PROGRESS REPORT: AVIAN USE OF THERMAL SITES AT CASA DIABLO, MONO COUNTY, CA.--JAN. TO AUG. 1990

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Introduction. In winter 1991, a new 10 megawatt binary-cycle geothermal plant built by Pacific Lighting Energy Systems (PLES I) will supplement the existing 7 megawatt unit (Mammoth Pacific I or MP I) at the Casa Diablo Geothermal Site (T 3S, R 27E, S 32). Numerous environmental concerns were raised prior to construction of the new plant. These included effects from spills of geothermal fluids, and changes in temperature, output and location of nearby thermal springs. Thus far, most of the studies have focussed on possible impacts to fisheries, Sage Grouse and mule deer (PLES I Geothermal Development Project: Draft Joint Environmental Assessment and Environmental Impact Report, 1987) (henceforth referred to as the PLES EIR), with little attention devoted to waterfowl and non-game bird species. Surrounding Casa Diablo are wetland, riparian, forest, meadow and alkali pond habitats that provide important breeding and wintering sites for birds. Many of the wetland areas are associated with thermal springs, which may provide unique habitat and/or conditions. As part of a mitigation package, funding was provided to Fish and Game to monitor and assess avian populations utilizing the Casa Diablo area. Studies will continue for at least two more years.

Study Area and Methods. Avian use of the area was determined by interviewing local birdwatchers, reviewing literature on thermal site utilization by vertebrates, and conducting field work.

The field work took place on an area approximately 3 km north and south and 7 km east of the Casa Diablo Geothermal Plant site (Figure I). The study site incorporated lands owned/managed by Hot Creek Ranch, the Los Angeles Dept. of Water and Power, the Bureau of Land Management, and Inyo National Forest.

For purposes of discussion, I delineated the four seasons as winter: December through Febuary; spring: March through May; summer: June and July; fall: August through November. In reality, seasonal differences vary for species and by year.

Three winter transects were established. The first two sites were in Hot Creek Gorge which is located about 1 km east of Hot Creek State Fish Hatchery. Ice formation was almost non-existent on this reach of the creek due to influx of springs ranging from 11.1 to 16.0 degrees centigrade at the Fish Hatchery to 73 to 94 degrees centigrade in the gorge (PLES EIR p. 3-29).

The Hot Creek West transect ran east from the footbridge just west of the Hot Creek Springs recreational site to the Hot Creek Ranch boundary. It contained ungrazed open streamside

habitat with grasses, forbs and low shrubs comprising most of the vegetation, along with a few junipers (Juniperus occidentalis) and Jeffrey pines (Pinus jeffreyi).

The second transect, Hot Creek East, runs west from the footbridge described above to a fenceline and gauging station. Streamside habitat consisted of coyote willow (Salix exigua), fernbush (Chamaebatiaria millefolium), scree and a small saltgrass meadow. The entire area was grazed by cattle during summer months. Jeffrey pines were scantily distributed on the rim of the gorge. This reach of the creek had numerous large pools and slow-moving runs that, in conjunction with the cover, provided excellent waterfowl habitat.

Each transect was approximately 1 km in length. The gorge walls, which were approximately 30-50 m high and 20-40 m apart, provided built-in loci for a fixed-width transect (Hutto 1985, Emlen 1971).

Waterfowl were frequently flushed during the counts. Most flushed away from me ie. towards areas yet to be censused, therefore making it impossible to merely add all birds sighted. Thus, to derive total numbers, I added the largest total of each species seen at once in one location to the number that flew past me to my point of origin. On the return trip, only individuals representing new species were added to the list, unless an individual bird of a previously tallied species was clearly new (example: a singing Song Sparrow 100 m west of the only other Song Sparrow seen earlier in the day).

Finally, an approximately 60 hectare plot was established on Chance Meadows in conformance with recommendations for censusing open habitat (Robbins 1970). Chance Meadows was selected because it contained several thermal springs, it is in the center of the study area and it is one of the few places in the study area with 60 hectares of fairly uniform habitat. The primary vegetation type was wet meadow. Chance Meadows receives heavy summertime grazing. A section of Mammoth Creek flows through the study plot. This creek is subject to substantial freezing; water temperatures range from 10 to 14 degrees centigrade (PLES EIR p. 3-29). The plot was censused by making parallel swathes through the area approximately 20 to 30 m apart.

During the 1989-1990 winter season, a scoping trip to Hot Creek was conducted on February 8. Two complete early spring surveys were conducted at each of the two transect sites (March 14 and 15) and the Chance Meadows plot was surveyed once (March 14). Although some species were singing, it was deemed too early in the season to make any conclusions regarding breeding status.

In June and July, breeding bird surveys were conducted on the areas described above. Behavior such as singing, distraction

displays and nest-building were recorded and from this data rough locations of suspected territories were mapped (Emlen 1971). Species were confirmed as breeding if there were observations of (1) nests with eggs or young, (2) nest-building, (3) food being carried repeatedly to a likely nest site, or (4) locally hatched fledglings being fed by adults. Records of probable breeding species were based on the presence of singing or territorial birds (Gaines 1988).

Only one survey per sample site was undertaken during the summer, except for two surveys at Mammoth Creek and the Fish Hatchery. These were conducted on June 26-29 and July 15.

Other sites surveyed during the spring and summer included the Jeffrey pine forest and fumaroles surrounding the Casa Diablo Geothermal Plant, Mammoth Creek between Highway 395 and Holton Spring, Chance Meadows ponds and Hot Bubbling Pool, Hot Creek between the Fish Hatchery and the gorge and from the gorge to approximately 1 km east of the Cashbaugh Ranch, Hot Creek Ranch, Little Hot Creek Valley, the "Rock Tub" thermal spring, Big and Little Alkali Lakes and an unnamed ephemeral pond below Whitmore Pool.

Rail censuses were conducted in wetland areas. These took place along Mammoth Creek at the meadows between Highway 395 and the county road, the outflow of Holton Hot Spring, the Hot Creek Fish Hatchery, Hot Creek Ranch, the wetlands surrounding both Big and Little Alkali Lakes, the outflow from Whitmore Pool and Little Hot Creek Valley. The Hot Creek sites were censused at approximately 50 m intervals from Hot Creek Fish Hatchery to the mouth of Hot Creek Gorge. Little Hot Creek Valley was censused at two 50 m locations along the thermal spring area, and at the pond below the thermal springs. The Alkali Lakes were censused on the west shore of the pond west of Big Alkali Lake, the isthmus between Big and Little Alkali Lakes and the east shore of Little Alkali Lake. All other locales were censused at one discrete location. Censuses were conducted at night utilizing a portable tapedeck (Johnson and Dinsmore 1986). The tape contained three sets each of Virginia Rail and Sora songs and calls. Songs and calls were played three consecutive times from a battery-operated portable tapedeck. An approximate 20 second pause was allowed between each of the six sets of songs/calls to allow time to listen for a response. Censuses were conducted on the nights of July 18, July 22, August 15 and August 17.

During all seasons, beginning and ending times, approximate temperature, wind speed and direction at the start and end of the census, snowpack, stream flow, and a description of weather patterns during the last 24 hours were recorded for each location. Mammal sightings and tracks, reptiles and amphibians, evidence of grazing and a rough vegetation description were also noted. Raw data was transcribed onto data sheets, which are in

my possession.

Results. Thus far, a total of 102 species were observed by me or documented from Gaines (1988), Buckberg and Taylor (1988), PLES I and Chance Meadows EIRs, and the American Birds notebooks (Table 1).

Of these, 29 were wintering (21 recorded by me and an additional 8 species recorded from the sources above). Waterfowl were the most abundant winter species: 166 individuals representing five species were tallied from Hot Creek Ranch to the the first pool east of the Hot Creek Recreational Area.

A total of 42 species (38 by me and 4 by other sources) were recorded during more extensive counts in mid-March. Waterfowl was again the prevalent avian group with 337 ducks, representing seven species, counted on Hot Creek from Hot Creek Ranch to the eastern end of Hot Creek gorge (March 15, 1990). These were mostly Green-winged and Cinnamon Teal, Mallards and American Wigeon. Becasue there are no November or January records for Cinnamon Teal, and because Gaines (1988) reports waterfowl spring migration initiating in March, I expect that some of these ducks may not have over-wintered.

Seventy-six (76) species were recorded during summer months (65 by me and 11 by other sources). Of these, 17 were confirmed as definitely breeding, either through my observations or through reliable accounts. An additional 23 bird species were probably breeding in the area.

Diversity varied greatly by area, but this is largely due to differences in hours afield devoted to each of the areas. The most species were tallied at Hot Creek (66) but it receives more attention from birdwatchers than the other areas, with the possible exception of the Alkali Lakes. Also, I spent 19 hours 5 minutes afield here. After Hot Creek, the species diversity dropped sharply with 28 species recorded at Little Hot Creek Valley (5 hours 5 minutes), 27 species at Mammoth Creek (5 hours 30 minutes), 25 species at Casa Diablo (4 hours 57 minutes), 23 species at Chance Meadows (10 hours 15 minutes) and 17 species at the Alkali Lakes (3 hours 30 minutes).

Seven (7) hours and 45 minutes were devoted to rail censues. One Sora responded to a tape on July 22 on Hot Creek about 1/2 km west of the gorge. Rail numbers may have been biased (1) because the search was conducted late in the breeding season when rails are less likely to respond to the tape and (2) dry conditions may have limited the available rail habitat this year.

Several new winter and early spring records were established for the Casa Diablo area. These are summarized in Table 3, along with other unusual records gleaned from the literature.

A number of unusual, rare or sensitive species were observed (Tables 2 and 3). Twelve (12) Fish and Game "Special Animal" species were nesting/sighted (Table 2) such as Prairie Falcons, Yellow Warblers and Black-crowned Night Herons. Sage Grouse, another Fish and Game species of special concern, was not sighted by me but the Chance Meadows draft Environmental Impact Report (1986, p. 3-55) lists four Sage Grouse leks within the study area. It also states that "There appears to be a high potential for (Sage Grouse) gathering in winter in the Hot Creek area" (p. 3-54). One State Fish and Game endangered species, the Willow Flycatcher, has been recorded nesting on the site (Gaines 1988). Two Federal Endangered Species have been recorded thus far, including four Bald Eagle sightings. One was observed on Feb. 8, 1990 perched on a large boulder along Hot Creek West and may have been hunting or roosting. The other circled high over the steam plume above Hot Bubbling Pool on March 14, 1990 and may have been utilizing the thermal benefits of the plume to gain elevation. Both individuals were adults. Another individual was reported in the PLES EIR (p. 3-43). There is also a fourth record for one adult and one immature Bald Eagle reported from the Fish Hatchery for Dec. 23, 1985 (Dave DeSante, American Birds unpublished notebooks). A Peregrine Falcon was sighted somewhere near Casa Diablo in June 1988 (Buckberg and Taylor 1988), but it may have been an individual recently hacked out from a Crowley Reservoir site.

Discussion. The censuses described above do not fully reflect species abundance or diversity at the Casa Diablo study area. The main limitation was lack of time. Robbins (1981), for instance, recommends at least eight winter site visits to adequately assess wintering species. I conducted only one winter visit and one to two early spring visits. Eight site visits are also recommended for establishing breeding use (Hall 1946) but again only one to two visits per site were possible.

Both breeding and winter bird populations are difficult to assess. Breeding bird detectability varies by stage of the breeding cycle, singing frequency, nesting synchrony, breeding season length, and flux in community composition (Best 1981). Wintering birds do not advertise their presence by singing or displaying. Many species flock, thus making detection even more variable (Robbins 1972). Regardless of season, other variabilities arise such as the time of day and length of time afield, and weather conditions.

The study was also affected by snow conditions. The 1989-90 winter was unusually dry and was indeed the third dry year for the Eastern Sierra. This may have limited distribution of some species and increased others in the study area. Low snowfall, for instance, may have lowered the desirability of the thermal areas to those species that depend on open ground for winter foraging (Laurence and Yensen 1985) since abundant open habitat

was available elsewhere in the Eastern Sierra. Breeding bird distribution may also have been altered. Many areas that had potential rail habitat in June, such as a pond below Whitmore Pool, proved dry by July. However, this may have concentrated rails at other areas like Hot Creek, thus making them easier to detect. Wetland dependent species may also have been limited by lack of habitat at the Alkali Lakes, Little Hot Creek Valley and Chance Meadows.

One of the goals of the study was to assess if the thermal sites provided unique habitat, especially in winter. Despite the limitations described above, there were a few observations both in the literature and in the field which would lend support to the argument for unique qualities. The geothermal sites, in addition to providing open foraging habitat in normal winters, may also reduce thermoregulatory expenses of wintering and migrating birds. Geothermally heated mine shafts (with stable temps of 29 degrees centigrade) allowed the bat Macrotus californicus to winter farther north than any other member of its family (Bell, Bartholomew and Nagy 1988). Gaines (1988) cites many instances of Eastern Sierran birds capitalizing on hot springs during winter (see pages 78, 82, 134, 234, 256, 274), and believed they serve as winter oases for small numbers of otherwise southward bound migrants.

Furthermore, winter habitat for ducks can be extremely limited in the Eastern Sierra (Gaines 1988 p. 73). When Crowley, Grant and Bridgeport Reservoirs freeze Hot Creek provides one of the few places for ducks to congregate. Trumpeter Swans from Yellowstone have ceased migrating due to the presence of warms springs near streams which maintain open water (Bliven, 1989). "This is a poor wintering area for swans; its climate is too harsh. The only reason the birds could survive at all was the warm springs" (p. 84). A 26 degree C industrial cooling pond provided winter waterfowl habitat in Utah (Webb 1988).

Also, small numbers of insects continue to hatch from winter hot springs, thus providing food for landbirds. On Feb. 8, 1990 Dave Herbst (entomologist, Sierra Nevada Aquatic Research Lab) and myself noted a recent emergence of mayflies on snow banks adjoining Hot Creek. Dark-eyed Juncos were observed feeding in the same area. Finally, the geothermal sites may provide drinking water for birds (Geoff Geupel, Director, Point Reyes Bird Observatory Landbird Program, pers. comm.).

Some springs may also provide trace minerals and salts. On June 28, 1990 I observed a flock of 15 Cassin's Finches feeding along the edge of the southern-most fumaroles located about 30 m east of Casa Diablo geyser. They appeared to be pecking at a white deposit associated with the fumarole, and fed intermittently for over thirty minutes, flushing several times and then returning to the white substance. A similar phenomenon

was observed by Fraser (1985), who reported Evening Grosbeaks, Purple Finches and Pine Siskins utilizing natural and artificial salt licks.

Conclusion. Although only a third of the project has been completed, some initial conclusions can be drawn regarding the importance of the Casa Diablo area for birds. Hot Creek provides substantial winter habitat for hundreds of ducks. It may also provide unique habitat for some wintering shorebirds and landbirds who couldn't otherwise survive cold or frozen conditions. One State Fish and Game endangered species, the Willow Flycatcher, has been recorded nesting on the site (Gaines 1988), and 12 Fish and Game Species of Special Concern have been observed on the study site. Federally endangered species utilizing the side include the Bald Eagle and the Peregrine Falcon. It is an area of high avian biodiversity with 102 species recorded thus far. Data from the next two field seasons will broaden understanding of the significance of the Casa Diablo geothermal area to birds.

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Table 1. Distribution by season and location of Casa Diablo avifauna.

	CASA DIABLO	MAMMOTH CREEK	CHANCE MEADOWS	HOT CREEK	L. HOT CREEK	ALKALI LAKES
..Pied-billed Grebe				W Sp		
Western Grebe						S
Am. White Pelican				S		S
Great Blue Heron				W		
Great Egret				S		
Snowy Egret				S		
Green-backed Heron				1 S		
Blk-crwnd.Night Hern				1 W Sp S		
Green-winged Teal				W Sp S		
Mallard			Sp S**	W Sp S		
Northern Pintail				W S		
Cinnamon Teal				Sp S**	S	S*
Teal sp.		S	S	S		
Northern Shoveler				Sp		
Gadwall				W 1 S**		
American Wigeon				W Sp		1 F
Red-brstd. Merganser						1 F
Turkey Vulture				S	. S	
Bald Eagle		Sp	W		.	
Northern Harrier			3 yes			4 yes
Red-tailed Hawk	S	S	Sp	W	S	
American Kestrel				S*		
Peregrine Falcon	2 S					

	CASA DIABLO	MAMMOTH CREEK	CHANCE MEADOWS	HOT CREEK	L. HOT CREEK	ALKALI LAKES
Prairie Falcon	2 S		5 yes	6 yes		
Sage Grouse				3 yes		
Sora				S		
Common Moorhen				1 Sp		
American Coot				W Sp		
Killdeer				Sp S*	S	7 S*, yes
American Avocet						S*
Greater Yellowlegs				W Sp		
Willet						S*
Spotted Sandpiper				1 W		
Dowitcher sp.				Sp		
Longbilled Dowitcher				1 W		
Common Snipe		S*	S*	W Sp	S *	
Wilson's Phalarope					S	S*
California Gull				Sp S		S
Caspian Tern						S
Mourning Dove		S	S	S		
West. Screech Owl	1 W					
Great-Horned Owl			8 yes	1 S**		
North. Pygmy-Owl	2 S					
Common Nighthawk			8 yes		.S	
Common Poorwill			8 yes			
Belted Kingfisher				W Sp		
Common Flicker	S**	S		W Sp	S	
Hairy Woodpecker	Sp					

	CASA DIABLO	MAMMOTH CREEK	CHANCE MEADOWS	HOT CREEK	L. HOT CREEK	ALKALI LAKES
White-headed Wdpkr	2 S					
West. Wood-Peewee	S	S			S	
Willow Flycatcher		1 S**				
Ash-throated Flychr.				1 S		
Purple Martin				1 F		
Horned Lark					S*	S
Tree Swallow			Sp	Sp S		
Violet-green Swallow				S	S	
Cliff Swallow	S	S*	S	S**	S	
Barn Swallow				1 Sp		
Steller's Jay	S	S			S	
Clark's Nutcracker			Sp	Sp	S	
Common Raven		S	Sp S	W Sp S	S	
Mountain Chickadee	Sp S	S		W Sp		
Red-breasted Nuthatc	S					
White-breasted Nutha	Sp S**				S	
Pygmy Nuthatch	Sp S**					
Rock Wren			S*	S*	S*	
Canyon Wren				W Sp S*		
Bewick's Wren				Sp		
House Wren		S*		S**		
Marsh Wren				1 W Sp		
American Dipper				Sp		
Mountain Bluebird		S	S			
American Pipit				W Sp		

	CASA DIABLO	MAMMOTH CREEK	CHANCE MEADOWS	HOT CREEK	L. HOT CREEK	ALKALI LAKES
American Robin	S**	S	S	W Sp	S**	
Sage Thrasher				1 W	S*	
Solitary Vireo	S*					
Yellow Warbler		S*				
Yellow-rumped (Aud.)	S	S	Sp	Sp	S	
Wilson's Warbler				S*		
McGillivry's Wrblr.		S*				
Western Tanager	S*				S*	
Green-tailed Towhee	S*	S*	S*	S*	S*	
Chipping Sparrow	S*					
Brewer's Sparrow	S*			S	S*	
Vesper Sparrow		9 yes				
Sage Sparrow					S*	
Savannah Sparrow		S*	S*	Sp		S*
Fox Sparrow				Sp		
Song Sparrow		S*		W S**		
Golden-crowned Sparr	1 S					
White-crowned Sparro			Sp	Sp		
Dark-eyed Junco			Sp	W Sp		
(Gray-headed Junco)		1 W				
Red-winged Blackbird		S*	S*	Sp S**	S*	S*
Western Meadowlark			S*	S	S	
Yellow-headed Blackb			S*	S**		S
Brewer's Blackbird	S**	S*	S*	S**	S*	S*
Brown-headed Cowbird		S*				

	CASA DIABLO	MAMMOTH CREEK	CHANCE MEADOWS	HOT CREEK	L. HOT CREEK	ALKALI LAKES
Rusty Blackbird				1 W		
Cassin's Finch	S*					
House Finch		S				
House Sparrow				1 S**		
European Starling		S*		Sp S		
Totals:	25 sp.	27 sp.	23 sp. Excluding area to the north	66 sp.	28 sp.	17 sp

KEY

No superscript indicates bird(s) were seen by Emilie Strauss (ES), 1990.

(W, Sp, S, F)[1]--Gaines 1988

(W, Sp, S, F)[2]--Buckberg and Taylor 1988

yes[3]--Chance Meadows EIR, 1986. No dates given for bird sightings

yes[4]--Observed by ES about 2 km W of Alkali Lakes.

yes[5]--A pair was observed in spring circling over cliffs N of Chance Meadows

yes[6]--Gaines (1988) reports a nest N of the Mammoth airport.

yes[7]--Also observed with chicks by ES at the outflow of the "Rock Tub" hot spring.

yes[8]--Observed by ES in the Jeffrey pines N of Chance Meadows.

yes[9]--Observed by ES in sage habitat N of Chance Meadows.

S* -- probably breeding.

S** -- confirmed breeding.

Table 2. List of state and federal endangered bird species and bird species of special concern that utilize the Casa Diablo site.

From 1989 Annual Report on the Status of Calif.'s State Listed Threatened and Endangered Plants and Animals (1990):

State and Federal Endangered:

Bald Eagle
Peregrine Falcon

State Endangered (since 1989 report):

Willow Flycatcher

California Dept. of Fish and Game Natural Diversity Data Base "Special Animals" List (1988):

Western Grebe
American White Pelican
Great Blue Heron
Great Egret
Black-crowned Night Heron
Northern Harrier
Prairie Falcon
Sage Grouse
California Gull
Caspian Tern
Purple Martin (vagrant species)
Yellow Warbler

from Audubon Blue List (Tate 1986) (those species not already mentioned):

Hairy Woodpecker

Total: 2 Federal Endangered species
1 State Endangered "
12 Fish and Game "Special Animals"
1 Audubon Blue List

Miscellaneous:

Vesper Sparrow--Forest Service sagebrush indicator species (Mono Basin National Forest Scenic Area final EIR, 1990)

Pygmy Nuthatch--Forest Service mixed conifer/Jeffrey pine indicater species (Sherwin Ski Area final EIR, 1990)

Table 3. Unusual bird sightings including rarities, unusual species for the Eastern Sierra, high counts, etc. for the Casa Diablo area.

Pied-billed Grebe--3/15/90--1--Hot Creek, Long Valley--ES. "Rare winter resident''-Gaines, 1988--ES.

Great Blue Heron--12/19/82--63--Hot Creek Fish Hatchery--high count (especially for winter)--DG

Snowy Egret--6/26/90--2--Hot Creek just east of the Owens River Road Crossing--ES.

Great Egret--6/29/90--1--Hot Creek Fish Hatchery--ES, 10/25/87--1--Alkali Ponds, late record.--DG, 10/25/87--1--marshes east of Owens River Road and east of Little Hot Creek Valley--ES.

Green-backed Heron--(No date)-- "At Hot Creek, they regularly raid the fish hatchery" (DG, p. 70).

American Wigeon--9/13/87--140--Alkali Ponds--Early record.--DG

Red-breasted Merganser--9/13/87--2--Alkali Ponds--Only three other summer or fall records.--DG

Common Moorhen--5/23/72--1--Hot Creek--late record--DG.

Willet--6/27/90--1 or 2 pairs defending territories--neck between east and west Big Alkali Lake, Long Valley, uncommon eastern Sierra breeding bird--ES ("defensive" Avocets and Wilson's Phalaropes here too).

Spotted Sandpiper--12/19/82--3--Hot Creek--one of two winter records--DG.

Dowitcher sp.--3/14/90--1--Hot Creek, Long Valley--ES. Only one March record for a Long-billed Dowitcher and none for Short-billeds.

Long-billed Dowitcher--12/22/85--1--Hot Creek--Only winter record--DG.

Greater Yellowlegs--2/8/90--1--Hot Creek (northwest side of Long Valley near Mammoth)--ES--Second winter record east of the crest! (Previous record was last year, same locale), 3/15/90--4--Hot Creek, Long Valley--ES. Very few March records (3/5/88, 3/25/80).

Western Screech Owl--12/26/76--1--found dead at junction U.S. 395 and Hwy. 203--DG.

Willow Flycatcher--1974--"a pair bred near Mammoth Creek"--DG, p. 192.

Ash-throated Flycatcher--6/28/78--1--Hot Creek--late spring record--DG.

Purple Martin--9/15/73--1--Hot Creek--only Eastern Sierra record--DG.

Cliff Swallow--Dave Gaines reports that "While they nest on cliffs in the Bodie Hills, other sites have all been on human-made structures (in the eastern Sierra) (p. 208). From 6/26 to 6/29/0, ES observed active nests in about five colonies on natural cliff faces in the Hot Creek gorge, and another active colony one-half mile east of the Owens River Road on Hot Creek. They were small colonies totalling 100 to 200 active nests total.

Barn Swallow--3/22/86--4--Hot Creek Fish Hatchery--early record--DG.

Sage Thrasher--12/15/79--1--Hot Creek--One of two Dec. records--DG.

Wilson's Warbler--6/27/90--1 singing--Hot Creek Gorge, 7200 feet--ES. Dave Gaines lists them as nesting from 8000 to 10000 feet in the eastern Sierra (p. 282).

Golden-crowned Sparrow--6/10/80--1--Mammoth turnoff from Hwy. 395--late spring record--DG.

"Gray-headed" Dark-eyed Junco--12/19/82--1--Mammoth Creek (7000')--only eastern Sierra record--DG.

Rusty Blackbird--12/31/83--2--Hot Creek Fish Hatchery--only three east-side records--DG.

CODES

DG--refers to Dave Gaine's book (1988), although he may not have been the original observer.

ES--Emilie Strauss

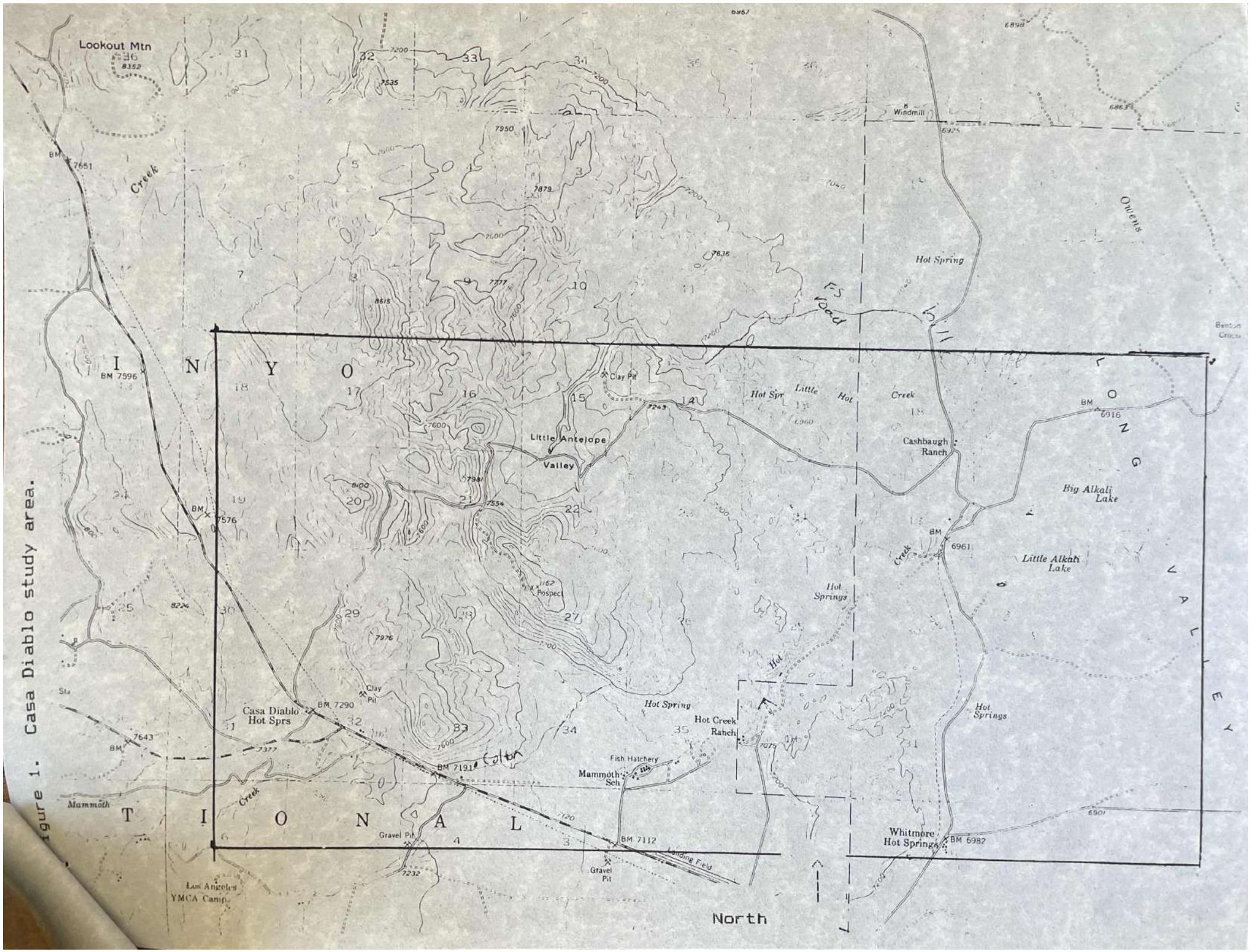

Figure 1. Casa Diablo study area.