have, a small population in its range. A rare plant may be common where it occurs but restricted in distribution, or may be widespread but sparse in occurrence. Many species of rare, endangered, and threatened plants grow in severe or unusual habitats and often possess unique qualities that make them particularly valuable to man: they contribute to ecological and genetic diversity; they commonly stock unstable and unusual habitats; some provide sources of medicines and other chemicals; some serve as bio-indicators of minerals and metal ores; some may possess potential value for food crops and horticultural use; and some provide man with sources of beauty. Impact analysis pertains primarily to federal candidate (see Section 3.2.2.8.1) rare plant species. The following discussion also applies primarily to federal candidate rare plant species, as defined in Section 3.2.2.8.1.

PROPOSED ACTION (4.3.2.9.3.2)

DDA Impacts

Even though there are no federally listed threatened or endangered plant species in the Nevada/Utah study region, there are several rare species which are either considered endangered by state agencies or are being considered for federal listing. Because of the large number of rare plant species under consideration by various authorities, and because some species have a high potential for being directly affected by the conceptual layout, rare plants were considered to be significantly affected by M-X in Nevada/Utah. Although it is anticipated that most locations will be avoided, an analysis of the potential direct impacts was performed. The method used for this analysis is described in detail in ETR-17 (Protected

Species) and briefly in the following paragraph. Seventy-four species of federal candidate rare plants occur in the Nevada/Utah study area and are being considered for protection under federal and state endangered species legislation. These species are listed in Table 4.3.2.9.3-1, and their rarity and the projected M-X impacts to them are summarized. Of these 74 species, 19 were found to be potentially directly intersected by the project layout; they are listed in Table 4.3.2.9.3-2. These tables present information in response to suggestions from agencies that a rare plant species priority table be developed, based on the relative rarity of the species and its known locations relative to M-X construction.

Impact analysis was performed in three steps: (1) analysis of project actions and an analysis, based on scientific literature, of their generic effects on rare plants (see Table 4.3.2.9.3-3); (2) an assessment of specific impacts (all effects combined) to the species of concern see ETR-17 (Protected Species) Table 3.2.2-2 and -3; and (3) a determination of the significance of the impact (see Table 4.3.2.9.3-4). Vegetation clearing for construction is considered to pose the greatest threat to rare plant species (because of the large areas involved). Vegetation clearing would narrow the distribution or decrease the abundance of rare plant species. Direct effects were determined by combining baseline information with project information. Locations of rare plants (see ETR-17 for a comprehensive list and detailed maps) were compiled from available literature, various institutions, and field work performed for this project. Each species was given a letter code and its locations were plotted on a frosted mylar overlay to a 1:250,000 scale topographical base map.

A clear mylar overlay of the Proposed Action layout was placed over the mylar rare plant overlays. Both of these overlays were then overlain to the base maps (1:250,000) for Nevada/Utah. Wherever project features such as clusters or the DTN appeared to intersect or approach within ½ mi of a plotted rare plant location, the occurrence was counted and entered in Table 4.3.2.9.3-2. Further analysis was organized by hydrologic subunit, and each species was considered individually.

Due to the uncertainty in plotting rare plant locations exactly, rare plants with map plots occurring within ½ mi of project features were considered to have the potential for being directly impacted. There is a substantial amount of unsurveyed rare plant habitat in the project area, making it possible that the impact to rare plants in general could actually be greater than now estimated.

PUBLIC COMMENT ON THE DRAFT EIS:

"Many of these plant species appear to be confined to a single valley, or even a small portion of a single valley. The proposed action would involve M-X shelters and related development in nearly all the intermountain valleys of the Southern Great Basin biogeographic region. Thus, even species not confined to a small number of valleys may be at risk, because no valleys have been set aside as suitable havens. The construction of shelters and roads would significantly alter spatial and temporal patterns of disturbance in the valleys. It is very likely that the direct effects estimated in the Draft EIS would be exceeded by the indirect and largely unanticipated results of the M-X program. The key

Table 4.3.2.9.3-1. Some characteristics and potential impact for rare plant taxa known to occur within or near M-X project area (Page 1 of 3).

Scientific Name[1]		Endemic to Project Valleys		Baseline Characteristics Range[2]		Location on Valley Floor[3]		Projected M-X Impact	
		Yes	No	Restricted	Widespread	Yes	No	Indirect Effect[4]	Direct Effect[5]
Agave utahensis Engelm. var. eborispina	(19)		X		?		X	Collecting	None
Arctomecon merriamii	(8)		X	X		X		None likely	None
Arenaria stenomeres	(2)	X		X			X	Quarry site	Near OB zone
Asclepias eastwoodiana	(13)	X			X	X		ORV	1/13
Astragalus ackermanii	(1)		X				X	None likely	None
Astragalus callithrix	(12)	X[6]			X	X		ORV	8/13+1
Astragalus calycosus var. monophyllidius	(15)	X		X		X		ORV	1/15
Astragalus cimae var. cimae	(1)		X	X			X	ORV	None
Astragalus convallarius var. finitimus	(3)		X	X			X	None likely	None
Astragalus funereus	(1?)		X	X		X		None likely	None likely
Astragalus geyeri var. triquetrus	(9)		X	X		X		None likely	Project change
Astragalus lentiginosus var. latus	(16)		X		X	X		ORV	Project change
Astragalus musimonum	(6)	X		X			X	None likely	None
Astragalus oophorus var. lonchocalyx	(2)		X		X	X		ORV	Project change
Astragalus pseudiodanthus	(5)		X		X	X		ORV	2/6
Astragalus serenoi var. sordescens	(17)	X[6]		X		X		ORV	5/17+1
Astragalus tephrodes var. eurylobus	(1)	X		X		X		None likely	Project change
Astragalus toquimanus	(8)	X		X			X	None likely	None
Astragalus uncialis	(3)	X		X		X		ORV	1/3
Brickellia knappiana	(1)		X		X		X	None likely	None
Castilleja salsuginosa	(1)	X		X		X		?	Within OB zone
Coryphantha vivipara var. rosea	(57?)		X		X	X		Collecting	8/57
Cryptantha compacta	(7)	X		X		X		ORV	Project change
Cryptantha tumulosa	(3)		X		X				
Cuscuta warneri	(1)	X		X		X		?	None
Cymopterus basalticus	(11)	X		X		X		ORV	1/11
Cymopterus ripleyi var. saniculoides	(6?)		X?		X?	X		?	None
Cymopterus goodrichii	(4)	X		X			X	None likely	None
Draba arida	(12)		X		X		X	None likely	None
Draba crassifolia var. nevadensis	(2)		X		X		X	None likely	None

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Table 4.3.2.9.3-1. Some characteristics and potential impact for rare plant taxa known to occur within or near M-X project area (Page 2 of 3).

Scientific Name[1]		Endemic to Project Valleys		Baseline Characteristics Range[2]		Location on Valley Floor[3]		Projected M-X Impact	
		Yes	No	Restricted	Widespread	Yes	No	Indirect Effect[4]	Direct Effect[5]
Erigeron ovinus	(5)	X		X			X	None likely	None
Erigeron uncialis var. conjugans	(7)		X		X		X	None likely	None
Eriogonum ammophilum	(4)	X		X		X		ORV	2/4
Eriogonum argophyllum	(1)	X		X		X		None likely	Project change
Eriogonum eremicum	(14)	X		X		X		ORV	1/14
Eriogonum holmgrenii	(3)	X		X			X	None likely	None
Eriogonum natum	(6)	X		X		X		ORV	4/6
Eriogonum nummulare	(2)		X			X		ORV	2/2+
Eriogonum viscidulum	(7)		X	X		X		None likely	None
Forsellesia pungens var. glabra	(2)		X		X		X	None likely	None
Frasera gypsicola	(2)	X		X		X		ORV	Project change
Frasera pahutensis	(9)		X		X	X		ORV	Project change
Fraxinus cuspidata var. macropetala	(12)		X		X	X		?	?
Gilia nyensis	(24)		X?		X	X		ORV	3/4
Lepidium nanum	(7)		X		X	X		ORV	Project change
Lepidium ostleri	(3)	X		X			X	None likely	DTN?
Lesquerella hitchcockii	(10)		X		X		X	None likely	None
Lewisia maguirei	(1)	X		X			X	None likely	None
Mertensia toiyabensis	(11)	X?		X			X	None likely	None
Opuntia pulchella	(38)		X		X	X		Collecting	8/38+
Oxytheca watsonni	(2)		X		X	X		ORV	Project change
Penstemon arenarius	(3)		X		X	X		ORV	1/3+
Penstemon bicolor var. roseus	(3)		X		X	X		ORV	Project change
Penstemon concinnus	(16)	X		X		X		ORV	1/17
Penstemon franciscipennellii	(2)	X		X			X	None likely	None
Penstemon moriahensis	(4)	X		X			X	None likely	None
Penstemon nanus	(25)	X[6]			X	X		ORV	8/25+1
Penstemon procerus var. modestus	(1)	X		X			X	None likely	None
Penstemon pudicus	(2)	X		X		X?		ORV	Project change
Penstemon thompsoniae var. jaegeri	(4)		X	X			X	None likely	None

Table 4.3.2.9.3-1. Some characteristics and potential impact for rare plant taxa known to occur within or near M-X project area (Page 3 of 3).

Scientific Name[1]		Endemic to Project Valleys		Baseline Characteristics Range[2]		Location on Valley Floor[3]		Projected M-X Impact	
		Yes	No	Restricted	Widespread	Yes	No	Indirect Effect[4]	Direct Effect[5]
Perityle megalocephala var. intricata	(2)		X		X	X		?	Project change
Phacelia anelsonii	(3)		X		X	X		ORV	Project change
Phacelia glaberrima	(13)		X		X	X		ORV	Project change
Phacelia parishii	(3)		X		X	X		ORV	Project change
Primula capillaris	(1)	X		X			X	None likely	None
Primula nevadensis	(3)	X		X			X	None likely	None
Sclerocactus polyancistrus	(6)		X		X	X		Collecting	?
Sclerocactus pubispinus	(24)		X		X	X		Collecting	4/24
Sphaeralcea caespitosa	(12)	X		X		X		ORV	3/12
Thelypodium sagittatum var. ovalifolium	(10)		X		X	X		ORV	Project change
Townsendia jonesii var. tumulosa	(7)		X	X			X	None likely	None
Trifolium andersonii var. beatleyae	(8)		X		X		X	None likely	None
Trifolium andersonii var. friscanum	(2)	X		X			X	?	DTN?
Zigadenus vaginatus	(1?)		X		X?	X		?	Within OB zone

Total number known rare plant locations: 541

Total number rare plant species: 74

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[1]Numbers in parenthesis are the total number of known locations in M-X project area. (?) indicates that locations are based on old data, or that a taxonomic problem is known to exist for that taxon.

[2]Restricted - species which are either restricted to 1 or 2 valleys, or those which are known to be restricted to a specific, identifiable habitat. Widespread - species which are known from more than 2 project valleys, or are also known outside M-X project area.

[3]In this case, valley floor includes washes, playas, bajadas, and low elevation areas, usually below the foothills and mountains.

[4]Effects are general; predicted on the basis of species characteristics and possibility of, or known occurrence, in identified recreational areas.

[5]Based on conceptual project layout. Fractions refer to the number of potentially intersected locations/total known locations in the project. (+) indicates that there are additional known locations outside M-X project area.

[6]These species each have one known location outside of project area.

Table 4.3.2.9.3-2. Federal candidate[1] rare plant species potentially directly intersected by conceptual project layout[2].

Scientific Name	Total Number Known Locations in Project Area	Total Number Intersected Locations[2]	Ratio[3]
Ascelepias eastwoodiana	13	1	7.7
Astragalus callithrix	12	8	66.7
Astragalus calycosus var monophyllidius	15	1	6.7
Astragalus pseudiodanthus	5	2	40.0
Astragalus serenoi var sordescens	17	5	29.4
Astragalus uncialis	3	1	33.3
Coryphantha vivipara	57	8	14.0
Cymopterus basalticus	11	1	9.1
Eriogonum ammophilum	4	2	50.0
Eriogonum eremicum	14	1	7.1
Eriogonum natum	6	4	66.7
Eriogonum nummulare	2	2	100.0
Gilia nyensis	4	3	75.0
Opuntia pulchella	38	8	21.1
Penstemon arenarius	3	1	33.3
Penstemon concinnus	16	1	6.2
Penstemon nanus	25	8	32.0
Sclerocactus pubispinus	24	4	16.7
Sphaeralcea caespitosa	12	3	25.0
Non-intersected species	270	N/A	N/A
All candidate plant species combined	541	64	11.8

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[1]Category (1) or (2) species as of Federal Register, December 15, 1980.

[2]Intersections wer · determined at a scale of 1:250,000. At this map scale, facilities, sizes and, sometimes, rare plant locality sizes are exaggerated. Due to locational uncertainty rare plant locations within 0.5 mi of project features are considered to be intersected, making this a conservative analysis.

[3]This number should only be regarded as an indication of the level of effect on that species, based on its known locations in the project area. For some species, additional locations are known from outside the project area, and for these species this ratio should actually decrease.

Table 4.3.2.9.3-3. Summary of general project effects and impacts for rare plants in the Nevada/Utah study area

Project Action	Effect	Impact
Construction of permanent roads, buildings, (e.g., operating base support community and construction camp buildings), parking areas, airfields, drainage diversions.	Removal of plants by clearing and grubbing.	Permanent loss of individual plants or entire populations. Impacts minimized by avoidance of rare plant[1] locations found through site-specific survey.
	Deposition of excavated material.	Probably a permanent loss of affected populations. Deposited material may, however, provide habitat for species such as bashful four o'clock (Mirabilis pudica) which thrives on disturbed sites.
	Generation of fugitive dust.	Changes in productivity. Annual species such as centaury (Centaurium namophilum) may be affected through interference with pollination (Harper, 1979).
Excavation of quarries and borrow pits.	Removal of plants from clearing or excavation.	May affect many species which are dependent on sandy soil types and other valley bottom and bajada substrates.
	Deposition of excavated material.	As stated above.
	Generation of fugitive dust.	As stated above.
Construction and operation of cement and aggregate plants.	Removal of plants by clearing and grubbing.	Possible permanent loss of individual plants or populations.
	Generation of cement or aggregate dust by plant operation.	Reduced photosynthetic rates of plants coated by dust (Beatley, 1965) with possible resultant decline in vigor of plant.
Withdrawal of groundwater.	Decreased groundwater availability to plants.	Possible loss of species which rely on underground water supply or specific substrates associated with groundwater flow.
Increased personnel access, including off-road security patrols and recreational activities.	Increased use of off-road areas by vehicles.	Physical breakage of stems and roots (Bury et al., 1977). Crushing of foliage, uprooting of small plants and cacti (Wilshire et al., 1978). Undercutting root systems (Wilshire et al., 1978). Such impacts are capable of destroying populations of rare plants.
	Increased use of off-road areas by hikers, campers, hunters.	Trampling and crushing of sensitive plants (Aitchison et al., 1977). Illegal collection of rare species of cacti or Agave.

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[1]Rare plants may be affected in the same manner as native vegetation. See ETR-14, Native Vegetation.

Table 4.3.2.9.3-4. Summary of impact[1,2] to rare plants, by hydrologic subunit.

Hydrologic Subunit No.	Hydrologic Subunit Name	Direct Impact Index	Number of Places Where DAA Features Could Directly Affect Rare Plant Locations	Number of Rare Plant Species Which Could Be Directly Affected	Number of Additional Rare Valley Floor Species Known to Occur in the Hydrologic Subunit	Short and Long Term Potential Impact[3] for Proposed Action and Alts. 1-6	Short and Long Term Potential Impact[3] for Alt. 8
	Subunits with M-X Clusters and DTN						
4	Snake, Nev./Utah	1.011	4	3	6	*****	*****
5	Pine, Utah	0.111	11	5	4	*****	*****
6	White, Utah	0.181	2	2	0	*****	*****
7	Fish Springs, Utah		0	0		-	-
8	Dugway, Utah		0	0		-	-
9	Government Creek, Utah	0.021	0	0		-	-
46	Sevier Desert, Utah		1	1	2?	***	***
46A	Sevier Desert-Dry Lake, Utah[4]	0.334	3	1	0	*****	*****
54	Wah Wah, Utah	0.319	6	5	4	*****	*****
137A	Big Smoky-Tonopah Flat, Nev.	0.214	4	4	4	*****	
139	Kobeh, Nev.		0	0	2	*	
140A	Monitor-North, Nev.		0	0	2	*	
140B	Monitor-South, Nev.		0	0	2	*	
141	Ralston, Nev.	0.047	4	3	4	*****	
142	Alkali Spring, Nev.		0	0	2	*	
148	Cactus Flat, Nev.		0	0	5	*	
149	Stone Cabin, Nev.[4]	0.08	1	1	5	*****	
151	Antelope, Nev.		0	0		-	
154	Newark, Nev.[4]		0	0		-	
155A	Little Smoky-North, Nev.		0	0	1	*	
155C	Little Smoky-South, Nev.	0.025	3	3	1	***	***
156	Hot Creek, Nev.	0.62	8	4	1?	*****	*****
170	Penoyer, Nev.		0	0		-	-
171	Coal, Nev.[5]		0	0	1	*	*
172	Garden, Nev.		0	0		-	-
173A	Railroad-South, Nev.		0	0		-	-
173B	Railroad-North, Nev.	0.479	13	6	4	*****	*****
174	Jakes, Nev.		0	0	1	*	
175	Long, Nev.		0	0		-	
178B	Butte-South, Nev.		0	0		-	
179	Steptoe, Nev.		0	0	4	*	
180	Cave, Nev.		0	0		-	-
181	Dry Lake, Nev.[4,5]		0	0		-	-
182	Delamar, Nev.		0	0		-	-
183	Lake, Nev.		0	0	2	*	*
184	Spring, Nev.		0	0	6	***	***
196	Hamlin, Nev./Utah	0.009	2	2	4	*****	*****
202	Patterson, Nev.		0	0		-	-
207	White River, Nev.[4]	0.006	2	2	6	*****	*****
208	Pahroc, Nev.		0	0	1	*	
209	Pahranagat, Nev.		0	0	1	*	
	Overall DDA, PA, and Alternatives 1-6	--	64	--		*****	
	Overall DDA, Alternative 8	--	55	--			*****

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[1]Only one candidate rare plant species may be affected as a result of M-X deployment in Texas/New Mexico. Using criteria similar to those below, a low impact is predicted for the DDA of Alternative 7.

[2]This table does not include impacts of operating bases. See text for discussion of potential impact to species occurring within suitability zones.

[3]
- - = No impact predictable. Further data required.
- * = Low impact. No rare plant species directly affected; less than 5 valley bottom species known to occur within hydrologic subunit.
- *** = Moderate impact. Rare plant species potentially directly affected, direct impact index is less than 0.10; and less than 5 valley bottom species are known to occur within hydrologic subunit OR no rare plant species potentially directly affected but greater than five valley bottom species are known to occur within hydrologic subunit.
- ***** = High impact. Rare plant species potentially directly affected; direct impact index is greater than 0.10; and more than 5 valley bottom species are known to occur within hydrologic subunit.

All ratings are based upon available data, which may be insufficient for some HSU's. Further analysis for subsequent tiered decision making could cause these ratings to change.

[4]Conceptual location of Area Support Centers (ASCs) for Proposed Action and Alternatives 1-6.

[5]Conceptual location of Area Support Centers (ASCs) for Alternative 8.

elements of the ecology of these rare plants--their habitat requirements, reproductive biology and relationships with other species--are essentially unknown. Many are likely to be highly specialized equilibrial species, with little tolerance of disturbance. Without detailed study of the possibilities of artificial propagation, there is risk of many extinctions. Even with the best planned mitigation measures, some species which could be potentially invaluable for human uses and needs could be lost."

Rare plant species which are known from only a few limited populations should be easily avoided. The direct impact analysis should be regarded as an indication of the potential level of effect on a species based on its known locations in the project area. Some species range outside the M-X project area, so that the level of quantified M-X project effect on these species would decrease if the external populations were also counted.

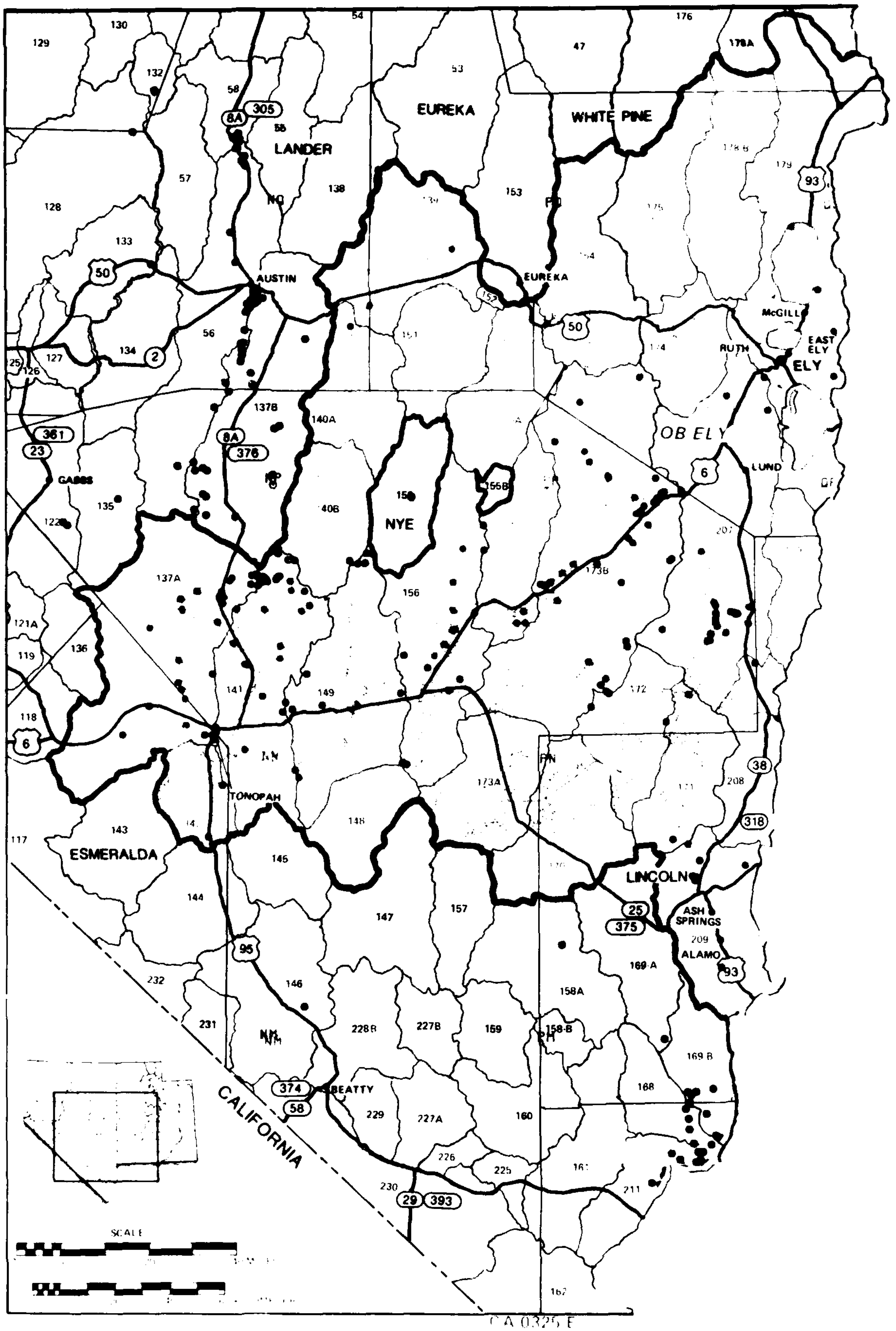
The following points were considered when analyzing the direct impacts:

(1) Undetected locations of rare species may be present in an HSU and may be significantly affected by the project. This analysis is preliminary and is based on available data, which indicate that for some areas there are few or no known occurrences of rare species. Hydrologic subunits with no known rare species were given a no impact predictable rating. Analysis for subsequent tiered decisionmaking will investigate project areas in greater detail and new locations or new species may be found. This possibility is not reflected in the numerical results of the direct impact analysis.

(2) Rare plant locations are difficult to quantify accurately. Locations can be made up of individual plants or large populations. Collections may have been made in the same place by more than one scientist, leading to duplication. Part of this difficulty is the problem of defining the limits of the population. "In the field of population genetics a population is often regarded as a naturally occurring group of individuals which share a common gene pool. Such a concept is difficult to apply upon superficial examination of an assemblage of individuals observed in nature" (Welsh and Neese, 1980). Often in mapping rare plant locations, one finds the available information difficult to translate into a point location. Because of the map scale used in this analysis, only one location of a particular rare plant species was plotted per legal subdivision (640 acres).

(3) The number of known locations in a hydrologic subunit may not reflect accurately the diversity or abundance of rare species in the area, since some areas have been more thoroughly studied than others.

Figure 4.3.2.9.3-1 shows concentrations of rare plants and the Proposed Action layout. The system layouts for full and split basing in Nevada/Utah are shown in Figures 4.3.2.9.3-1 and 4.3.2.9.3-2. The project would affect rare plants in two ways:


LANDER
EUREKA
WHITE PINE
NYE
ESMERALDA
LINCOLN
CALIFORNIA
AUSTIN
EUREKA
McGILL
EAST ELY
RUTH
ELY
LUND
GABBS
TONOPAH
ASH SPRINGS
ALAMO
BEATTY
SCALE
CA 0325 E

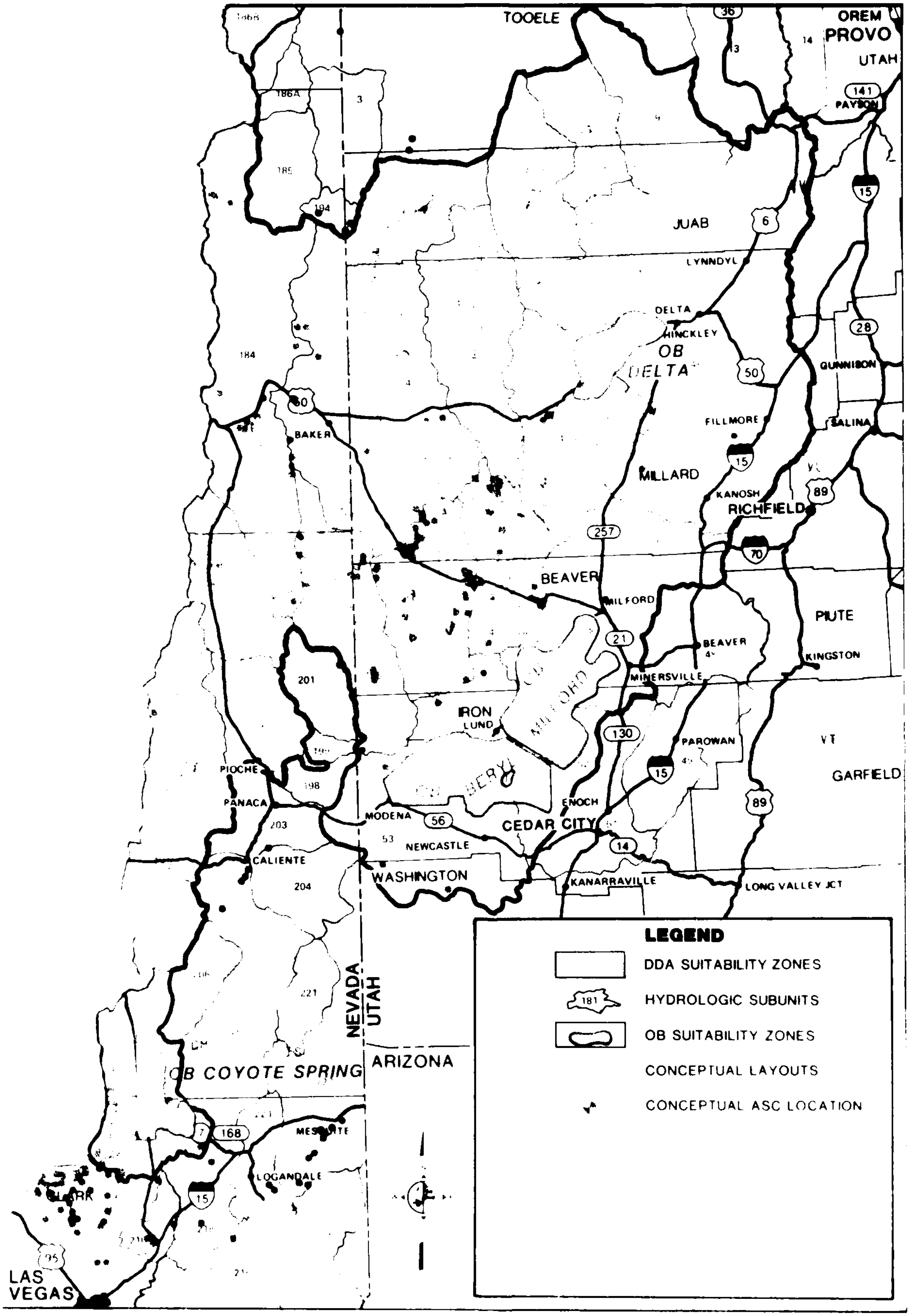
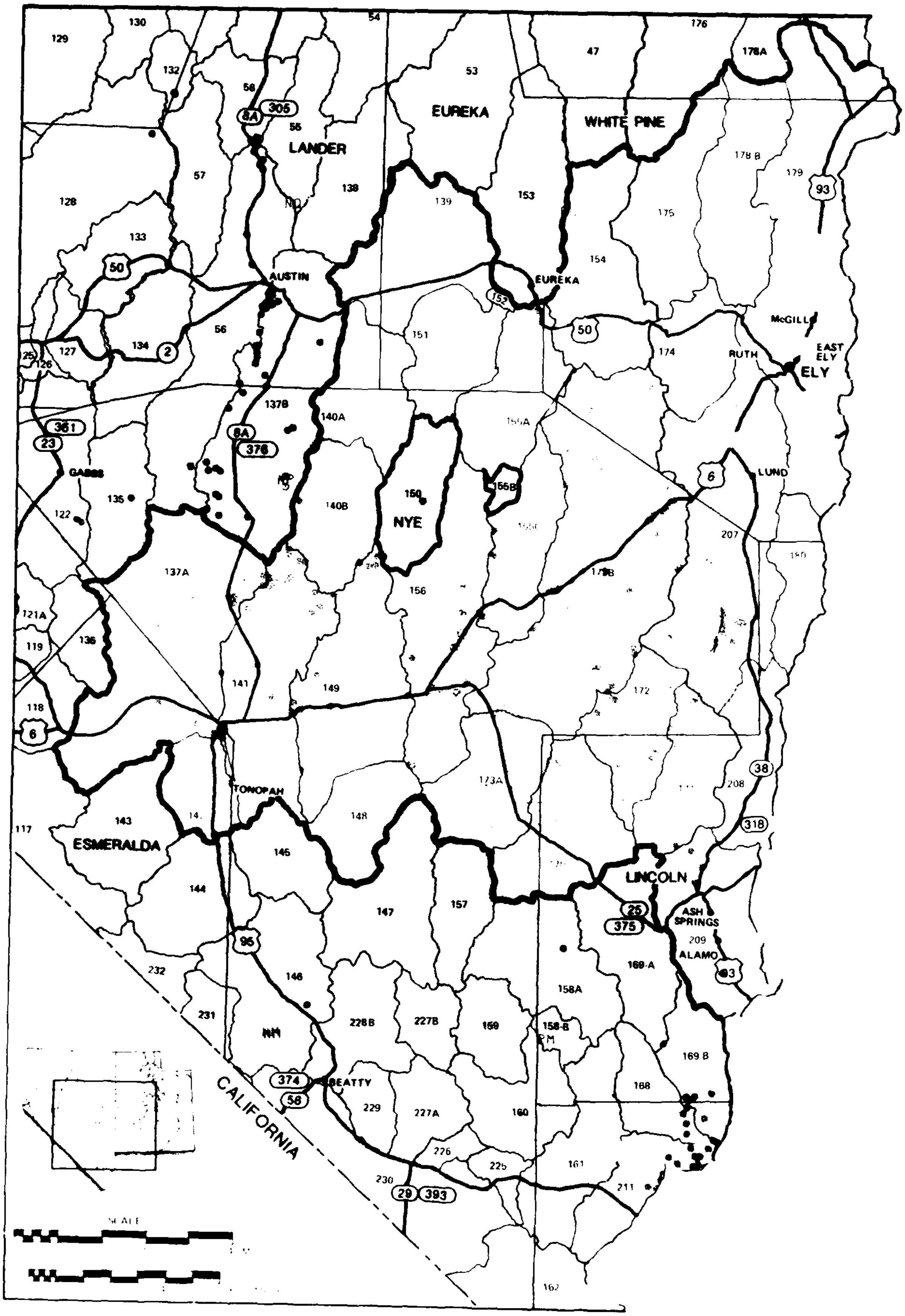


Figure 1.3.2.9.3-1. Base plants and the Proposed Action conceptual ASC layout.


LANDER
EUREKA
WHITE PINE
AUSTIN
EUREKA
McGILL
EAST ELY
ELY
RUTH
LUND
GABBS
NYE
TONOPAH
ESMERALDA
LINCOLN
ASH SPRINGS
ALAMO
BEATTY
CALIFORNIA
SCALE

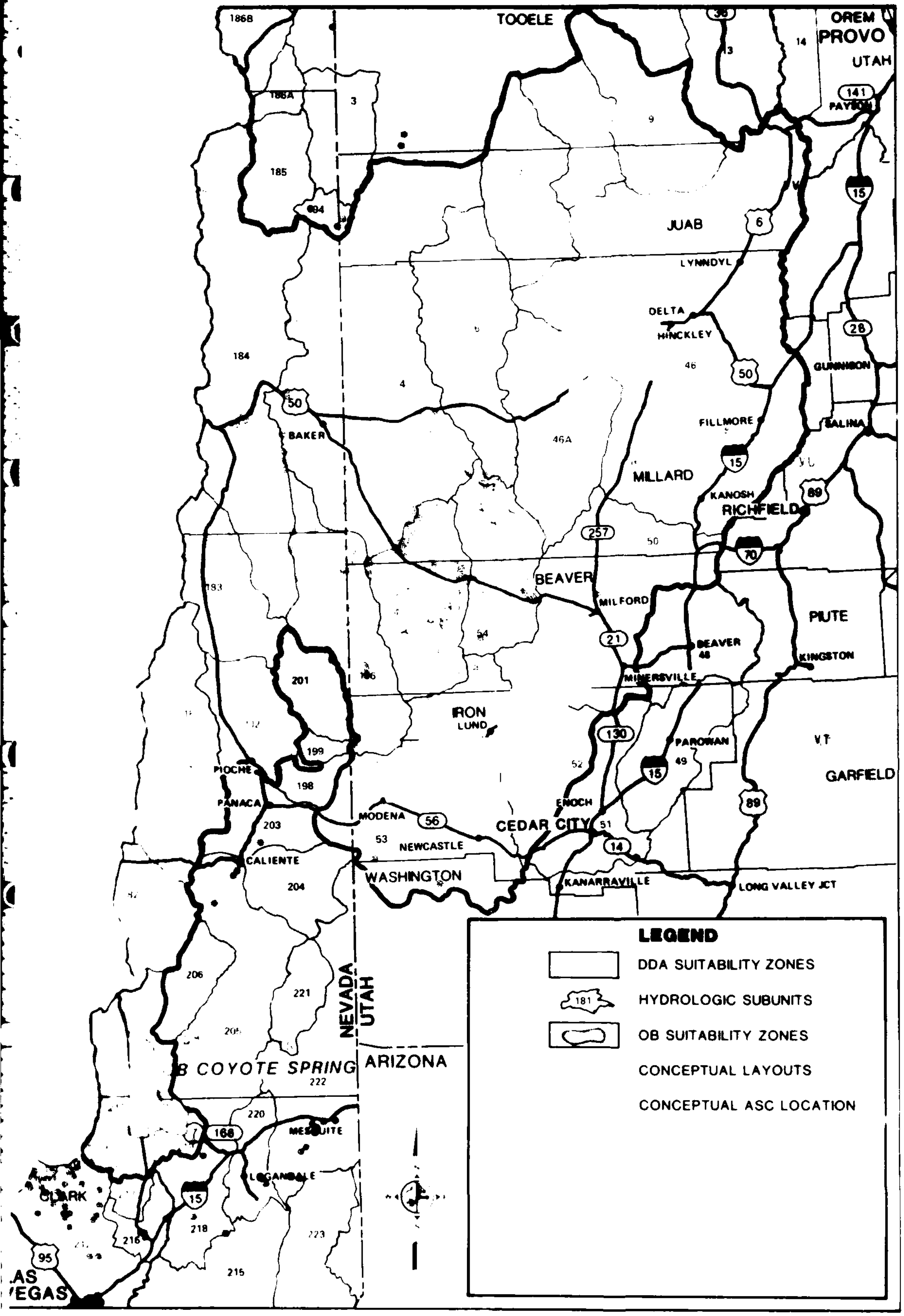


Figure 4.3.2.9.3-2. Rare plants and the Alternative 8 conceptual project layout.

by removing them and by altering their habitat. Rare plant habitat usually involves a specific substrate type; a region where substantial moisture is found; a region where the correct biological "link" is found; or a combination of the above factors. Rare plants are usually tied, in some way, to a specific habitat, and destruction or alteration of this habitat lowers the viability of the rare species. Many rare species are extremely slow to reinvade altered habitat, so that their overall abundance and distribution is lowered. Such habitat disruption could be caused by erosion, compaction, sedimentation and off-road vehicle use, as well as by vegetation clearing.

Project actions that potentially affect rare plants are (1) the construction of permanent roads (e.g., the DTN and cluster roads), protective shelters, buildings, parking areas, and airfields; (2) the excavation of quarries and borrow pits; (3) the construction and operation of cement and aggregate plants; and (4) increased use of the land by security patrols and ORVs. These actions generally involve removal of plants by clearing and grubbing and deposition of excavated material, and increased use of off-road areas by vehicles. Rare plants are potentially affected by these actions primarily because they may be damaged or removed or their habitat may be modified, as stated above.

Indirectly affected species are defined as those occurring more than ½ mi from project features, but in areas which may receive high ORV use. These species are discussed further in ETR-17 (Protected Species). Habitat degradation, crushing of foliage, breakage of stems and uprooting of small plants are all potential impacts resulting from ORV use (Bury et al., 1977; Wilshire, Shipley, Nakata, 1978) and can cause a decrease in the abundance of the plants and their distributional range. Increased collection of plants, especially cacti, for commercial, scientific, or other purposes, is another indirect impact which is likely to increase (see Figure 4.3.2.9.3-3).

The long-term productivity of rare plant species would be affected by the permanent removal of plants and their habitat during construction. Recovery rates for most rare species are not known. Some may be remnants of ancient species and others may be newly evolved. In regions where a portion of a population remains after scarification, some recovery may occur, but the population would not be likely to regain its present productivity. Halogeton, a toxic annual weed, may invade suitable habitat and extend the time required for the recovery of native vegetation beyond the life of the project.

Scarification, which means the clearing of land to build roads and other project features, will result in an irretrievable resource commitment if it involves the loss of rare plants. Species lost in this manner or for any other reasons cannot, of course, be replaced.

The possible effects of groundwater withdrawal are projected to be minimal, but may occur. This subject is discussed in detail in the impact section of ETR-17.

Approximately 12 percent (Table 4.3.2.9.3-2) of the known locations of rare plants in hydrologic subunits where the DDA is located are within ½ mi of project elements. Many of these rare plants are found in localized habitat, making it highly probable that certain species would be locally extirpated if these locations are not avoided. The exact distributions of all candidate rare plant species in the project

THE CLOKEY PINCUSHION CACTUS (*Coryphantha vivipara* var *rosea*) OCCURS WITH BLACK SAGEBRUSH ON SHALLOW, WELL-DRAINED SOILS. THE SPECIES IS THREATENED BY COLLECTORS.

2035-A

Figure 4.3.2.9.3-3 Photographs of the Clokey pincushion cactus.

area are not known. Available data suggest that for some species, the Proposed Action has the potential to alter a high percentage of all known habitat or cause the loss of many known locations. For example, the Callaway milkvetch (Astragalus callithrix) is found in five valleys in the Great Basin. In four valleys it is potentially affected by the project as proposed. It is usually restricted to a sandy habitat (Barneby, 1942). Other species potentially directly intersected are listed in Table 4.3.2.9.3-2.

Table 4.3.2.9.3-4 summarizes the effects on rare plants by hydrologic subunit (HSU). For each HSU, it includes the direct impact index (refer to ETR-17, Table 3.2.2-2), the number of rare plant species and locations which could be directly intersected, and the number of additional rare valley-floor species known to occur in the HSU.

Many factors should be taken into account when assessing the significance of the impact of the M-X project in a particular HSU. Among these factors are the number of species affected, the rarity of species affected, the cumulative project effect on rare species, and the indirect effects. The direct impact index is a close approximation to consideration of all of the above factors. However, the number and location of additional valley-floor species can be used in making recommendations regarding the sensitivity of each HSU to aggregated impacts.

PUBLIC COMMENT ON THE DRAFT EIS:

> "The HSU (Species per hydrologic subunit) evaluation system is adequate but should be based on data that a field survey would provide. Indicating precise boundaries between 'moderate' and 'severe' impact is premature at this point. Also, given the potential extent of rare plant range to be destroyed by the project, it appears that more plants have the potential of being damaged than is indicated in the report."

The purpose of Table 4.3.2.9.3-4 is to show the level of impact which the Proposed Action is projected to have on rare plants in each watershed. The impact is considered on four levels: high, moderate, low, and no impact predictable. The high impact level applies to HSUs where there are rare plant species potentially directly affected, the direct impact index is high (0.10 or greater, see below), and there are more than five valley-floor species known to occur in the HSU (the valley floor includes washes, playas, bajadas, and low elevation areas below the foothills and mountains). The Moderate impact level applies to two types of HSUs: those where there are rare plant species potentially directly affected, but the direct impact index is low (0.10 or less), and there are less than five rare valley-floor species known to occur in the HSU; and those where there are no potentially directly affected species but there are more than five rare valley-floor species. The low impact level applies to HSUs in which there are no rare plant species directly affected and there are less than five valley-floor rare plant species.

For some HSUs, no impact is predictable from present knowledge, but further data are required to support a sound conclusion of no impact. Field studies and analysis for subsequent tiered decisionmaking will be undertaken in these areas. Additional new data may also cause the HSU ratings of high, medium, or low to change. In the interim, these "no impact predictable" HSUs are considered the least sensitive to project deployment because the data that are available show no rare species occuring in them (Nevada State Museum, 1980). They are indicated by a dash in Table 4.3.2.9.3-4.

PUBLIC COMMENT ON THE DRAFT EIS:

> "Much is discussed with regard to determining the existence and sensitivity of rare plants in the project area. This is good but there is perhaps too much emphasis on classifications (intermediate, etc.) delineated by numbers alone. Because numerous exceptions are made in the classification system (for rare plants, for example) to simplify the evaluation it would be better to list only whether a plant was impacted and eliminate the categories which are highly subjective. The HSU (species per hydrologic subunit) classifications appear to be too arbitrary to be of use, for example."

Setting up the criteria which define the boundaries between High, Moderate, and Low impact is a rather subjective process. The classifications should not be considered well-defined groups, but generalized zones which range from unpredictable through low to high, and which depend on many factors. The ratings are meant to provide a means of evaluating siting alternatives.

Coyote Spring Valley OB Impacts

One rare plant species, the Steno sandwort (Arenaria stenomeres), occurs at the edge of the suitability zone of the Coyote Spring OB. It is known from only one other locality which is within the boundary of the Desert National Wildlife Range (Nevada State Museum, 1980) adjacent to the OB suitability zone. Direct impacts are not likely but indirect impacts resulting from ORVs and recreation could alter habitat for this species, possibly decreasing its abundance or narrowing its distribution. The Steno sandwort is protected by the State of Nevada under NRS 527.270. Rare plants occurring in the Coyote Spring OB vicinity are shown in Figure 4.3.2.9.3-4.

Indirect impacts to rare species are likely to occur in recreational areas surrounding the OB. Many habitat-restricted, endemic, and state-protected species occur in lowland areas in the vicinity of this OB and may be impacted through an increase in ORV activity. Four species, the Nye milkvetch (Astragalus nyensis), the fragrant ash (Fraxinus cuspidata var. macropetala), the rosy bicolored penstemon (Penstemon bicolor spp. roseus), and the triangle Geyer milkvetch (Astragalus geyeri var. triquetrus), occur in areas identified by the BLM as high potential ORV-use areas. The risk to these species is likely to increase as the human population increases. Both species of milkvetch are state-protected.

An increase in population has been identified as contributing to an increase in the illegal collection of plants (Murphy, 1980). The Mormon Mountains, in southern Lincoln and Clark counties, have been identified as a potential trouble spot regarding species of cacti. Several populations of the rare ivory spined agave (Agave utahensis var. eborispina) are located in the foothills of the Sheep Range (Desert National Wildlife Range). Agaves are in great commercial demand, and some illegal collection is likely.

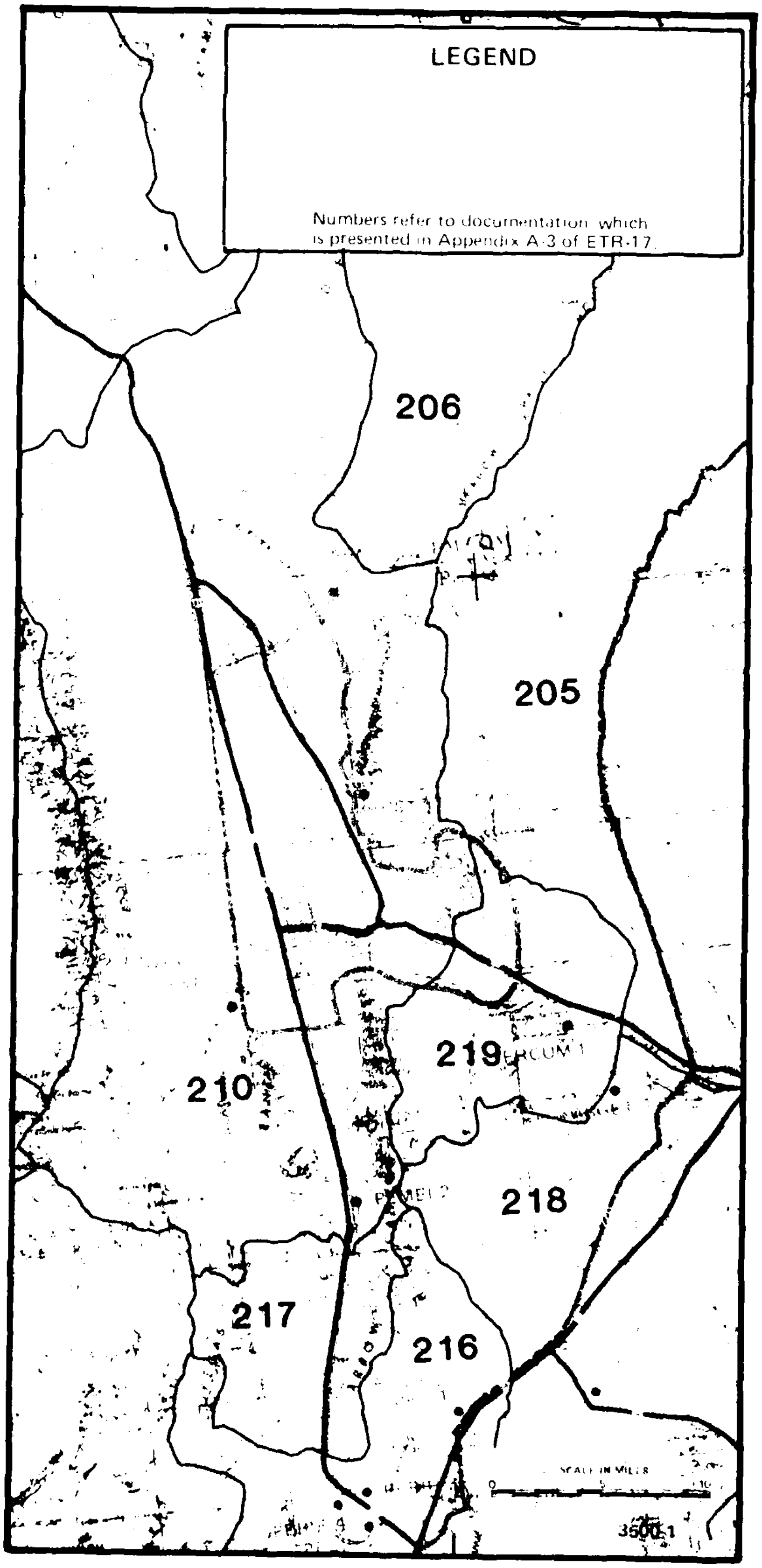


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Figure 4.3.2.9.3-4. Federal candidate rare plants in the vicinity of the Coyote Spring OB.

Expansion of Moapa, the town nearest the proposed OB site, could impact locations of the triangle Geyer milkvetch (Astragalus geyeri var. triquetrus) and the state protected Nye milkvetch (A. nyensis), which are reported to occur near the town.

Milford OB Impacts

The limestone buckwheat (Eriogonum eremicum) is reported to occur just within the suitability zone. Assuming the locations of this plant are avoided, no direct impacts to rare plants are anticipated from vegetation clearing for construction of the OB. However, indirect impacts from recreation are possible.

One federal candidate rare plant species, the dwarf beardtongue (Penstemon nanus), is reported to occur just north of Milford. The Tunnel Springs beardtongue (Penstemon concinnus) is known to occur west of the road to the DDA and the OBTS. One population of a rare cactus (Sclerocactus pubispinus) lies adjacent to Highway 21, about 20 mi north of the layout. It is found in association with six other rare plant species which are limited to the soils of the Sevy Dolomite Formation found in this area (see Figure 4.3.2.9.3-5). The Tunnel Springs beardtongue has a high possibility of being federally listed in the near future and the cactus is recommended for endangered status by authorities in Nevada/Utah. Analysis for subsequent tiered decisionmaking is planned to identify potential habitat areas.

ALTERNATIVE 1 (4.3.2.9.3.3)

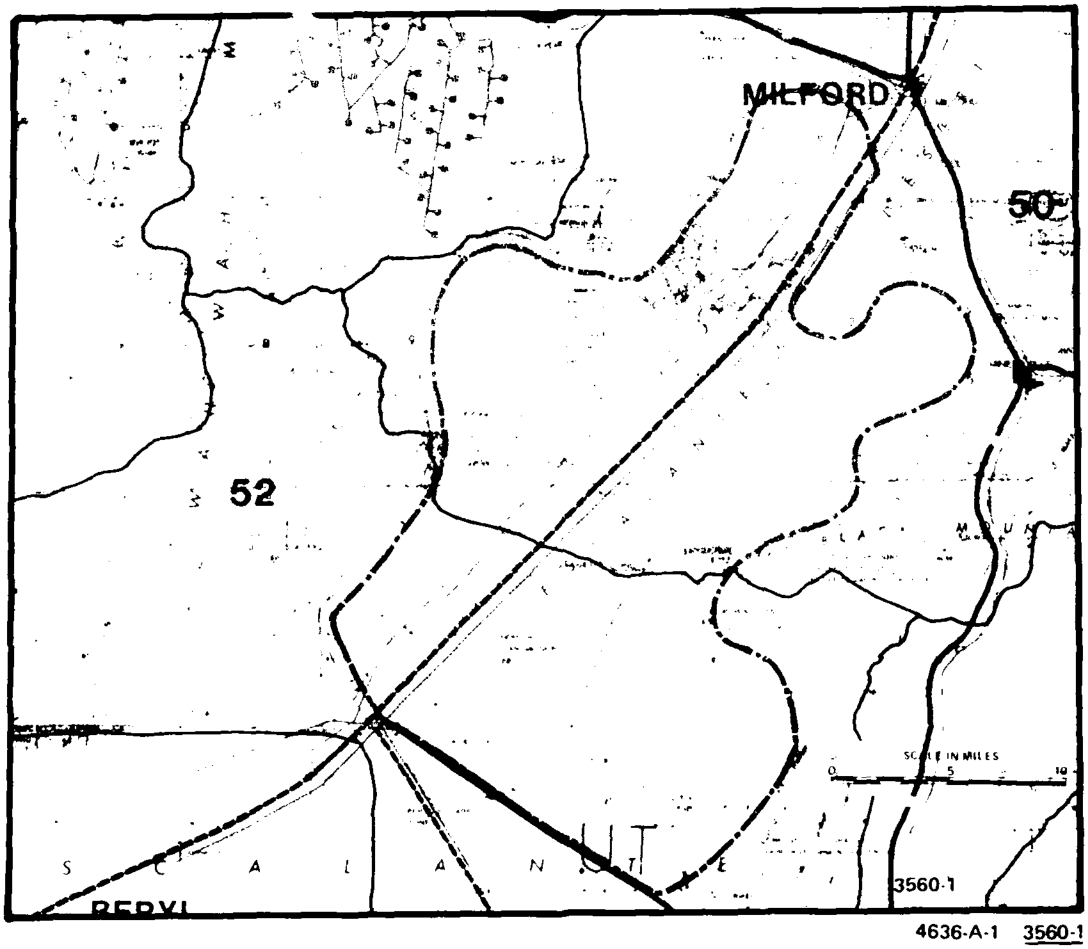
Impacts in the DDA and at the Coyote Spring OB are the same as those for the Proposed Action. No direct impacts to rare plants are anticipated from construction and operation of the second OB at Beryl (Figure 4.3.2.9.3-6). As is true for all OB sites, previously undetected populations may be located during site-specific studies.

ALTERNATIVE 2 (4.3.2.9.3.4)

Impacts in the DDA and at the Coyote Spring OB would be the same as those for the Proposed Action. Two known locations of the terrace buckwheat (Eriogonum natum) occur within the suitability zone of the Delta OB (Figure 4.3.2.9.3-7). This endemic federal candidate species, discovered in 1975 (Welsh, Atwood, and Reveal, 1975), has been recommended for threatened status (Welsh and Thorne, 1979). Only six locations are currently documented, all in Millard County, Utah. The plant has been found on "low white alkaline clay outcrops" in the Sevier Lake area (Welsh, Atwood, and Reveal, 1975). Most of these locations are near the 5,000 ft elevation level, and it is likely that more locations could be found in the surrounding area. Four of the six locations are intersected by clusters in the conceptual layout. OB construction or ORV use in this area would be likely to affect the habitat of this rare species.

ALTERNATIVE 3 (4.3.2.9.3.5)

Impacts in the DDA are the same as those for the Proposed Action. Impacts at the Beryl OB are the same as those for Alternative 1, except that in this case the OB includes a DAA and an OBTS, which require additional personnel. More extensive indirect effects could result from the greater population.



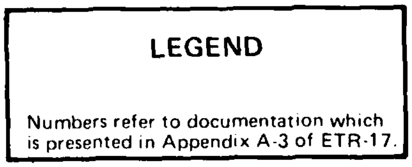
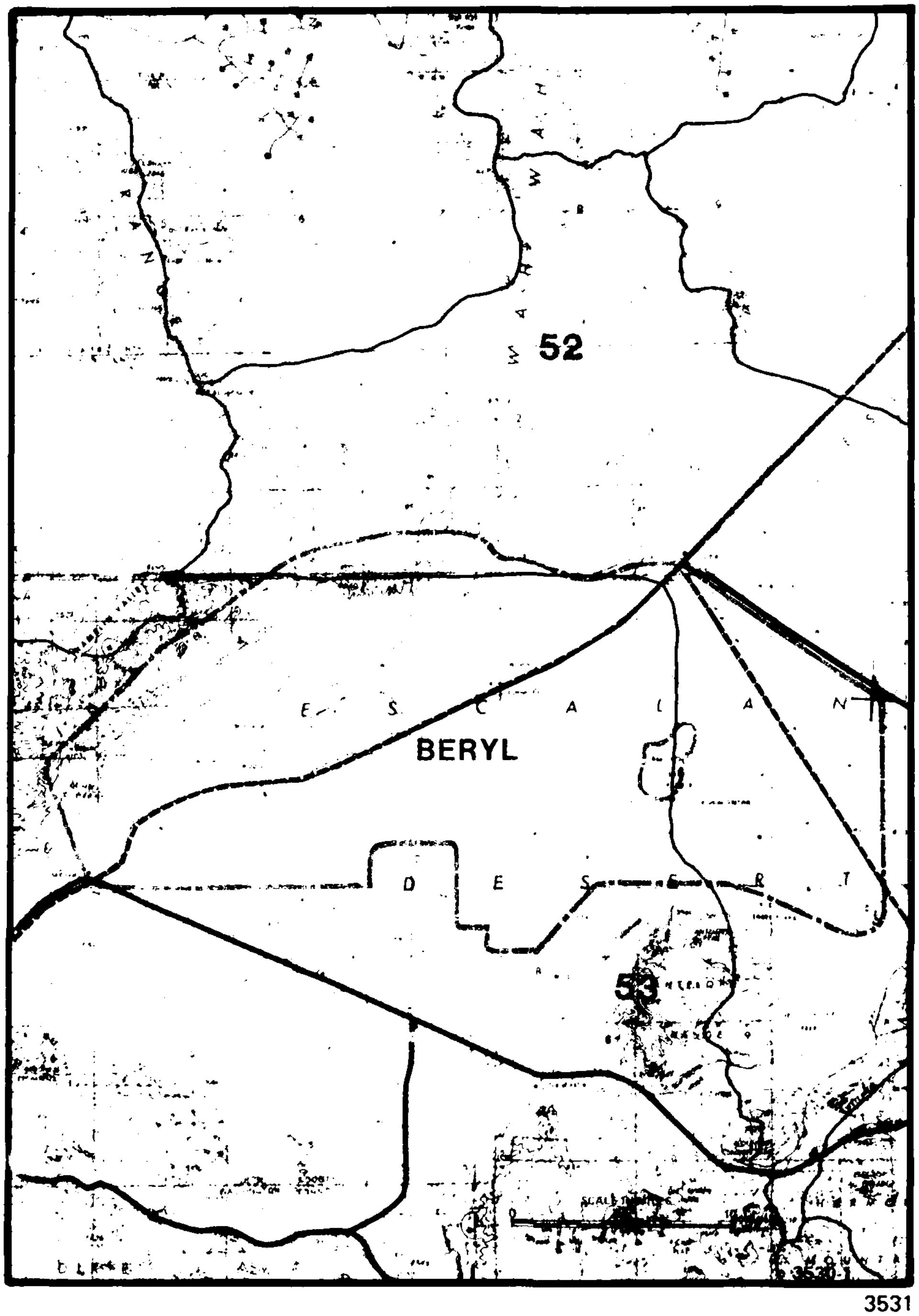


Figure 4.3.2.9.3-5. Federal candidate rare plants in the vicinity of the Milford OB.



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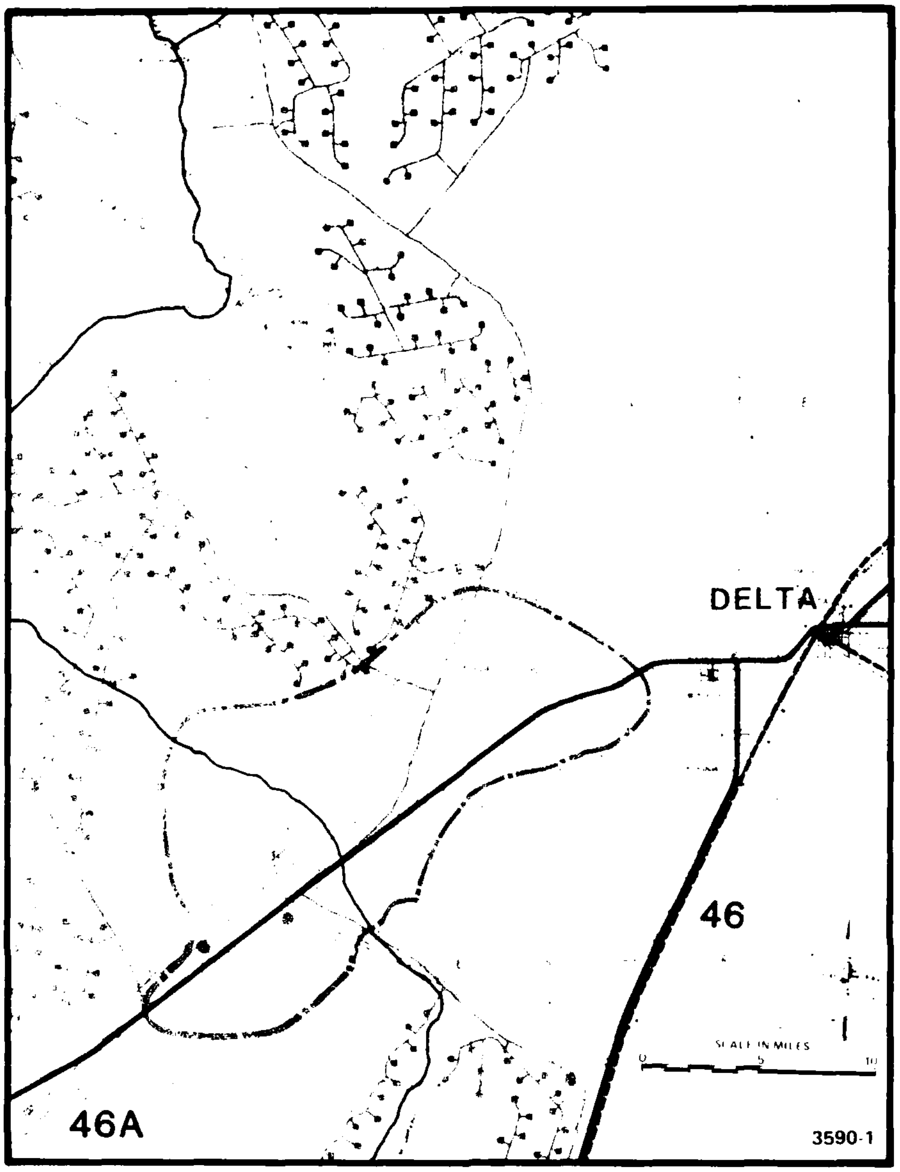
ASCOF	*Astragalus convallarius var finitimus*
PECO	*Penstemon concinnus*

Numbers refer to documentation which is presented in Appendix A-3 of ETR-17

Figure 4.3.2.9.3-6. Federal candidate rare plants in the vicinity of the Beryl OB.



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Numbers refer to documentation which is presented in Appendix A-3 of ETR-17.

Figure 4.3.2.9.3-7. Federal candidate rare plants in the vicinity of the Delta OB.

Two federal candidate rare plant species occur at Monte Neva Hot Springs, within the boundaries of the Ely OB suitability zone. They are the Monte Neva Indian paintbrush (Castilleja salsuginosa), and the sheathed deathcamus (Zigadenus vaginatus). Figure 4.3.2.9.3-8 shows the locations of these species. The paintbrush is known only from this location. Available information indicates that both species occur on private land, but they may be affected by a drop in the level of surface water or groundwater (Heckard, 1980). This problem is discussed in detail in the general impact section of ETR-17 (Protected Species).

The effects of recreational activity in the area could pose a substantial risk to the species, as the hot springs site was once used as a resort. Local population growth could encourage the reopening of the resort, and thereby affect the species.

Rare species that occur at high elevations in the mountain ranges to the east and west of the OB may be affected by increased recreational use resulting from population growth.

ALTERNATIVE 4 (4.3.2.9.3.6)

Impacts in the DDA are the same as those for the Proposed Action. Impacts at the Beryl OB are the same as those for Alternative 3. For the Coyote Spring OB, impacts are the same as those for the Proposed Action except that there would be no DAA or OBTS. The presence or absence of these features does not change the impacts at this OB site.

ALTERNATIVE 5 (4.3.2.9.3.7)

Impacts in the DDA are the same as those for the Proposed Action. No direct impacts to rare plants are anticipated as a result of construction and operation of the Milford OB. There are currently no known rare plant locations in the vicinity of the DAA, the OBTS, or the OB. Analyses for subsequent tiered decisionmaking is planned to ascertain the presence of sensitive species. Indirect impacts as a result of recreation are likely, but cannot be measured yet. Impacts at the Ely OB are the same as those for Alternative 3.

ALTERNATIVE 6 (4.3.2.9.3.8)

Impacts in the DDA are the same as those for the Proposed Action, impacts at Milford are the same as those for Alternative 5, and impacts at Coyote Spring are the same as those for Alternative 4.

ALTERNATIVE 7 (4.3.2.9.3.9)

No significant impacts to rare plants in the Texas/New Mexico area can be predicted on the basis of available data. Only one federal candidate rare plant species is known to occur in the DDA. None of its locations appear to be directly intersected by project elements. (The same method of analysis was used for Texas/New Mexico as for Nevada/Utah.) A few locations are known outside the DDA for some state-listed sensitive species, but suitable habitat for rare plant species apparently does not exist in the immediate vicinity of the Clovis or Dalhart OB sites because the land is in agricultural use.

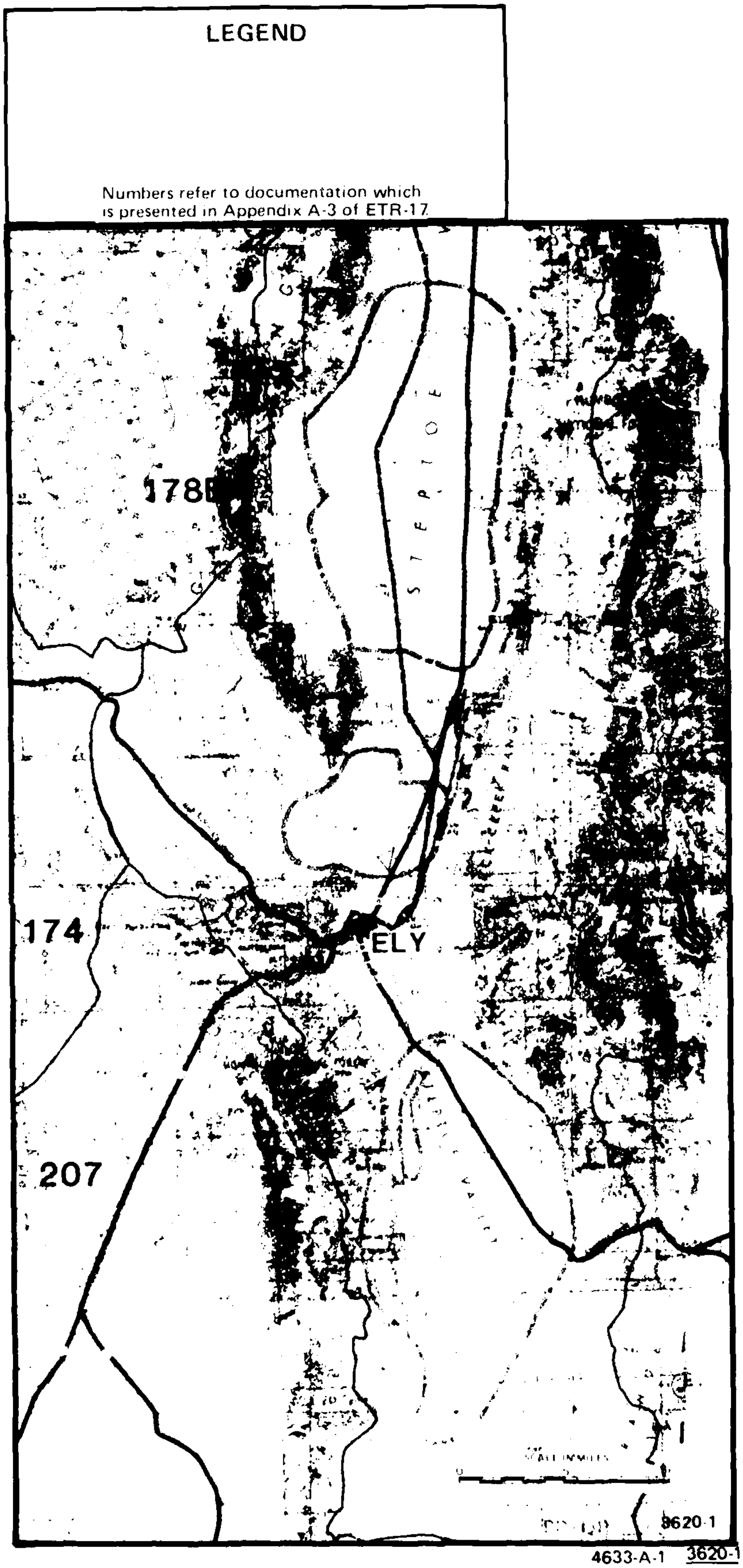


Figure 4.3.2.9.3-8. Federal candidate rare plants in the vicinity of the Ely OB.

ALTERNATIVE 8 (4.3.2.9.3.10)

Impacts are the same as those for the Proposed Action, except that only half the number of valleys are involved in Nevada/Utah. Clearly, the decrease in the number of valleys involved reduces the number of potentially directly affected rare species locations. Fifty-five known rare plant locations would be directly affected (i.e., are within ½ mi of project elements) under split basing, compared to 64 under the Proposed Action. In Texas/New Mexico, no significant impacts to rare plants can be predicted on the basis of available data. Only one federal candidate species is known to occur within the DDA and none of its locations are directly affected.

Impacts at the OBs would be comparable to those for the Proposed Action and Alternative 7.

MITIGATIONS (4.3.2.9.3.11)

Mitigation measures for rare plants need to be directed toward preservation of existing habitats.

The Air Force will implement rare, threatened, and endangered species programs in accordance with Section 7 of the Endangered Species Act. These programs will include identifying areas which contain rare, threatened, and endangered species, avoiding identified areas, fencing and otherwise preserving identified areas, transplanting directly impacted species as necessary, limiting construction off-road travel, controlling dust, monitoring populations, providing conservation programs, and offsetting unavoidable impacts with additional refuges where required.

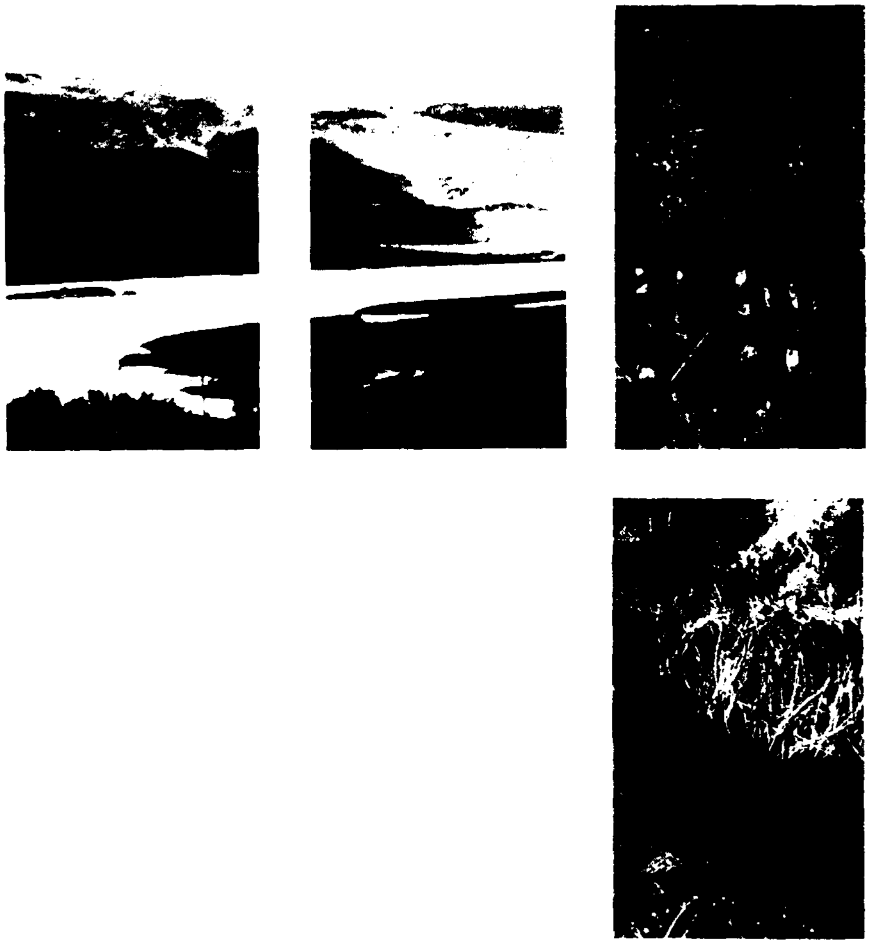
In order to prevent the spread of noxious vegetation and the inadvertent introduction of new species, the Air Force will survey noxious vegetation and introduced species and monitor infestation levels.

For additional discussion on mitigations, refer to ETR-17 (Protected Species) and ETR-38 (Mitigations).

PUBLIC COMMENT ON THE DRAFT EIS:

"A statement is made that the best mitigation strategy for rare plants would be the 'avoidance of all critical habitats'. In fact, this may be the only effective mitigation measure in the long run for most of our endangered plants. We simply do not know enough about them, (and are not likely to in the near future, given the level of funding available), to 'manage' them successfully as we do with the common range and agricultural plants. However, this is a recommendation not easily followed, since the determination of the characteristics and extent of individual critical habitats is a very labor-intensive and lengthy process, certainly one that cannot be accomplished in a single growing season."

Aquatic Species



AQUATIC SPECIES

INTRODUCTION (4.3.2.9.4.1)

A large, dispersed construction project in the water-limited southwestern United States may impinge upon habitats of endemic and rare fishes and invertebrates. Their habitats will be subject to project-related impacts, both direct and indirect, not only during construction, but also operation. The primary method used to estimate direct impact on protected aquatic species was to overlay the conceptual project layout on a map showing known locations of the resource. Impacts were estimated by considering the habitat requirements of species of concern and the effects of project activities, including depletion of groundwater, erosion of soils, and disposal of wastes. With the exception of impacts related to groundwater withdrawal, a critical radius of direct impact on aquatic habitats has been established. Details of this decision are presented in ETR-17 (Protected Species). The state of Nevada, the Nevada Department of Wildlife (NDOW), and others feel that an overall lack of data in the analysis presented makes any in-depth assessment of the impact of the proposed project highly dubious. This analysis represents the extent of knowledge to date, which is admittedly incomplete. Refined predictions will result through analysis for subsequent tiered decisionmaking.

The significance of the predicted impacts was estimated after consideration of the following questions: (1) What is the effect of the disturbance on the viability of the resource? (2) To what extent will the effect be masked by normal variation expressed by the resource? (3) How rapidly will the resource recover from temporary disturbance? (4) What is the scientific or intrinsic value of the resource? (5) To what extent is the resource limited by an ongoing process independent of the project? (6) Are the consequences such that the ecosystem will not recover at all? (7) Are the consequences such that the impact may be large but the recovery process will overcome the damage in a reasonable period of time? (8) Are the deleterious effects measurable? (9) To what extent will funding be required to mitigate the effects on the resource? More detailed and site-specific analysis will be performed. NDOW requests that "without biological predictability, the project should not be initiated."

PROPOSED ACTION (4.3.2.9.4.2)

DDA Impacts

The distribution of federally and state-protected aquatic species and the Proposed Action are shown on Figure 4.3.2.9.4-1. Construction and operation of the M-X project in the Great Basin desert could impact protected aquatic species directly through (1) habitat disturbance, (2) altered rainfall runoff patterns, (3) addition of pollutants, and 4) groundwater withdrawal. The last is most difficult to assess, yet most likely to cause adverse impacts. Indirect impacts would largely result from recreation activities such as fishing, camping, swimming, and use of off-road vehicles. The introduction of exotic aquatic species could impact protected species through predation and competition.

The potential impact that appears to be most pervasive is that of groundwater withdrawal for certain aquatic habitats that are hydrologically linked to aquifers that would be used for M-X. The Wildlife Society, along with more than 25 other commentors, including the state of Nevada, expressed concern about groundwater withdrawal effects on aquatic habitats. Although there is substantial uncertainty associated with these impact predictions, the prospects for impact can be estimated based on known hydrological conditions and expected project requirements; such estimates are given in Table 4.3.2.9.4-1. The state of Utah requests that groundwater impacts upon the least chub be summarized in this table. However, the purpose of this table is to emphasize interrelationships of known interbasin exchange using the White River system as an example. Groundwater withdrawal effects on the least chub are estimated later in this section.

The area of greatest potential impact occurs primarly in the White River Valley system, including White River, Pahranagat, Coyote Spring, and Moapa valleys in addition to feeder hydrologic subunits, including Dry Lake, Delamar, Pahroc, Coal, Garden, Long, and Jakes Valleys. Railroad, Spring, Meadow Valley Wash, Steptoe, and Snake Valleys also contain numerous localized habitats with protected aquatic species which could be subject to either direct or indirect impacts by the Proposed Action. Federally and state protected fish occurring in Moapa and Pahranagat valleys (the most important being the Moapa dace and the Pahranagat roundtail chub) stand the greatest chance of being affected by groundwater withdrawal either as a result of water use directly in the valley of concern or in feeder valleys. (See Groundwater Resources, Section 4.3.2.1.) The state of Nevada, USFWS, and NDOW have asked whether the present analysis includes possible groundwater withdrawal effects on the Ash Meadows area. Since information on sources of distant water for Ash Meadows is presently both insufficient and conflicting, this question will be studied in more detail in further analysis for subsequent tiered decisionmaking.

Since the greatest percentage of groundwater withdrawal would occur in valleys removed from White River, Moapa, and Pahranagat valleys, impacts could occur after water withdrawal takes place. This depends upon various hydrological features, such as substrate transmissivity, slope, and fault structure. Water withdrawal impacts on springs in Moapa, Pahranagat, and White River valleys would probably occur on the order of months or years after the initiation of the action. More detailed project requirement data are required before impacts can accurately be measured, but the potential for significant loss of downslope aquatic habitat is

LEGEND

PROTECTED FISH SPECIES FOR NEVADA AND AND UTAH

A ASH MEADOWS AMARGOSA PUPFISH
B CUI UI*
E RAILROAD VALLEY SPRINGFISH
G WARM SPRINGS AMARGOSA PUPFISH*
H DEVIL'S HOLE PUPFISH*
I BIG SPRING SPINEDACE
J WHITE RIVER SPINEDACE
K WHITE RIVER DESERT SUCKER
L WHITE RIVER SPRINGFISH
M PAHRANAGAT ROUNDTAIL CHUB*
N PAHRUMP KILLIFISH*
O MOAPA DACE*
P LAHONTAN CUTTHROAT TROUT*
Q LEAST CHUB
R VIRGIN SPINEDACE
S VIRGIN RIVER ROUNDTAIL CHUB
T WOUNDFIN*

RECOMMENDED PROTECTED FISH SPECIES FOR NEVADA AND UTAH

1 PRESTON WHITE RIVER SPRINGFISH
2 MORMON WHITE RIVER SPRINGFISH
3 WHITE RIVER SPRINGFISH
3a HIKO WHITE RIVER SPRINGFISH
3b MOAPA WHITE RIVER SPRINGFISH
4 SH MEADOWS SPECKLED DACE
5 INDEPENDENCE VALLEY SPECKLED DACE
6 CLOVER VALLEY SPECKLED DACE
7 MOAPA SPECKLED DACE
8 NEWARK VALLEY TUI CHUB
9 LAHONTAN TUI CHUB
11 INDEPENDENCE VALLEY TUI CHUB
13 FISH SPRINGS TUI CHUB
14 JUNE SUCKER
16 UTAH LAKE SCULPIN
18 WHITE RIVER SPECKLED DACE
C RELICT DACE
F BONNEVILLE CUTTHROAT TROUT
(R) VIRGIN SPINEDACE

RECOMMENDED PROTECTED INVERTEBRATES MOLLUSCS

19 EVERTON ASSIMINEA
20 MOAPA VALLEY TURBAN
21 ASH MEADOWS TURBAN
22 PAHRANAGAT VALLEY TURBAN
23 HOT CREEK TURBAN
24 STEPTOE TURBAN
25 WHITE RIVER VALLEY FONTELICELLA
26 RUBY VALLEY FONTELICELLA
27 CURRENT FONTELICELLA
28 DUCKWATER FONTELICELLA
29 RED ROCK FONTELICELLA
30 WHITE RIVER VALLEY HYDROBID
31 DUCKWATER SNAIL
32 CORN CREEK SNAIL
33 ASH MEADOWS TRYONIA
34 MOAPA TRYONIA
35 ZION CANYON PHYSA
36 RUSSELL'S SNAIL

INSECTS

DIPTERANS
37 VIRGIN RIVER NET WINGED MIDGE
HEMIPTERANS
38 ASH SPRINGS CREEPING WATER BUG
39 MOAPA CREEPING WATER BUG
PLECOPTERANS
40 GIANT STONEFLY NYMPH

MAJOR WETLANDS AND RIPARIAN HABITAT

WATER BODY
WATER COURSE WITH FLOW DIRECTION INDICATED
INTERMITTENT WATER COURSE
INTERMITTENT WATER BODY
MARSH
SPRING
WMA WILDLIFE MANAGEMENT AREA

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AD-A149 881 DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ACQUISITION CHAPTER 4 M-X/M..(U) HENNINGSON DURHAM AND RICHARDSON SANTA BARBARA CA 02 OCT 81 5/5

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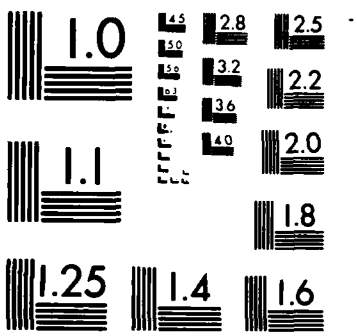
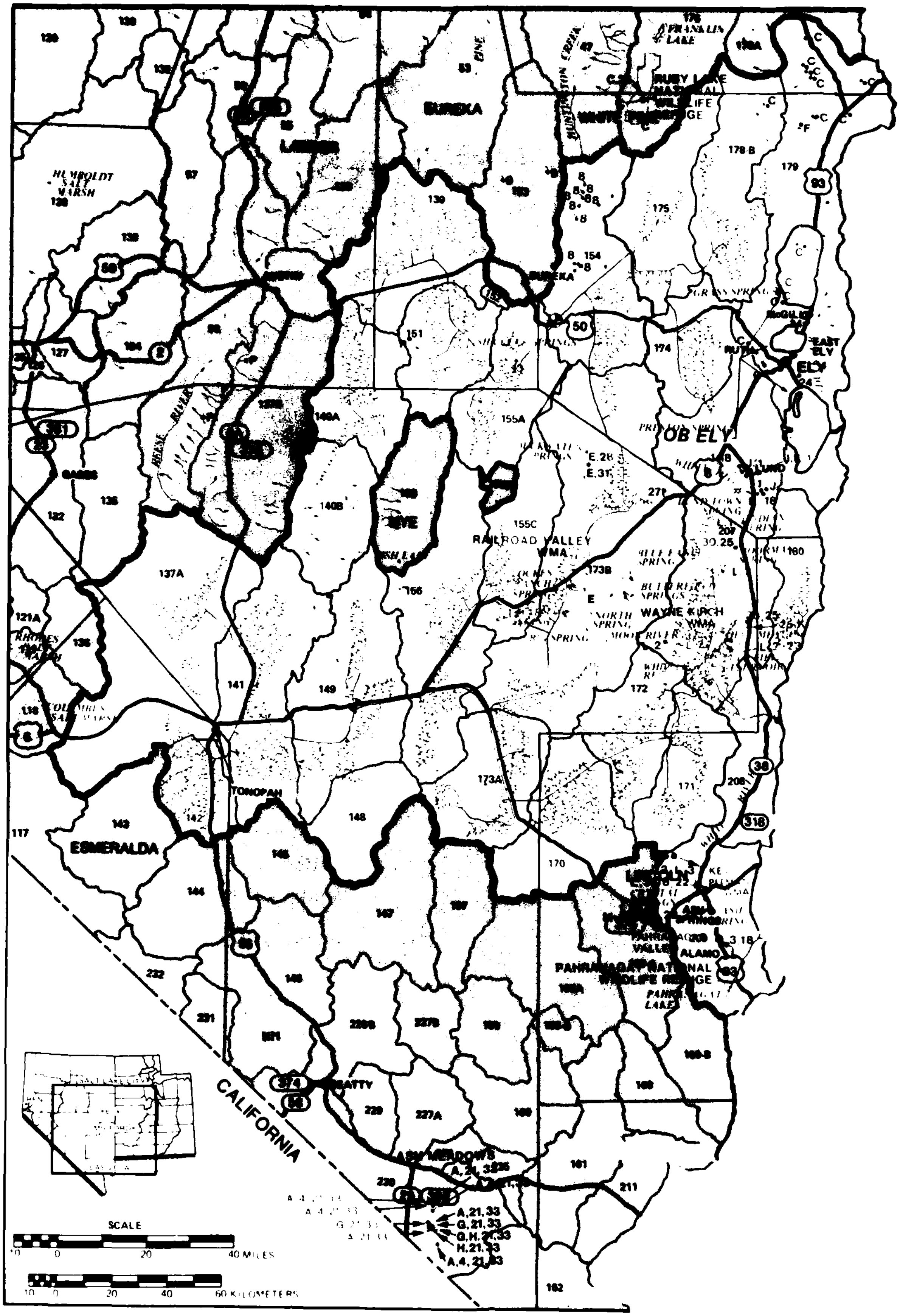


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A


EUREKA
HUMBOLDT SALT MARSH
RUBY LAKE NATIONAL WILDLIFE REFUGE
WHITE PINE
FRANKLIN LAKE
RAILROAD VALLEY WMA
NYE
WAYNE KIRCH WMA
LINCOLN
TONOPAH
ESMERALDA
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ALAMO
CALIFORNIA
ASH MEADOWS
SCALE
40 MILES
60 KILOMETERS

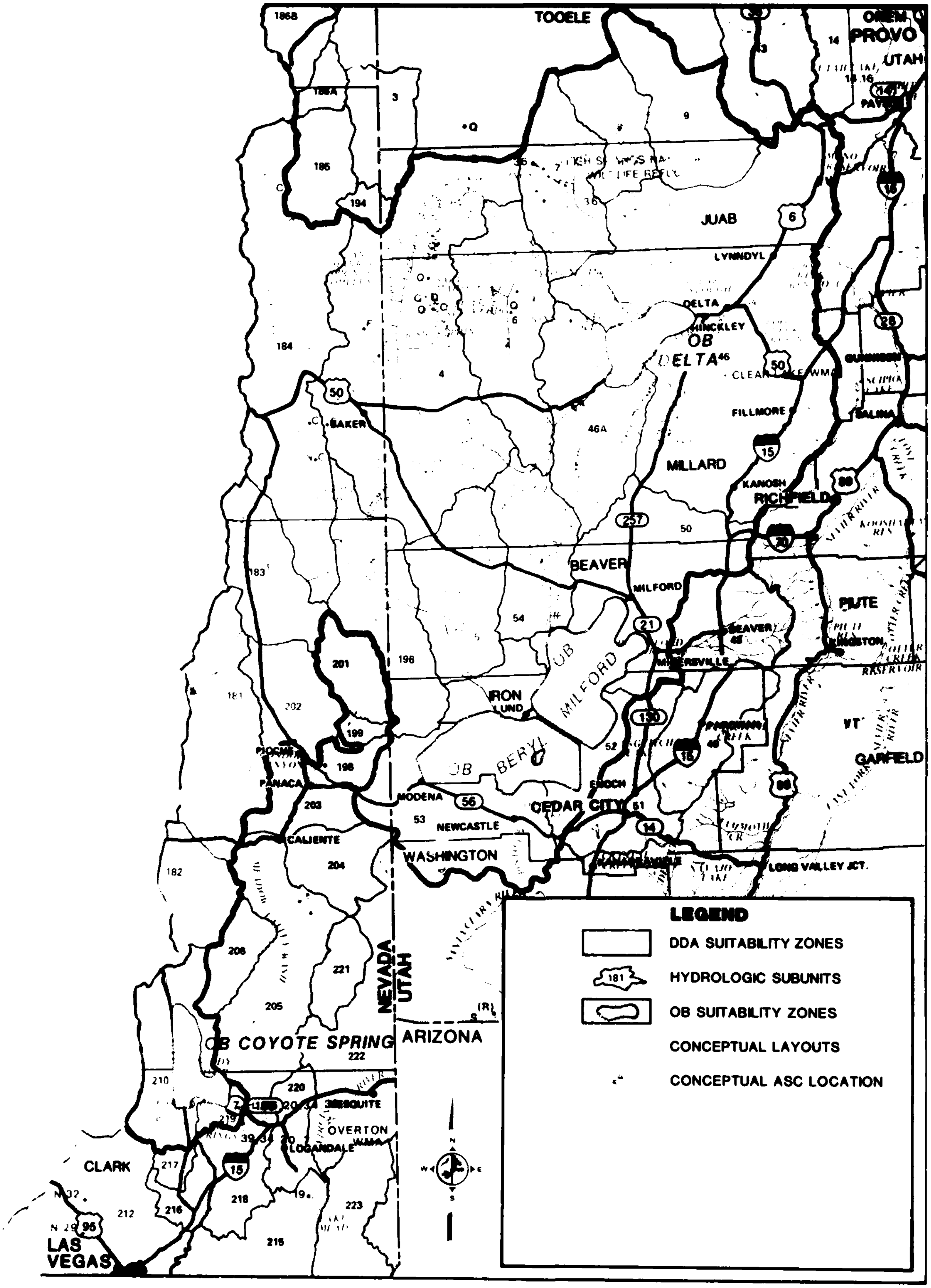

Figure 4.3.2.9.4-1. Protected and recommended protected aquatic species and the Proposed Action conceptual project layout.

Table 4.3.2.9.4-1. Protected or recommended protected aquatic biota for which available data indicate close monitoring for water withdrawal-related impacts during construction or operation of the DDA in Nevada/Utah.

Potentially Impacted Protected or Recommended Protected Biota[1]	Legal Status[2]	Species Location[3]	Estimated Water Use (Percent of Perennial Yield[4])	Interbasin Exchange - Input[5]			
				Adjacent Basin	Estimated Water Use by Project (Percent of Perennial Yield)	Nearby Basin	Estimated Water Use by Project (Percent of Perennial Yield)
Moapa dace	FE	Moapa	N/A	Coyote/Kane	N/A	Dry Lake	90
Moapa White River springfish	ST	Moapa				Delamar	90
Moapa speckled dace	RT	Moapa				Coal	50
Moapa Valley turban	RT	Moapa				Garden	50
Moapa tryonia	RT/RE	Moapa				Cave	80
Moapa creeping water bug	RT/RE	Moapa				Jakes	13
						Long	35
Pahranagat roundtail chub	FE	Pahranagat	3	Coal	50	Garden	50
White River springfish	ST/RE	Pahranagat		Dry Lake	90	Cave	80
Hiko White River springfish	ST	Pahranagat		Delamar	90	Jakes	13
White River speckled dace	RT/RE	Pahranagat				Long	35
Pahranagat Valley turban	RT	Pahranagat					
Moorman White River springfish	ST	White River	7	Jakes	13	Long	35
Preston White River springfish	ST						
White River desert sucker	ST/RE	White River					
White River spinedace	ST/RE	White River					
Hot Creek turban	RE	White River					
White River Valley fontelicella	RE	White River					
White River Valley hydrobiid	RE	White River					

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[1]Scientific names are listed in ETR-16.

[2]F = federal, E = endangered, S = state, T = threatened, R = recommended.

[3]Valley, watershed, or hydrologic unit.

[4]PD/PY = Estimated DDA use as determined by full basing, peak M-X demand (PD) divided by perennial yield (PY) as expressed in percent, per information derived from Table 4.3.2.1-3 in Chapter 4.

[5]Information derived from Figure 6 in Eakin (1966).

N/A - Not applicable (i.e. no DDA impacts; however, see discussion of Coyote Spring OB impacts under Proposed Action).

especially likely in Moapa, Pahranagat, and White River valleys. Although the magnitude of this effect could be large, its duration would not be expected to exceed the duration of the action causing the depletion of groundwater. Since the habitat requirements for the species of concern are also incompletely known, the magnitude of the biological impact cannot be predicted.

Current endangerment of federally protected species appears to have resulted, in some instances, from stresses such as water diversion for irrigation or use of the water source by livestock. For instance, in the Ash Spring outflow in Pahranagat Valley, the federally protected Pahranagat roundtail chub has dwindled to less than 45 adults (Deacon et al., 1980). This has likely resulted from the introduction of exotic species and from the loss of spawning and feeding habitat due to periodic reductions in water level by 50 percent for irrigation purposes (Deacon et al., 1980). Irrigation diversion may have also caused the extirpation of the White River spinedace from Preston Big Spring in White River Valley and the virtual loss of the White River desert sucker from the same habitat. Neither the normal variation in population size of individual species, nor baseline conditions including seasonal fluctuations, are presently known. Present knowledge indicates that population numbers remain fairly constant in some habitats, but fluctuate widely in others; a case-by-case evaluation of baseline conditions and potential project impacts would be required to answer these questions.

Most aquatic species of concern produce at least one new generation per year and thus recovery would be fairly rapid if the impact were sufficiently mitigated and temporary, and if subsequent conditions permitted recovery. Such population reductions, however, could result in reduced genetic diversity in the recovered population, which would limit its ability to survive future natural or man-induced perturbations. Once a species population is reduced to an unmaintainable level, it will be extirpated from that particular habitat. Stated differently by the state of Nevada and the NDOW, "a population can exist by the grace of marginal conditions and be exterminated by further degradation of habitat."

With respect to groundwater withdrawal, direct avoidance of sensitive aquatic habitats is not possible since the vagaries of groundwater movement are not presently well understood. The most promising mitigation is to change well pumping rates and locations as soon as effects on aquatic habitats of concern are noted. However, since the natural groundwater flow recovery might be slow, additional mitigations could be required. This could mean piping in additional supplies from distant wells. Such pumping, however, could actually increase negative impacts on the habitat of concern by altering water quality. In this case, the only remaining mitigation would be transplantation of the affected population to another aquatic habitat unaffected by project impacts. This procedure would be difficult because of the variable water quality and habitat conditions between isolated aquatic habitats near and distant from the affected one. The USFWS discourages transplantation, and the state of Nevada and NDOW recommend that ecosystem protection is the means by which endangered species should be preserved.

Direct intersection of project structures with sensitive aquatic habitats is not expected to cause significant impacts on protected aquatic species (Table 4.3.2.9.4-2). Only in Railroad and Snake valleys do proposed project structures approach within one mile of habitats containing protected aquatic species -- the state protected Railroad Valley springfish and least chub,

Table 4.3.2.9.4-2. Valleys containing both sensitive aquatic habitat, inhabited by either legally or recommended protected aquatic species, and proposed project structures.

Hydrologic Subunit		Sensitive Aquatic Habitats				
No.	Name	Total[1]	I[2]	Percent of Total	I[3]	Percent of Total
4	Snake, Nev./Utah	13	4	31	2	15
5	Pine, Utah					
6	White, Utah	2	1	50	0	0
7	Fish Springs, Utah	3	1	33	0	0
8	Dugway, Utah					
9	Government Creek, Utah					
46A	Sevier Desert-Dry Lake, Utah					
52	Lund District, Utah					
53	Beryl, Utah					
54	Wah Wah, Utah					
137A	Big Smoky-Tonopah Flat, Nev.	1	0	0	0	0
139	Kobeh, Nev.					
140A	Monitor-North, Nev.	2	0	0	0	0
141	Ralston, Nev.					
142	Alkali Spring, Nev.					
148	Cactus Flat, Nev.					
149	Stone Cabin, Nev.					
150	Little Fish Lake, Nev.					
151	Antelope, Nev.					
154	Newark, Nev.	11	0	0	0	0
155A	Little Smoky-North, Nev.	1	1	100	0	0
155C	Little Smoky-South, Nev.					
156	Hot Creek, Nev.	1	0	0	0	0
170	Penoyer, Nev.					
171	Coal, Nev.					
172	Garden, Nev.					
173A	Railroad-South, Nev.					
173B	Railroad-North, Nev.	4	2	50	0	0
174	Jakes, Nev.					
175	Long, Nev.					
178B	Butte-South, Nev.					
179	Steptoe, Nev.	14	3[4]	21	0	0
180	Cave, Nev.					
181	Dry Lake, Nev.					
182	Delamar, Nev.					
183	Lake, Nev.					
184	Spring, Nev.	4	0	0	0	0
196	Hamlin, Nev./Utah					
202	Patterson, Nev.					
207	White River, Nev.	9	3	33	3	33
208	Pahroc, Nev.					
209	Pahranagat, Nev.	5	0	0	0	0
210	Coyote Spring, Nev.					
214	Muddy River Springs, Nev.	1	1[4]	100	1[4]	100

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[1]Numbers of habitats or habitat clusters (several occurring in close proximity).

[2]Intersection with aquatic habitats (within 5 mi) for full basing.

[3]Intersection with aquatic habitats (within 5 mi) for split basing.

[4]With OB.

respectively. In determining the occurrence of aquatic habitats in a valley, clusters of springs emanating from the same aquifer were considered in this analysis as a single habitat. The state of Utah suggested that more least chub habitats occur in Snake Valley than listed in Table 4.3.2.9.4-2; the state of Nevada questioned the spring count in Railroad Valley. Most springs occurring in the valleys in question belong to a few major clusters of springs dispersed throughout the area. However, some significant aquatic habitats in other valleys may be lacking from this analysis if they have not been inventoried. Habitats of the Moorman White River springfish, Pahranagat roundtail chub, and White River springfish occur within 5 mi of some portion of the proposed DDA. Direct impacts might occur in these several locations during DDA construction. As mentioned previously, habitat disturbance, altered rainfall runoff patterns, and addition of pollutants might result from project construction in the immediate vicinity of sensitive aquatic habitats. However, these impacts could be readily mitigated by avoidance or site-specific design, thus reducing the potential for significant impacts.

Of particular concern are some of the last known habitats of a pure strain of the federally protected Lahontan cutthroat trout located in the Reese River headwaters and adjacent to some of the westernmost cluster construction areas (Big Smoky Valley, etc.). Fishing pressure, increased by M-X workers (for example, from nearby construction camps), could produce significant losses unless mitigated. Populations of the state-protected Bonneville cutthroat trout occurring in the mountains bordering Spring and Snake valleys also would be subjected to increased fishing pressure. Special fishing restrictions might be required for these areas to protect this species. For other locations, most of the impacts could be mitigated first by avoidance, then by various site-specific measures initiated to protect the uniqueness and integrity of sensitive habitats. At this stage, however, neither these impacts nor mitigating measures can be accurately quantified.

A summary of the impacts for the Proposed Action is presented in Table 4.3.2.9.4-3. High direct DDA impacts are expected only in Muddy River Springs Valley; moderate effects are predicted for Pahranagat, White River, and Railroad valleys.

Groundwater withdrawal causes the most concern. "Drawing conclusions from inadequate information probably understates the influence of groundwater removal and spring viability," cautions the state of Nevada and NDOW. Long-term effects are estimated to be low to nonexistent in all valleys. Impacts of the project, however, may become long-term as a result of the short-term effects.

Coyote Spring Valley OB Impacts

The impacts of locating an OB in Coyote Spring Valley (Figure 4.3.2.9.4-2) add to DDA impacts resulting from groundwater withdrawals. The boundary of the OB suitability zone approaches as close as 1-2 mi from the Moapa National Wildlife Refuge. Locating an OB at Coyote Spring could reduce the perennial yield for this hydrologic subunit such that when the reduction is added to effects of groundwater withdrawal in connecting feeder valleys upslope from the Moapa National Wildlife Refuge, the chance for preventing irretrievable losses of the protected aquatic species in the refuge would be low. Thus, this OB is expected to cause high direct impacts to Muddy River Springs (Table 4.3.2.9.4-3). Pumping of water allotted to Las Vegas from Lake Mead to supply the OB would effectively mitigate the water withdrawal impacts of the OB upon the Moapa National Wildlife Refuge.

Table 4.3.2.9.4-3. Potential direct impacts to protected aquatic species in Nevada/Utah DDA for the Proposed Action and Alternatives 1-6.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1]	Highest Legal Status[4]	Short-Term: Ground-water With-drawal (%)[3,7]	Short-Term: Habitat Within 5 mi of Project Structures (%)[5,7]	Short-Term: Impact[2,6]	Long-Term: Ground-water With-drawal (%)[3,7]	Long-Term: Habitat Within 5 mi of Project Structures (%)[5,7]	Long-Term: Impact[2,6]
	Subunits with M-X Clusters and DTN								
4	Snake, Nev./Utah	M	ST	10	31	*	5	20	*
5	Pine, Utah	-	--	N/A	0	-	N/A	0	-
6	White, Utah	-	--	N/A	0	-	N/A	0	-
7	Fish Springs, Utah	-	--	N/A	0	-	N/A	0	-
8	Dugway, Utah	-	--	N/A	0	-	N/A	0	-
9	Government Creek, Utah	-	--	N/A	0	-	N/A	0	-
46	Sevier Desert, Utah	-	--	N/A	0	-	N/A	0	-
46A	Sevier Desert-Dry Lake, Utah	-	--	N/A	0	-	N/A	0	-
54	Wah Wah, Utah	-	--	N/A	0	-	N/A	0	-
137A	Big Smoky-Tonopah Flat, Nev.	-	--	N/A	0	-	N/A	0	-
139	Kobeh, Nev.	-	--	N/A	0	-	N/A	0	-
140A	Monitor-North, Nev.	-	--	N/A	0	-	N/A	0	-
140B	Monitor-South, Nev.	-	--	N/A	0	-	N/A	0	-
141	Ralston, Nev.	-	--	N/A	0	-	N/A	0	-
142	Alkali Spring, Nev.	-	--	N/A	0	-	N/A	0	-
148	Cactus Flat, Nev.	-	--	N/A	0	-	N/A	0	-
149	Stone Cabin, Nev.	-	--	N/A	0	-	N/A	0	-
151	Antelope, Nev.	-	--	N/A	0	-	N/A	0	-
154	Newark, Nev.	L	RT	14	0	*	7	0	*
155A	Little Smoky-North, Nev.	-	--	N/A	0	-	N/A	0	-
155C	Little Smoky-South, Nev.	-	--	N/A	0	-	N/A	0	-
156	Hot Creek, Nev.	-	--	N/A	0	-	N/A	0	-
170	Penoyer, Nev.	-	--	N/A	0	-	N/A	0	-
171	Coal, Nev.	-	--	N/A	0	-	N/A	0	-
172	Garden, Nev.	-	--	N/A	0	-	N/A	0	-
173A	Railroad-South, Nev.	-	--	N/A	0	-	N/A	0	-
173B	Railroad-North, Nev.	M	RE	10	50	***	5	15	*
174	Jakes, Nev.	-	--	N/A	0	-	N/A	0	-
175	Long, Nev.	-	--	N/A	0	-	N/A	0	-
178B	Butte-South, Nev.	L	RT	13	0	*	7	0	*
179	Steptoe, Nev.	M	RE	8	21	*	4	10	*
180	Cave, Nev.	-	--	N/A	0	-	N/A	0	-
181	Dry Lake, Nev.	-	--	N/A	0	-	N/A	0	-
182	Delamar, Nev.	-	--	N/A	0	-	N/A	0	-
183	Lake, Nev.	-	--	N/A	0	-	N/A	0	-
184	Spring, Nev.	H	FE	3	0	*	1	0	*
196	Hamlin, Nev./Utah	-	--	N/A	0	-	N/A	0	-
202	Patterson, Nev.	-	--	N/A	0	-	N/A	0	-
207	White River, Nev.	H	RE	7	33	***	3	5	*
208	Pahroc, Nev.	-	--	N/A	0	-	N/A	0	-
209	Pahranagat, Nev.	H	FE	40	0	***	15	0	*
	Other Affected Subunits								
56	Upper Reese River, Nev.	M	FT	0	0	*	0	0	*
176	Ruby, Nev.	L	RT	0	0	*	0	0	*
187	Goshute, Nev.	L	RT	0	0	*	0	0	*
205	Meadow Valley Wash, Nev.	L	RE	0	0	*	0	0	*
219	Muddy River Springs, Nev.	H	FE	50	100	*****	25	30	*
222	Virgin River, Nev.	H	FE	0	0	*	0	0	*
230	Amargosa Desert, Nev.	H	FE	0	0	*	0	0	*
	Overall DDA Impact[6]			10	17	*	5	3	*

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[1] Abundance and legal status index:
- \- = No protected aquatic species Abundance Index.
- L = Low resource Abundance Index.
- M = Moderate resource Abundance Index.
- H = High resource Abundance Index.

For details of methodology, see Section 5.2.1 in ETR 17.

[2] Impact index:
- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

For details of methodology, see Section 5.2.1 in ETR 17.

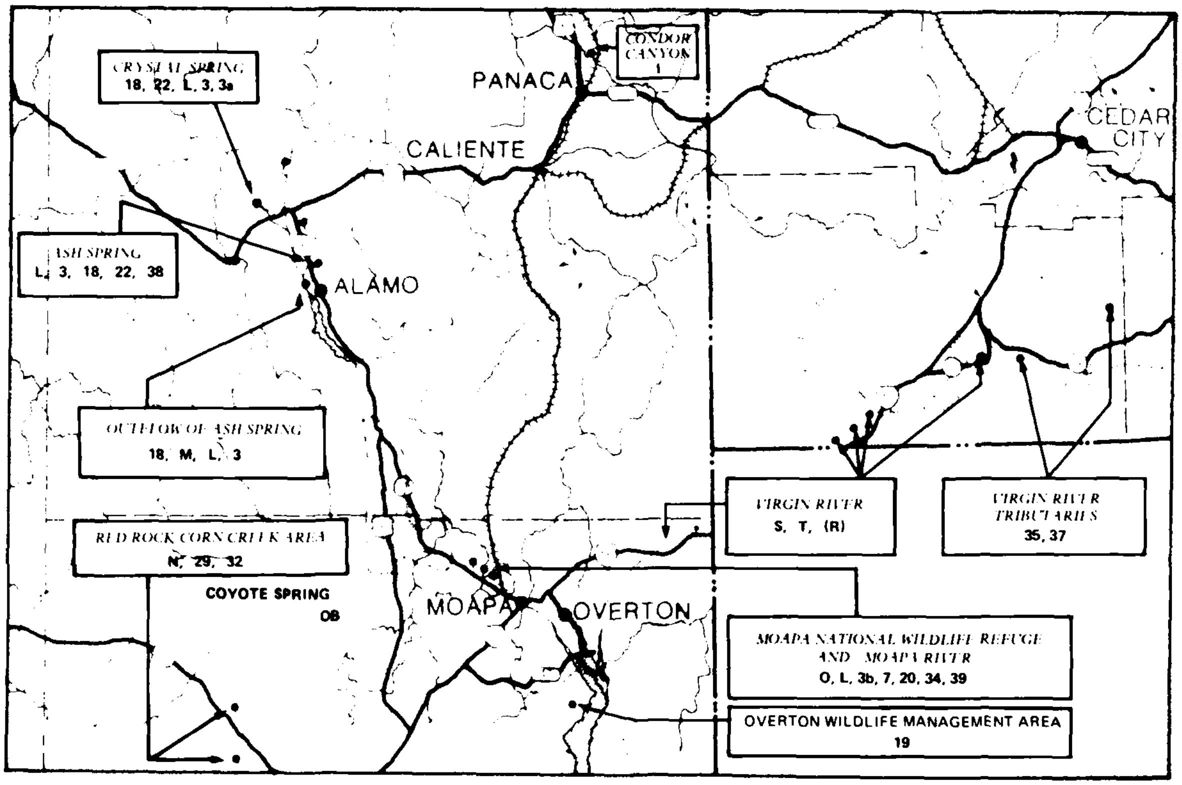
[3] From Table 4.3.2.1-3 in Chapter 4; N/A = not applicable; interbasin exchange (Eakin, 1966) estimated; % withdrawal = (peak water demand/perennial yield) X 100.

[4] Protection Status: FE = federal endangered; FT = federal threatened; SE = state endangered; ST = state threatened; RE = recommended endangered; RT = recommended threatened.

[5] Percent of total habitats or clusters of habitats in subunit potentially affected by construction activity, altered rainwater runoff patterns, and/or addition of pollutants (see Table 4.3.2.9.4-2 in Chapter 4).

[6] Averaged in hydrologic subunits with protected or recommended protected species only.

[7] OB included if applicable. N/A = not applicable since no species of concern occur in this subunit.



LEGEND

PROTECTED FISH SPECIES FOR NEVADA AND UTAH

- I BIG SPRING SPINEDACE
- L WHITE RIVER SPRINGFISH
- M PAHRANAGAT ROUNDTAIL CHUB*
- N PAHRUMP KILLIFISH*
- O MOAPA DACE*
- S VIRGIN RIVER ROUNDTAIL CHUB
- T WOUNDFIN*

RECOMMENDED PROTECTED FISH SPECIES FOR NEVADA

- 3 WHITE RIVER SPRINGFISH
- 3a HIKO WHITE RIVER SPRINGFISH
- 3b MOAPA WHITE RIVER SPRINGFISH
- 7 MOAPA SPECKLED DACE
- (R) VIRGIN SPINEDACE
- 18 WHITE RIVER SPECKLED DACE

RECOMMENDED PROTECTED INVERTEBRATES
MOLLUSKS

- 20 MOAPA VALLEY TURBAN
- 22 PAHRANAGAT VALLEY TURBAN
- 29 RED ROCK FONTELICELLA
- 32 CORN CREEK SNAIL
- 34 MOAPA TRYONIA
- 35 ZION CANYON PHYSA

INSECTS

DIPTERANS
- 37 VIRGIN RIVER NET WINGED MIDGE

HEMIPTERANS
- 38 ASH SPRINGS CREEPING WATER BUG
- 39 MOAPA CREEPING WATER BUG

* FEDERALLY PROTECTED

STREAM OR CREEK
SPRING
OPEN WATER

LEGEND

10 0 10 20 30 MILES
10 0 10 20 30 40 KILOMETERS

1870-B-7

Figure 4.3.2.9.4-2. Protected and recommended protected aquatic species near the Coyote Spring OB zone.

Indirect impacts from the construction and accompanying population growth of the support communities and the OB could be high in Muddy River, White River, Spring, Railroad, and Pahranagat valleys (Table 4.3.2.9.4-4). These high impacts are predicted to occur as a result of increased recreation and the introduction of exotic species. Federally and state protected species occur both in the Virgin River, 30 mi to the east of the proposed OB location in Coyote Spring Valley, and in certain habitats located at an approximately equal distance to the west. Some indirect impacts could be expected in the Virgin River but not in habitats west of Las Vegas. Increased recreation is not expected for these latter habitats, since people are more likely to be drawn to areas near the Coyote Spring site such as Lake Mead, the Virgin River, and Las Vegas.

Milford OB Impacts

Since no federally or state protected fish occur within at least a 40-mi radius of the proposed Milford OB (Figure 4.3.2.9.4-3), no significant direct effects of construction or operation of this facility impacting protected aquatic species within this area are predicted. However, indirect effects from this base contribute to high impacts in Snake and Spring valleys (Table 4.3.2.9.4-4).

ALTERNATIVE 1 (4.3.2.9.4.3)

DDA Impacts

The impacts for the DDA from this alternative would be identical to those for the Proposed Action.

Coyote Spring Valley OB Impacts

The impacts would be the same as for the Proposed Action (Table 4.3.2.9.4-5).

Beryl OB Impacts

The impacts would be similar to those of the Proposed Action.

ALTERNATIVE 2 (4.3.2.9.4.4)

DDA Impacts

The impacts of the DDA would be identical to those for the Proposed Action.

Coyote Spring Valley OB Impacts

The impacts of the Coyote Spring Valley OB would be the same as discussed for the Proposed Action.

Delta OB Impacts

The potential impacts of the OB located near Delta are shown in Table 4.3.2.9.4-6. The nearest relevant aquatic biological resource is the occurrence of the state protected least chub in Twin Springs near the Bishop Springs area, located about 55 mi to the west (Figure 4.3.2.9.4-4). No direct effects of water

Table 4.3.2.9.4-4. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for the Proposed Action.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone							
46	Sevier Desert, Utah							
46A	Sevier Desert-Dry Lake, Utah							
50	Milford, Utah							
52	Lund District, Utah							
53	Beryl-Enterprise, Utah							
179	Steptoe, Nev.	M	RE	*	*	***	***	*
210	Coyote Spring, Nev.							
219	Muddy River Springs, Nev.	H	FE	***	***	***	***	
	Curry County, N. Mex.							
	Hartley County, Tex.							
	Other Affected Subunits or Counties							
4	Snake, Nev./Utah	M	ST		*	*		
47	Huntington, Nev.	M	FT		*	*	*	
56	Upper Reese River, Nev.	M	FT	*	*	***	***	*
154	Newark, Nev.	L	RT		*	*	*	
173	Railroad, Nev.	M	RE	*	*	***	*****	***
176	Ruby, Nev.	L	RT		*	*	*	
178B	Butte-South, Nev.	L	RT	*	*	*	*	
184	Spring, Nev.	H	FE	***	*****	*****	*****	***
187	Goshute, Nev.	L	RT		*	*	*	
205	Meadow Valley Wash, Nev.	L	RE	*	*	*	*	
207	White River, Nev.	H	RE	***	*****	*****	*****	***
209	Pahranagat, Nev.	H	FE	***	*****	***	***	***
222	Virgin River, Nev.	H	FE	*	*	*	*	
230	Amargosa Desert, Nev.	H	FE		***	***		
	Overall Alternative Impact			*	*	*	*	*

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[1] Abundance and legal status index:

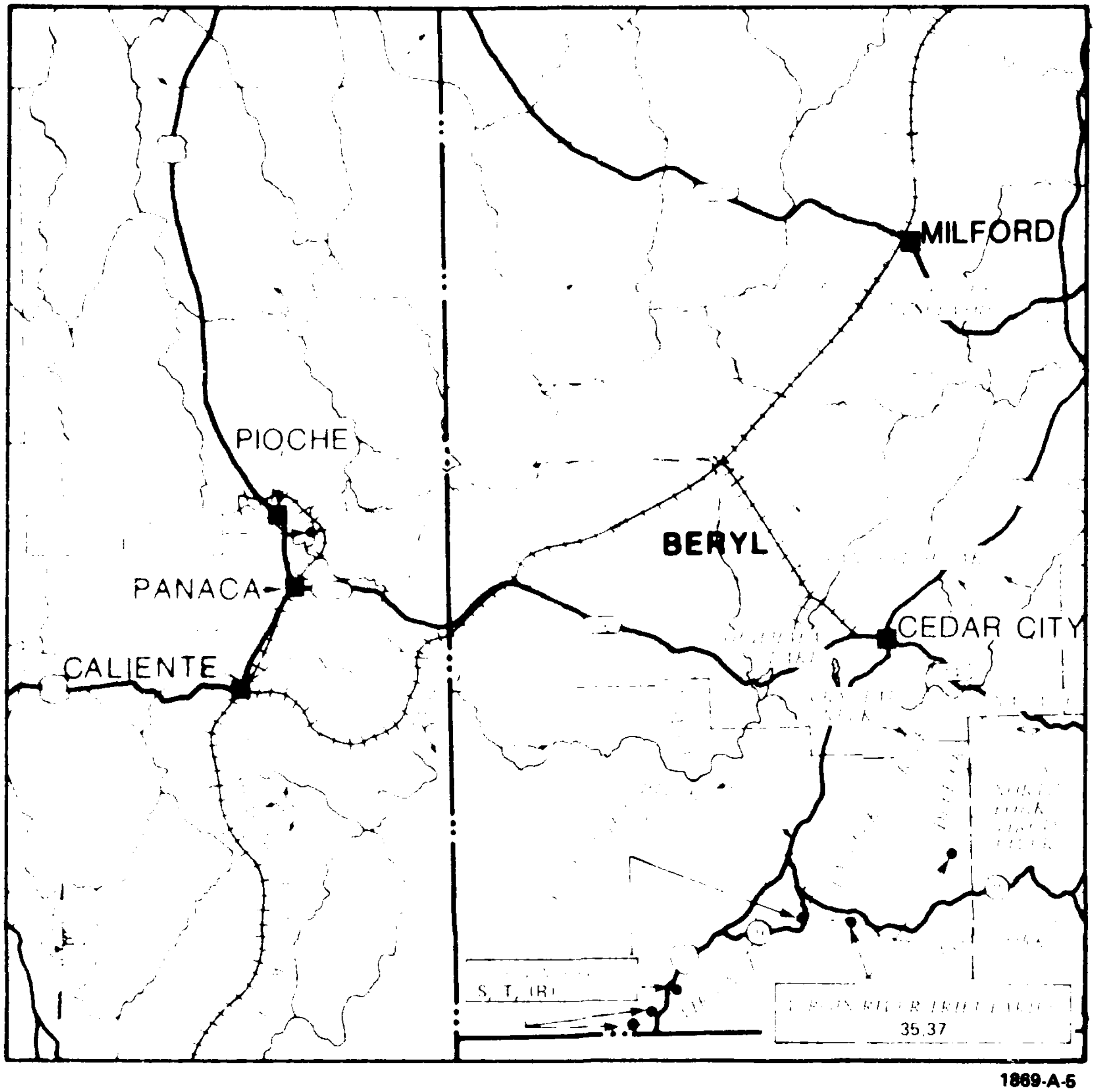
- \- = No protected aquatic species.
- L = Low protected aquatic species abundance index.
- M = Moderate protected aquatic species abundance index.
- H = High protected aquatic species abundance index.

[2] Impact index:

- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.



LEGEND

PROTECTED FISH SPECIES

- ●I BIG SPRING SPINEDACE
- ●S VIRGIN RIVER ROUNDTAIL CHUB
- ●T WOUNDFIN*

RECOMMENDED PROTECTED FISH SPECIES

- ●(R) VIRGIN SPINEDACE
- STREAM OR CREEK
- SPRING
- OPEN WATER

RECOMMENDED PROTECTED INVERTEBRATES
MOLLUSKS

- ●35 ZION CANYON PHYSA

INSECTS

- ●37 VIRGIN RIVER NET WINGED MIDGE

* FEDERALLY PROTECTED

SCALE

10 0 10 20 30 MILES

10 0 10 20 30 40 KILOMETERS

Figure 4.3.2.9.4-3. Protected and recommended protected aquatic species near the Beryl and Milford OB zones.

Table 4.3.2.9.4-5. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 1, Coyote Spring/Beryl.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone							
46	Sevier Desert, Utah							
46A	Sevier Desert-Dry Lake, Utah							
50	Milford, Utah							
52	Lund District, Utah							
53	Beryl-Enterprise, Utah							
179	Steptoe, Nev.	M	RE	*	*	***	***	*
210	Coyote Spring, Nev.							
219	Muddy River Springs, Nev.	H	FE	***	***	***	***	
	Curry County, N. Mex.							
	Hartley County, Tex.							
	Other Affected Subunits or Counties							
4	Snake, Nev./Utah	M	ST					
47	Huntington, Nev.	M	FT		*	*	*	
56	Upper Reese River, Nev.	M	FT					
154	Newark, Nev.	L	RT					
173	Railroad, Nev.	M	RE					
176	Ruby, Nev.	L	RT					
178B	Butte-South, Nev.	L	RT					
184	Spring, Nev.	H	FE					
187	Goshute, Nev.	L	RT					
205	Meadow Valley Wash, Nev.	L	RE					
207	White River, Nev.	H	RE					
209	Pahranagat, Nev.	H	FE					
222	Virgin River, Nev.	H	FE					
230	Amargosa Desert, Nev.	H	FE					
	Overall Alternative Impact			*	*	*	*	*

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[1] Abundance and legal status index:
- \- = No protected aquatic species.
- L = Low protected aquatic species abundance index.
- M = Moderate protected aquatic species abundance index.
- H = High protected aquatic species abundance index.

[2] Impact index:
- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

Table 4.3.2.9.4-6. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 2, Coyote Spring/Delta.

Hydrologic Subunit No.	Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone							
46	Sevier Desert, Utah							
46A	Sevier Desert-Dry Lake, Utah							
50	Milford, Utah							
52	Lund District, Utah							
53	Beryl-Enterprise, Utah							
179	Steptoe, Nev.	M	RE	*	*	***	***	*
210	Coyote Spring, Nev.							
219	Muddy River Springs, Nev.	H	FE					
	Curry County, N. Mex.							
	Hartley County, Tex.							
	Other Affected Subunits or Counties							
4	Snake, Nev./Utah	M	ST		*	*		
47	Huntington, Nev.	M	FT		*	*	*	
56	Upper Reese River, Nev.	M	FT	*	*	***	***	*
154	Newark, Nev.	L	RT		*	*	*	*
173	Railroad, Nev.	M	RE	***	***	*****	*****	*****
176	Ruby, Nev.	L	RT		*	*	*	*
178B	Butte-South, Nev.	L	RT		*	*	*	*
184	Spring, Nev.	H	FE	***	***	*****	*****	***
187	Goshute, Nev.	L	RT		*	*	*	
205	Meadow Valley Wash, Nev.	L	RE	*	*	*	*	
207	White River, Nev.	H	RE	***	***	*****	*****	***
209	Pahranagat, Nev.	H	FE	***	*****	*****	*****	***
222	Virgin River, Nev.	H	FE		***	***		
230	Amargosa Desert, Nev.	H	FE					
	Overall Alternative Impact			*	*	*	*	

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[1]Abundance and legal status index:
- \- = No protected aquatic species.
- L = Low protected aquatic species abundance index.
- M = Moderate protected aquatic species abundance index.
- H = High protected aquatic species abundance index.

[2]Impact index:
- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3]Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4]Methodology in ETR 17.

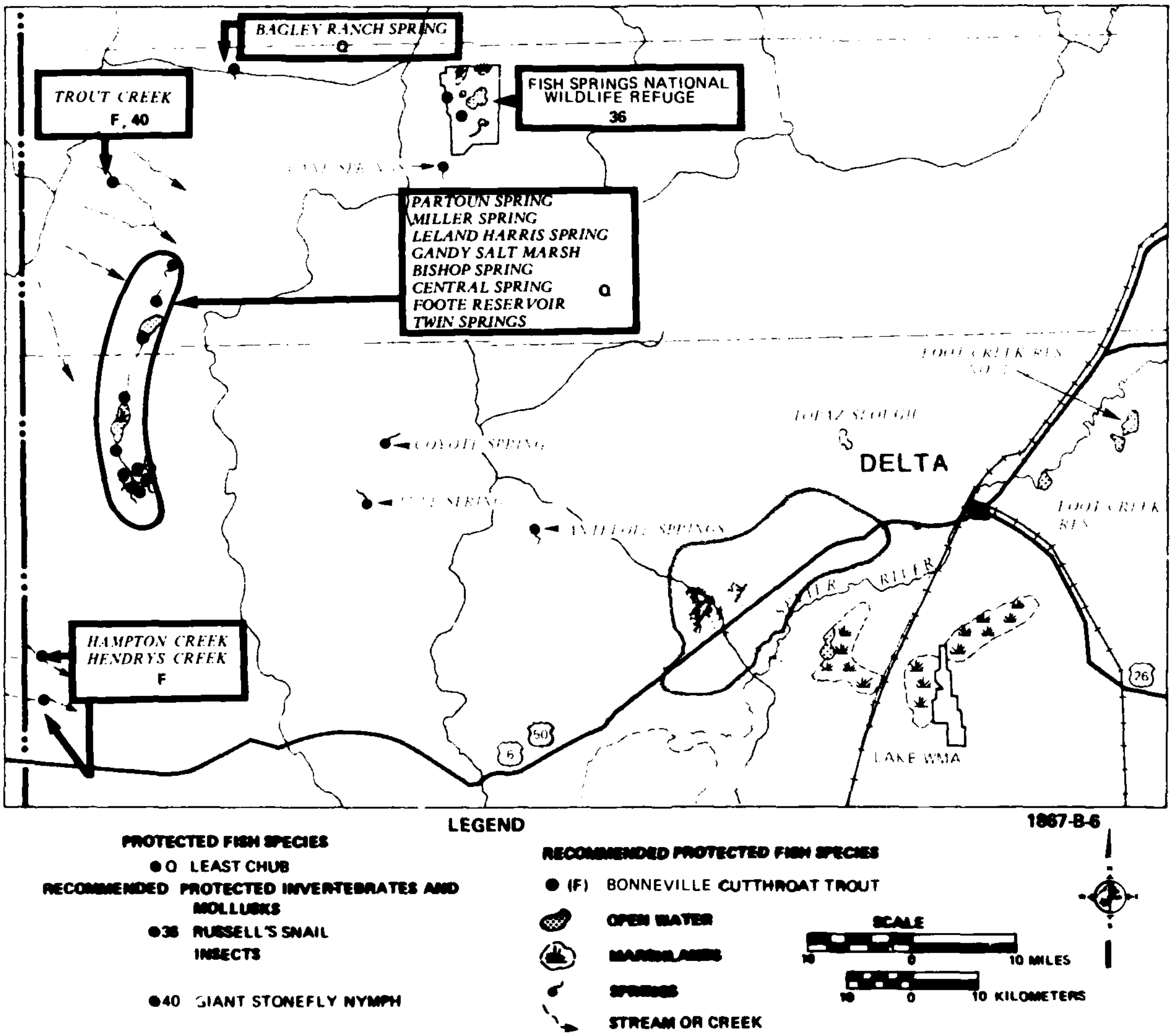

Figure 4.3.2.9.4-4. Protected and recommended protected aquatic species near the Delta OB zone.

withdrawal from construction at this site would be expected on these least chub habitats since they occur one valley distant and perpendicular to the direction of groundwater flow. The greatest potential impact resulting from a base at Delta is expected to be related to recreation by persons either directly or indirectly associated with the project (Table 4.3.2.9.4-6). High recreational impacts related to this OB are expected for Spring and Snake valleys. Peak recreational activities would occur during the end of the construction period (short-term) and extend into the operational (long-term) period. Cumulative impacts from M-X and the Intermountain Power Project can be expected.

ALTERNATIVE 3 (4.3.2.9.4.5)

DDA Impacts

The impacts of the DDA would be identical to those for the Proposed Action.

Beryl OB Impacts

The impacts would be the same as discussed for Alternative 1.

Ely OB Impacts

The Ely OB would be in a valley containing state protected aquatic species and subject to cumulative effects from other existing and proposed projects unrelated to M-X (Kennecott Copper Mine and the White Pine Power Project). The recommended protected relict dace and Bonneville cutthroat trout reside in Steptoe Valley (Figure 4.3.2.9.4-5). A transplanted population of the federally protected Pahrump killifish resides in Spring Valley approximately 40 mi southeast of Ely while several state protected species occur in White River valley 25 mi or farther to the southwest.

Water withdrawal impacts as a result of the Ely OB (Table 4.3.2.9.4-3) would likely be localized, affecting only small portions of Steptoe Valley, since the ratio of water available to that needed by the project is large (4 to 1). Cumulative effects from M-X and the White Pine Power Project along with continued growth could significantly reduce groundwater supplies. Only one population of the relict dace occurs near enough to the proposed OB location to be considered subject to a threat of habitat loss from groundwater withdrawal. However, if the M-X OB were in Ely and the proposed White Pine Power Project were constructed in Steptoe or White River valleys, significant cumulative effects of groundwater withdrawal could occur to the southern portions of the Steptoe Valley relict dace populations, at the least (at Grass, Spring, Steptoe Ranch Spring, and Steptoe Creek).

High recreational impacts from this OB are expected for Steptoe, Railroad, Spring, and White River valleys (Table 4.3.2.9.4-7). A population of a pure strain of Bonneville cutthroat trout is located in the northern portion of the valley in Goshute Creek, approximately 60 mi north of the proposed OB location. It is expected that increased illegal fishing, as a result of not only the M-X project but also the White Pine Power Project, could significantly impact this cutthroat trout. One mitigating measure could be strictly enforcing protection of Goshute Creek as a preserve for the Bonneville cutthroat trout. Measures to protect critically sensitive habitats, such as those at Shoshone Ponds and Preston or Lund Town Springs, could include

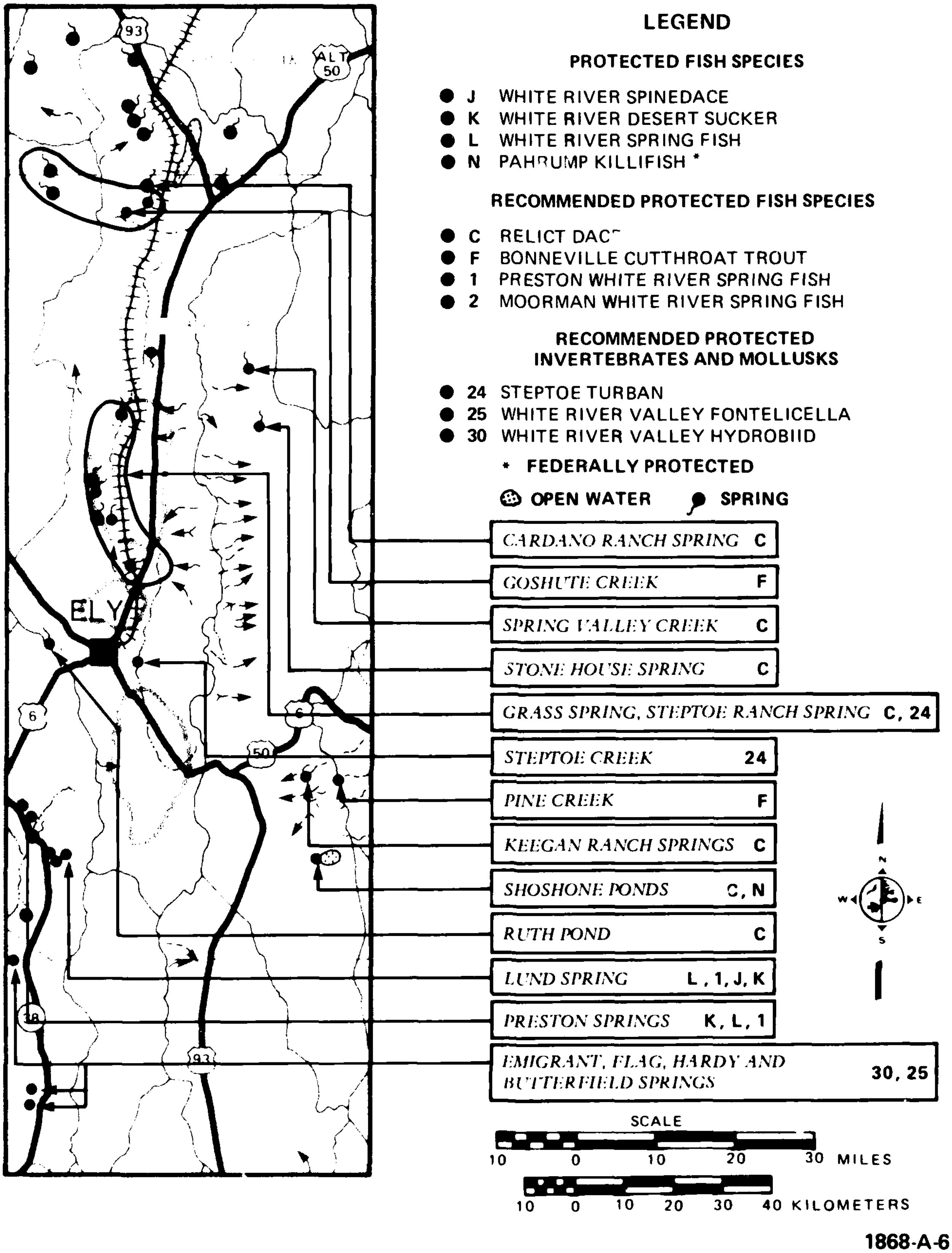

Figure 4.3.2.9.4-5. Protected and recommended protected aquatic species near the Ely OB zone.

Table 4.3.2.9.4-7. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 3, Beryl/Ely.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1984	1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone								
46	Sevier Desert, Utah								
46A	Sevier Desert-Dry Lake, Utah								
50	Milford, Utah								
52	Lund District, Utah								
53	Beryl-Enterprise, Utah								
179	Steptoe, Nev.	M	RE	•	•••	•••••	•••••	•••••	•••••
210	Coyote Spring, Nev.								
219	Muddy River Springs, Nev.	H	FE						
	Curry County, N. Mex.								
	Hartley County, Tex.								
	Other Affected Subunits or Counties								
4	Snake, Nev./Utah	M	ST		•	•	•		
47	Huntington, Nev.	M	FT		•	•	•		
56	Upper Reese River, Nev.	M	FT		•	•••	•••	•	
154	Newark, Nev.	L	RT		•	•	•••	•	
173	Railroad, Nev.	M	RE		•••	•••••	•••••	•••••	•••••
176	Ruby, Nev.	L	RT		•	•	•••	•	
178B	Butte-South, Nev.	L	RT		•	•	•••	•	
184	Spring, Nev.	H	FE		•••••	•••••	•••••	•••••	•••••
187	Goshute, Nev.	L	RT			•	•		
205	Meadow Valley Wash, Nev.	L	RE		•	•	•		
207	White River, Nev.	H	RE		•••••	•••••	•••••	•••••	•••••
209	Pahranagat, Nev.	H	FE			•••	•••		
222	Virgin River, Nev.	H	FE		•	•	•		
230	Amargosa Desert, Nev.	H	FE						
	Overall Alternative Impact				•	•	•	•	•

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[1] Abundance and legal status index:
- - = No protected aquatic species.
- L = Low protected aquatic species abundance index.
- M = Moderate protected aquatic species abundance index.
- H = High protected aquatic species abundance index.

[2] Impact index:
- - = No impact.
- • = Low impact.
- ••• = Moderate impact.
- ••••• = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

fencing of the aquatic habitats in order to limit swimming or habitat disturbance that tend to reduce the viability of the resident populations. One of the Shoshone ponds containing the Pahrump killifish is already fenced, and this should be sufficient to continue protecting the existing populations. Another pond adjacent to this habitat which also contains the Pahrump killifish might also need to be fenced. Snake Valley will also attract residents from the Ely OB. Peak recreational pressure should occur toward the end of the construction period, and for the duration of the operational period of the OB. Recreational impacts to the other protected species are not likely to be significant either because of the unattractiveness of their habitats for recreational pursuits or because they are too remote or already protected from recreation.

ALTERNATIVE 4 (4.3.2.9.4.6)

DDA Impacts

The impacts of DDA construction and operation would be the same as described for the Proposed Action.

Coyote Spring Valley OB Impacts

The impacts of the OB at Coyote Spring Valley would be similar to those described for the Proposed Action. The DTN would not be in Pahranagat Valley, however, and the OBTS would be at the Beryl OB. Thus, impacts to protected aquatic species in Pahranagat Valley would be alleviated with respect to DTN construction. Impacts of groundwater withdrawal upon the downslope Moapa Fish Sanctuary would decrease slightly because of the reduced water needs at Coyote Spring for this alternative. However, direct impacts to protected fish at Moapa would be significant and possibly irretrievable, unless water were piped to the OB from Las Vegas.

The indirect effects related to the Coyote Spring OB are shown in Table 4.3.2.9.4-8.

Beryl OB Impacts

The impacts would be similar to those of the Proposed Action.

ALTERNATIVE 5 (4.3.2.9.4.7)

DDA Impacts

The impacts for this alternative would be identical to those for the Proposed Action.

Milford OB Impacts

The impacts would be the same as described for the Proposed Action. Indirect effects are summarized in Table 4.3.2.9.4-9.

Table 4.3.2.9.4-8. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 4, Beryl/Coyote Spring.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone							
46	Sevier Desert, Utah							
46A	Sevier Desert-Dry Lake, Utah							
50	Milford, Utah							
52	Lund District, Utah							
53	Beryl-Enterprise, Utah							
179	Steptoe, Nev.	M	RE	*	*	***	***	*
210	Coyote Spring, Nev.							
219	Muddy River Springs, Nev.	H	FE		***	***		
	Curry County, N. Mex.							
	Hartley County, Tex.							
	Other Affected Subunits or Counties							
4	Snake, Nev./Utah	M	ST		*	*		
47	Huntington, Nev.	M	FT			*	*	
56	Upper Reese River, Nev.	M	FT		*	***	***	*
154	Newark, Nev.	L	RT		*	*	*	*
173	Railroad, Nev.	M	RE	*	*	***	*****	***
176	Ruby, Nev.	L	RT		*	*	*	*
178B	Butte-South, Nev.	L	RT		*	*	*	*
184	Spring, Nev.	H	FE	***	*****	*****	*****	***
187	Goshute, Nev.	L	RT					
205	Meadow Valley Wash, Nev.	L	RE	*	*	*	*	
207	White River, Nev.	H	RE	***	*****	*****	***	***
209	Pahranagat, Nev.	H	FE	*	*	*		
222	Virgin River, Nev.	H	FE		*	*		
230	Amargosa Desert, Nev.	H	FE					
	Overall Alternative Impact				*	*		

T5228/9-20-81/F

[1] Abundance and legal status index:
- \- = No protected aquatic species.
- L = Low protected aquatic species abundance index.
- M = Moderate protected aquatic species abundance index.
- H = High protected aquatic species abundance index.

[2] Impact index:
- \- = No impact.
- * = Low impact.
- *** = Moderate impact.
- ***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

Table 4.3.2.9.4-9. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 5, Milford/Ely.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1984	1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone								
46	Sevier Desert, Utah								
46A	Sevier Desert-Dry Lake, Utah								
50	Milford, Utah								
52	Lund District, Utah								
53	Beryl-Enterprise, Utah								
179	Steptoe, Nev.	M	RE	*	***	*****	*****	*****	*****
210	Coyote Spring, Nev.								
219	Muddy River Springs, Nev.	H	FE						
	Curry County, N. Mex.								
	Hartley County, Tex.								
	Other Affected Subunits or Counties								
4	Snake, Nev./Utah	M	ST		*	*	*		
47	Huntington, Nev.	[illegible]	FT		*	*	*		
56	Upper Reese River, Nev.	M	FT		*	***	***	*	
154	Newark, Nev.	L	RT		*	*	***	*	
173	Railroad, Nev.	M	RE		***	*****	*****	*****	*
176	Ruby, Nev.	L	RT		*	*	***	*	
178B	Butte-South, Nev.	L	RT		*	*	***	*	
184	Spring, Nev.	H	FE	***	*****	*****	*****	*****	***
187	Goshute, Nev.	L	RT						
205	Meadow Valley Wash, Nev.	L	RE		*	*	*		
207	White River, Nev.	H	RE		*****	*****	*****	*****	***
209	Pahranagat, Nev.	H	FE			***	***		
222	Virgin River, Nev.	H	FE		*	*			
230	Amargosa Desert, Nev.	H	FE						
	Overall Alternative Impact				*	*	*	*	

T5229/9-20-81/F

[1] Abundance and legal status index:
- = No protected aquatic species.
L = Low protected aquatic species abundance index.
M = Moderate protected aquatic species abundance index.
H = High protected aquatic species abundance index.

[2] Impact index:
- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

Ely OB Impacts

The impacts would be the same as described for Alternative 3.

ALTERNATIVE 6 (4.3.2.9.4.8)

DDA Impacts

The impacts would be identical to those for the Proposed Action.

Milford OB Impacts

The impacts would be the same as discussed for the Proposed Action. Indirect effects are summarized in Table 4.3.2.9.4-10.

Coyote Spring Valley OB Impacts

The impacts would be the same as described for Alternative 4.

ALTERNATIVE 7 (4.3.2.9.4.9)

DDA Impacts

No significant impacts are expected for the Texas/New Mexico full basing alternative since water depletion and other direct project impacts are not expected to occur at sensitive aquatic habitats. Recreational impacts are more difficult to predict, but are not expected to be significant because of the proximity of recreational areas more attractive than those containing protected species.

Clovis OB Impacts

No state or federally protected fish occur in the immediate vicinity of the proposed Clovis OB suitability zone, and no direct or indirect impacts are predicted.

Dalhart OB Impacts

No state or federally protected fish occur in or near the Dalhart OB suitability zone, and thus no impacts are predicted.

ALTERNATIVE 8 (4.3.2.9.4.10)

DDA Impacts

In Nevada/Utah, impacts resulting from this split basing alternative would be less than those predicted for full deployment in the Nevada/Utah study area (discussed in the Proposed Action section). Direct impacts of cluster construction would occur in White River Valley upon the habitats of one or two state protected fish, but they are expected to be mitigatable. Groundwater withdrawal effects are not expected to be as large as predicted for previous alternatives since feeder valleys of the White River system would not be used so heavily for their water yield as with full deployment in the same area. Recreational effects of the project would occur but in fewer hydrologic subunits than for full development. Effects of

Table 4.3.2.9.4-10. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 6, Milford/Coyote Spring.

Hydrologic Subunit No.	Hydrologic Subunit Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1984	1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone								
46	Sevier Desert, Utah								
46A	Sevier Desert-Dry Lake, Utah								
50	Milford, Utah								
52	Lund District, Utah								
53	Beryl-Enterprise, Utah								
179	Steptoe, Nev.	M	RE		*	***	***	*	
210	Coyote Spring, Nev.								
219	Muddy River Springs, Nev.	H	FE						
	Curry County, N. Mex.								
	Hartley County, Tex.								
	Other Affected Subunits or Counties								
4	Snake, Nev./Utah	M	ST		*	*	*		
47	Huntington, Nev.	M	FT						
56	Upper Reese River, Nev.	M	FT		*	*	***	***	*
154	Newark, Nev.	L	RT			*	*	*	*
173	Railroad, Nev.	M	RE		*	*	***	*****	***
176	Ruby, Nev.	L	RT			*	*	*	*
178B	Butte-South, Nev.	L	RT			*	*	*	*
184	Spring, Nev.	H	FE	***	*****	*****	*****	*****	***
187	Goshute, Nev.	L	RT						
205	Meadow Valley Wash, Nev.	L	RE		*	*	*	*	
207	White River, Nev.	H	RE		***	***	*****	*****	***
209	Pahranagat, Nev.	H	FE			***	***	***	***
222	Virgin River, Nev.	H	FE		*	*	*	*	
230	Amargosa Desert, Nev.	H	FE						
	Overall Alternative Impact				*	*	*	*	

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[1] Abundance and legal status index:
- = No protected aquatic species.
L = Low protected aquatic species abundance index.
M = Moderate protected aquatic species abundance index.
H = High protected aquatic species abundance index.

[2] Impact index:
- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

recreation upon the federally protected Lahontan cutthroat trout would be alleviated as a result of the elimination of cluster construction in valleys adjoining the nearest location of this fish (e.g., Big Smoky Valley and vicinity). Direct impacts in Nevada/Utah are summarized in Table 4.3.2.9.4-11.

No significant impacts are expected for the Texas/New Mexico portion of this alternative for reasons discussed under Alternative 7.

Coyote Spring Valley OB Impacts

The impacts to protected aquatic species would be similar to, but less than, those discussed for the Proposed Action. Indirect effects are summarized in Table 4.3.2.9-12.

Clovis OB Impacts

The impacts would be the same as discussed under Alternative 7.

MITIGATIONS (4.3.2.9.4.11)

Mitigation measures for protected aquatic species need to be directed toward preservation of existing habitats, especially those containing threatened or endangered species.

To protect rare, threatened, and endangered aquatic species, the Air Force will institute cooperative programs with federal and state management agencies. The Air Force will identify the critical habitat of rare, threatened, or endangered species and will monitor populations. Sensitive habitats will be avoided and construction activities will be scheduled to minimize disturbance insofar as possible. When avoidance of habitats is not possible, the Air Force will determine suitable replacement habitats and will relocate species as required.

Additional discussion of mitigations is contained in ETR-17 (Protected Species) and ETR-38 (Mitigations).

Table 4.3.2.4.4-1. Potential direct impacts to protected aquatic species in Nevada/Utah DDA and Texas/New Mexico[1] DDA for Alternative 8.

No.	Hydrologic Subunit or County Name	Abundance Index[2]	Highest Legal Status[4]	Short-Term: Groundwater Withdrawal (%)[7,9]	Short-Term: Habitat Within 5 mi of Project Structures (%)[5,7]	Short-Term: Impact[3]	Long-Term: Groundwater Withdrawal (%)[7,9]	Long-Term: Habitat Within 5 mi of Project Structures (%)[5,7]	Long-Term: Impact[3]
	Subunits or Counties with M-X Clusters and DTN								
4	Snake, Nev./Utah	M	ST	3	15	•	1	5	•
5	Pine, Utah	-	--	N/A	0	-	N/A	0	-
6	White, Utah	-	--	N/A	0	-	N/A	0	•
7	Fish Springs, Utah	-	--	N/A	0	-	N/A	0	•
46	Sevier Desert, Utah	-	--	N/A	0	-	N/A	0	-
46A	Sevier Desert-Dry Lake, Utah	-	--	N/A	0	-	N/A	0	-
54	Wah Wah, Utah	-	--	N/A	0	-	N/A	0	-
155C	Little Smoky-South, Nev.	-	--	N/A	0	-	N/A	0	-
156	Hot Creek, Nev.	-	--	N/A	0	-	N/A	0	-
170	Penoyer, Nev.	-	--	N/A	0	-	N/A	0	-
171	Coal, Nev.	-	--	N/A	0	-	N/A	0	-
172	Garden, Nev.	-	--	N/A	0	-	N/A	0	-
173A	Railroad-South, Nev.	-	--	N/A	0	-	N/A	0	-
173B	Railroad-North, Nev.	M	RE	4	0	-	2	0	-
180	Cave, Nev.	-	--	N/A	0	-	N/A	0	-
181	Dry Lake, Nev.[6]	-	--	N/A	0	-	N/A	0	-
182	Delamar, Nev.	-	--	N/A	0	-	N/A	0	-
183	Lake, Nev.	-	--	N/A	0	-	N/A	0	-
184	Spring, Nev.	H	FE	1	0	•	0	0	•
196	Hamlin, Nev./Utah	-	--	N/A	0	-	N/A	0	-
202	Patterson, Nev.	-	--	N/A	0	-	N/A	0	-
207	White River, Nev.	H	RE	5	33	•••	2	5	•
	Other Affected Subunits								
56	Upper Reese River, Nev.	M	FT	0	0	•	0	0	•
154	Newark, Nev.	L	RT	0	0	•	0	0	•
176	Ruby, Nev.	L	RT	0	0	•	0	0	•
178B	Butte-South, Nev.	L	RT	0	0	•	0	0	•
179	Steptoe, Nev.	M	RE	0	0	•	0	0	•
187	Goshute, Nev.	L	RT	0	0	•	0	0	•
205	Meadow Valley Wash, Nev.	L	RE	0	0	•	0	0	•
209	Pahranagat, Nev.	H	FE	30	0	•••	10	0	•
219	Muddy River Springs, Nev.	H	RE	40	100	•••••	20	30	•
222	Virgin River, Nev.	H	FE	0	0	•	0	0	•
230	Amargosa Desert, Nev.	H	FE	0	0	•	0	0	•
	Overall DDA Impact[8]			6	9	•	2	2	•

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[1]There are no known protected aquatic species that would be affected by direct impacts as a result of M-X deployment in Texas/New Mexico.

[2]Abundance and legal status index:
- - = No protected aquatic species Abundance Index.
- L = Low resource Abundance Index.
- M = Moderate resource Abundance Index.
- H = High resource Abundance Index.

For details of methodology, see Section 5.2.1 in ETR 17.

[3]Impact index:
- - = No impact.
- • = Low impact.
- ••• = Moderate impact.
- ••••• = High impact.

For details of methodology, see Section 5.2.1 in ETR 17.

[4]Protection Status: FE = federal endangered; FT = federal threatened; SE = state endangered; ST = state threatened; RE = recommended endangered; RT = recommended threatened.

[5]Percent of total habitats or clusters of habitats in subunit potentially affected by construction activity, altered rainwater runoff patterns, and/or addition of pollutants.

[6]Conceptual location of Area Support Center (ASC).

[7]OB influence included if applicable. N/A = not applicable since no species of concern occur in this subunit.

[8]Averaged in hydrologic subunits with protected or recommended protected species only.

[9]From Table 4.3.2.1-4 in Chapter 4; N/A = not applicable; interbasin exchange (East to West), estimated [illegible] withdrawal = (peak water demand/perennial yield) X 100.

Table 4.3.2.9.4-12. Potential impact to protected aquatic species which could result from construction and operation of M-X operating bases for Alternative 8, Coyote Spring/Clovis.

Hydrologic Subunit No.	Name	Abundance Index[1,4]	Highest Legal Status[3]	Mean Impact Level[2,4] 1985	1986	1987	1988	1989
	Subunits or Counties within OB Suitability Zone							
46	Sevier Desert, Utah							
46A	Sevier Desert-Dry Lake, Utah							
50	Milford, Utah							
52	Lund District, Utah							
53	Beryl-Enterprise, Utah							
179	Steptoe, Nev.	M	RE	*	*			
210	Coyote Spring, Nev.							
219	Muddy River Springs, Nev.	H	FE	***	***	***	***	
	Curry County, N. Mex.							
	Hartley County, Tex.							
	Other Affected Subunits or Counties							
4	Snake, Nev./Utah	M	ST					
47	Huntington, Nev.	M	FT					
56	Upper Reese River, Nev.	M	FT				*	
154	Newark, Nev.	L	RT					
173	Railroad, Nev.	M	RE	*	*	*	*	
176	Ruby, Nev.	L	RT					
178B	Butte-South, Nev.	L	RT					
184	Spring, Nev.	H	FE	***	***	***		
187	Goshute, Nev.	L	RT					
205	Meadow Valley Wash, Nev.	L	RE	*	*	*		
207	White River, Nev.	H	RE	***	***	***		
209	Pahranagat, Nev.	H	FE	***	***	***	***	***
222	Virgin River, Nev.	H	FE					
230	Amargosa Desert, Nev.	H	FE					
	Overall Alternative Impact			*	*			

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[1] Abundance and legal status index:
- = No protected aquatic species.
L = Low protected aquatic species abundance index.
M = Moderate protected aquatic species abundance index.
H = High protected aquatic species abundance index.

[2] Impact index:
- = No impact.
* = Low impact.
*** = Moderate impact.
***** = High impact.

[3] Protection status: F = federal, S = state, R = recommended, E = endangered, T = threatened.

[4] Methodology in ETR 17.

Wilderness

WILDERNESS

INTRODUCTION (4.3.2.10.1)

Wilderness is intended to preserve natural conditions and outstanding opportunities for solitude. For areas classified under the Wilderness Act of 1964 (P.L. 88-577) this is a legal requirement. Wilderness Act criteria, Section 2(c), were used in developing the impact analysis. The analysis was performed in three steps: (1) a description of project effects on wilderness resources (Chapter 3), (2) an assessment of the impact to the wilderness resource as defined in ETR-18, and (3) a determination of impact significance. M-X effects on wilderness ecosystem integrity and quality of experience were estimated by combining baseline information with project information. These effects would result primarily from construction and from recreation by project-related population.

Primary sources of impact include (1) alteration of scenic landscapes by construction of clusters and road networks, (2) enhanced noise levels and changes in air quality, (3) increased access to formerly remote areas, and (4) increased numbers of people during both construction and operation.

Hydrologic subunits were ranked on a scale of high to low potential for impact according to (1) the potential noise and visual effects resulting from construction, and (2) the potential for increased visitation as measured by the proximity of wilderness resource areas to project-induced population centers and roads. This analysis assumes that sustained, rapid growth in the recreational use of wilderness lands would threaten the preservation and solitude, since increases in visitation are related to decreases in opportunities for solitude, increased impacts on flora and fauna, increased litter and sanitation problems, and other factors conflicting with wilderness setting and experience (ETR-18). Project-related wilderness users are anticipated to originate primarily from OB population centers. Use of wilderness resources in visitor-days was derived from a model using travel times from population centers and the opportunities available at a particular site (ETR-30).

PROPOSED ACTION (4.3.2.10.2)

DDA Impacts

The primary sources of project-related DDA impacts to the wilderness resource include (1) valley floor scarification by construction of cluster and DTN road networks, with the resultant alteration of scenic landscapes visible from montane vista points, (2) intensified noise levels and changes in air quality during construction activites, (3) increased access to formerly remote areas, and (4) increased number of people during both construction and operation. (Figure 4.3.2.10.2-1 illustrates the relationship between the study area wilderness resources and the project). Short-term effects of M-X deployment on wilderness resources would include those effects associated with construction--changes in noise and air quality levels--as well as those associated with the dispersed recreational activities of construction workers.

In those wilderness resource areas within 3 mi of a project feature, wilderness qualities of naturalness and solitude could be diminished depending on several factors, such as vegetation covering and screening, topograhic features, etc. Approximately 35 percent of deployment area wilderness resources are within this zone, and the audible range (6 mi) of project construction would affect roughly 80 percent of the total resource acreage (ETR-18). While siting clusters and road networks adjacent to prospective wilderness increases access to, and, hence, opportunities for enjoyment of wilderness, it would also reduce the unimpaired primitive/natural qualities associated with wildlands. Once construction were completed, the presence of protective structures, DTN, and cluster road networks would permanently alter valley scenic vistas from montane potential wilderness resource areas. These essentially irreversible and irretrievable long-term effects would result in an average of a 94 percent increase in the number of visible road intercepts as detailed in ETR-18.

Population-related effects on the quality of the wilderness experience would be proportional to user density. Construction personnel, operations personnel, and dependents, as well as people moving into the area as a result of increased economic activity, would place increased recreational pressure on local wilderness resources. In the short-term these effects would be primarily a function of construction-related population centers. In the long term such effects would be those associated with OBs. Effect levels would also be related to the recreational preferences of the in-migrants.

PUBLIC COMMENT ON THE DRAFT EIS:

> ". . . much of the Great Basin is de facto wilderness. It exists in an essentially natural condition. The dispersed type of recreation that occurs in this area occurs in all mountains and open valleys. When these are irreversibly altered by M-X, how will the remaining areas be affected, particularly in northern Nevada?" (B0873-8-022)

This public comment suggests the potential for substantial regulation pressures on the resource managing agencies. The same conclusion has been drawn, although from a different perspective:

PUBLIC COMMENT ON THE DRAFT EIS:

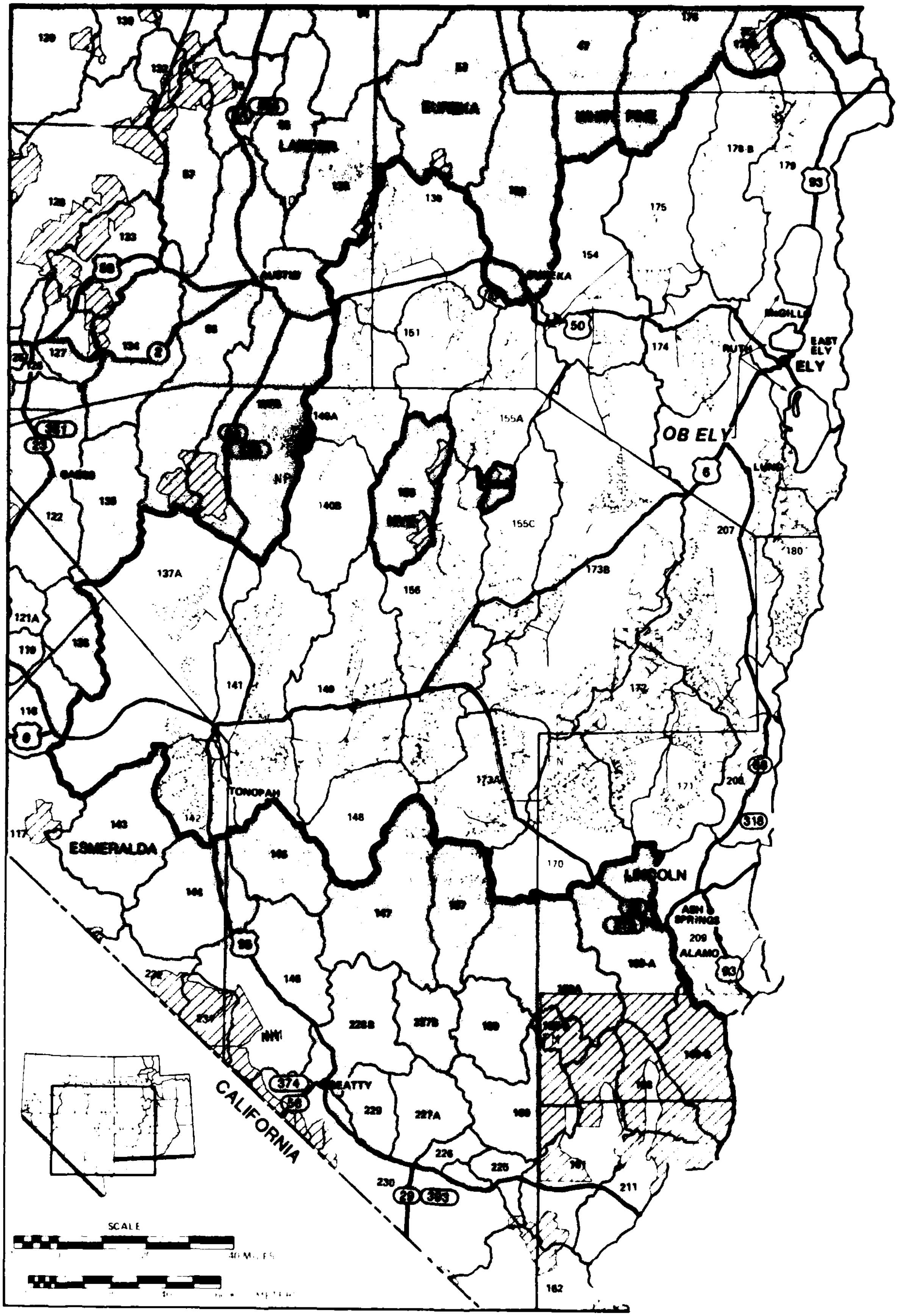
"..management techniques are available to lessen or control these impacts. The 100,000 immigration due to M-X is unlikely to cause significant degradation of wilderness values to WSAs if these actions are mitigated through appropriate management practices." (B0855-5-020)

M-X construction in approximately 50 percent of the 41 hydrologic subunits would be expected to produce significant but short-term DDA noise impacts, depending upon site-specific topographic relief and vegetative screening factors within or adjacent to wilderness resource areas. This would be in addition to the long-term visual impact on the scenic values of the project area produced by the grid pattern of M-X roadways (Table 4.3.2.10.2-1). Audible evidence of project activity would affect roughly 80 percent of the total wilderness resource acreage in the study area (ETR-18 and ETR-10). It is estimated that M-X construction and operation in those hydrologic subunits with several wilderness resources would result in a greater potential for impact on the overall wilderness quality of the area than in those with only one resource. More than 50 percent of the 41 DDA hydrologic subunits contain more than one wilderness resource with subsequent greater vulnerability to the effects of M-X construction.

Implementation of other projects such as the Anaconda Molybdenum Mine near Tonopah, the White Pine Power Project (WPPP), Pine Grove Molybdenum project in Pine Valley, Allen Warner project in Dry Lake Valley, Alunite Mine in Wah Wah Valley, Rocky Mountain Natural Gas Pipeline Project, and the Intermountain Power Project (IPP) near Delta would cause additional land disturbance and population growth. Construction activites for most of these projects would be small compared to that for M-X, and the cumulative effects are expected to be small. IPP is the exception, where population increases would be similar to those of M-X during construction of both projects.

Wilderness characteristics would be diminished for some wilderness resource areas. The total affects would depend upon both the relative M-X configuration and the influence of other projects. The wilderness resource areas under formal review and/or study for inclusion in the National Wilderness Preservation System (NWPS) will be evaluated on a case-by-case basis before final determinations are made by Congress on whether the areas are suitable for inclusion in the NWPS.

The Great Basin has some of the last, relatively unspoiled scenic vistas in the continental United States. These are a priceless national and regional resource. Vast expanses of sage, Indian paintbrush, and other arid land vegetation carpet the valley floor, and sweep upward to meet rugged mountain ranges. It is a land of expansive vistas, gentle colors, and bold relief--where man's activities predominantly blend into the landscape. The traveller going east and west crosses mountain range after mountain range, descending from each with an unobstructed view onto the valley landscape below. Travelling north and south there are expanses of sage sweeping up on either hand to upfaulted ridges and stretching far ahead, largely untrammeled, except for ranching and rangeland improvements. In the qualities of the landscape and its lifestyle are retained the American heritages of open spaces and frontier life styles. Even the multitude of travellers and brief visitors partake of the spiritual and aesthetic experience and the sense of national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TONOPAH
CALIFORNIA
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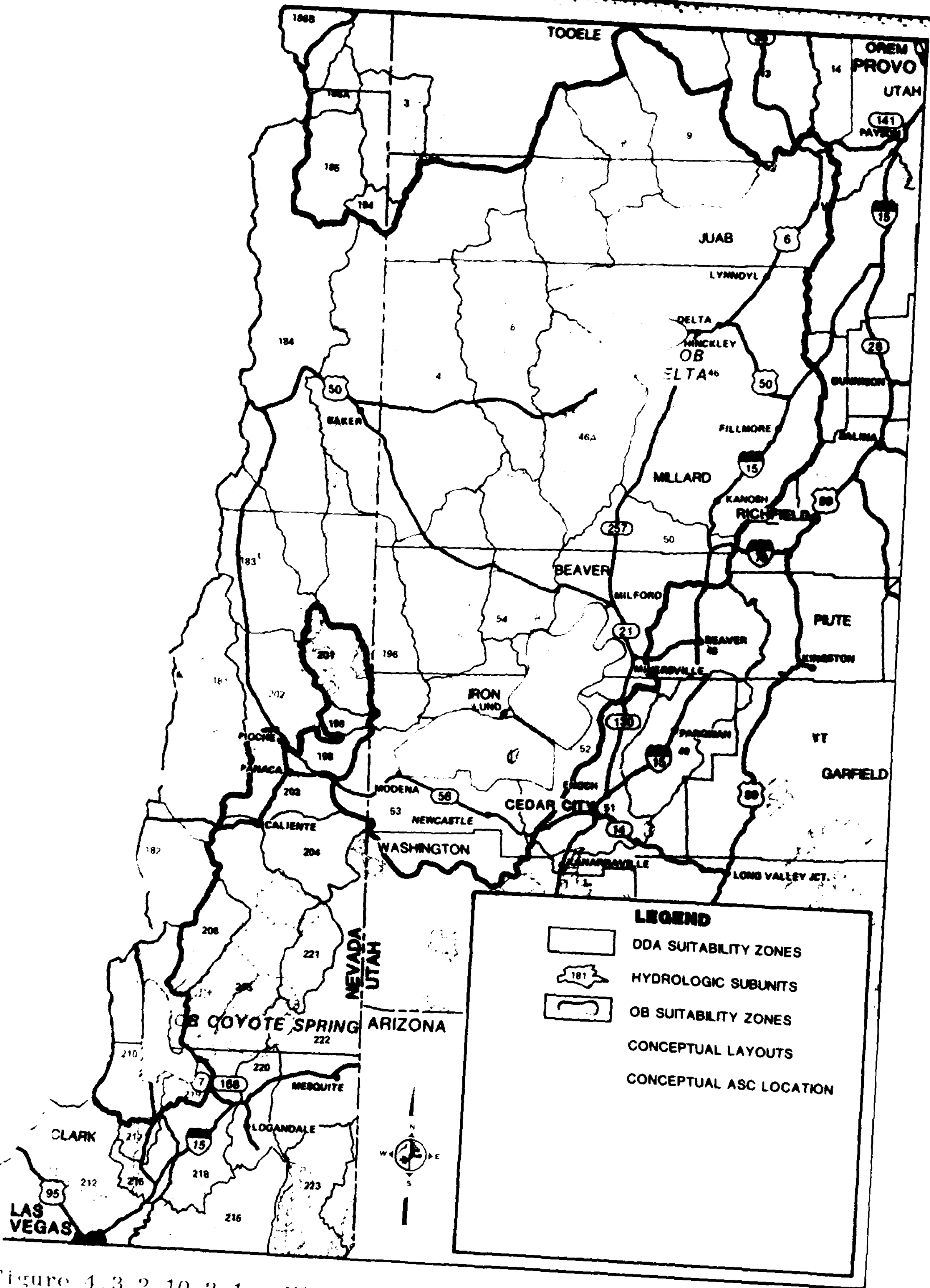

Figure 4.3.2.10.2-1. Wilderness resources and the Proposed Action conceptual layout.

4458-D

Table 4.3.2.10.2-1. Potential impact[1] to wilderness resources in the Nevada/Utah DDA and associated OB hydrologic subunits for Proposed Action and Alternatives 1-2.

Hydrologic Subunit No.	Hydrologic Subunit Name	Approximate Wilderness Resource Acreage Within Subunit	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[3]
	DDA					
4	Snake, Nev./Utah	252,776	*****	*****	*****	*****
5	Pine, Utah	37,478	*****	***	***	*****
6	White, Utah	124,636	*****	*****	*****	*****
7	Fish Springs, Utah	50,313	*****	*****	*****	*****
8	Dugway, Utah	10,691	***	***	***	***
9	Government Creek, Utah	0	*	-	-	*
46	Sevier Desert, Utah	20,536	***	***	***	***
46A	Sevier Desert-Dry Lake, Utah	48,574	*****	*****	*****	*****
50	Milford, Utah[2]	0	*	-	-	*
52	Lund District, Utah[2]	0	*	-	-	*
53	Beryl-Enterprise, Utah[2]	835	***	-	***	***
54	Wah Wah, Utah	43,208	*****	*****	*****	*****
137A	Big Smoky-Tonopah Flat, Nev.	3,775	***	-	***	***
139	Kobeh, Nev.	29,947	*****	***	*****	*****
140A	Monitor-North, Nev.	0	*	-	-	*
140B	Monitor-South, Nev.	0	*	-	-	*
141	Ralston, Nev.	0	*	-	-	*
142	Alkali Spring, Nev.	0	*	-	-	*
148	Cactus Flat, Nev.	6,785	*	***	*****	*****
149	Stone Cabin, Nev.	38,662	*****	*****	*****	*****
151	Antelope, Nev.	0	*	-	-	*
154	Newark, Nev.	0	*	-	-	*
155A	Little Smoky-North, Nev.	27,516	*****	*****	*****	*****
155C	Little Smoky-South, Nev.	15,918	*****	*****	*****	*****
156	Hot Creek, Nev.	208,069	*****	*****	*****	*****
170	Penoyer, Nev.	44,303	*****	*****	*****	*****
171	Coal, Nev.	17,568	***	***	*****	*****
172	Garden, Nev.	86,941	*****	***	*****	*****
173A	Railroad-South, Nev.	89,527	***	***	*****	*****
173B	Railroad-North, Nev.	266,651	*****	*****	*****	*****
174	Jakes, Nev.	0	*	-	-	*
175	Long, Nev.	0	*	-	-	*
178B	Butte-South, Nev.	16,748	***	*	***	***
179	Steptoe, Nev.	67,582	*****	*****	***	*****
180	Cave, Nev.	74,850	*****	*****	***	*****
181	Dry Lake, Nev.	0	*	-	-	*
182	Delamar, Nev.	22,927	*****	***	*****	*****
183	Lake, Nev.	60,193	*****	*****	*****	*****
184	Spring, Nev.	77,733	*****	*****	***	*****
196	Hamlin, Nev./Utah	56,351	*****	***	*****	*****
202	Patterson, Nev.	39,732	*	***	***	***
205	Meadow Valley Wash, Nev.[2]	325,062	*****	***	***	*****
207	White River, Nev.	144,953	*****	*****	***	*****
208	Pahroc, Nev.	43,432	*	***	*****	*****
209	Pahranagat, Nev.	89,708	*****	*****	***	*****
210	Coyote Spring, Nev.[2]	339,708	*****	*****	***	*****
219	Muddy River Springs, Nev.[2]	17,360	***	***	***	***
	(For Alternative 2)		***	***	*	***

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[1] - = None
a) Value not used.
b) Wilderness resources lie beyond 6 mi from nearest project feature.
c) No wilderness resources.

* = Low
a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
c) Value not used.

*** = Moderate
a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
c) Average value of indirect effects indices, including user increase, access, and crowding is less than four (ETR-18, Section 4.2.5).

***** = High
a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) If more than one wilderness resource is less than 3 mi from any project feature.
c) Average value of indirect effects indices is four or greater.

[2] Subunits containing OB sites.

[3] Impact index determined as the maximum of the effect ratings.

history which are provided by this landscape. The physical and visual qualities of the M-X project would irreversibly and irretrievably degrade these opportunities and diminish the value of this national resource. This highly significant impact transcends evaluation by this analysis. Considerable public concern was expressed that:

PUBLIC COMMENT ON THE DRAFT EIS:

". . . these always fragile resources are an important part of our vanishing natural American heritage, a heritage almost extinct in this world of ever increasing urbanization and industrialization." (B0570-0-003)

Coyote Spring Valley OB Impacts

As currently planned, the conceptual layout for the Coyote Spring suitability zone overlaps portions of six wilderness resource areas. Figure 4.3.2.10.2-2 shows the interaction of the conceptual base elements with these areas.

The proposed airfield conceptual location and surrounding area conflicts with WSA no. NV-050-0201, Fish and Wildlife no. 1, and WSA no. NV-050-0216, Fish and Wildlife no. 2. Other portions of the proposed suitability zone and DTN conflict with WSA no. NV-050-0215, Arrow Canyon Range, WSA no. NV-050-0177, Delamar Mountains, WSA no. NV-050-0516, Meadow Valley Mountains, and FW-915, Desert National Wildlife Range. Under current law (Wilderness Act of 1964, FLPMA, 1976) these direct impacts would not be allowed since, in addition to congressionally designated wilderness, all wilderness resources under review are legally excluded from such encroachments. Thus, two options are presently available: (1) the proposed layout could be altered so that the project facility location would not impinge on the wilderness resources in question or 2) the Congress could resolve the conflict by authorizing the Air Force to withdraw the land for M-X.

Indirectly, as a result of base operations, WSA no. NV-050-01R-16 (A, B, and C), Evergreen, would be expected to experience an indeterminable amount of degradation in wilderness quality. Most of this additional loss would occur as a result of the increased noise and visual intrusion associated with the base.

A further potential impact to wilderness resources adjoining the proposed base could result from the siting of the operating base testing site (OBTS). This project feature would most likely be sited along the DTN leading toward Delamar Valley near Kane Springs Valley. It must be located on geotechnically suitable terrain between the OB and the nearest cluster site. Therefore, it is possible that the OBTS could create further potential impact on the Meadow Valley Mountain and Delamar Mountain wilderness resources.

Movement of base features within the OB suitability zone away from wilderness resource areas could lessen the potential impacts to those areas. Exact siting information of all project features would be required for precise estimation of the amount of wilderness resource areas that would be disturbed. However, existing

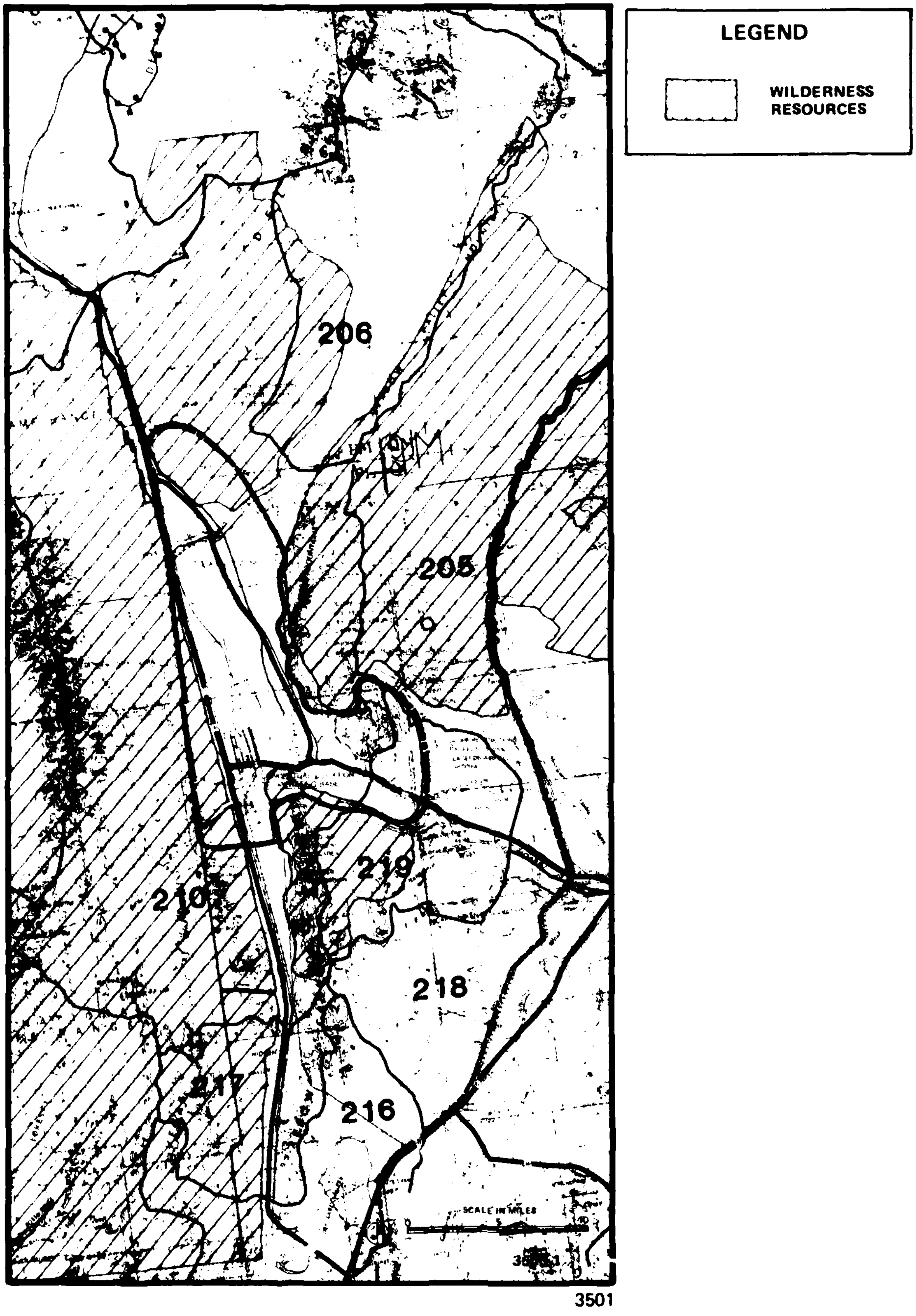

Figure 4.3.2.10.2-2. Wilderness resources in the vicinity of the Coyote Spring OB.

estimates (ETR-18) indicate that approximately 12,000 acres of the Fish and Wildlife nos. 1 and 2 resource areas, as well as approximately 10,000 acres of the Delamar Mountains and nearly 2,000 acres of the Arrow Canyon WSA, located within the Arrow Canyon Range (Significant Natural Areas, Section 4.4.4), fall within the proposed conceptualized OB suitability zone. The consequence of project effects on the subject WSAs would be permanent wilderness loss; an irreversible and irretrievable commitment of resources not replaceable through mitigation measures. The effects of construction activities would be unavoidable if the present plan for the Coyote Spring OB were implemented.

An influx of permanent residents to the Coyote Spring area is anticipated with project implementation. The effects of this large human population growth would be largely unavoidable, and would vary with the socioeconomic and demographic characteristics of the in-migrants. Based on extrapolation from a recreation preference survey of construction and military personnel at the Strategic Air Command (SAC) base at Mountain Home, Idaho (Ludeman, 1981), wilderness resources in the area could receive up to 1,200 additional visitors (7 percent of the projected in-migrant population according to ETR-2). If predicted use appeared to impair the wilderness quality of an area, management effort to regulate visitor use could be undertaken. The precise extent to which increased use would impact a particular wilderness resource would depend upon the fragility of the individual ecosystem.

Table 4.3.2.10.2-1 summarizes wilderness abundance and level of population-related effects on hydrologic subunit basis with Coyote Spring as operating base for the Proposed Action. According to the indirect effects analysis, regions outside the DDA which are anticipated to receive a greater than 15 percent increase in visitor-days as a result of M-X include the BLM-managed Cedar Ridge, Red Spring, Little Humboldt River, Gabbs Valley, Basalt, Hontone Mine, Silver Peak Range, Tunnel Spring, Grapevine Spring, Pigeon Spring, Bonnie Claire Flat, and Queer Mountain, as well as the USFS-managed Excelsior and White Mountains (ETR-18).

There are no wilderness resources in the immediate vicinity of the Milford OB site. The closest wilderness resource is the Central Wah Wah Range, approximately 20 mi north-northwest of the site. A projected long-term population increase of approximately 15,400 is anticipated for the Milford area as a result of base siting (ETR-2). Additional hydrologic subunits outside the DDA anticipated to receive increased visitation by M-X-related personnel are the same as those for Coyote Spring. Table 4.3.2.10.2-1 summarizes wilderness resource abundance and level of population-related impacts by hydrologic subunit, with Milford as a second base for the Proposed Action.

ALTERNATIVE 1 (4.3.2.10.3)

The DDA, first OB, and associated impacts would be the same as for the Proposed Action. The second OB would be located at Beryl, Utah. The closest wilderness resources are the BLM-managed White Rock and Central Wah Wah Mountain units and the RARE II Wilderness Recommendation, Pine Valley Mountain. All are located approximately 30 air-miles from the proposed OB site.

Impacts of an OB in this area would stem from the indirect effects of the movements and recreational activities of an estimated 14,400 additional permanent residents in the Beryl region (ETR-2). Table 4.3.2.10.2-1 summarizes wilderness abundance and level of population related impacts. The level of population-related effects as identified by the indirect effects index are the same as for the Proposed Action both within and outside of the DDA.

ALTERNATIVE 2 (4.3.2.10.4)

The DDA, first OB, and associated impacts would be the same as for the Proposed Action. The second OB would be located near Delta, Utah. There are no wilderness resources intersecting the OB suitability zone. The nearest WSA is the Swasey Mountains, approximately 12 mi northwest of the OB site. Additional areas nearby include the Howell and Notch Peak WSAs located approximately 18 and 16 mi, respectively, to the west of the proposed site.

An estimated 14,500 permanent residents in the Delta area would be expected (ETR-2). Although recreational use preferences would be a function of the socioeconomic and demographic characteristics of the in-migrants, the level of population-related effects as identified by the indirect effects index (ETR-18) would be the same as for the Proposed Action and Alternative 1, except for the Muddy River Springs subunit (Table 4.3.2.10.2-1).

ALTERNATIVE 3 (4.3.2.10.5)

The DDA and associated impacts would be the same as for the Proposed Action. Using Beryl as the first OB location for Alternative 3 would result in an increase of 20,000 long-term residents in the area, approximately 27 percent more than for Alternative 1, which has Beryl as a second OB (ETR-2). Although these figures differ, no qualitative change in the potential population-related effects of an OB location at Beryl are anticipated.

The second OB would be located near Ely. There are no wilderness resources within the OB suitability zone. The closest wilderness resources include Martin Spring (a BLM-managed inventory unit under appeal to the Interior Board of Land Appeals) located approximately 22 mi southwest of the proposed site; and the designated South Egan Range and Mt. Grafton WSAs, located 30 and 35 air-miles southwest and south, respectively, of the conceptual OB site. Additional nearby resources are the USFS Further Planning Unit, Mt. Moriah, and the designated BLM WSA South Egan Range. Both are within approximately 30 air-miles of the Ely suitability zone. Impacts to wilderness would stem from the recreational activities of an estimated 15,400 additional permanent residents in the region (ETR-2). Table 4.3.2.10.5-1 summarizes wilderness abundance and level of population-related impacts.

ALTERNATIVE 4 (4.3.2.10.6)

The DDA and associated impacts would be the same as for the Proposed Action. Impacts for the first OB at Beryl would be the same as those for Alternative 3.

Impacts for the proposed OB location at Coyote Spring are discussed under the Proposed Action. Although use of the Coyote Spring site for a second base would reduce the growth of permanent residents by about 24 percent, there would be no

Table 4.3.2.10.5-1. Potential impact[1] to wilderness resources in the Nevada/Utah DDA and associated OB hydrologic subunits for Alternatives 3 and 5.

Hydrologic Subunit No.	Hydrologic Subunit Name	Approximate Wilderness Resource Acreage Within Subunit	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[3]
	DDA					
4	Snake, Nev./Utah	252,776	*****	*****	*****	*****
5	Pine, Utah	37,478	*****	***	***	***
6	White, Utah	124,636	*****	*****	*****	*****
7	Fish Springs, Utah	50,313	*****	*****	*****	*****
8	Dugway, Utah	10,691	***	***	***	***
	Alternative 5				*****	
9	Government Creek, Utah	0	*	-	-	*
46	Sevier Desert, Utah	20,536	***	***	*****	*****
46A	Sevier Desert-Dry Lake, Utah	48,574	*****	*****	*****	*****
50	Milford, Utah[2]	0	*	-	-	*
52	Lund District, Utah[2]	0	*	-	-	*
53	Beryl-Enterprise, Utah[2]	835	***	-	***	***
54	Wah Wah, Utah	43,208	*****	*****	*****	*****
137A	Big Smoky-Tonopah Flat, Nev.	3,775	***	-	*	***
139	Kobeh, Nev.	29,947	*****	***	*****	*****
140A	Monitor-North, Nev.	0	*	-	-	*
140B	Monitor-South, Nev.	0	*	-	-	*
141	Ralston, Nev.	0	*	-	-	*
142	Alkali Spring, Nev.	0	*	-	-	*
148	Cactus Flat, Nev.	6,785	*	***	*****	*****
149	Stone Cabin, Nev.	38,662	*****	*****	*****	*****
151	Antelope, Nev.	0	*	-	-	*
154	Newark, Nev.	0	*	-	-	*
155A	Little Smoky-North, Nev.	27,516	*****	*****	*****	*****
155C	Little Smoky-South, Nev.	15,918	*****	*****	*****	*****
156	Hot Creek, Nev.	208,069	*****	*****	*****	*****
170	Penoyer, Nev.	44,303	*****	*****	*****	*****
171	Coal, Nev.	17,568	***	***	***	***
172	Garden, Nev.	86,941	*****	***	***	*****
173A	Railroad-South, Nev.	89,527	***	***	*****	*****
173B	Railroad-North, Nev.	266,651	*****	*****	*****	*****
174	Jakes, Nev.	0	*	-	-	*
175	Long, Nev.	0	*	-	-	*
178B	Butte-South, Nev.	16,748	***	*	*****	*****
179	Steptoe, Nev.	67,582	*****	*****	*****	*****
180	Cave, Nev.	74,850	*****	*****	*****	*****
181	Dry Lake, Nev.	0	*	-	-	*
182	Delamar, Nev.	22,927	*****	*****	***	*****
183	Lake, Nev.	60,193	*****	*****	*****	*****
184	Spring, Nev.	77,733	*****	*****	***	*****
196	Hamlin, Nev./Utah	56,351	*****	***	*****	*****
202	Patterson, Nev.	39,732	*	***	***	***
205	Meadow Valley Wash, Nev.[2]	325,062	*****	***	***	*****
207	White River, Nev.	144,953	*****	*****	***	*****
208	Fahroc, Nev.	43,432	*	***	***	***
209	Pahranagat, Nev.	89,708	*****	*****	***	*****
210	Coyote Spring, Nev.[2]	339,708	*****	*****	***	*****
219	Muddy River Springs, Nev.[2]	17,360	***	***	*	***

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[1] - = None
a) Value not used.
b) Wilderness resources lie beyond 6 mi from nearest project feature.
c) No wilderness resources.

* = Low
a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
c) Average value of indirect effects indices, including user increase, access, and crowding is less than three (ETR-18, Section 4.2.5).

*** = Moderate
a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
c) Average value of indirect effects indices, is less than four.

***** = High
a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) If more than one wilderness resource is less than 3 mi from any project feature.
c) Average value of indirect effects indices is four or greater.

[2] Subunits containing OB sites.

[3] Impact index determined as the maximum of the effect ratings.

substantial change in the indirect population-related effects of an OB location in this region. Table 4.3.2.10.6-1 summarizes wilderness abundance and level of population-related impacts.

ALTERNATIVE 5 (4.3.2.10.7)

The DDA and associated impacts would be the same as for the Proposed Action. Impacts for the proposed OB location at Milford are discussed under the Proposed Action. Using Milford as the first OB would result in an estimated 28 percent increase in permanent residents over that projected for Milford as a second OB, but no substantial qualitative changes in the anticipated recreational impacts on wilderness resources are expected (Table 4.3.2.10.5-1). Impacts for the proposed Ely OB are the same as for Alternative 3.

ALTERNATIVE 6 (4.3.2.10.8)

The DDA and associated impacts would be the same as for the Proposed Action. Impacts for a first OB at Milford and a second OB at Coyote Spring would be the same as those for Alternatives 5 and 4, respectively. Table 4.3.2.10.8-1 summarizes wilderness abundance and level of population-related impacts for Alternative 6.

ALTERNATIVE 7 (4.3.2.10.9)

DDA Impacts

Wilderness resources within the Texas/New Mexico study region include the Sabinosa Wilderness Study Area (WSA) and the congressionally designated Salt Creek Wilderness within the Bitter Lake National Wildlife Refuge. It is not anticipated that M-X construction activities would result in significant impact to the wilderness quality of either area. The Sabinosa WSA is located approximately 40 mi from the nearest project feature and the wilderness quality of Salt Creek is already compromised due to its proximity to the City of Roswell (Figure 4.3.2.10.9-1). Table 4.3.2.10.9-1 summarizes potential impacts to wilderness resources for Alternative 7.

With the exception of hunting, siting the OB at Clovis is anticipated to result in substantial increases in recreational activities only in the Salt Creek Wilderness which is located with the USFWS-managed Bitter Lake National Wildlife Refuge. Present management strategies are to promote educational and scientific use of the wildlife refuge and to discourage picnicking (Marlatt, 1980). However, the steep, rock-walled canyons and densely vegetated landscape characterizing the Sabinosa WSA could serve as a magnet for wilderness recreationists from as far away as Clovis (approximately 100 mi). No direct or substantial indirect impacts to the wilderness resources are anticipated as a result of the Dalhart OB.

OB Impacts

The first OB site at Clovis is approximately 80 air-miles from the nearest wilderness resource, Salt Creek Wilderness in the Bitter Lake National Wildlife Refuge, and about 100 air-miles from the Sabinosa WSA. No significant direct or indirect effects would be expected. The second OB site near Dalhart is also about

Table 4.3.2.10.6-1. Potential impact[1] to wilderness resources in the Nevada/Utah DDA and associated OB hydrologic subunits for Alternative 4.

Hydrologic Subunit No.	Name	Approximate Wilderness Resource Acreage Within Subunit	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[3]
	DDA					
4	Snake, Nev./Utah	252,776	*****	*****	*****	*****
5	Pine, Utah	37,478	*****	***	*****	*****
6	White, Utah	124,636	*****	*****	*****	*****
7	Fish Springs, Utah	50,313	*****	*****	*****	*****
8	Dugway, Utah	10,691	***	***	***	***
9	Government Creek, Utah	0	*	-	-	*
46	Sevier Desert, Utah	20,536	***	***	*****	*****
46A	Sevier Desert-Dry Lake, Utah	48,574	*****	*****	*****	*****
50	Milford, Utah[2]	0	*	-	-	*
52	Lund District, Utah[2]	0	*	-	-	*
53	Beryl-Enterprise, Utah[2]	835	***	-	***	***
54	Wah Wah, Utah	43,208	*****	*****	*****	*****
137A	Big Smoky-Tonopah Flat, Nev.	3,775	***	-	***	***
139	Kobeh, Nev.	29,947	*****	***	*****	*****
140A	Monitor-North, Nev.	0	*	-	-	*
140B	Monitor-South, Nev.	0	*	-	-	*
141	Ralston, Nev.	0	*	-	-	*
142	Alkali Spring, Nev.	0	*	-	-	*
148	Cactus Flat, Nev.	6,785	*	***	*****	*****
149	Stone Cabin, Nev.	38,662	*****	*****	*****	*****
151	Antelope, Nev.	0	*	-	-	*
154	Newark, Nev.	0	*	-	-	*
155A	Little Smoky-North, Nev.	27,516	*****	*****	*****	*****
155C	Little Smoky-South, Nev.	15,918	*****	*****	*****	*****
156	Hot Creek, Nev.	208,069	*****	*****	*****	*****
170	Penoyer, Nev.	44,303	*****	*****	*****	*****
171	Coal, Nev.	17,568	***	***	*****	*****
172	Garden, Nev.	86,941	*****	*****	*****	*****
173A	Railroad-South, Nev.	89,527	***	***	*****	*****
173B	Railroad-North, Nev.	266,651	*****	*****	*****	*****
174	Jakes, Nev.	0	*	-	-	*
175	Long, Nev.	0	*	-	-	*
178B	Butte-South, Nev.	16,748	***	*	***	***
179	Steptoe, Nev.	67,582	*****	*****	***	*****
180	Cave, Nev.	74,850	*****	*****	***	*****
181	Dry Lake, Nev.	0	*	-	-	*
182	Delamar, Nev.	22,927	*****	*****	***	*****
183	Lake, Nev.	60,193	*****	*****	*****	*****
184	Spring, Nev.	77,733	*****	*****	***	*****
196	Hamlin, Nev./Utah	56,351	*****	***	*****	*****
202	Patterson, Nev.	39,732	*	***	***	***
205	Meadow Valley Wash, Nev.[2]	325,062	*****	***	***	*****
207	White River, Nev.	144,953	*****	*****	***	*****
208	Pahroc, Nev.	43,432	*	***	*****	*****
209	Pahranagat, Nev.	89,708	*****	*****	***	*****
210	Coyote Spring, Nev.[2]	339,708	*****	*****	***	*****
219	Muddy River Springs, Nev.[2]	17,360	***	***	*	***

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[1] - = None
- a) Value not used.
- b) Wilderness resources lie beyond 6 mi from nearest project feature.
- c) No wilderness resources.

* = Low
- a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
- b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
- c) Average value of indirect effects indices, including user increase, access, and crowding is less than three (ETR-18, Section 4.2.5).

*** = Moderate
- a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
- b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
- c) Average value of indirect effects is less than four.

***** = High
- a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
- b) If more than one wilderness resource is less than 3 mi from any project feature.
- c) Average value of indirect effects indices is four or greater.

[2] Subunits containing OB sites.

[3] Impact index determined as the maximum of the effect ratings.

Table 4.3.2.10.8-1. Potential impact[1] to wilderness resources in the Nevada/Utah DDA and associated OB hydrologic subunits for Alternative 6.

Hydrologic Subunit No.	Hydrologic Subunit Name	Approximate Wilderness Resource Acreage Within Subunit	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[3]
	DDA					
4	Snake, Nev./Utah	252,776	*****	*****	*****	*****
5	Pine, Utah	37,478	*****	***	***	*****
6	White, Utah	124,636	*****	*****	*****	*****
7	Fish Springs, Utah	50,313	*****	*****	*****	*****
8	Dugway, Utah	10,691	***	***	***	***
9	Government Creek, Utah	0	*	-	-	*
46	Sevier Desert, Utah	20,536	***	***	*****	*****
46A	Sevier Desert-Dry Lake, Utah	48,574	*****	*****	*****	*****
50	Milford, Utah[2]	0	*	-	-	*
52	Lund District, Utah[2]	0	*	-	-	*
53	Beryl-Enterprise, Utah[2]	835	***	-	***	***
54	Wah Wah, Utah	43,208	*****	*****	*****	*****
137A	Big Smoky-Tonopah Flat, Nev.	3,775	***	-	***	***
139	Kobeh, Nev.	29,947	*****	***	*****	*****
140A	Monitor-North, Nev.	0	*	-	-	*
140B	Monitor-South, Nev.	0	*	-	-	*
141	Ralston, Nev.	0	*	-	-	*
142	Alkali Spring, Nev.	0	*	-	-	*
148	Cactus Flat, Nev.	6,785	*	***	*****	*****
149	Stone Cabin, Nev.	38,662	*****	*****	*****	*****
151	Antelope, Nev.	0	*	-	-	*
154	Newark, Nev.	0	*	-	-	*
155A	Little Smoky-North, Nev.	27,516	*****	*****	*****	*****
155C	Little Smoky-South, Nev.	15,918	*****	*****	*****	*****
156	Hot Creek, Nev.	208,069	*****	*****	*****	*****
170	Penoyer, Nev.	44,303	*****	*****	*****	*****
171	Coal, Nev.	17,568	***	***	*****	*****
172	Garden, Nev.	86,941	*****	***	*****	*****
173A	Railroad-South, Nev.	89,527	***	***	*****	*****
173B	Railroad-North, Nev.	266,651	*****	*****	*****	*****
174	Jakes, Nev.	0	*	-	-	*
175	Long, Nev.	0	*	-	-	*
178B	Butte-South, Nev.	16,748	***	*	***	***
179	Steptoe, Nev.	67,582	*****	*****	***	*****
180	Cave, Nev.	74,350	*****	*****	***	*****
181	Dry Lake, Nev.	0	*	-	-	*
182	Delamar, Nev.	22,927	*****	***	*****	*****
183	Lake, Nev.	60,193	*****	*****	*****	*****
184	Spring, Nev.	77,733	*****	*****	***	*****
196	Hamlin, Nev./Utah	56,351	*****	***	*****	*****
202	Patterson, Nev.	39,732	*	***	***	***
205	Meadow Valley Wash, Nev.[2]	325,062	*****	***	***	*****
207	White River, Nev.	144,953	*****	*****	***	*****
208	Pahroc, Nev.	43,432	*	***	*****	*****
209	Pahranagat, Nev.	89,708	*****	*****	***	*****
210	Coyote Spring, Nev.[2]	339,708	*****	*****	***	*****
219	Muddy River Springs, Nev.[2]	17,360	***	***	-	***

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[1]- = None
a) Value not used.
b) Wilderness resources lie beyond 6 mi from nearest project feature.
c) No wilderness resources.

* = Low
a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
c) Value not used.

*** = Moderate
a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
c) Average value of indirect effects indices, including user increase, and crowding is less than four (ETR-18, Section 4.2.5).

***** = High
a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) If more than one wilderness resource is less than 3 mi from any project feature.
c) Average value of indirect effects indices is four or greater.

[2]Subunits containing OB sites.

[3]Impact index determined as the maximum of the effect ratings.

100 air-miles from the Sabinosa WSA and nearly 200 air-miles from the Salt Creek Wilderness. No significant impacts to either of the two resources would be anticipated as a result of siting a base at Dalhart.

ALTERNATIVE 8 (4.3.2.10.10)

Figures 4.3.2.10.10-1 and 4.3.2.10.10-2 show the relationship of wilderness to project elements for the Nevada/Utah and Texas/New Mexico portions, respectively, of the split basing alternative. Deploying half the project in Nevada/Utah would reduce by about 55 percent the number of hydrologic subunits containing project elements and having high potential for impact to wilderness resources (Table 4.3.2.10.10-1). In Texas/New Mexico, the overall project area is also reduced by about half, but the proximity to wilderness resource is the same as for full basing.

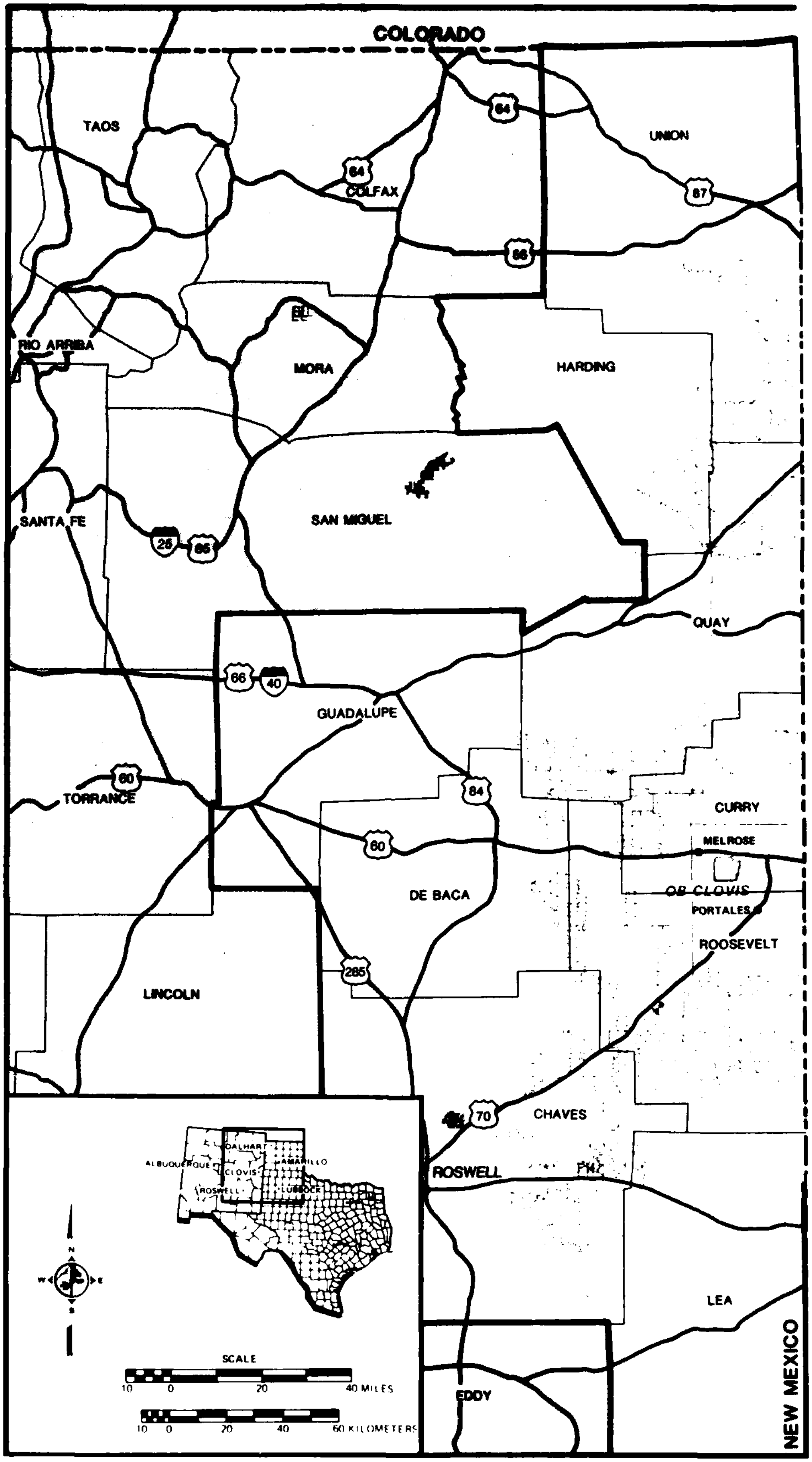
Split basing would differ from the Proposed Action and Alternative 7 in terms of visual aesthetics, noise levels, air quality, and in population growth. The potential for combined effects of M-X and other projects planned for the Nevada/Utah study area would be reduced, since the Anaconda Molybdenum project and most of the potential site for the White Pine Power Project would be outside the deployment area. Interactions with Alunite, Pine Grove Molybdenum, Rocky Mountain Natural Gas Pipeline Project, IPP and the Harry Allen Power Plant could still occur. No significant projects are known to be planned for the Texas/New Mexico area.

Table 4.3.2.10.10-1 summarizes the estimated DDA impact on the wilderness resource for each hydrologic subunit in which project elements would be sited for split basing. In Nevada and Utah, significant impacts to wilderness resources from noise, visual interference, and increased access are predicted for 22 of the 27 hydrologic subunits containing project elements. Long-term effects would be the same as those discussed for the Proposed Action. In Texas and New Mexico, both direct and indirect effects for this alternative would be the same as those described for Alternative 7.

MITIGATIONS (4.3.2.10.11)

Mitigation measures for wilderness resources need to be directed toward the preservation of the biological, physical, and aesthetic qualities of these areas.

The Air Force will cooperate with federal, state, and local agencies in managing visitations to wilderness resource areas, and will provide an education program for M-X workers and dependents. Wilderness resource areas will be avoided in siting, where possible. These include congressionally designated wilderness, as well as resource tracts under various stages of review for inclusion in the National Wilderness Preservation System (BLM Wilderness Study Areas and units under appeal to the Interior Board of Land Appeals; U.S. Forest Service RARE II Wilderness Recommendations and Further Planning Units; USFWS and NPS Administratively Endorsed Wilderness Proposals). Impacts such as noise and lowered air quality will be minimized during construction and operation. Visual impacts will be minimized by means of visual resources management during siting and design. Additional details on mitigations for wilderness resources are included in ETR-18 (Wilderness) and ETR-38 (Mitigations).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SAN MIGUEL
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TORRANCE
CURRY
MELROSE
CLOVIS
PORTALES
DE BACA
ROOSEVELT
LINCOLN
CHAVES
ROSWELL
LEA
EDDY
NEW MEXICO
ALBUQUERQUE
DALHART
AMARILLO
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4461-D

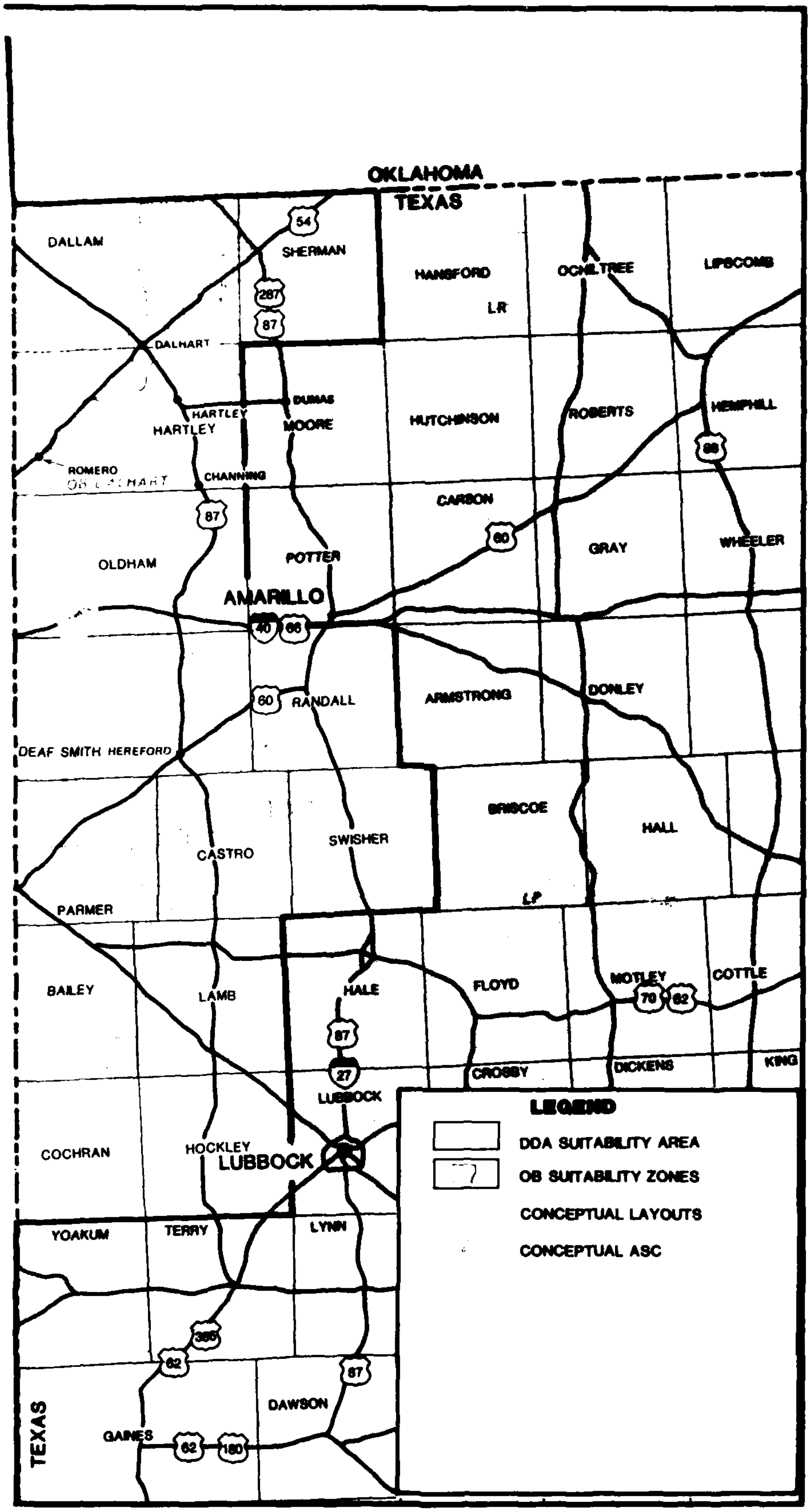

Figure 4.3.2.10.9-1. Wilderness resources and the Alternative 7 conceptual project layout.

Table 4.3.2.10.9-1. Potential impact[1] to wilderness resources in the Texas/New Mexico study area for Alternative 7.

DDA Counties	Wilderness Resource	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[2]
Bailey, Tex.		-	-		
Castro, Tex.		-	-		
Cochran, Tex.		-	-		
Dallam, Tex.		-	-		
Deaf Smith, Tex.		-	-		
Hartley, Tex.		-	-		
Hockley, Tex.		-	-		
Lamb, Tex.		-	-		
Oldham, Tex.		-	-		
Parmer, Tex.		-	-		
Randall, Tex.		-	-		
Sherman, Tex.		-	-		
Swisher, Tex.		-	-		
Chaves, N. Mex.	Salt Creek Wilderness	-	-	***	***
Curry, N. Mex.		-	-		
DeBaca, N. Mex.		-	-		
Guadalupe, N. Mex.		-	-		
Harding, N. Mex.		-	-		
Lea, N. Mex.		-	-		
Quay, N. Mex.		-	-		
Roosevelt, N. Mex.		-	-		
Union, N. Mex.		-	-		

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[1]- = None
a) Value not used.
b) Wilderness resources lie beyond 6 mi from nearest project feature.
c) No wilderness resources.

* = Low
a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
c) Average value of indirect effect indices, including user increase, access, and crowding is less than three (ETR18 Section 4.2.5).

*** = Moderate
a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
c) Average value of indirect effect indices is less than four.

***** = High
a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) If more than one wilderness resource is less than 3 mi from any project feature.
c) Average value of indirect effect indices is four or greater.

[2]Index determined as the maximum of the impact ratings.

Table 4.3.2.10.10-1. Potential impact[1] to wilderness resources in the Nevada/Utah-Texas/New Mexico DDAs and associated OB hydrologic subunits/counties for Alternative 8.

No.	Split Basing DDA Hydrologic Subunits Name	Approximate Wilderness Resource Acreage Within Subunit	Visual Effects[a]	Noise Effects[b]	Indirect Effects[c]	Estimated Overall Impact[3]
4	Snake, Nev./Utah	252,776	*****	*****	***	*****
5	Pine, Utah	37,478	*****	***	***	*****
6	White, Utah	124,646	*****	*****	*****	*****
7	Fish Springs, Utah	50,313	*****	*****	*****	*****
46	Sevier Desert, Utah	20,536	***	***	*****	*****
46A	Sevier Desert-Dry Lake, Utah	48,574	*****	*****	*****	*****
54	Wah Wah, Utah	43,208	*****	*****	***	*****
155C	Little Smoky-South, Nev.	15,918	*****	*****	*****	*****
156	Hot Creek, Nev.	208,069	*****	*****	*****	*****
170	Penoyer, Nev.	44,303	*****	*****	*****	*****
171	Coal, Nev.	17,568	***	***	***	***
172	Garden, Nev.	86,941	*****	*****	***	*****
173A	Railroad-South, Nev.	89,527	***	***	*****	*****
173B	Railroad-North, Nev.	266,651	*****	*****	***	*****
180	Cave, Nev.	74,850	*****	*****	***	*****
181	Dry Lake, Nev.	0	*	-	-	*
182	Delamar, Nev.	22,927	*****	*****	***	*****
183	Lake, Nev.	60,193	*****	*****	*****	*****
184	Spring, Nev.	77,733	*****	*****	***	*****
196	Hamlin, Nev./Utah	56,351	*****	***	***	*****
202	Patterson, Nev.	39,732	*	***	***	***
205	Meadow Valley Wash, Nev.[2]	325,062	*****	***	***	*****
207	White River, Nev.	144,953	*****	*****	***	*****
208	Pahroc, Nev.	43,432	*	***	***	***
209	Pahranagat, Nev.	89,708	*****	*****	***	*****
210	Coyote Spring, Nev.[2]	339,708	*****	*****	*	*****
219	Muddy River Springs, Nev.[2]	17,360	***	***	***	***
	Split Basing DDA Counties					
	Bailey, Tex.		-	-		
	Cochran, Tex.		-	-		
	Dallam, Tex.		-	-		
	Deaf Smith, Tex.		-	-		
	Hartley, Tex.		-	-		
	Hockley, Tex.		-	-		
	Lamb, Tex.		-	-		
	Oldham, Tex.		-	-		
	Parmer, Tex.		-	-		
	Chaves, N. Mex.	Salt Creek Wilderness	-	-	***	***
	Curry, N. Mex.[2]		-	-		
	DeBaca, N. Mex.		-	-		
	Guadalupe, N. Mex.		-	-		
	Harding, N. Mex.		-	-		
	Lea, N. Mex.		-	-		
	Quay, N. Mex.		-	-		
	Roosevelt, N. Mex.		-	-		
	Union, N. Mex.		-	-		

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[1] - = None
a) Value not used.
b) Wilderness resources lie beyond 6 mi from nearest project feature.
c) No wilderness resources.

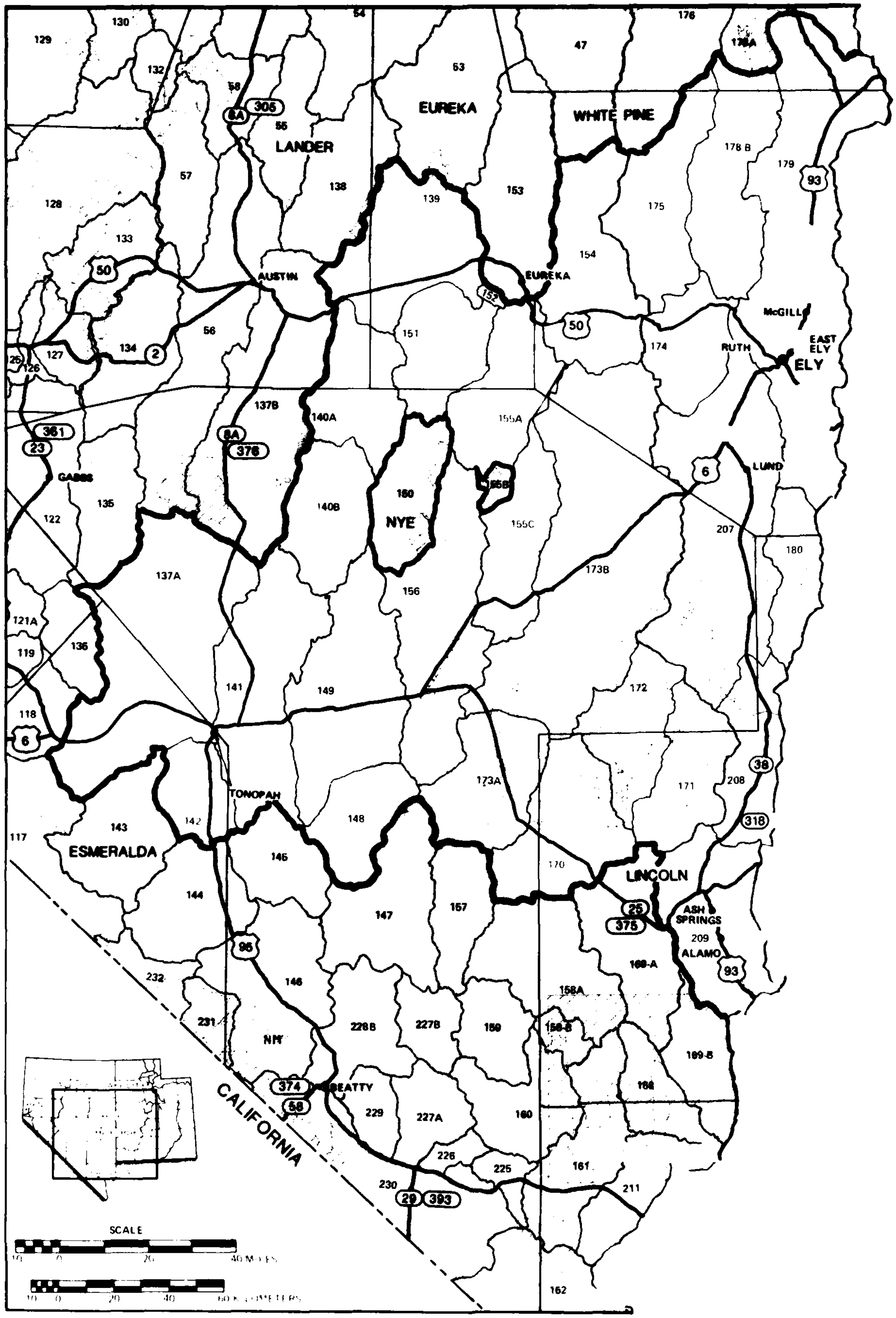
* = Low
a) Due to the pervasive nature of the project on "de facto" wilderness areas, a low visual impact value was accorded to subunits which presently contain no wilderness resource areas.
b) Only one wilderness resource lies between 3 and 6 mi from nearest project feature.
c) Average value of indirect effect indices, including user increase, access, and crowding is less than three (ETR-18, Section 4.2.5).

*** = Moderate
a) One to ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) Two or three wilderness resources each lie between 3 to 6 mi from a project feature; or only one wilderness resource is less than 3 mi from a project feature.
c) Average value of indirect effect indices is less than four.

***** = High
a) More than ten percent additional road intercepts due to M-X are visible from more than one wilderness resource.
b) If more than one wilderness resource is less than 3 mi from any project feature.
c) Average value of indirect effect indices is four or greater.

[2] Subunits containing OB sites.

[3] Impact index determined as the maximum of the effect ratings.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WHITE PINE
NYE
ESMERALDA
LINCOLN
CALIFORNIA
AUSTIN
EUREKA
McGILL
EAST ELY
ELY
RUTH
LUND
GABBS
TONOPAH
BEATTY
ASH SPRINGS
ALAMO
SCALE
40 MILES
60 KILOMETERS

4459-D

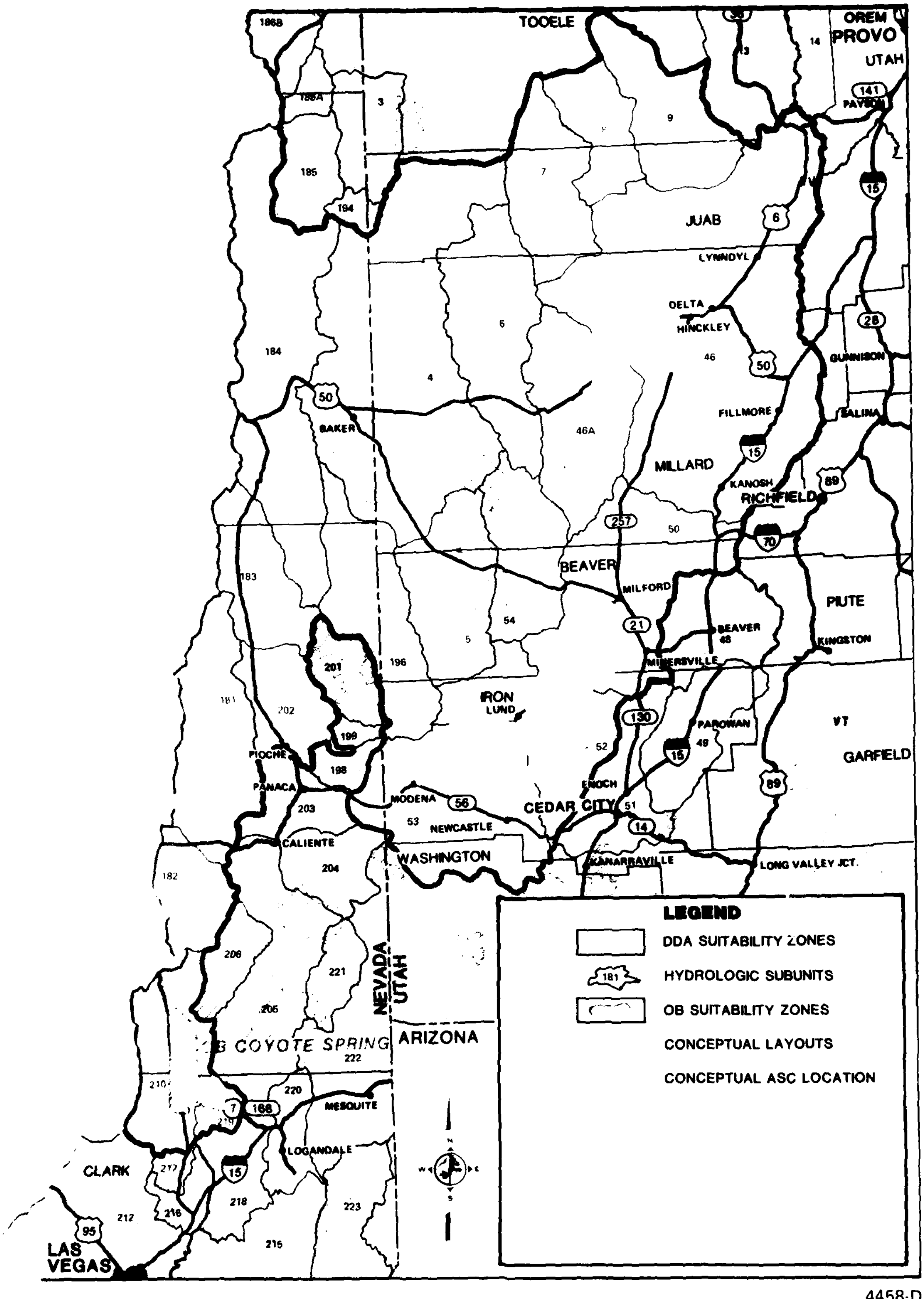
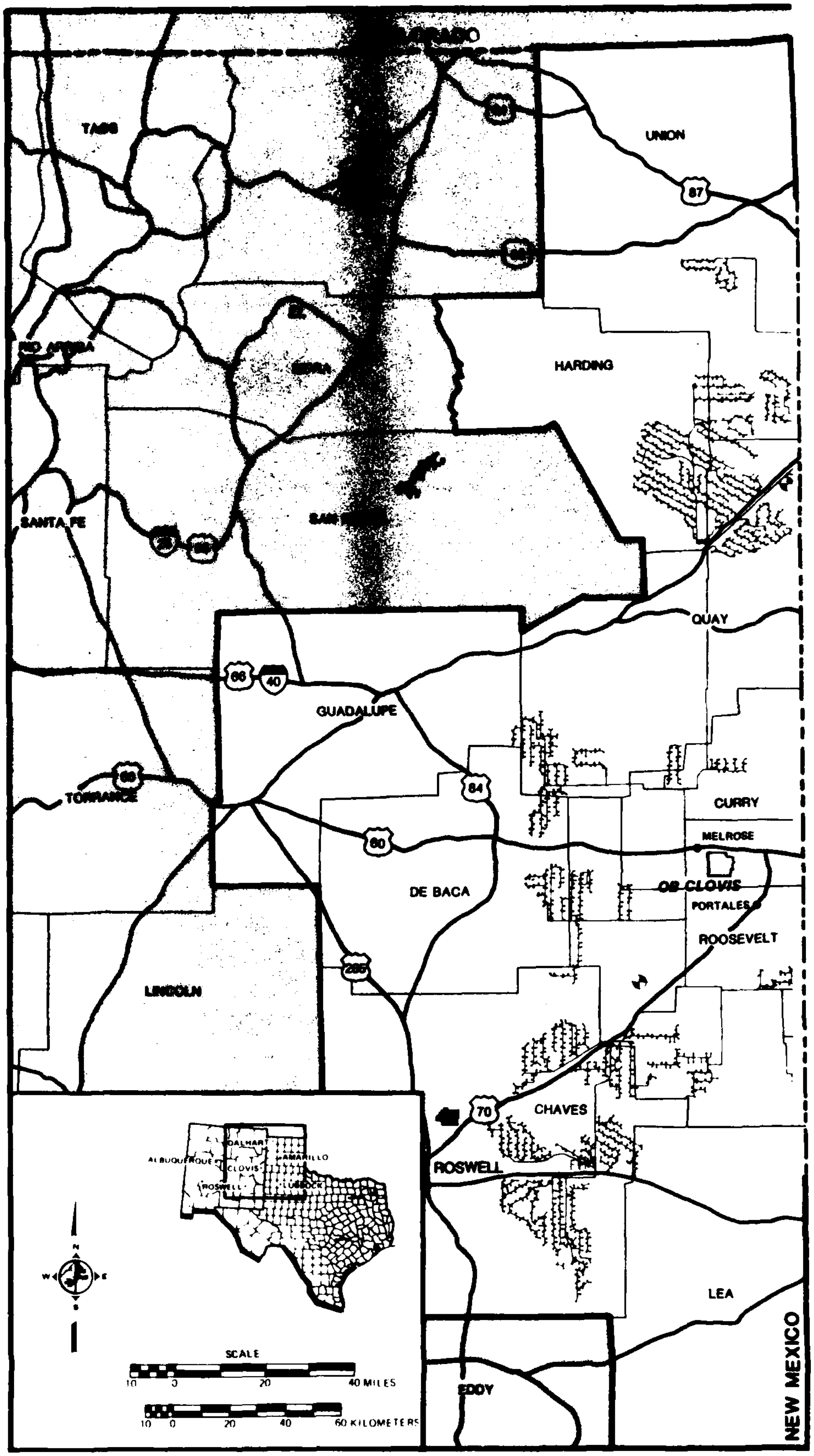


Figure 4.3.2.10.10-1. Wilderness resources and the Alternative 8 (split basing) conceptual project layout.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QUAY
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CURRY
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DE BACA
SANTA FE
TORRANCE
LINCOLN
285
70
CHAVES
ROSWELL
LEA
EDDY
NEW MEXICO
ALBUQUERQUE
DALHART
AMARILLO
CLOVIS
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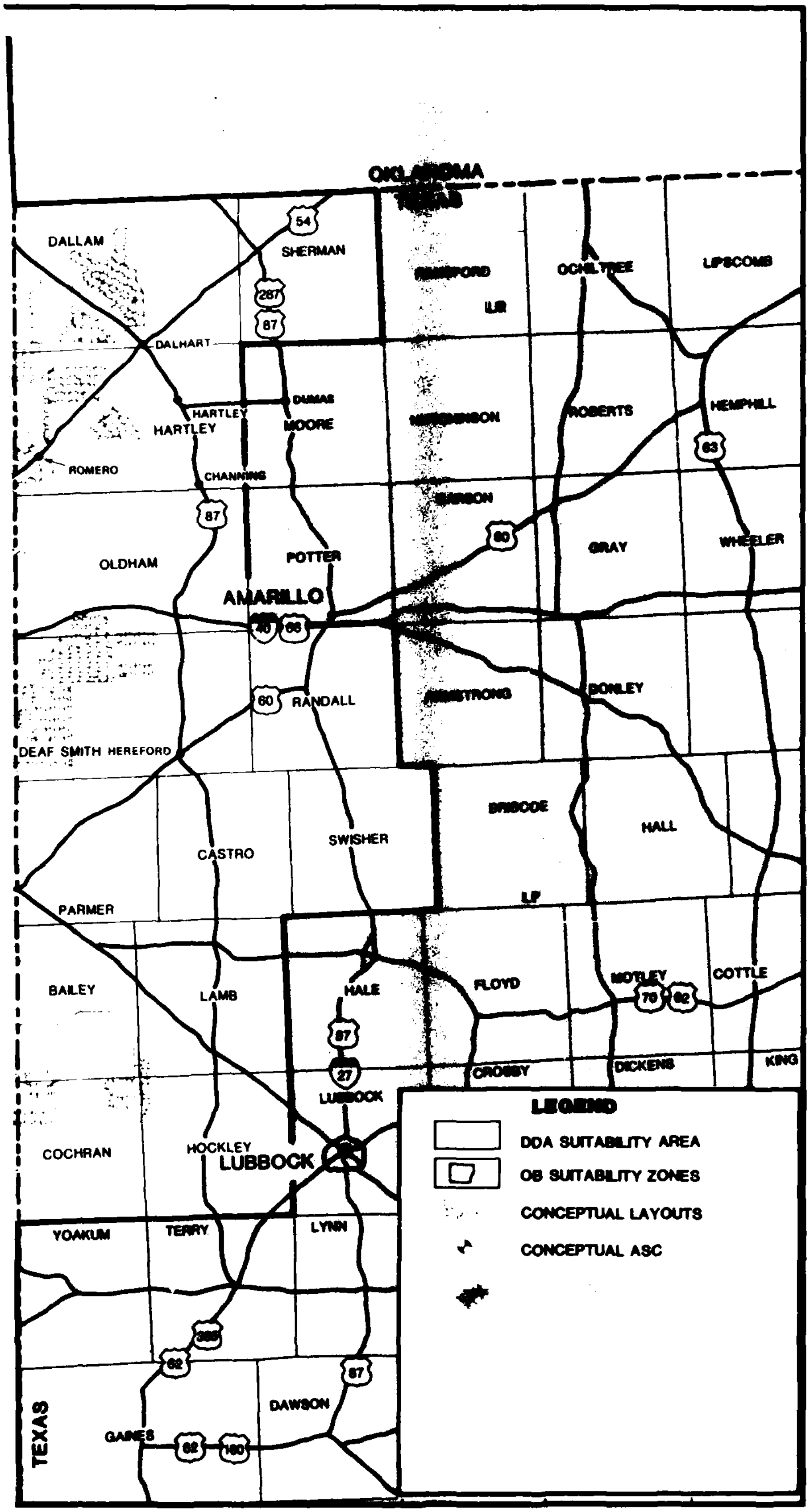

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Figure 4.3.2.10.10-2. Wilderness resources and the Alternative 8 conceptual project layout (Texas/New Mexico).

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