

4.5 EARTH RESOURCES

The evaluation of impacts to geologic resources resulting from the alternatives includes the effects on metallic minerals potential, oil and gas potential, geothermal resources, and industrial minerals potential.

To assess potential impacts to soil resources on McGregor Range, the annual soil loss from water and wind was calculated using the Revised Universal Soil Loss Equation (RUSLE) (Soil and Water Conservation Society, 1995) and the Wind Erosion Equation (Fuller, 1987). Three categories of impacts to the soil resource were used: undisturbed (no impact), moderate impact, and maximum impact. Soil data for the equations were obtained from the Otero Area, New Mexico Soil Survey (USDA, 1981), RUSLE software databases, and NRCS Map Unit Interpretation Record (MUIR) databases. Results are reported in Table 4.5-1.

The undisturbed scenario assumes current conditions with little disturbance to vegetation or soil from military or nonmilitary actions. The moderate impact scenario assumes a 50 percent reduction in vegetative cover and 50 percent disturbance to the soil surface from military or nonmilitary activities. The maximum impact assumes 100 percent removal of vegetation and 100 percent disturbance to the soil surface from military or nonmilitary activities (See Appendix H for additional assumptions and examples of soil loss calculations). McGregor Range vegetative cover and vegetative cover change from 1986 to 1996 are discussed in Section 4.8, *Biological Resources*. During this period, reductions in vegetative cover from all natural and noninduced sources were in the lower range of the moderate soil disturbance category.

Examples of moderate impacts from military activities include two-track roads, maneuvering lanes, areas with intermittent small craters, and small excavations from ordnance removal activities. Examples of moderate impacts from nonmilitary activities include livestock trails, livestock holding and bedding areas, and excavations from small mining operations. Examples of maximum impact areas for military activities would include vehicle staging areas. Examples of maximum impact areas for nonmilitary activities would include excavations from large mining operations. Table 4.5-1 presents soil associations, acceptable soil loss, and estimated annual soil loss from wind and water for three impact scenarios for soils on McGregor Range. Figure 3.5-7 presents a map of the soils listed in the table. Table 4.5-2 shows the acreage of each soil type on withdrawn lands by alternative. Acreages are not shown for Alternatives 5 (No Action) and 6.

4.5.1 Alternative 1

As described in Section 2.1.1, military activities could vary from the same as currently conducted, to an expanded range of capabilities and intensified use. The impacts to earth resources, including geologic resources and soils, resulting from Alternative 1 (current withdrawal boundaries) are discussed in this section.

4.5.1.1 Geology

Under this alternative, lands on McGregor Range that are currently withdrawn from the mining and mineral leasing laws would remain closed to mineral exploration and possible development in accordance with the RMPA (BLM, 1990a). Some public domain lands within McGregor Range on Otero Mesa and north of New Mexico Highway 506 are managed according to a MOU (BLM, 1990b) between the Army and the BLM (Figure 2.1-1). Currently, the McGregor Range is closed for locatable mineral exploration. However, sales of industrial minerals, and oil and gas development is possible on portions of the range in accordance with the RMPA. Under Alternative 1, it is assumed that these developments would continue to be allowed.

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Table 4.5-1. Predicted Soil Loss

Map ID ¹	Soil Unit Name	Acceptable Soil Loss ² (tons/acre/yr)	Impact Scenario ³					
			Undisturbed		Moderate		Maximum	
			Water	Wind	Water	Wind	Water	Wind
13	Forest Service Land-Typic Calciorthids	5	0.62	16.50	0.78	35.07	0.6	103.20
283	Forest Service Land-Typic and Lithic Argiborolls	5	0.04	16.50	0.11	35.07	8.00	103.20
293	Forest Service Land-Lithic Argiustolls	5	0.06	0.60	1.50	27.12	2.10	103.20
294	Forest Service Land-Lithic Argiustolls	5	0.09	16.50	2.20	35.07	6.10	103.20
295	Forest Service Land-Lithic Argiustolls	5	0.33	16.50	8.40	35.07	11.00	103.20
602	Forest Service Land-Lithic Torriorthents	5	0.45	16.50	0.55	35.07	0.70	103.20
603	Forest Service Land-Typic Camborthids	5	2.20	16.50	4.00	35.07	4.60	103.20
604	Forest Service Land-Lithic Torriorthents	5	0.73	16.50	2.47	35.07	3.80	103.20
AMC	Armesa very fine sandy loam, 0 to 5 percent slopes	5	0.11	6.40	0.51	30.02	2.70	103.20
BOA	Bluepoint-Onite-Wink association, nearly level	5	0.06	90.62	0.18	87.90	0.59	141.22
DRF	Deama-Rock Outcrop complex, 20 to 50 percent slopes	1	0.04	0.19	0.45	8.48	5.48	49.85
DTB	Doña Ana-Berino association, gently sloping	5	0.35	21.36	0.71	46.88	1.55	129.39
ECF	Ector-Rock Outcrop complex, 20 to 50 percent slopes	1	0.03	0.00	0.15	0.00	1.03	0.00
ESB	Espy-Shanta Variant association, gently sloping	5	0.06	0.45	0.28	20.34	1.28	77.40
HPB	Holloman-Reeves association, nearly level	5	0.09	8.79	0.30	28.53	1.14	92.88
LOB	Lozier-Rock Outcrop complex, 0 to 5 percent slopes	1	0.06	1.65	0.23	3.51	0.83	10.32
LOD	Lozier-Rock Outcrop complex, 5 to 20 percent slopes	1	0.06	1.75	0.31	3.86	1.82	12.60
MTA	Mimbres-Tome association, nearly level	5	0.10	17.16	0.39	26.25	1.34	79.80
NTD	Nickel-Tencee association, strongly sloping	5	0.14	21.34	0.64	29.68	3.03	80.04
PCB	Pena-Cale-Kerrick association, nearly level	5	0.03	3.09	0.18	18.98	1.84	75.60
PEC	Philder very fine sandy loam, 0 to 9 percent slopes	1	0.17	4.10	0.86	28.87	4.44	103.20
PFB	Philder-Armesa association, undulating	5	0.10	4.86	0.57	28.18	3.55	99.07
PGB	Pintura-Doña Ana complex, 0 to 5 percent slopes	5	0.12	21.73	0.35	54.57	1.10	143.22

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Table 4.5-1. Predicted Soil Loss (Continued)

Map ID ¹	Soil Unit Name	Acceptable Soil Loss ² (tons/acre/yr)	Impact Scenario ³					
			Undisturbed		Moderate		Maximum	
			Water	Wind	Water	Wind	Water	Wind
PHB	Pintura-Tome-Doña Ana complex, 0 to 5 percent slopes	5	0.16	27.33	0.48	57.68	1.50	150.60
RAB	Reakor-Tome-Tencee association, gently sloping	5	0.24	43.80	0.68	51.65	1.92	109.65
RFA	Reyab-Armesa association, gently sloping	5	0.04	2.60	0.30	26.78	2.50	98.04
RRF	Rock Outcrop-Lozier complex, 20 to 65 percent slopes	1	0.11	7.43	0.56	15.78	3.04	46.44
TAC	Tencee very gravelly silt loam, 0 to 10 percent slopes	1	0.05	9.60	0.28	13.59	1.55	57.60
TDB	Tome silt loam, 0 to 5 Percent slopes	5	0.23	25.20	0.76	39.42	2.64	103.20
WKA	Wink	5	0.042	25.20	0.14	47.60	0.52	129.00

¹ Identification code for soils map in Chapter 3.

² Acceptable soil loss - the maximum rate of soil erosion (tons/ac/year) that will permit sustained productivity indefinitely. Given as the t-factor in the soil survey. Acceptable soil losses for Forest Service Land soils were assumed to be 5 tons/ac/year.

³ Undisturbed = no disturbance to vegetation or soil, moderate impact = 50 percent reduction in vegetative cover and 50 percent disturbance of soil surface, and maximum impact = 100 percent removal of vegetation and 100 percent disturbance of the soil surface.

The impacts of limited mineral access on 608,385 acres of the proposed land withdrawal are economic. Economic impacts depend on the size and strategic importance of the mineral resources that are precluded from development. In general, the withdrawal area has a low to moderate potential for oil and gas (Figure 3.5-8), a high potential for geothermal resources at the southern end of the range (Figure 3.5-7), scattered deposits of various industrial minerals (Figures 3.5-5 and 3.5-6), and a moderate to low potential for metallic minerals including gold, silver, copper, lead, zinc, platinum group, iron, niobium, thorium and rare earths, beryllium, tin, and manganese (Figure 3.5-4). It is not possible to quantify these economic impacts with certainty.

4.5.1.2 Soils

Military Activities. Under Alternative 1, military activities would range from continuation of the status quo to a future potential level based on installation capacity. Regardless of the activity level, major sources of impacts to soil resources on McGregor Range would be the off-road vehicle maneuvering of tracked and wheeled vehicles in TA 8, and ground disturbance associated with missile firings. Other sources of impacts to soils would include facility construction and demolition.

Most off-road vehicle movement has been and will be confined to fixed locations. For instance, movement during Roving Sands 1996 was restricted to twenty 0.4 square mile sites and five 30-acre air defense sites. In addition, Roving Sands sites are located less than 0.3 miles from the road to minimize off-road movement. Within these locations, impacts to soils and vegetation varied from light soil disturbance resulting from foot traffic to complete devegetation and soil surface disturbance on a small percentage of Roving Sands sites.

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Table 4.5-2. Acreage of Soil Types on Withdrawn Lands by Alternatives

<i>Soil Unit (map symbol)</i>	<i>Alternative 1</i>	<i>Alternative 2</i>	<i>Alternative 3</i>	<i>Alternative 4</i>
Forest Service Land-Typic and Lithic Argiborolls (283)	7	0	0	0
Forest Service Land-Lithic Argiustolls (293)	240	0	0	0
Forest Service Land-Typic Calciorthids (13)	2,482	0	0	0
Forest Service Land-Lithic Argiustolls (294)	1,039	0	0	0
Forest Service Land-Lithic Argiustolls (295)	809	0	0	0
Forest Service Land-Lithic Torriorthents (602)	1,345	0	0	0
Forest Service Land-Typic Camborhids (603)	2,927	0	0	0
Forest Service Land-Lithic Torriorthents (604)	10,174	0	0	0
Armesa very fine sandy loam (AMC)	13,836	13,836	0	0
Bluepoint-Onite-Wink association (BOA)	1,302	1,302	1,302	0
Deama-rock outcrop complex (DRF)	1,899	0	0	0
Doña Ana-Berino association (DTB)	1,115	1,115	1,115	1,115
Duneland (DU)	7	7	7	7
Ector-Rock outcrop complex (ECF)	26,817	221	103	0
Espy-Shanta Variant association (ESB)	421	0	0	0
Holloman-Reeves association (HPB)	951	951	951	0
Lozier-Rock outcrop complex (0-5 %) (LOB)	4,231	4,207	2,625	2,625
Lozier-Rock outcrop complex (5-20 %) (LOD)	96,858	96,620	70,860	62,542
Mimbres-Tome association (MTA)	106,233	106,233	106,233	89,447
Nickel-Tencee association (NTD)	66,978	64,526	56,958	44,722
Pena-Cale-Kerrick association (PCB)	804	0	0	0
Philder very fine sandy loam (PEC)	51,122	51,122	2,766	2,766
Philder-Armesa association (PFB)	25,595	22,791	0	0
Pintura-Tome-Doña Ana complex (PHB)	34,843	34,843	34,843	26,182
Pintura-Doña Ana complex (PGB)	75,324	74,841	74,841	55,680
Reakor-Tome-Tencee association (RAB)	1,368	1,350	0	0
Reyab-Armesa association (RFA)	19,708	19,708	334	334
Rock outcrop-Lozier complex (RRF)	91,541	65,743	60,399	59,720
Tencee very gravelly silt loam (TAC)	2,845	2,845	2,845	2,845
Tome silt loam (TDB)	37,603	37,598	31,667	31,667
Wink association (WKA)	12	12	12	12

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These types of disturbances can accelerate soil erosion by wind and water because they reduce vegetative cover, compact soils, and disrupt protective soil covers such as plant litter and gravel layers. Tracked vehicle maneuvering has been found to disrupt soil crusts and bisect coppice dunes on soils on the Doña Ana Range–North Training Areas at Fort Bliss (Marston, 1984). Such impacts can also supply loose sand that increases the potential for transport of soil by wind.

Wheeled vehicles (High Mobility Multi-purpose Wheeled Vehicles [HMMWVs], heavy trucks) may also cause major impacts to soils. In addition, training sites and roads over soils with a high potential for soil loss from natural, military, or nonmilitary activities may be affected by frequent and concentrated traffic during FTXs. Studies have recently been commissioned by Fort Bliss to determine wheeled vehicle impacts on plants and soil on the Fort Bliss Training Complex. Results of these studies showed that wheeled vehicles increased soil bulk densities, decreased seed germination of native plants and decreased above-ground plant productivity (MacKay et al.,1996; USDA, 1995, 1996).

Range fires ignited by military activities can also impact soils. Range fires can be ignited during military training exercises from hot missile debris, tracer ammunition, flares, and spotting charges used to mark the location of inert ordnance. Range fires reduce vegetative cover, thus making soils more vulnerable to wind and water erosion.

The construction and demolition of military facilities can impact soil resources. The greatest impacts to soils by construction activities would occur during construction of new structures in previously undisturbed areas. These impacts would result from disturbance to vegetation and soil caused by excavation and soil compaction by heavy equipment at the construction site and on access roads. Impacts could also occur from dust and rainwater runoff. Rainwater runoff could cause gullying, mud slides, and flooding. Activities such as clean up, construction, and demolition would require project-specific environmental analyses and mitigations.

Cleanup activities can also impact soils. Cleanup activities such as ordnance and explosive hazards, hazardous waste, and toxic waste removal could lead to moderate and maximum impacts to soil resources depending on the size of the area and the soil unit (Table 4.5-2).

Construction on previously disturbed sites would cause few additional impacts to the soil, unless dust is not controlled or runoff from the disturbance causes erosion on adjacent undisturbed soils. Significant adverse impacts could occur if facility construction occurs in sensitive areas having soils with a high potential for wind and water erosion (Table 4.5-2).

Impacts to soils from building demolition are similar to those described for building construction with the exception that most soils on demolition sites have been previously disturbed. Impacts include excavation, compaction by heavy equipment, erosion caused by rainwater runoff, and dust from exposed soils. Soils at most construction and demolition sites would receive maximum impact (no vegetation, 100 percent disturbance of soil surface) during and after demolition activities. Therefore, without erosion control treatments, soil loss from wind and water could be adverse or significantly adverse depending upon the location of the disturbance with respect to sensitive areas (i.e., areas having sensitive species, stream courses, cultural resources or facilities) and the soil unit (Table 4.5-2).

The proposed 5,120-acre USAF tactical target complex on Otero Mesa would encompass a large undisturbed area and has the potential for impacting soil resources. Soil erodibility at this location ranges from low to high. Soils at the target sites would be impacted either by construction of the targets, or grooming of targets by blading and dragging the soil surface. Operations and maintenance at the Otero Mesa site could cause range fires, especially from the use of tracer ammunition and spotting charges. Fires would consume vegetation and plant litter, and expose the soil surface to erosion. Several roads

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used to access the sites would need to be upgraded. This action could cause soil erosion unless careful engineering is conducted to protect the roads and surrounding environment from flowing water. Soils exposed during ordnance and explosive hazards removal, construction, and grooming would be vulnerable to erosion by water and wind, and would be similar to that for the maximum impact in Table 4.5-1.

Military activities could lead to adverse or significantly adverse environmental impacts depending on the location of the activity with respect to sensitive areas (i.e., sensitive species, stream courses, cultural resource areas, or facilities), and the soil unit (Table 4.5-2) where the activity is taking place. The potential for significantly adverse impacts is greatest on those soils identified as having the greatest potential for soil erosion in the maximum soil impact scenario (Table 4.5-1).

4.5.2 Alternative 2

4.5.2.1 Geology

Under this alternative, all but 40,000 acres of currently withdrawn land at the northeast end of McGregor Range would be re-withdrawn for use by the Army. Except for Otero Mesa and selected areas north and south of New Mexico Highway 506 that are managed according to the MOU (BLM, 1990b) between the Army and BLM, the withdrawn area would be closed to locatable mineral exploration (Figure 2.2-1). Possible development of leasable and salable minerals would continue as described in the RMPA.

4.5.2.2 Soils

Under Alternative 2, the Tularosa Basin and Otero Mesa portions of McGregor Range would be withdrawn for continued military use and the Sacramento Mountains foothills portion of McGregor Range would be returned to the public domain. Military activities for Alternative 2 would be the same as those described in Alternative 1 except that military exercises currently conducted or planned for the Sacramento Mountains foothills would be reduced with the exception of activities on Army fee-owned lands. Therefore, activities on fee-owned lands would have the same impacts to soils as described for Alternative 1. The reduction of military activities could be beneficial to the soil resource because of decreased soil erosion from dismounted training.

Lands released to the public may require ordnance and explosive hazards cleanup by the military, although compared to other portions of the range (Tularosa Basin), the quantity of ordnance and explosive cleanup in the Sacramento Mountains foothills is small. These activities have the potential to impact soils in localized areas. Ordnance and explosive hazards removal activities that involve excavation of the soil could cause moderate to maximum impacts depending on the size of the area and the soil unit (Table 4.5-1).

4.5.3 Alternative 3

4.5.3.1 Geology

Under this alternative, about 70 percent (428,385 acres) of the existing McGregor Range withdrawal would be re-withdrawn for use by the Army. These lands would continue to be closed to locatable mineral exploration and possible development. Lands associated with the 1990 MOU with the BLM would be open to leasable and salable mineral exploration and development only if the Army agrees to allow these activities to occur.

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4.5.3.2 Soils

Under Alternative 3, the Tularosa Basin portion of McGregor Range would be withdrawn for continued military use and the Sacramento Mountains foothills and Otero Mesa portions of McGregor Range would be returned to the public domain. With the loss of Otero Mesa and the Sacramento Mountains foothills, McGregor Range could only support some of the current military activities. Other military activities would be reduced. Military activities on Army fee-owned lands would be the same as described for Alternative 1. The reduction of military activities could be beneficial to soil resources because of decreased soil erosion from ground troop maneuvers, and construction and maintenance of the tactical target complex on Otero Mesa.

Lands released to the public under Alternative 3 may require ordnance and explosive hazards cleanup by the military. Ordnance and explosive hazards removal activities that involve excavation of the soil could cause moderate to maximum impacts depending on the size of the area and the soil unit (Table 4.5.-1). The increased land area requiring cleanup under this alternative could potentially lead to adverse or significantly adverse impacts depending upon the area, with respect to sensitive areas and the soil units.

4.5.4 Alternative 4

4.5.4.1 Geology

Under this alternative, about 60 percent (364,385 acres) of the existing McGregor Range withdrawal would be re-withdrawn for use by the Army. These lands would continue to be closed to locatable mineral exploration and possible development. Lands associated with the MOU (BLM, 1990b) with the BLM would be open to leasable and salable mineral exploration and development only if the Army agrees to allow these activities to occur.

4.5.4.2 Soils

Under Alternative 4, all portions of McGregor Range north of New Mexico Highway 506 and on Otero Mesa would be released to the public, except for Army fee-owned lands. This reduction in withdrawn land would severely limit military exercises, so that many activities would be discontinued. Released lands would be free from future impacts to soils from military activities, and impacts to soils from military uses on withdrawn lands and fee-owned lands would be reduced.

Lands released to the public under Alternative 4 may require ordnance and explosive hazards cleanup by the military. Ordnance and explosive hazards removal activities that involve excavation of the soil could cause moderate to maximum impacts depending on the size of the area and the soil unit (Table 4.5-1). The increased land area requiring cleanup under this alternative could potentially lead to adverse or significantly adverse impacts depending upon the area, with respect to sensitive areas and the soil units.

4.5.5 Alternative 5 – No Action

4.5.5.1 Geology

Under this alternative (No Action), all public-domain lands within the current withdrawal for military use could revert back to BLM management and control. Depending on the extent and danger posed by prior Army activities, the BLM could open these lands to the mining and mineral-leasing laws.

4.5.5.2 Soils

Under Alternative 5, the withdrawal of McGregor Range would not be renewed and the land would be returned to the public domain. Therefore, there would be no further use of McGregor Range for military activities. Consequently, except for ordnance and explosive hazards cleanup activities, there would be no continuing impacts to the soil resource from military activities.

Ordnance and explosives cleanup has the potential to cause moderate to maximum impacts to soils depending on the size of the area disturbed and the soil unit (Table 4.5-1). Under this alternative, the Tularosa Basin would be released to the public domain and, therefore, may require cleanup. Compared to other portions of McGregor Range, the Tularosa Basin would require more cleanup, which translates to more soil disturbance and greater soil loss from wind and water. If cleanup of Tularosa Basin occurred at the same intensity as that proposed for the tactical target complex, impacts to soils in cleanup areas could be significantly adverse.

Beneficial effects on soil resources, from suspending all military activities, would include reduced erosion from ground troop maneuvering, missile cratering, and off-road vehicle maneuvering (TA 8 only) by wheeled and tracked vehicles. In addition, disturbance of soils from future construction and demolition of military structures would cease.

4.5.6 Alternative 6

Alternative 6 addresses consideration of possible congressional action, if Alternatives 3, 4, or 5 were to be implemented, to designate Otero Mesa, the Sacramento Mountains foothills, and Army fee lands as a NCA. Designation of these lands as an NCA could enhance the protection and restoration of natural resources if appropriate funding levels were made available, and may also encourage public use of these lands. Since it is assumed that NCA lands would remain under a management structure similar to the current RMPA, impacts to geology and soils on these lands is likely to be similar to impacts described for released lands in Alternatives 3, 4, and 5. The precise nature and extent of the congressional action cannot be determined until the proposal is specified for this type of nonmilitary withdrawal by the DOI.

4.5.7 Cumulative Impacts

4.5.7.1 Geology

Many parts of south-central New Mexico are controlled by various branches of the DoD for military training and for research and development. These areas are generally off limits to mineral exploration. Impacts to the availability of energy and mineral resources as a result of these withdrawals are not quantifiable with certainty. In general, however, as the acreage of restricted land increases, so does the adverse impact to the availability of energy and mineral resources.

The cumulative impacts vary only by the amount of land withdrawn for McGregor Range under all alternatives. The cumulative impacts include past, present, and reasonably foreseeable actions by the Army, other federal agencies, and public and private organizations that limit access to land for the purpose of mineral and energy resource exploration and development.

The impacts of limited access for mineral and energy resource development on withdrawn land are primarily economic as the level of the potential for development have little effect on regional geological resources. Economic impacts depend on the size and strategic importance of the mineral resources that are precluded from development. In general, the withdrawal area has a low to moderate potential for oil and gas (Figure 3.5-8), a high potential for geothermal resources at the southern end of McGregor Range

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(Figure 3.5-7), scattered deposits of various industrial minerals (Figures 3.5-5 and 3.5-6), and a moderate to low potential for metallic minerals including gold, silver, copper, lead, zinc, platinum group, iron, niobium, thorium and rare earths, beryllium, tin, and manganese (Figure 3.5-4). It is not possible to quantify these economic impacts with certainty.

4.5.7.2 Soils

Cumulative effects to soils under each alternative from military use and nonmilitary sources on military lands for these alternative are discussed in this section. Military effects are described in the previous discussion. Nonmilitary activities include those activities described in the White Sands RMP (BLM, 1986a) as amended by the McGregor Range RMPA (BLM, 1990a).

Over one-third of McGregor Range is currently grazed by livestock. Grazing occurs on the grasslands of Otero Mesa, the shrublands north of New Mexico Highway 506, and in the shrubland and pinyon pine/juniper communities of the Sacramento Mountains foothills. The BLM and USFS are responsible for the management of livestock in their respective jurisdictions on McGregor Range.

Grazing animals impact soils indirectly by decreasing plant cover through grazing and trampling of plants (Stoddart et al., 1975) and directly by disrupting soil structure and compacting the soil through hoof action (Orodho et al., 1990; Weigel et al., 1990). Reduced soil structure and compaction leads to decreased pore space in soil, which in turn leads to decreased infiltration and increased water runoff. Unchecked water runoff causes soil erosion. Gamougoun et al., (1984) and Wertz et al., (1989) studied effects of cattle trampling on water erosion at the Fort Stanton Experimental Ranch in south-central New Mexico near Fort Bliss, and found that sediment production was greatest under heavy grazing.

Impacts from large grazing animals vary with the distribution of animals across the various pastures on McGregor Range. Grazing impacts are greatest in areas where animals congregate, such as in holding and bedding areas, and around stock tanks, troughs, and mineral licks. Areas around stock tanks and troughs often have much bare ground, little vegetation, and numerous trails (USAF, 1997g), although these areas are typically small and have vegetation within 100 feet of the trough. The soil within an area of 10 acres around a water facility is compacted by cattle trampling. Cattle trampling contributes to soil compaction on about 800 acres on McGregor Range (BLM, 1980). Although no observations of impacts to wetlands on McGregor Range have been made, the heavy use of cattle around stock tanks is an indication of the types of impacts that could occur to soils in the immediate vicinity of wetlands. Impacts can also be severe on livestock trails. In extreme cases, livestock trails on slopes can cut into the slope causing terraces. For the above impacts, the soil surface is generally denuded of vegetation, and surface soils are disturbed and compacted through hoof action. Soils at these sites could receive moderate to maximum cumulative impact from natural factors, military actions, and grazing, depending upon the soils within the individual BLM natural unit. Therefore, without remediation, soil loss from wind and water could be adverse or significantly adverse depending on the location of the disturbance with respect to sensitive areas and the soil unit (Table 4.5-1).

However, cattle trailing and consequent deterioration of McGregor Range were not observed. In contrast to localized disturbances, which are caused by intensive livestock use around water facilities, most impact to soils from livestock on McGregor Range is relatively minor and distributed evenly across the landscape. These impacts are typically manifested by reductions in vegetative cover, disruption of protective soil crusts, and minor soil compaction. Compared to disturbances caused by military exercises and facility construction and demolition, impacts by livestock, although often more wide spread, are less severe because the protective vegetation is generally left intact. However, impacts by livestock grazing added to the soil loss from military activities could lead to cumulative impacts on the soil resource on parts of McGregor Range.

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Range fires originating on neighboring lands could potentially migrate onto McGregor Range and destroy vegetative cover, which, in turn, could impact soils. Mining activities on neighboring lands could also initiate soil loss that could accelerate soil erosion on parts of McGregor Range.

Other nonmilitary activities contributing to cumulative impacts would be similar to current activities which include recreation (hunting, hiking, camping), construction of wildlife drinkers, construction of interpretive trails and signs, fence construction, and cultural resource activities.

Recreational activities such as hunting, hiking, and camping cause relatively few impacts to soils on McGregor Range, particularly because off-road driving is prohibited. Activities such as the construction of livestock and wildlife drinkers (and associated pipelines), fence construction and maintenance, and construction of interpretive trails and signs can cause localized soil impacts if they are not remediated. All of these activities have occurred in the past on McGregor Range and could potentially occur in the future.

Cultural resource activities that could impact soils on McGregor Range include surveying and evaluating potential cultural sites, and archeological diggings. Archeological diggings can be destructive to the soil resource when they are conducted in previously undisturbed areas. However, they are typically very localized and small in area and are not expected to cause severe adverse impacts on soils if they are mitigated.

4.5.8 Mitigation

There may be impacts that require mitigation measures. Adverse effects to soils from military activities would be analyzed in project-specific NEPA documents.

4.5.9 Irreversible and Irretrievable Commitment of Resources

Under each of the action alternatives, the Army could develop and use geothermal resources at the southern end of McGregor Range. Development of this resource is irretrievable, even though depletion of the resource in the foreseeable future is unlikely.

Construction associated with Army activities on McGregor Range, under the action alternatives, would consume sand, gravel, and other industrial minerals; and range operations would consume oil, gas, and other natural resources. Consumption and use of these resources are irreversible and irretrievable.

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The impact of military activities has exposed soils in TA 8 to increased gully erosion and irretrievable loss of soil by wind. These impacts would likely continue regardless of which withdrawal configuration alternative is selected. By following installation management practices and avoiding highly erodible soils, these impacts can be minimized.