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Memo to: Gary Bratcher, VCT Executive Director,
Dennis Trujillo, VCT General Manager

Subject: Range Readiness Analysis for VCT livestock program for summer, 2009

I. Introduction:

The purpose of this range assessment is to determine the potential ecological outcome of the proposed Valles Caldera Trust (VCT) 2009 livestock grazing program on the Valles Caldera National Preserve (VCNP). This report is based on analyses of field data collected in May 2009 by VCT science staff, USDA ARS Jornada Experimental Range scientists, volunteer citizens from the Sierra Club, and University of New Mexico climatology scientist Douglas Moore, and provides an evaluation of the condition of the pastures, including amounts of available forage, potential for continued forage growth in terms of soil moisture, and water availability in streams and stock tanks. In addition, a report on projected climate conditions for the summer of 2009 is provided for the purpose of anticipating possible temperature levels and precipitation amounts in regard to sustained production of forage for livestock and wildlife.

II. Sampling Design and Methods:

Forage availability data were derived from vegetation clip plots at 40 sites across the VCNP. These sites are part of the long-term monitoring network for forage productivity and utilization by livestock and elk, and are associated with permanent monitoring sites for plant species composition and cover. Sites are stratified by grassland type: Grazeable woodland (GW) sites are found in the sub-canopy areas of forests surrounding the VCNP valles, generally dominated by Ponderosa pines; mountain valley sites are upland slopes of the valles, dominated by Parry oatgrass and fescues; mountain meadow sites are typically in the low areas of the valles on relatively moist soils, and commonly support Kentucky bluegrass and a wide variety of other grasses and forbs; and riparian sites, found along streams in the valles, and dominated by several species of sedges. At each site, four replicated ¼ square-meter rings are clipped of all vegetation to a height of approximately 1 cm. The clipped vegetation is collected in paper bags, dried in ovens at 60º C for at least 48 hours, and weighed to the nearest gram. Estimates are then calculated for standing crop biomass in kilograms/hectare, and converted to pounds per acre units for report presentation. These estimates are then scaled up to the entire VCNP, and a

calculation is made for the number of livestock that could be supported with the available forage, allowing for retention of forage for other herbivores (e.g., elk, rodents, grasshoppers, aphids, etc.) and sustaining ecosystem function (e.g., prevention of soil erosion, carbon sequestration, promotion of nutrient cycles, maintaining the health of forage plants, etc.). The 2009 results are also compared to those of previous years. In addition, grass stubble height transects (30 paces each) were measured at each of the forage clip plot sites. At each pace location, the dominant grass species were measured (cm) for average live height of leaf blades. Each plant was inspected to determine if it had been grazed or not grazed at the time of measurement.

Meteorological data were analyzed for precipitation and soil moisture. Data from the current year were compared to conditions in previous years.

Meteorological forecast data for the summer period of 2009, including both precipitation and temperatures in northern New Mexico, were obtained from the NOAA-supported center for Climate Assessment for the Southwest (CLIMAS) web site: (http://www.ispe.arizona.edu/climas/forecasts/swoutlook.html).

To ascertain overall runoff conditions in Jemez Mountain streams, stream flow data for the Jemez River watershed (based on the USGS stream gauge near Cañon in the Jemez Valley) were obtained from the USGS web site (http://waterdata.usgs.gov/nm/nwis/current/?type=flow).

In 2006, we determined the water holding capacity of upland stock tanks for livestock from an inventory of stock tanks and their water-holding condition conducted by Mr. Leonard Atencio (former VCT Board Member and former US Forest Service Supervisor, Santa Fe National Forest). Stock tanks in upland locations surrounding the valles were visited and photographed, and water levels in the tanks following snowmelt were noted. In May 2009, several of the major stock tanks were visited to determine their water level status.

III. Results:

A. Forage Availability. The results of the forage assessments indicated that spring standing crop biomass is high, and is even higher than the record amount observed in 2007. The results of the May, 2009, sampling are as follows:

Pasture habitat type	Standing Crop Biomass (pounds/acre)			
	2006	2007	2008	2009
Grazeable Woodland	547	1,088	698	1,042
Mountain Meadow	894	1,892	1,364	2,329
Mountain Valley	1,010	1,332	833	1,768
Riparian	988	1,840	1,300	2,274

In addition to having substantial forage available this year, as in 2007, the forage quality is considerably better due to the May precipitation. Average precipitation and soil conditions have allowed plants to add substantial growth already this season. Previous nutritional analyses of plants during this stage of growth have shown very good protein, energy and nutrient levels. While some of the forage materials are certainly the cured, nutritionally poor leaves and grass

blades from the summer of 2008, much of the material is new spring growth. The following list shows the average leaf blade heights (new growth only) of the dominant grass species in late May, 2009, measured on stubble height transects at the same time forage clip plots were taken.

Species Name	*n*	Average Height (Ungrazed, cm)	*n*	Average Height (Grazed, cm)
Arizona fescue	269	18.17	42	11.36
Bluegrass	732	12.21	232	7.60
Idaho fescue	121	14.62	24	13.10
Mountain muhly	94	9.28	0	None found
Parry's oatgrass	270	12.96	66	7.96
Pine dropseed	72	5.47	2	2.00
Prairie junegrass	229	9.25	13	5.35
Sedge	549	10.92	96	6.22
Thurber fescue	22	43.89	5	23.40
Timothy grass	127	13.68	19	7.92
Tufted hairgrass	114	9.43	15	5.13
Western wheatgrass	11	10.00	0	None found

In the above list for 2009, note that many of the grass species had been grazed by elk or other herbivores; however, for those species that showed some grazing, the number of plants that had been grazed was small relative to the number found. For those individual plants that were grazed, the amount of height reduction from the grazing appeared to be in the target range of 40% (38% for bluegrass, 38% for Arizona fescue, 43% for sedges, and 39% for Parry's oatgrass).

The data from spring 2008 are given below. Note that spring grazing in 2009 is somewhat higher than in 2008 in terms of the proportion of sampled plants grazed, and in the level of utilization.

Species Name	*n*	Average Height (Ungrazed, cm)	*n*	Average Height (Grazed, cm)
Arizona fescue	230	15.39	0	None found
Bluegrass	575	10.95	49	7.86
Idaho fescue	112	12.83	0	None found
Mountain muhly	31	9.23	0	None found
Parry's oatgrass	215	11.44	6	8.50
Pine dropseed	5	6.50	0	None found
Prairie junegrass	118	8.23	0	None found
Sedge	439	11.45	26	7.92
Thurber fescue	26	31.92	0	None found
Timothy grass	2	14.00	0	None found
Tufted hairgrass	14	17.64	0	None found

B. Climate. Precipitation conditions in northern New Mexico during the winter of 2009 have been variable. Precipitation as snowfall was higher than average in December, 2008, but below average from January through April, 2009 (Fig. 1). May produced somewhat above-average rainfall, leading to an overall average winter-spring precipitation total. Data from the VCNP Headquarters meteorological station show that total precipitation during the "water year" (that starts in October and runs through the following September) of 2008-2009 is now (early June) right on average; the other 4 weather stations across the VCNP show similar patterns.

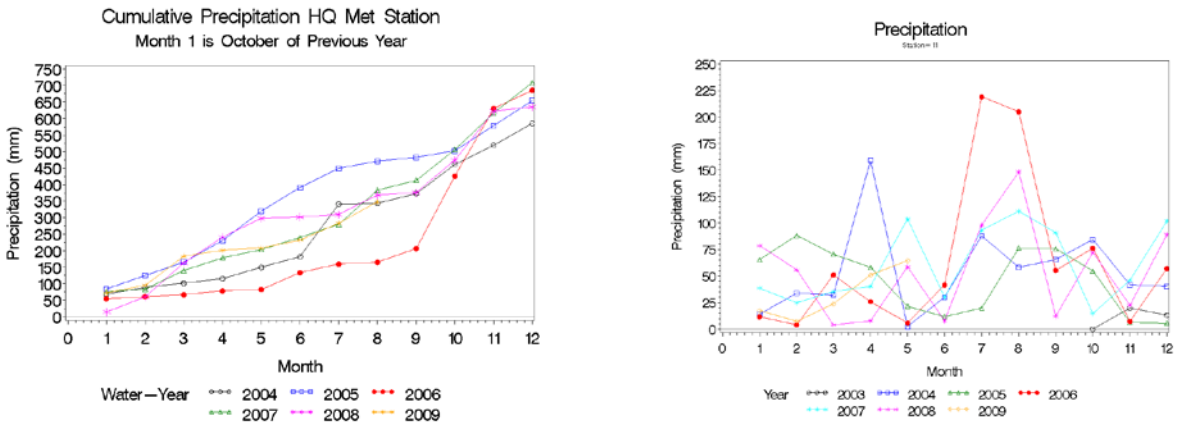

Figure 1. Left: Cumulative precipitation at the VCNP HQ station in Valle Grande. Monthly data are for annual "water year" running from October through September. Right: Monthly precipitation at the HQ station, showing January – December patterns. Note that cumulative precipitation in 2009 is near average.

C. Soil Moisture. Soil moisture conditions (Fig. 2) as of early June were also excellent for supporting continued plant growth into the early summer. Soil moisture at the HQ station has benefited from the above-average wet month of May.

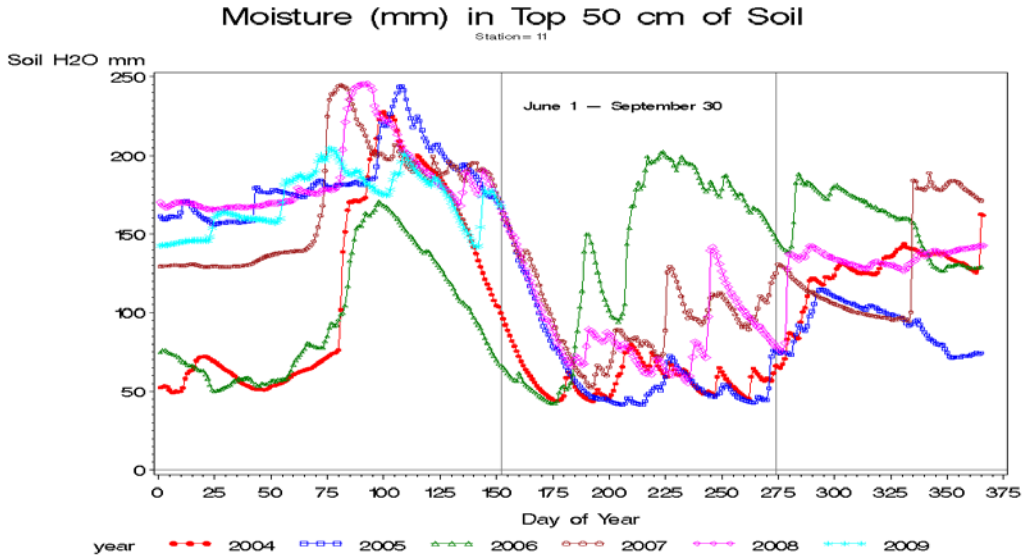

Figure 2. Soil moisture at HQ station, top 50 cm. Dates based on Julian Days (Jan. 1 = Day 1, Dec. 31 = Day 365. The livestock grazing season is shown as June 1 – Sept. 30). Note that soil moisture is essentially equal to values observed in previous wet years.

D. Climate forecast for summer, 2009. Projected long-term forecasts of temperature by the NOAA CLIMAS Center for northern New Mexico indicate a statistically higher probability of somewhat higher than average temperatures (Fig. 3 below). These estimated projections were generated in May, 2009. This may lead to realized higher evapo-transpiration rates, and potentially drier soils if the monsoon rains do not materialize. Fortunately, the forecast for precipitation is for normal summer moisture amounts in northern New Mexico (Fig. 4). However, given that monsoons periodically fail, continued monitoring of precipitation and forage condition will be undertaken throughout the summer.

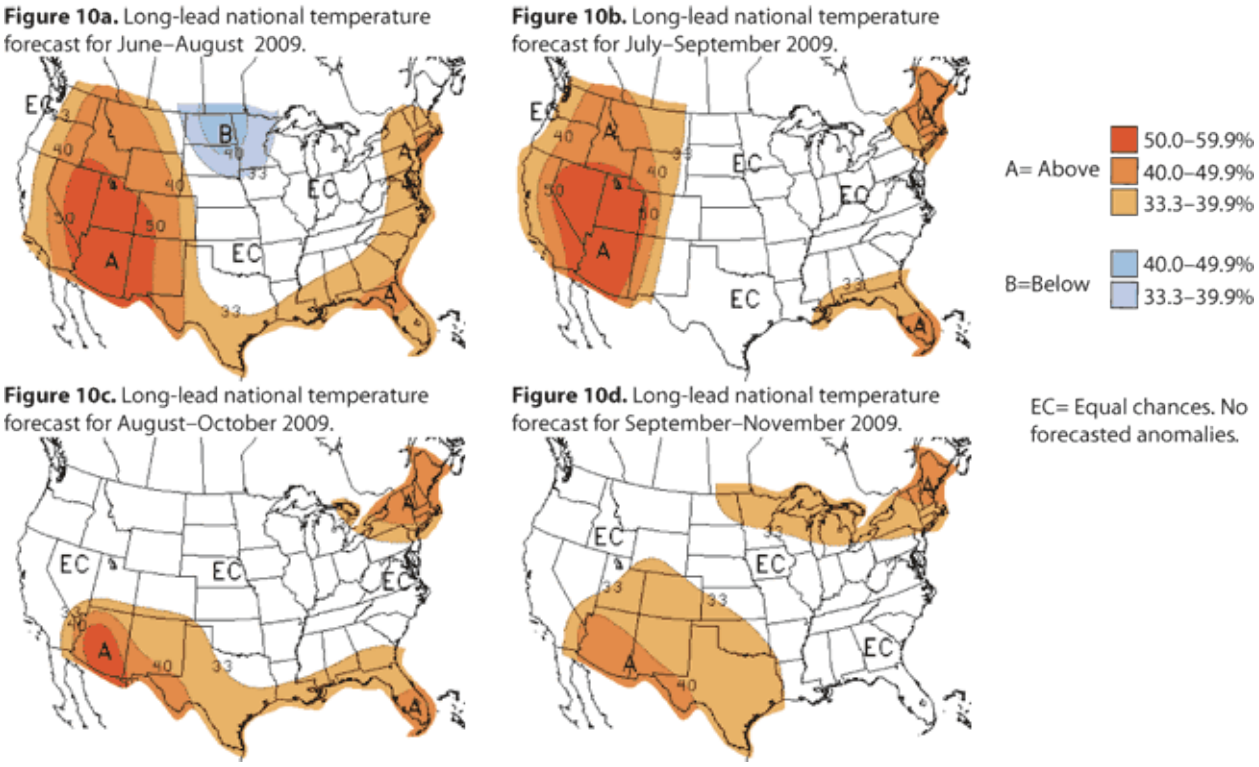

Figure 3. Temperature forecasts for summer-fall, 2009. These outlooks predict the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps are % probabilities and do not refer to degrees.

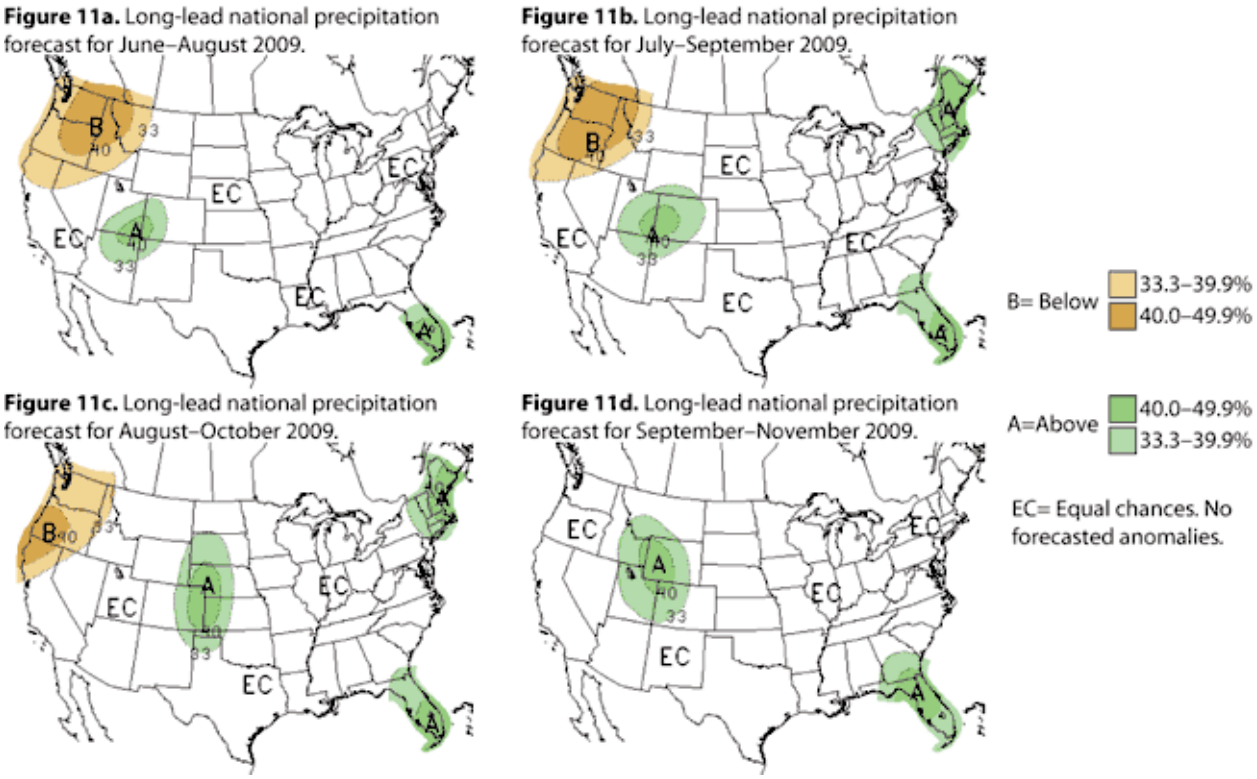

Figure 4. Precipitation forecasts for summer, 2009. These outlooks predict the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps do not refer to inches of precipitation.

Drought conditions have lessened in northern New Mexico, and appear to be at normal levels.

Figure 12. Seasonal drought outlook through August 2009 (released May 21, 2009).

Figure 5. Drought outlook through August, 2009, in the United States as of May, 2009.

E. Stream flow and runoff. Data from the USGS stream gauge on the Jemez River show lower stream flows in early June 2009 than at the same time last year. Discharge was ~70 cubic feet per second (cfs) on June 7, 2008, whereas on June 7, 2009, discharge was ~40 cfs. This 2009 low flow rate resulted from the early melting of the snowpack during the late winter of 2009, and even the spring rains in May provided only a temporary increase in stream flow. The low discharge rate may indicate lower stream flows in VCNP into the summer until the monsoon rains arrive.

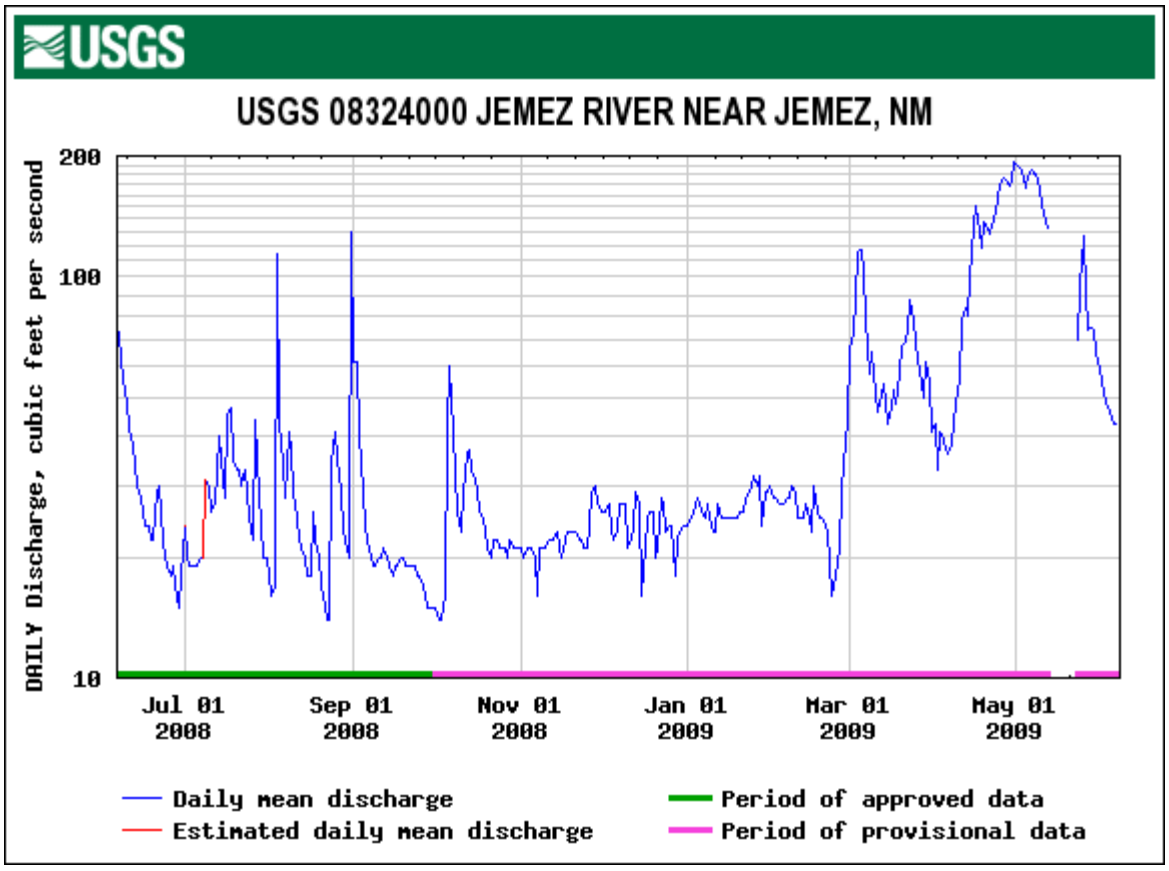

Figure 6. Discharge (cubic feet per second, or cfs) of the Jemez River (USGS stream gauge near Cañon, NM).

F. Stock tank water-holding conditions. In May, 2009, the major stock tanks in the Valle Grande, Valle de Los Posos, and the Valle Seco, were nearly full to capacity, though water was not flowing through the spillways. Upland water tanks that were visible from back-country roads also appeared to be nearly full. While many of the VCNP stock tanks are in need of repair and maintenance, and some are not functional, the remaining tanks appear to have sufficient water levels to support livestock and elk through the pre-monsoon periods.

IV. Livestock Stocking Level.

Based on forage data collected from 2002 – 2008, forage utilization and elk/livestock abundance has been estimated for five levels of precipitation and forage production (Fig. 7), ranging from historic high levels to low levels. Average capacity for the VCNP is 541 Animal Units for 4 months of grazing, in addition to an elk herd estimated by the NM Department of Game and Fish of 3,000 animals. The forage allocation calculations are based on total utilization by elk and livestock of 40% of available forage production, with 60% of the forage remaining behind for ecosystem services (soil erosion prevention, carbon sequestration, and health of forage plants).

VCNP forage production estimates (fall standing crop biomass, lbs/acre dry weight)

		Reflects forage available for allocation to elk and cattle (40% of total on suitable areas)				
Pasture Name	Sum of ACRES	Sum of HIGHMODEL	Sum of MIDHIMODEL	Sum of AVGMODEL	Sum of MIDLOMODEL	Sum of LOWMODEL
Field Trap	329.5	291,957	239,136	186,230	141,172	96,159
Jaramillo Trap	805.1	459,886	379,367	298,731	227,973	157,294
Lake Trap	653.9	592,190	485,525	378,735	290,024	201,402
Lower San Antonio Trap	1,895.7	1,029,266	850,652	671,818	513,992	356,373
Middle San Antonio Trap	838.9	649,416	535,105	420,637	321,731	222,929
Mohawk Trap	749.3	327,898	269,747	211,516	161,593	111,721
Redondo	25,982.5	1,395,627	1,144,534	893,236	678,424	463,921
Rincon	3,835.0	911,027	748,285	585,327	443,884	302,617
Round Mountain	555.9	464,815	382,190	299,483	230,247	161,087
San Antonio Bench	11,237.2	1,045,614	861,092	676,381	512,152	348,181
Seco-Santa Rosa-San Luis	14,632.3	2,174,694	1,799,839	1,424,556	1,085,955	747,860
Shipping Trap	1,232.0	1,004,446	835,101	665,612	514,445	363,501
Toledo-Obsidian Valley-Posos-Slot	15,619.3	2,904,053	2,415,809	1,926,998	1,476,697	1,027,079
Upper San Antonio Trap	2,316.3	1,269,223	1,048,402	827,277	634,882	442,683
Valle Grande	5,892.1	3,416,862	2,809,101	2,200,594	1,683,006	1,165,989
Grand Total (lbs dry forage, fall)	86,575.0	17,936,972	14,803,884	11,667,132	8,916,180	6,168,793
Elk allocation (3,000 elk * 6 months @ 540 lbs/month):		9,720,000	9,720,000	9,720,000	9,720,000	9,720,000
Remaining for allocation to DL		8,216,972	5,083,884	1,947,132	-803,820	-3,551,207
Stocking levels Animal Units (1 AU = 900 lb/month) for 4 months		2,282	1,412	541	-223	-986
Stocking levels for Steer (630#/month/head for 4 months)		3,261	2,017	773	-319	-1,409

Figure 7. Results of forage allocation calculations for VCNP.

The analyses of forage availability, precipitation, soil moisture, stream flow, and stock tank water content for spring, 2009, indicate that spring forage amounts and soil moisture levels are above average, while cumulative precipitation and stream flow are average and below average, respectively. Grazing by resident elk during the spring of 2009 is higher than in previous years, but still within the ~40% utilization level targeted by the VCT managers. Stock tank water capacities are good, but not at capacity. The climate forecast for summer in northern New Mexico calls for above-average temperatures, with average monsoonal precipitation.

Therefore, based on these measurements, the potential stocking rate for livestock on the VCNP should be near average or slightly above average levels. This would indicate that the VCNP could support at least the 541 Animal Units sustainable in an average year. Depending on which

pastures are used, stocking levels could be somewhat higher, although continued monitoring of forage resources will be necessary, especially if the monsoons fail to materialize by early July. Higher than average predicted temperatures could accelerate drying of soils and reduce plant growth, especially if summer rains are late or produce below average precipitation amounts. But as of early June, 2009, range conditions are suitable for sustaining the 541 Animal Units of an average year on the VCNP.