

To: Steven Kerns
Wildlands Resource Managers
P.O. Box 102
Round Mountain, CA 96084

June 18, 2001

From: Jim Paulus
Consulting Botanist, EMA Associates
PO Box 244
Bishop, CA 93515

RE: Plant communities found at the Basalt Canyon Geothermal Exploration Survey Area

Dear Mr. Kerns,

I am writing to inform you of results of botanical survey work I have recently completed within the approximately 800 acre Basalt Canyon geothermal exploration area of the proposed Mammoth Pacific Geothermal Project. The botanical survey was performed to determine the presence or absence of sensitive plant species. All of the land surveyed is located west of Highway 395 north of the Highway 203 exit, near the Town of Mammoth Lakes, Mono County, California and is administered by the Inyo National Forest.

Great Basin Mixed Scrub and Jeffrey Pine Forest plant communities were found on currently undeveloped, rolling hills and steep slopes, crossed by many dirt roads and bicycle trails. "Murphy Gulch", an ephemeral stream channel, parallels Highway 203 near the southern edge of the survey area (Figure 1). No other hydrologic features (streams, seeps, wet meadows) were encountered. My survey strategy was floristic, striving to identify every species occurring along the transects. I have attached a list of the species found.

Typical dominants of the Great Basin Mixed Scrub were found at high frequencies at lower elevations, especially big sagebrush (*Artemisia tridentata*), antelope bush (*Purshia tridentata*), while tobacco brush (*Ceanothus velutinus*) and manzanita (*Arctostaphylos nevadensis* and *A. patula*) were restricted to patches on the steep slopes of the ridge west of Highway 395. Dominance by *A. tridentata* was usually 60-80%, and scrub height averaged 1 m. Perennial grasses (*Achnatherum hymenoides*, *A. occidentale*, *A. nevadensis*, and *Leymus cinereus*) make up a significant percentage of the Mixed Scrub cover. Riparian vegetation was not found where Murphy Gulch (a conduit for runoff from impervious surfaces in Mammoth Lakes, upstream) bisected rolling hills dominated by Great Basin Mixed Scrub. However, a few patches of pine, and thick but small stands of shrubs such as bitter cherry (*Prunus emarginata*), were present to provide cover for animals. Deer sign was relatively profuse along the length of the Gulch.

Forest canopy cover is nearly monospecific Jeffrey pine (*Pinus jeffreyi*) at lower elevations. On steeper slopes near the ridge line west of Highway 395, white fir (*Abies concolor*), pinyon pine (*Pinus monophylla*), and juniper (*Juniperus occidentalis*) are mixed into the Forest canopy. Forest floor cover consisting of sometimes dense perennial grasses (mostly *Poa*

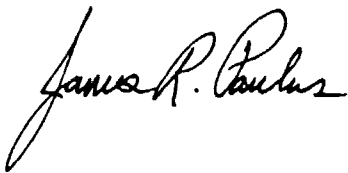
wheeleri) and snowberry (*Symphoricarpos rotundifolia*) was found to be widespread. Habitat quality for deer in otherwise dense Forest near the eastern edge of the survey area is probably further enhanced by the high frequency of small, shrubby forest gaps.

Larger openings in the Forest canopy occur on the steeper slopes of higher elevations in the study area. Great Basin Mixed Scrub of higher diversity, ranging from nearly impassable inclusions of Tobacco Brush Chaparral to more open, herb-dominated inclusions of low Buckwheat Scrub, was found on these dry steep slopes. The frequency of the browse species *P. tridentata* occasionally increases to > 90%, and these areas were associated with high use by mule deer. Patches of desert peach (*Prunus andersonii*) showed similar relatively high usage by deer.

I did not see a lot of sign of deer use in Scrub-covered lower slopes central to the Basalt Canyon study area. I saw about 15 deer during the 8 days I have spent on site, all in Murphy Gulch, at the forest/scrub interfaces on lower slopes, and in heavy scrub cover on higher slopes. I did not find any water sources on the study area at the time of the survey. I believe the nearest surface water is Sherwin Creek south of Highway 203. Ground squirrels are common in Murphy Gulch. I observed a pair of red-tailed hawks on several consecutive days near the rocky outcrop on the ridgeline west of Highway 395. Smaller migratory birds were the only other wildlife observed during this work.

I hope this helps with your wildlife assessment. Call me at (760) 873-8516 if you have any questions.

Yours truly,

A handwritten signature in cursive script that reads "James R. Paulus". The signature is written in dark ink and is positioned above the printed name.

James R. Paulus, Ph.D.

cc. Dwight Carey

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Boraginaceae				
<i>Cryptantha circumscissa</i>	NAH	X		X
<i>Cryptantha confertifolia</i>	NPH	X		
<i>Cryptantha echinella</i>	NAH	X		
<i>Cryptantha micrantha</i>	NAH	X		
Brassicaceae				
<i>Arabis holboellii</i> var. <i>retrofracta</i>	NPH	X	X	
<i>Arabis inyoensis</i>	NPH	X		X
<i>Arabis platysperma</i> var. <i>platysperma</i>	NPH	XMG		
<i>Arabis puberula</i>	NPH	X		
<i>Arabis pulchra</i> var. <i>pulchra</i>	NPH	X		
<i>Arabis sparsiflora</i> var. <i>sparsiflora</i>	NPH	X		
<i>Descurainia californica</i>	NAH	X		X
<i>Descurainia sophia</i>	IAH	X		X
<i>Erysimum capitatum</i> ssp. <i>capitatum</i>	NBH	X		
<i>Lepidium desiflorum</i> var. <i>macrocarpum</i>	NBH	XMG		
<i>Thelypodium milleflorum</i>	NBH	X		
Caprifoliaceae				
<i>Symphoricarpos rotundifolius</i> var. <i>parishii</i>	NS		X	
<i>Symphoricarpos rotundifolius</i> var. <i>rotundifolius</i>	NS	X	X	
Caryophyllaceae				
<i>Stellaria borealis</i> ssp. <i>sitchana</i>	NPH	XMG		
Chenopodiaceae				
<i>Chenopodium ambrosioides</i>	IAH			X
<i>Chenopodium foliosum</i>	IAH			XPO
<i>Chenopodium pratericola</i>	NAH	X		X
<i>Grayia spinosa</i>	NS	X		
<i>Salsola tragus</i>	IAH	X		X
Ericaceae				
<i>Arctostaphylos nevadensis</i>	NS	X	X	
<i>Arctostaphylos patula</i>	NS	X		
Fabaceae				
<i>Astragalus purshii</i>	NPH	X		X
<i>Lupinus albicaulis</i>	NPH	X		
<i>Lupinus andersonii</i>	NPH	X		
<i>Lupinus argenteus</i> var. <i>heteranthus</i>	NPH	X		X
<i>Lupinus bicolor</i>	NAH	X		
<i>Trifolium andersonii</i> var. <i>beatlyae</i>	NPH	X		
Fagaceae				
<i>Chrysolepis sempervirens</i>	NS	X		
Geraniaceae				
<i>Erodium cicutarium</i>	IAH			XFU

List of plant species occurring in the area of the Basalt Canyon Geothermal Exploration. Habit summarizes the growth form of each species. Plants occurred in one of four habitats. Habit codes are defined below.

Plant Families and Species	Habit	Occurrence in Study Area		
		Scrub	Forest	Disturbed
Cupressaceae				
<i>Juniperus occidentalis</i>	NT	X	X	
Dryopteridaceae				
<i>Woodsia oregana</i>	NPH	XMG		
Pinaceae				
<i>Abies concolor</i>	NT		X	
<i>Pinus contorta</i> ssp. <i>murrayana</i>	NT	XMG		
<i>Pinus flexilis</i> (? , 1 ind.)	NT	XMG		
<i>Pinus jeffreyi</i>	NT	X	X	
<i>Pinus monophylla</i>	NT		X	
Dicots				
Amaranthaceae				
<i>Amaranthus californicus</i>	NAH			XFU
Apiaceae				
<i>Cymopterus terebinthinus</i> var. <i>petraeus</i>	NPH	X		
Asteraceae				
<i>Achillea millefolium</i>	NPH	XMG		
<i>Agoseris glauca</i> var. <i>laciniata</i>	NPH	X		
<i>Agoseris retrorsa</i>	NPH	X		
<i>Ambrosia acanthicarpa</i>	NAH			X
<i>Artemisia cana</i> ssp. <i>bolanderi</i>	NS	X		
<i>Artemisia douglasiana</i>	NPH	XMG		
<i>Artemisia tridentata</i>	NS	X	X	X
<i>Aster ascendens</i>	NPH	X		
<i>Chaenactis stevioides</i>	NAH	X		X
<i>Chrysothamnus nauseosus</i>	NS	X		X
<i>Chrysothamnus parryi</i> ssp. <i>nevadensis</i>	NS	X		
<i>Chrysothamnus teretifolius</i>	NS	X		
<i>Chrysothamnus viscidiflorus</i> ssp. <i>puberulus</i>	NS	X		
<i>Chrysothamnus viscidiflorus</i> ssp. <i>viscidiflorus</i>	NS	X		
<i>Crepis acuminata</i>	NPH	X		
<i>Machaeranthera canescens</i> var. <i>canescens</i>	NPH	X		
<i>Rigiopappus leptocladus</i>	NAH			XPO
<i>Senecio aronicoides</i>	NPH	XMG		
<i>Senecio integerrimus</i> var. <i>exaltatus</i>	NPH	XMG		
<i>Stephanomeria paniculata</i>	NAH	X		
<i>Stephanomeria spinosa</i>	NPH	X		
<i>Tetradymia canescens</i>	NS	X		
<i>Tragopogon dubius</i>	IBH			X
<i>Wyethia mollis</i>	NPH	X		

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Grossulariaceae				
<i>Ribes cereum</i> var. <i>cereum</i>	NS	X	X	
Hydrophyllaceae				
<i>Nama aretioides</i> var. <i>multiflorum</i>	NAH			X
<i>Nama californicum</i>	NAH			X
<i>Nama rothrockii</i>	NPH	X		X
<i>Phacelia bicolor</i>	NAH	X		
<i>Phacelia vallis-mortae</i>	NAH	X		X
<i>Phacelia glandulifera</i>	NAH	X		
<i>Phacelia hastata</i> ssp. <i>hastata</i>	NPH			X
<i>Phacelia</i> sp.	NAH	X		
Lamiaceae				
<i>Monardella odoratissima</i> ssp. <i>odoratissima</i>	NPH	X		
Loasaceae				
<i>Mentzelia congesta</i>	NAH	X		X
<i>Mentzelia dispersa</i>	NAH	X		X
<i>Mentzelia veatchiana</i>	NAH			X
Onagraceae				
<i>Gayophytum diffusum</i> ssp. <i>parviflorum</i>	NAH	X		X
Papaveraceae				
<i>Argemone minuta</i>	NPH	X		X
Polemoniaceae				
<i>Allophyllum gilioides</i>	NAH	X		X
<i>Gilia brecciarum</i> ssp. <i>brecciarum</i>	NAH	X		
<i>Eriastrum sparsiflorum</i>	NAH	X		X
<i>Leptodactylon pungens</i>	NPH	X		
<i>Linanthus nuttallii</i> ssp. <i>pubescens</i>	NPH	X	X	
<i>Phlox condensata</i>	NS	X		
<i>Phlox gracilis</i>	NAH	XMG		
<i>Phlox stansburyi</i>	NPH	X		
Polygonaceae				
<i>Eriogonum maculatum</i>	NAH	X		X
<i>Eriogonum ovalifolium</i>	NPH	X		X
<i>Eriogonum parishii</i>	NAH	X		
<i>Eriogonum umbellatum</i>	NS	X		
<i>Eriogonum umbellatum</i> var. <i>nevadense</i>	NS	X		
<i>Polygonum arenastrum</i>	IAH			X
<i>Polygonum polygaloides</i>	NAH	X		
<i>Rumex crispus</i>	IPH	XMG		
Portulacaceae				
<i>Calyptridium monospermum</i>	NPH	X		X
<i>Calyptridium umbellatum</i>	NPH			X

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Rhamnaceae				
<i>Ceanothus velutinus</i>	NS	X		
<i>Rhamnus</i> sp.	NS	X		
Ranunculaceae				
<i>Delphinium</i> cf. <i>parishii</i>	NPH	X		
Rosaceae				
<i>Amelanchier utahensis</i>	NS		X	
<i>Holodiscus microphyllus</i> var. <i>microphyllus</i>	NS	X	X	
<i>Prunus andersonii</i>	NS	X		
<i>Prunus emarginata</i>	NS	X	X	
<i>Rosa woodsii</i>	NS	X		
<i>Purshia tridentata</i> var. <i>tridentata</i>	NS	X		
Rubiaceae				
<i>Galium multiflorum</i>	NPH	X	X	
<i>Kelloggia galioides</i>	NPH	X		
Scrophulariaceae				
<i>Castilleja angustifolia</i>	NPH	X		
<i>Mimulus nanus</i>	NAH	X		
<i>Orthocarpus luteus</i>	NPH	X		
<i>Penstemon azureus</i> var. <i>angustissimus</i>	NPH	X		
<i>Penstemon rostriflorus</i>	NPH	X	X	
<i>Verbascum thapsus</i>	IBH	XMG		
Solanaceae				
<i>Chamaesaracha nana</i>	NPH	X		X
<i>Nicotiana acuminata</i> var. <i>multiflora</i>	IAH			XFU
Violaceae				
<i>Viola purpurea</i> ssp. <i>venosa</i>	NPH	X		
Monocots				
Cyperaceae				
<i>Carex douglasii</i>	NPGL	X		X
<i>Carex microptera</i>	NPGL	XMG		
<i>Carex raynoldsii</i>	NPGL		X	
<i>Cyperus laevigatus</i>	NPGL			XFU
Juncaceae				
<i>Juncus mexicanus</i>	NPGL			XPO
Liliaceae				
<i>Allium atrorubens</i> var. <i>crisatum</i>	NPGL	XMG		
<i>Calochortus leichtlinii</i>	NPGL	X		

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Poaceae				
<i>Achnatherum hymenoides</i>	NPG	X		X
<i>Achnatherum nevadensis</i>	NPG	X	X	X
<i>Achnatherum occidentale</i> ssp. <i>californicum</i>	NPG	X		
<i>Achnatherum occidentale</i> ssp. <i>pubescens</i>	NPG	X		
<i>Agropyron desertorum</i>	IPG			X
<i>Bromus laevipes</i>	NPG	X		
<i>Bromus madritensis</i> ssp. <i>rubens</i>	IAG	X	X	X
<i>Bromus suksdorfii</i>	NPG	X		
<i>Bromus tectorum</i>	IAG	X	X	X
<i>Cynodon dactylon</i>	IPG			XPO
<i>Dactylis glomerata</i>	IPG	XMG		
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	NPG	X		X
<i>Hesperostipa comata</i> ssp. <i>comata</i>	NPG	X		
<i>Hordeum brachyantherum</i> ssp. <i>brachyantherum</i>	NPG	X		
<i>Hordeum jubatum</i>	NPG	X		
<i>Leymus cinereus</i>	NPG	X	X	
<i>Leymus triticoides</i>	NPG			XPO
<i>Melica stricta</i>	NPG	X	X	
<i>Muhlenbergia richardsonis</i>	NPG			
<i>Poa fendleriana</i> ssp. <i>longiligula</i>	NPG	X		
<i>Poa palustris</i>	IPG	XMG		
<i>Poa pratensis</i>	IPG	X	X	
<i>Poa wheeleri</i>	NPG		X	
<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	NPG	XMG		

key to growth habit codes:

A annual
 B biennial
 G grass
 GL grass-like
 H herb
 HS half-shrub
 I introduced
 N native
 P perennial
 S shrub

key to occurrence codes: MG restricted to channel at Murphy Gulch
 FU restricted to disturbed fumarole areas
 PO restricted to disturbed ponding basin
 at extreme eastern tip of survey area



Plant community boundaries are broadly depicted at the Basalt Canyon Geothermal Exploration Area. Aerial photo taken June, 1993.



Basalt Canyon Geothermal Surveys
Sensitive Species Search