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CITY OF BOULDER PARKS DEPARTMENT

Boulder Reservoir Wildlife Habitat Impact
OSMP Studies 4051

Study



Jones, Stephen R.

BOULDER RESERVOIR
WILDLIFE HABITAT IMPACT STUDY

Stephen R. Jones
1197B Bear Mountain Dr.
Boulder, CO 80303

5 December, 1993

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INTRODUCTION AND METHODS

INTRODUCTION

The ecological mosaic of wetlands, grasslands, and prairie dog colonies around Boulder Reservoir is a concentration area for wintering birds of prey and a nesting area for more than 60 species of birds, including at least 16 species of countywide concern (Camp Dresser, and McKee 1986, Boulder County Comprehensive Plan 1988, Jones 1989). Cattail marshes on the west side of the reservoir support nesting American bitterns, northern harriers, and savannah sparrows, as well as wintering short-eared owls (all species of concern in Boulder County). Burrowing owls, which are rare and threatened in Boulder County, nested in prairie dog colonies around the reservoir from 1980-89. A large number of raptors roost and forage around the reservoir in winter. Wintering species include bald eagles, golden eagles, ferruginous hawks, rough-legged hawks, red-tailed hawks, prairie falcons, merlins, and short-eared owls. Migrating osprey forage along the west shoreline. Much of the marsh and grassland area surrounding the reservoir has been designated "critical wildlife habitat" in the Boulder County Comprehensive Plan.

Concern has been expressed about possible conflicts between recreational users of the reservoir and wildlife. In 1985 a northern harrier nest was reported abandoned after being disturbed by hikers (Camp, Dresser, and McKee 1986). At least two observers have reported seeing raptors being chased by model airplanes flown

from the aeromodelling facility on the northwest side of the reservoir. Nesting burrowing owls have been disturbed during the annual Kinetics Conveyance Race.

The 1986 Camp, Dresser, and McKee report to the City of Boulder concerning the effects of increased water storage on the Boulder Reservoir wetlands recommended that recreational activity on the west side of the reservoir be monitored and controlled to limit disturbance of nesting and wintering raptors. However, this study made no attempt to measure specific impacts of recreational activities on wildlife.

In 1993 the City of Boulder Parks and Recreation Department commissioned the present study to examine habitat use by wildlife at Boulder Reservoir and potential conflicts with recreational users. The goals of the study were:

1. To map roosting and foraging areas for wintering raptors.
2. To map nesting areas for raptors and other species of special concern.
3. To compile a comprehensive list of breeding bird species at Boulder Reservoir.
4. To observe potential conflicts between wildlife and recreational users.
5. To develop management recommendations for wildlife habitat at the reservoir.

Field observations were conducted from 1 January-30 August, 1993. Data from field observations were supplemented by data from the Boulder County Wildlife Inventory (Boulder County Audubon Society 1975-93) and ongoing Boulder County Nature Association studies of burrowing owls, northern harriers, and wintering

raptors. Interviews were conducted with recreational users and with Reservoir and Mountain Park ranger staff. The recommendations within this report were developed to protect and enhance wildlife habitat at the reservoir while continuing to allow for historic recreational uses.

STUDY AREA

The study area includes Boulder Reservoir, Sixmile Reservoir, and all land within approximately 1 km of the Boulder Reservoir shoreline (Figure 1). The study area is bounded roughly to the north by Monarch Road, to the east by North 63rd Street, to the south by State Highway 119 (the Boulder-Longmont "Diagonal"), and to the west by a north-south line running approximately 1 km west of North 51st Street.

Boulder Reservoir was constructed in the early 1950's to provide water storage. It lies in the Dry Creek and Little Dry Creek drainages. These drainages historically supported extensive wetlands (Camp, Dresser, and McKee 1986). Wetlands were inundated during reservoir construction and reduced by channelization of both Dry Creek and Little Dry Creek. When the storage capacity of the reservoir was increased in 1986, additional wetlands were inundated along the western shoreline.

Beginning in 1986, the City of Boulder initiated an effort to restore wetlands along Little Dry Creek, Dry Creek, and in the borrow pits west of Coot Lake. Check dams were constructed to "dechannelize" Little Dry Creek and Dry Creek, and native cattails were planted in the Little Dry Creek drainage and in the borrow pits. These three wetlands now occupy about 8 hectares, complementing the approximately 27 hectares of wetlands previously existing around the reservoir (Camp, Dresser, and McKee 1986).

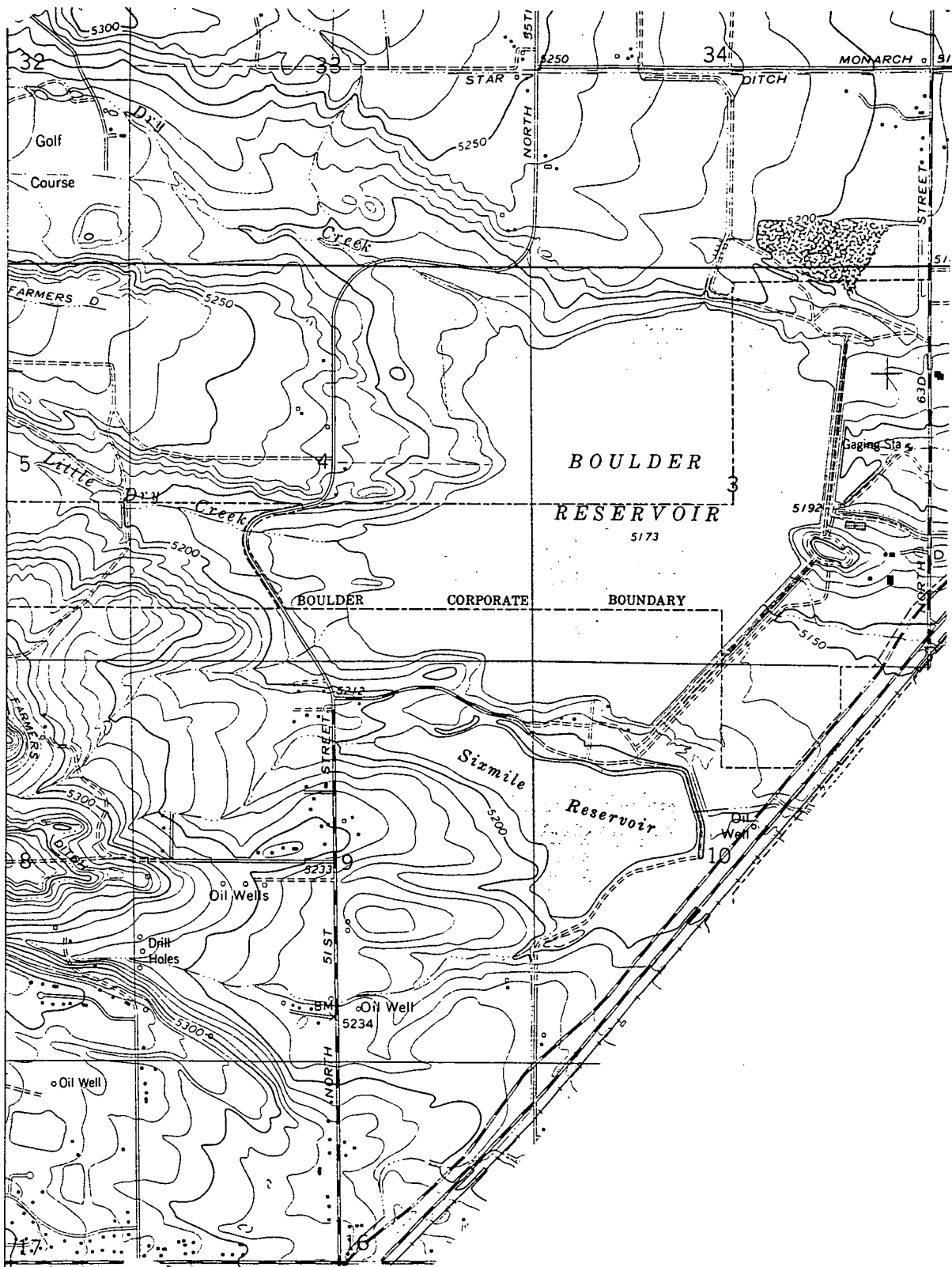


Figure 1. Study Area.

The Boulder Reservoir wetlands are interspersed among grasslands and scattered cottonwood groves. Grasslands within the study area currently support approximately 120 hectares of active prairie dog colonies (extrapolation from aerial photographs and ground surveys). These prairie dog colonies attract large numbers of ferruginous hawks, bald eagles, and other raptors during the winter (Jones 1989) and provide nesting habitat for burrowing owls during the summer. Cottonwood groves within the study area provide nest sites for great horned owls, red-tailed hawks, Swainson's hawks, and a variety of songbirds. Shallows along the reservoir's west shoreline attract migrating and nesting waterfowl, including white pelicans, Canada geese, green-winged teal, blue-winged teal, cinnamon teal, northern shovelers, and mallards.

Most of the land to the west and to the north of the reservoir is City of Boulder Parks and Open Space, which is managed for ecosystem preservation and passive recreational use. Much of the area to the south of Boulder Reservoir is privately owned agricultural and residential land.

Recreational uses at Boulder Reservoir include swimming, fishing, power boating, water skiing, and sailboarding. Recreational activities around the shores of the reservoir include hiking, jogging, birdwatching, and aeromodelling. Heaviest recreational use occurs during the summer months, but joggers, hikers, and aeromodellers are active on the west side of the reservoir, along North 51st Street, throughout the year.

METHODS

Between 1 January-15 May, 1993, I visited the study area 10 times to map perching and foraging locations of wintering raptors. A 12 km survey route beginning and ending at the intersection of Colorado Highway 119 and North 51st Street (Figure 2) was driven 10 times during the period. I drove at a constant speed of 35 km/hr, stopping only when I saw a perching or soaring raptor. Initial location of all sighted raptors was marked on a 7-1/2' topographic map. To gauge the impacts of recreational users on wintering raptors, I observed perching birds and noted the apparent stimuli causing them to leave their perches. Observed stimuli included "hiker," "jogger," "automobile," "bird" (displacement or aggressive encounter), and "forage."

To observe the impacts of the aeromodelling activity on wintering raptors, I conducted 30 minute point counts of soaring and perching raptors from two locations. The first, "Ray Bob Hill," is located in the Dry Creek drainage, approximately 200 m south of the aeromodelling facility. The second, on a hillside south of Little Dry Creek, is approximately 1.6 km southwest of the aeromodelling facility (Figure 2). During a 30 minute period at each count station, I counted all raptors perching or soaring within 1 km of the count station. I conducted counts both on days when the aeromodelling facility was in use (five counts at each station) and on days when the facility was not in use (five counts

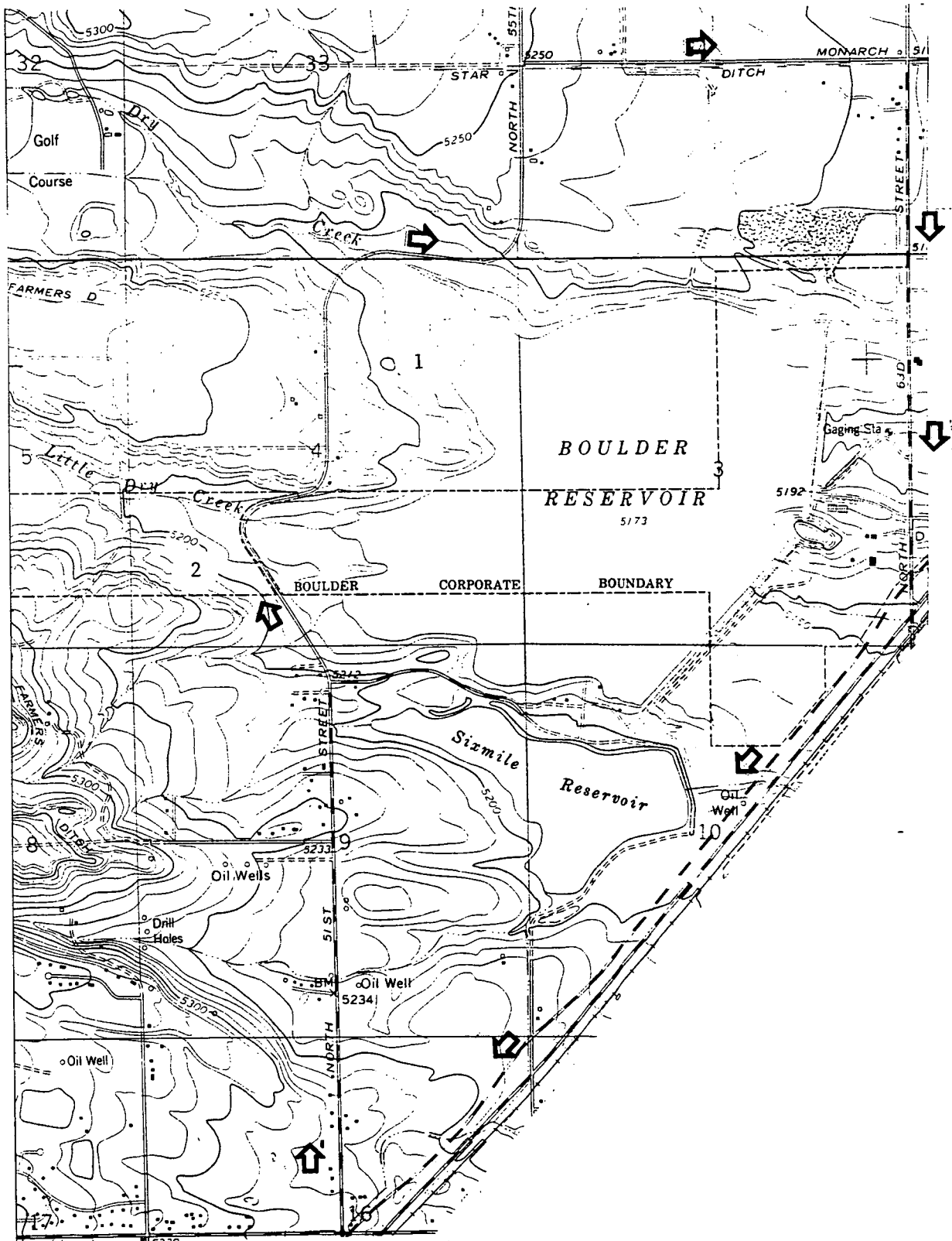


Figure 2. Survey Route and Point Count Stations.

1. Dry Creek (Ray Bob Hill).
2. Little Dry Creek.

at each station). Data were analyzed using a χ^2 test of association and a two-sided t-test.

Between 15 May-30 August, 1993, I visited the study area five times to search for breeding birds and observe interactions between breeding birds and recreational users. Nesting locations of species of special concern (Boulder County Parks and Open Space 1993) were mapped. A breeding bird list was compiled from these observations and from data from the Audubon Society's Boulder County Wildlife Inventory. Breeding bird populations within the three recently expanded wetlands along Little Dry Creek, Dry Creek, and west of Coot Lake were sampled on 16 May, 6 July, and 20 July. During these surveys I walked around the periphery of each wetland for 30 minutes between sunrise and 0700 hours, noting all species seen and observing breeding behaviors.

From 1983-93 I walked all active prairie dog colonies within the study area at least two times between 15 April and 15 July, searching for burrowing owls. These surveys were supplemented by observations provided by the Mountain Park rangers and by Boulder County Nature Association volunteers. Location of all active nests was marked on a 7 1/2' topographic map. During the same 11-year period, I and other volunteers searched sporadically for northern harrier nests in the Little Dry Creek and Dry Creek drainages.

RESULTS AND DISCUSSION

WINTERING RAPTORS

A total of nine raptor species were observed within the study area during 10 road surveys. Species seen, in order of abundance, were red-tailed hawk, bald eagle, ferruginous hawk, American kestrel, rough-legged hawk, northern harrier, prairie falcon, golden eagle, and short-eared owl (Table 1). Highest concentrations of wintering raptors occurred along Dry Creek northwest of North 51st Street and in the lower Little Dry Creek drainage between North 51st Street and the reservoir. Lowest wintering raptor densities occurred in the area east of the reservoir and south of Coot Lake and in the area northwest of Colorado Highway 119 and south of the reservoir (Figure 3).

Wintering raptor populations near Boulder Reservoir have increased during the last several years after a decline during the late 1980's (Figure 4). The decline was a result of a bubonic plague outbreak that killed most of the prairie dogs in the Boulder Reservoir vicinity (Jones 1989). This plague outbreak occurred between 1985 and 1987. As prairie dogs have become reestablished around the reservoir, wintering raptor populations have steadily increased. Ferruginous hawks and bald eagles are particularly dependent on prairie dogs as a local prey base (Jones 1989).

Wintering raptors are probably attracted to the Dry Creek drainage by the large prairie dog colony on the Axelson property and in Boulder Valley Ranch Field #7, extensive cattail and sedge wetlands, and numerous perches, including two powerlines that run north-south across the drainage. Wintering raptors were much less

Table 1. Mean Raptor Densities on Boulder Reservoir Survey Route¹

<u>Species</u>	<u>No./Count</u>	<u>No./Km</u>
Northern Harrier	0.1	0.01
Red-tailed Hawk	4.2	0.35
Ferruginous Hawk	1.3	0.11
Rough-legged Hawk	0.6	0.05
Golden Eagle	0.1	0.01
Bald Eagle	2.0	0.17
American Kestrel	0.5	0.04
Prairie Falcon	0.1	0.01
Short-eared Owl	<u>0.1</u>	<u>0.01</u>
Total	9.0	0.75

¹Mean number of each species seen per survey, based on 10 surveys between 1 January and 15 March, 1993.

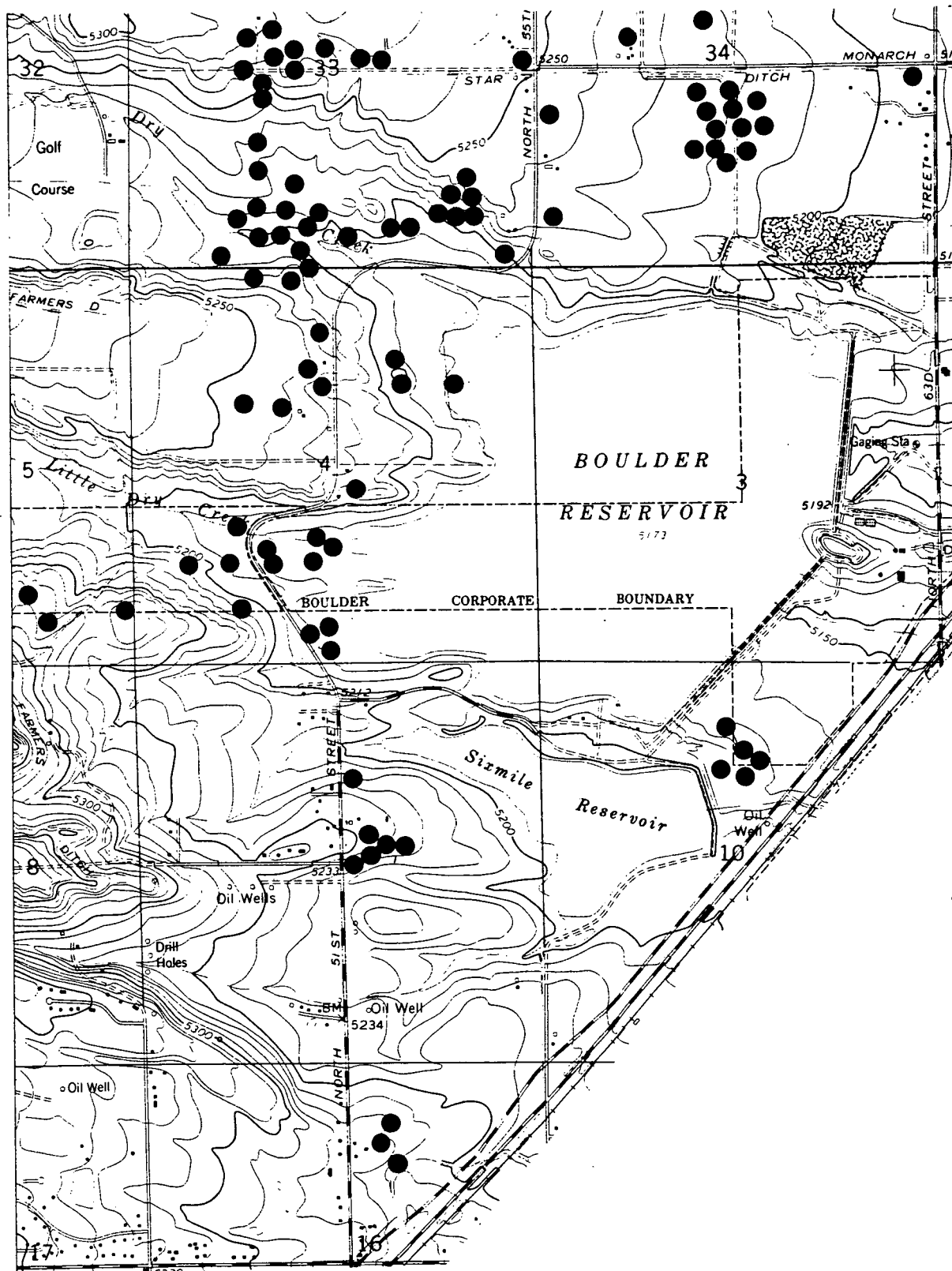
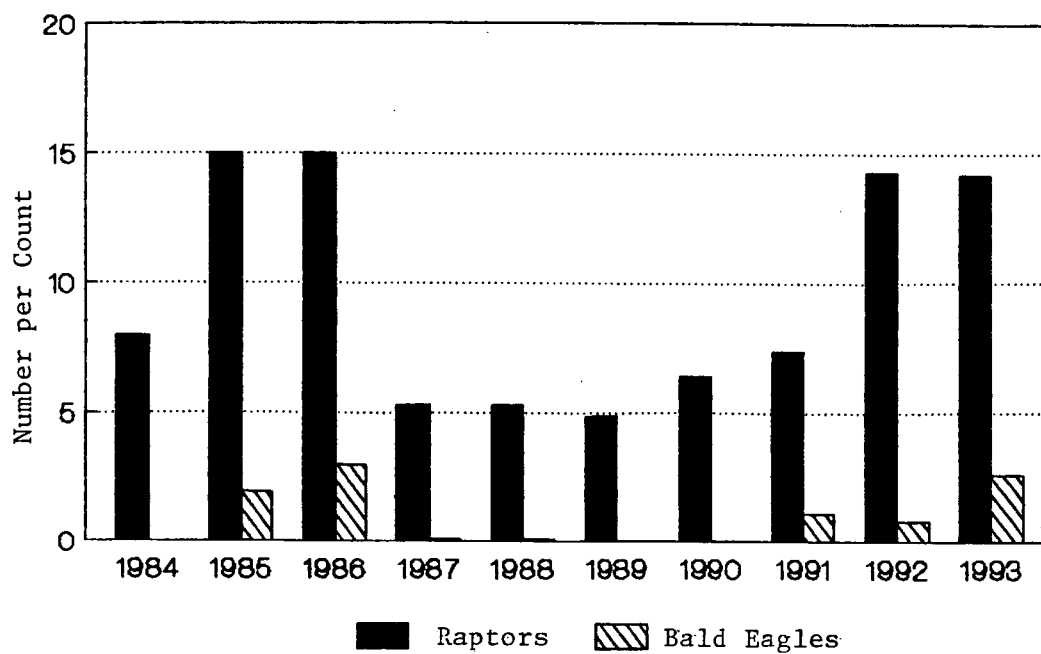


Figure 3. Wintering Raptor Distribution, 1 January–15 March, 1993.
Each dot represents one raptor on one survey (10 surveys).

Figure 4. Mean Wintering Raptor Density, Boulder Reservoir/Haystack Mountain/
Boulder Valley Ranch Survey Route.¹



¹ 20 km survey route, 5-10 surveys each year, 15 October-15 March.

concentrated on the southeast side of North 51st Street. This area supports a sizable prairie dog colony but has fewer perches and is the site of the Boulder Aeromodelling Club.

Results of raptor point counts conducted from "Ray Bob Hill" and from the ridge overlooking the Little Dry Creek drainage indicate that raptors avoid the aeromodelling area when model airplanes are flying (Table 2). During counts conducted when model airplanes were flying, raptor numbers seen from Ray Bob Hill decreased while numbers seen from the ridge south of Little Dry Creek increased ($\chi^2 = 5.12$, $p < .025$).

There were no observed instances of model airplanes displacing perching raptors. More than 80% of observed instances of raptors leaving perches were attributed to "natural" stimuli, such as foraging or encountering other birds (Table 3). Joggers and automobiles were the only "non-natural" stimuli causing raptors to abandon perches.

Bald Eagle

Three to five bald eagles were observed within the study area throughout the winter of 1993. These eagles often perched in cottonwoods and willows to the north and south of Dry Creek (Figure 5). Bald eagles are federally endangered, rare breeders in Colorado (13 pairs in 1991, Craig 1991), and fairly common winter visitants in Boulder County (Boulder County Wildlife Inventory 1975-93). No records exist of bald eagles nesting in Boulder County, but three pairs did nest in eastern Colorado in 1993.

Table 2. Mean Wintering Raptor Densities in Dry Creek and Little Dry Creek Drainages¹

<u>Drainage</u>	<u>Aeromodelling Facility</u>	
	<u>Active</u>	<u>Inactive</u>
Dry Creek	3.0	5.4
Little Dry Creek	3.6	1.4

¹Based on 10 counts (5 "active" and 5 "inactive") between 1 January and 15 March, 1993. The aeromodelling facility is located in the Dry Creek drainage.

Table 3. Observed Causes of Perch Abandonment by Wintering Raptors

<u>Species</u>	<u>Forage</u>	<u>Bird</u>	<u>Jogger</u>	<u>Auto</u>
Northern Harrier	6	5	0	0
Red-tailed Hawk	6	3	1	1
Rough-legged Hawk	7	3	2	1
Ferruginous Hawk	2	1	0	0
Bald Eagle	2	1	0	0
American Kestrel	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>
Total	25	14	5	3

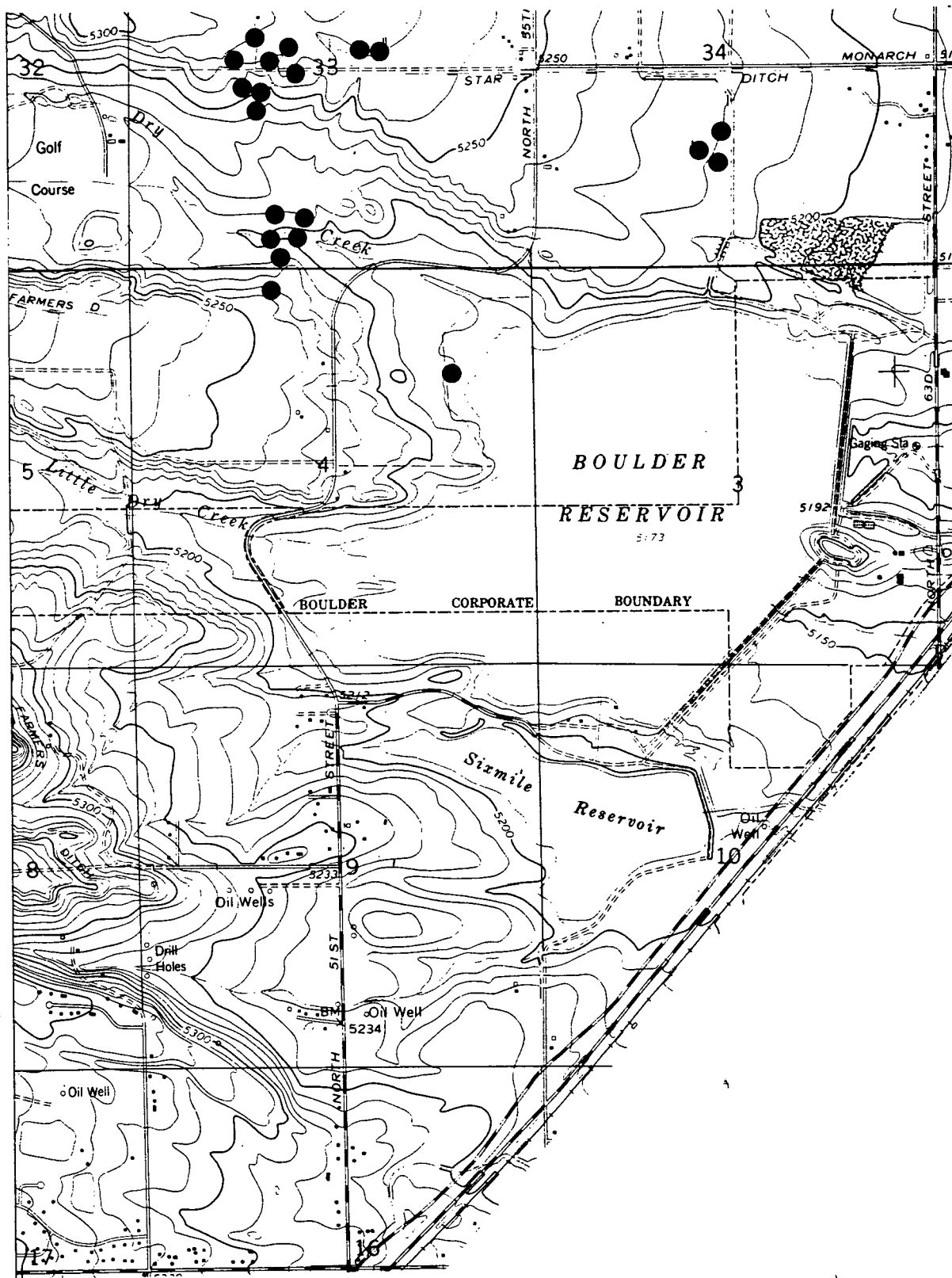


Figure 5. Bald Eagle Distribution, 1 January-15 March, 1993.

(Michael Carter, pers. comm.). Two of these sites, at Barr Lake and Stanley Lake, were located in habitats similar to the wetlands/grasslands/cottonwood grove mosaic on the west side of Boulder Reservoir. However, heavy recreational use of Boulder Reservoir during the summer months may discourage bald eagle nesting within the study area in the future.

Numbers of wintering bald eagles seen at Boulder Reservoir increased from 1988-93 (Figure 4). Preservation of prairie dog colonies and bald eagle roost areas will benefit wintering bald eagle populations. The fenced area on the Axelson property northwest of North 51st Street currently provides a "safe haven" for roosting eagles. Hikers and joggers should be discouraged from entering this area.

Northern Harrier

Three northern harriers (one adult male, one adult female and one juvenile female) were observed in the Little Dry Creek drainage throughout the winter of 1993 (Figure 6). Northern harriers are a rare and declining breeding species in Boulder County and are included on the Audubon Blue List of North American birds with declining populations (Tate 1986). Preservation of wetlands and open grasslands west of Boulder Reservoir will benefit harriers. No additional trails should be constructed in this area, and dog control restrictions should be strictly enforced, especially during the spring and summer breeding seasons.

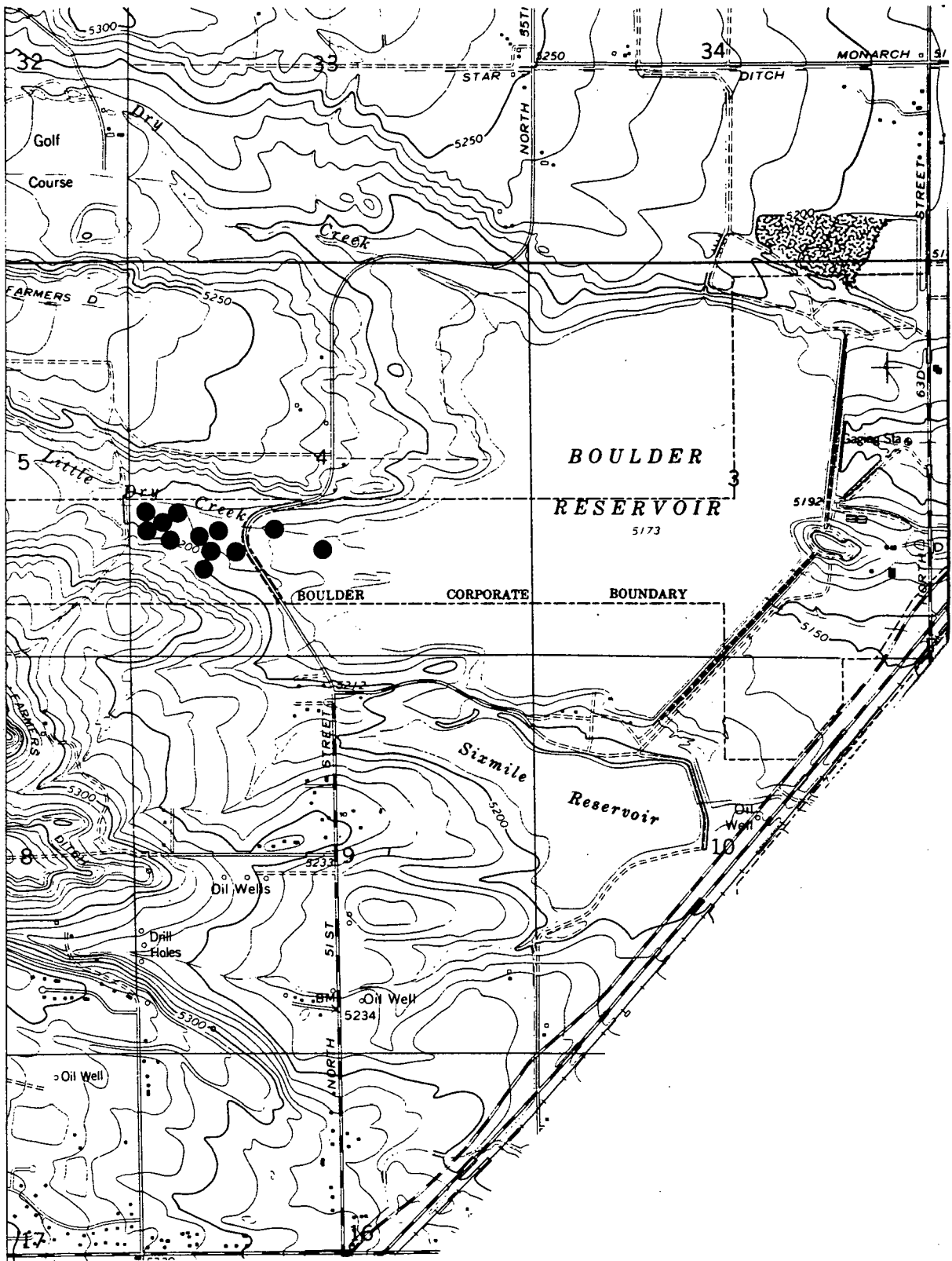


Figure 6. Northern Harrier Sightings, 1 January-15 April.

Short-Eared Owl

Wintering short-eared owls have been seen within the study area during 8 of the last 19 years. One short-eared owl was seen on 28 February 1993, in the Little Dry Creek drainage (Figure 7). Short-eared owls are considered rare and declining in Boulder County and are included on the Audubon Blue List (Boulder County Parks and Open Space 1993, Tate 1986). Boulder Reservoir is one of only two locations in Boulder County where short-eared owls have been reported to the Boulder County Wildlife Inventory more than twice during the last 19 years (Boulder Audubon Society 1975-93). Degradation of wetlands, or recreational incursion into wetlands and grasslands on the west side of Boulder Reservoir, may threaten this species' viability in Boulder County.

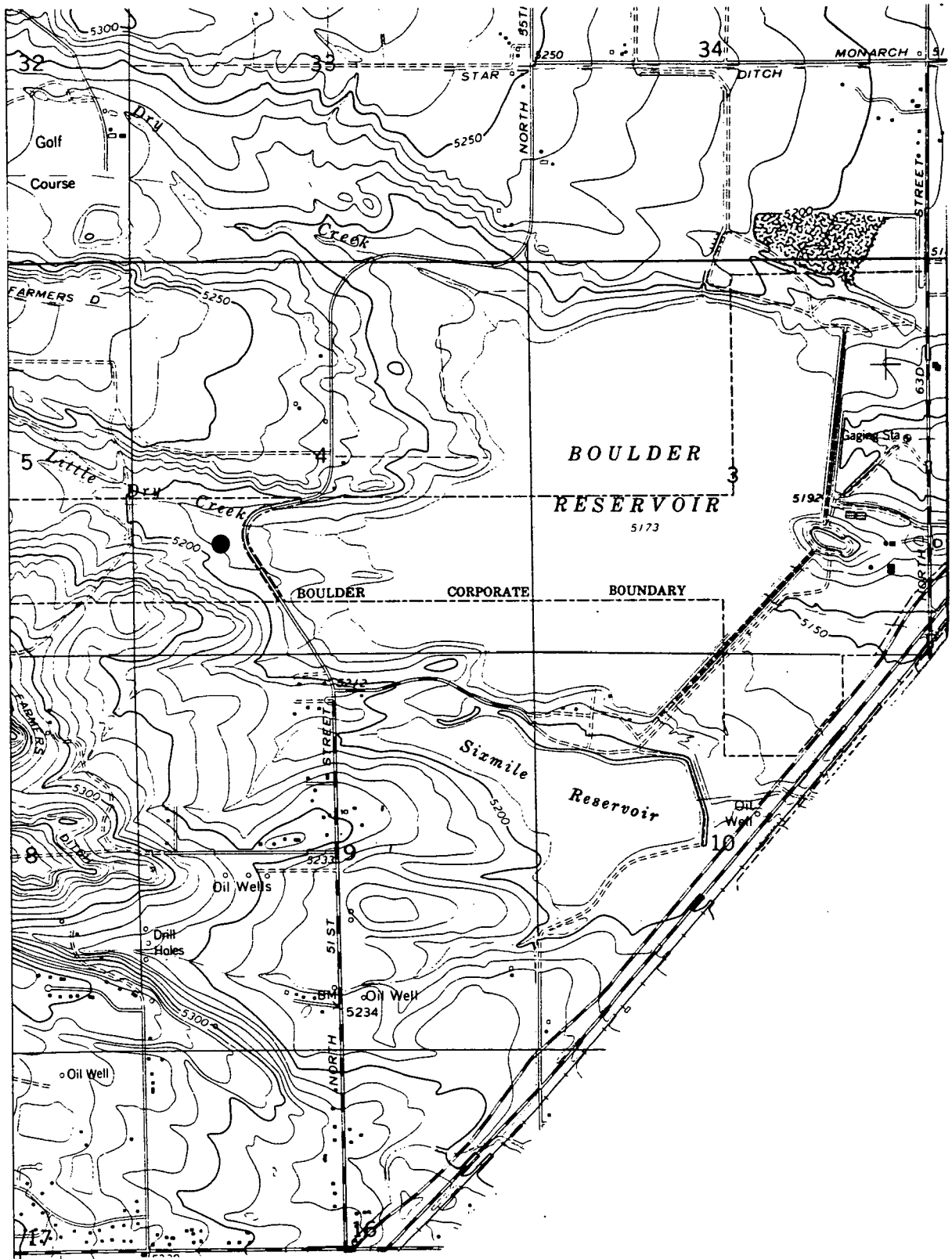


Figure 7. Short-eared Owl Sighting Location.

BREEDING BIRD POPULATIONS

A total of 60 breeding species and 11 non-breeding species were observed within the study area between 15 May and 30 July, 1993 (Table 4). An additional three breeding species were observed within the study area during the 1984-92 breeding seasons. Of the grand total of 63 breeding species, 31 are confirmed breeders (evidence of nesting), 15 are probable breeders (strong indications of nesting), and 17 are possible breeders (seen or heard in appropriate nesting habitat--see Appendix A for a complete description of breeding codes.

Raptors

Figure 8 shows location of raptor nests within the study area during the 1993 breeding season. A northern harrier nest on the north side of the Little Dry Creek drainage fledged five young. A second nest, in the cattail marsh along Little Dry Creek, was apparently abandoned.

A red-tailed hawk nest on the Axelson property northwest of the reservoir fledged at least two young. Two additional pairs of red-tailed hawks nested just outside the study area, the first at Boulder Valley Ranch and the second near the intersection of 47th Street and Jay Road.

Swainson's hawks nested at two locations within the study area: 100 m south of Monarch Road, between North 51st Street and North 63rd Street, and approximately 100 m east of Colorado Highway 119. The Monarch Road nest failed. Success of the second nest was undetermined.

Table 4. Boulder Reservoir Breeding Season Sightings
1993 Breeding Season, Unless Noted

Habitat Codes: G--Grassland, L--Lake or Pond, R--Riparian Woodland,
U--Urban Area, W--Wetland

Breeding Codes: Cf--Confirmed Breeder, Pr--Probable Breeder,
Po--Possible Breeder, Ob--Observed Non-breeder

<u>Species</u>	<u>Habitat</u>	<u>Status</u>	<u>Breeding Behavior</u>
Pied Billed Grebe	L, W	Cf	Fledged young
Western Grebe	L, W	Po	Seen
American White Pelican	L	Ob	Seen
Double Crested Cormorant	L	Ob	Seen
American Bittern	W	Po	Seen
Great Blue Heron	R	Ob	Seen
Black-crowned Night Heron	R	Ob	Seen
Canada Goose	L, W	Cf	Nest with eggs
Green-winged Teal	L, W	Cf	Fledged young
Mallard	L, W	Cf	Fledged young
Blue-winged Teal	L, W	Cf	Fledged young
Cinnamon Teal	L, W	Cf	Fledged young
Northern Shoveler	L, W	Pr	Pair
Gadwall	L, W	Po	Seen
Redhead	L, W	Ob	Seen
Turkey Vulture	---	Ob	Seen
Northern Harrier	G, W	Cf	Nest with young
Swainson's Hawk	R	Cf	Occupied nest
Red-tailed Hawk	R	Cf	Nest with young
American Kestrel	R	Cf	Occupied nest
Ring-necked Pheasant	G	Po	Heard
Virginia Rail	W	Po	Heard
American Coot	L, W	Cf	Fledged young
Killdeer	G, L	Cf	Distraction display
American Avocet	G, W	Po	Seen
Spotted Sandpiper	W	Pr	Seen
Long-billed Curlew	G, W	Ob	Seen
Common Snipe	W	Pr	Territorial male
Rock Dove	U	Pr	Courtship
Mourning Dove	R	Cf	Fledged young
Common Barn Owl	U	Pr	Roost site, 1992
Great Horned Owl	R	Cf	Nest with young
Burrowing Owl	G	Cf	Occupied nest, 1982-9
Common Nighthawk	R	Po	Seen
Broad-tailed Hummingbird	R	Po	Seen
Belted Kingfisher	R	Po	Seen
Downy Woodpecker	R	Po	Seen
Northern Flicker	R	Cf	Occupied nest
Say's Phoebe	U	Po	Seen
Western Kingbird	R	Pr	Pair

Table 4. Boulder Reservoir Breeding Season Sightings cont'd.

<u>Species</u>	<u>Habitat</u>	<u>Status</u>	<u>Breeding Behavior</u>
Eastern Kingbird	R	Pr	Pair
Tree Swallow	L, R	Pr	Pair
Violet-green Swallow	---	Ob	Seen
Rough-winged Swallow	G, L	Po	Seen .
Cliff Swallow	U	Cf	Occupied nest
Barn Swallow	U	Cf	Occupied nest
Blue Jay	R	Po	Seen
Black-billed Magpie	R	Cf	Occupied nest
American Crow	R	Po	Seen
Common Raven	---	Ob	Seen
Black-capped Chickadee	R	Po	Seen
House Wren	R, W	Cf	Feeding young
American Robin	R, U, W	Cf	Nest with young
Starling	R, U	Cf	Occupied nest
Yellow Warbler	R	Pr	Territory
Yellow-rumped Warbler	---	Ob	Seen
Common Yellowthroat	R, W	Cf	Feeding young
Chipping Sparrow	---	Ob	Seen
Vesper Sparrow	G	Pr	Territory
Lark Bunting	G	Po	Seen, May 1984
Savannah Sparrow	W	Pr	Territory
Grasshopper Sparrow	G	Pr	Territory
Song Sparrow	W	Pr	Territory
Red-winged Blackbird	W	Cf	Occupied nest
Western Meadowlark	G	Cf	Feeding young
Yellow-headed Blackbird	L, W	Cf	Occupied nest
Brewer's Blackbird	R, W	Pr	Pair
Common Grackle	R, U	Cf	Occupied nest
Brown-headed Cowbird	R, U, W	Cf	Nest with eggs
Northern Oriole	R	Cf	Used nest
House Finch	U	Cf	Occupied nest
Lesser Goldfinch	R	Po	Seen
American Goldfinch	R, W	Pr	Pair
House Sparrow	U	Cf	Occupied nest

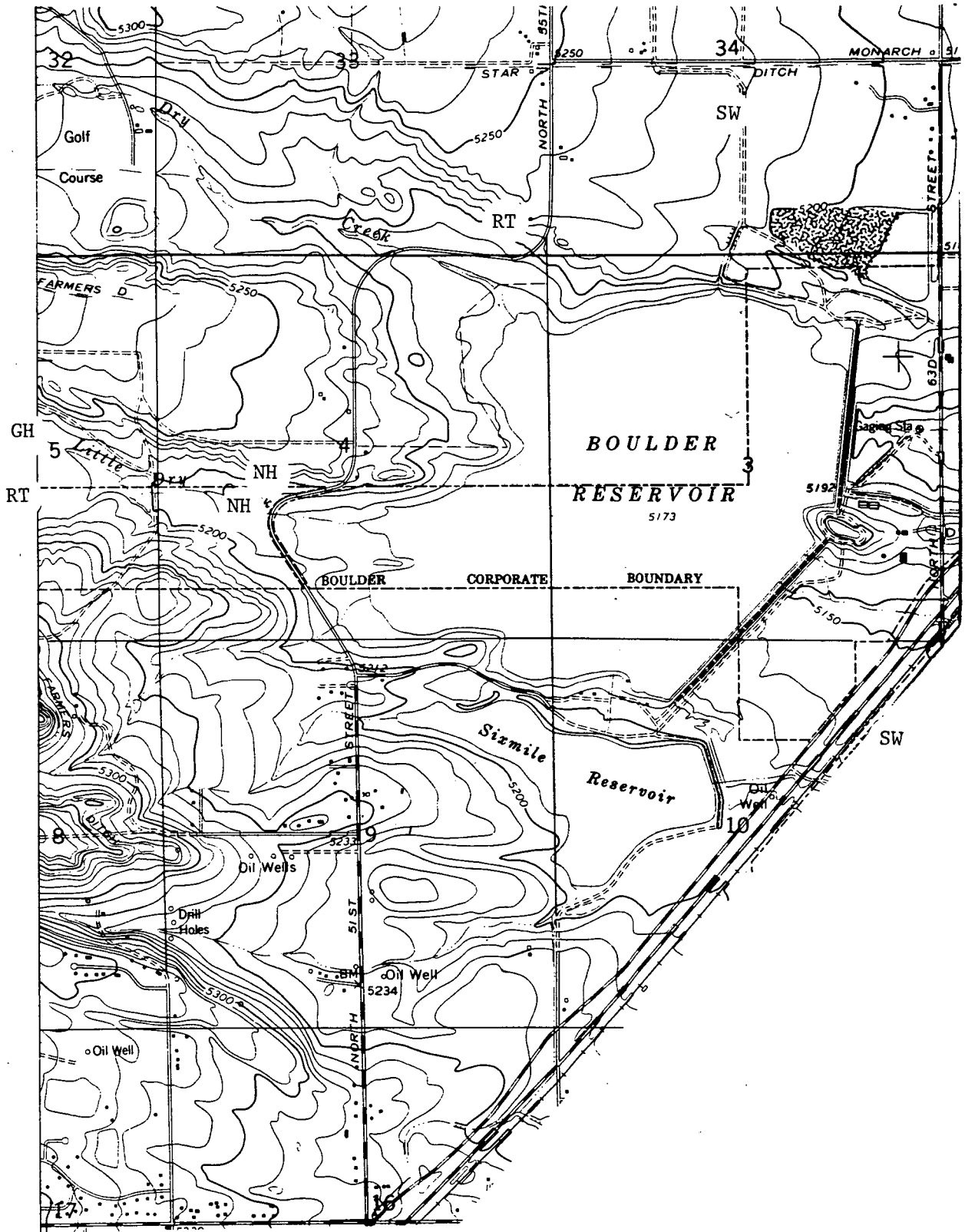


Figure 8. Raptor Nest Location, 1993.

- GH: Great Horned Owl
- NH: Northern Harrier
- RT: Red-tailed Hawk
- SW: Swainson's Hawk

A great horned owl nest 1.5 km west of the reservoir fledged at least two young. A common barn owl was seen at Coot Lake on 19 December, 1992 (Boulder Audubon Christmas Bird Count), and a barn owl roost or nest site was discovered by Open Space Rangers on the Johnson Farms property south of Monarch Road, but there was no confirmation of barn owl nesting within the study area during the 1993 breeding season. All historic burrowing owl nest sites were field checked at least twice between 15 May and 30 July. All of these sites appeared to be inactive, and no burrowing owls were seen within the study area during the 1993 breeding season.

Marsh Birds

A total of 39 breeding and non-breeding species were seen or heard within the Dry Creek, Little Dry Creek, and Coot Lake wetland areas between 15 May and 30 July, 1993 (Table 5). The Little Dry Creek wetland supported 27 species, 17 of which probably nested. The Dry Creek drainage supported 25 species, including 9 probable nesting species. The Coot Lake wetland supported 17 species, including 11 probable nesters.

The Little Dry Creek wetland covers a larger area than the other two sampled wetlands and appears to contain a greater diversity of nesting habitats. The Little Dry Creek and Dry Creek wetlands are surrounded by barbed wire fences and are rarely visited by recreational users. During more than 20 visits to the study area, I saw no one enter these wetland areas. In contrast, the Coot Lake wetland is surrounded by a hiking and jogging trail

that receives heavy use from IBM employees. Human disturbance could account, in part, for the relatively low numbers of breeding birds in the Coot Lake wetland.

Table 5. Species Observed in Boulder Reservoir Wetlands

Boldfaced species are probable or confirmed breeders.

Little Dry Creek

Common Egret
Canada Goose
Green-winged Teal
Mallard
Blue-winged Teal
Cinnamon Teal
Northern Harrier
Killdeer
Common Snipe
 Rock Dove
Mourning Dove
Western Kingbird
Eastern Kingbird
Cliff Swallow
Barn Swallow
Common Raven
Yellow Warbler
Yellow-rumped Warbler
Common Yellowthroat
Chipping Sparrow
Vesper Sparrow
Song Sparrow
Red-winged Blackbird
Western Meadowlark
Yellow-headed Blackbird
Brown-headed Cowbird
American Goldfinch

Dry Creek

White Pelican
Great Blue Heron
Black Crowned--
Night Heron
Green-winged Teal
Mallard
Blue-winged Teal
Cinnamon Teal
Northern Shoveler
Red-tailed Hawk
Ring-billed Gull
Franklin's Gull
Killdeer
Common Snipe
Mourning Dove
Great Horned Owl
Broad-tailed Hummingbird
Belted Kingfisher
Cliff Swallow
Barn Swallow
Common Raven
Common Yellowthroat
Vesper Sparrow
Savannah Sparrow
Red-winged Blackbird
Western Meadowlark

Coot Lake

American Bittern
Great Blue Heron
Black Crowned--
Night Heron
Mallard
Killdeer
Spotted Sandpiper
Mourning Dove
Cliff Swallow
Barn Swallow
Common Yellowthroat
Savannah Sparrow
Song Sparrow
Red-winged Blackbird
Western Meadowlark
Brown-headed Cowbird
House Finch
American Goldfinch

Species of Special Concern

The Boulder County Parks and Open Space Department has published a list of avian species of special concern in Boulder County (Boulder County Parks and Open Space 1993). This list includes the following categories of avian species:

- I. Rare and Declining
- II. Declining (but not yet rare)
- III. Rare and Stable
- IV. Extirpated
- V. Isolated or Restricted Population
- VI. Additional National or Statewide Concern

Sixteen of the species observed within the Boulder Reservoir study area during the 1993 breeding season are included on this list. Species accounts follow.

Double Crested Cormorant 10

V.--Isolated Population

Double crested cormorants nest on and around lakes in eastern Boulder County, but there are no historical records of nesting at Boulder Reservoir. I observed double crested cormorants perching and foraging at Boulder Reservoir throughout the 1993 breeding season.

American Bittern u

I.--Rare and Declining

V.--Isolated Population

American bitterns nest in fewer than four known locations in Boulder County (Boulder County Parks and Open Space 1993). I observed an immature American bittern in the cattail marsh west of Coot Lake on 20 July, 1993 (Figure 9). This species will benefit from preservation of cattail marshes throughout the study area.

Great Blue Heron

V.--Isolated Population

Great blue herons nest at a single location in Boulder County, a rookery along Boulder Creek east of 95th Street. Great blue herons were observed fishing in Boulder Reservoir throughout the 1993 breeding season.

Black-crowned Night Heron ((

V.--Isolated Population

See Great Blue Heron above.

Green-winged Teal

V.--Isolated and Restricted Population

Green-winged teal nest in wetlands throughout Boulder County, primarily in the middle to high mountains (Boulder County Comprehensive Plan 1988, Andrews and Righter 1992). I observed a pair of green-winged teal with young in the Little Dry Creek

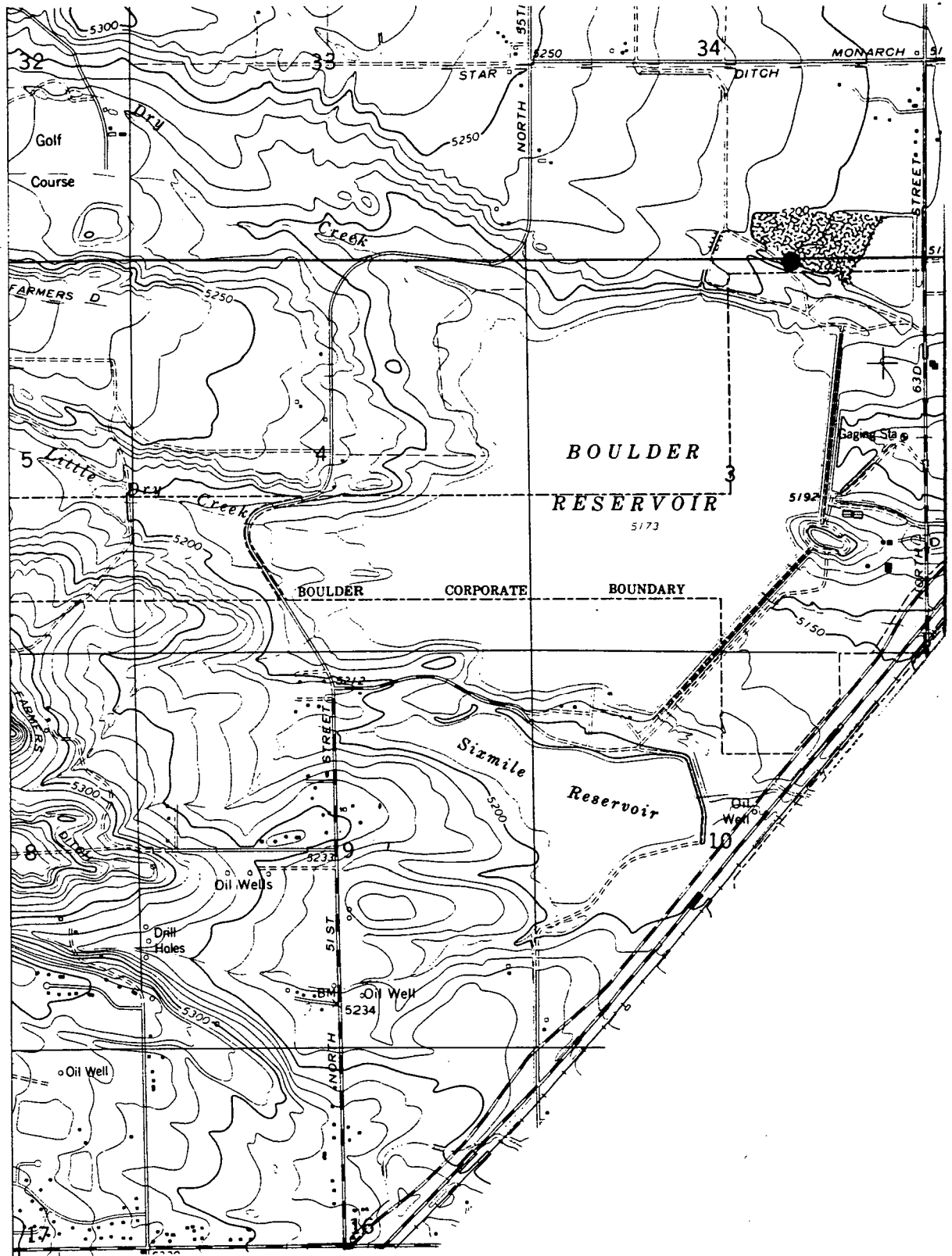


Figure 9. American Bittern Sighting Location.

drainage on 6 July, 1993. Buffering of wetland areas from recreational users and domestic dogs will benefit this species.

Northern Harrier

I.--Rare and Declining

V.--Isolated and Restricted Population

Northern harriers were once considered fairly common breeders in Boulder County (Henderson 1908). Between 1983-93 harriers nested at only three known locations within the County: Boulder Reservoir, Lagerman Reservoir, and a wetland near the intersection of US 287 and Baseline Road (Dave Hallock, pers. comm.). Harriers nest in grasslands and wetlands throughout eastern Colorado (Andrews and Righter 1992).

Figure 10 shows northern harrier nesting locations at Boulder Reservoir from 1984-93. During summer, 1992, I observed a pair of northern harriers in the Little Dry Creek drainage, but I made no effort to find a nest. During spring and summer, 1993, I observed one adult male harrier, one adult female harrier, and one immature female harrier in the Little Dry Creek drainage, mostly west of North 51st Street. A nest constructed by the adult female in the cattail marsh west of North 51st Street was later abandoned. A second nest constructed by the immature female on the grassy slope north of the cattail marsh fledged five young on 1 August.

Since northern harriers nest on the ground, they are vulnerable to predation by domestic dogs and other canids.

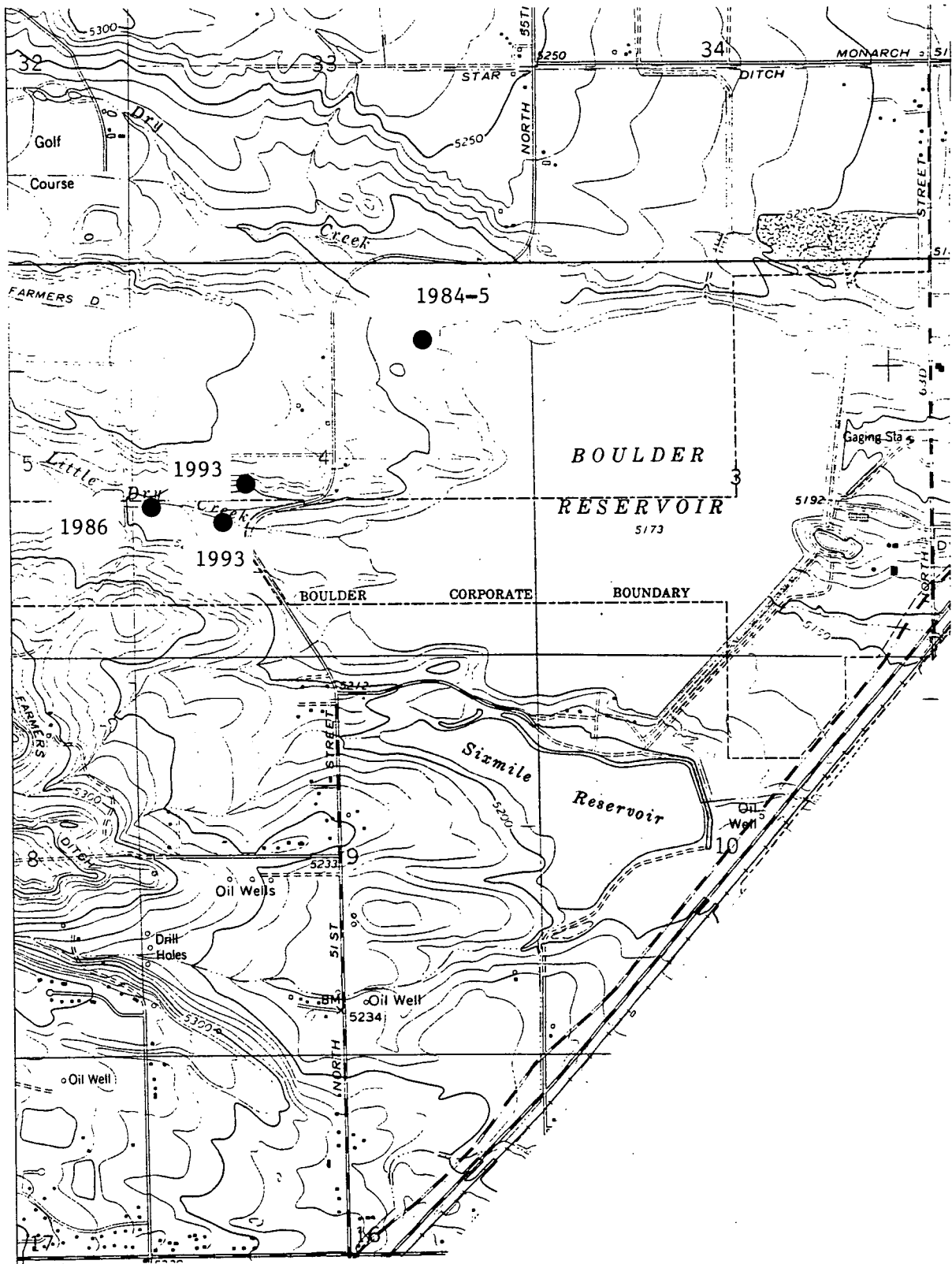


Figure 10. Northern Harrier Nest Sites, 1984-93.

Northern harrier nesting locations should be closed to recreational users, and warning signs advising of the dangers posed by unleashed dogs should be placed at trailheads during the nesting season. Northern harrier nesting success at Boulder Reservoir should be carefully monitored annually by Parks and Open Space personnel and/or volunteers.

Swainson's Hawk

II.--Declining li

Swainson's hawks nest throughout the prairies of eastern Colorado (Andrews and Righter 1992). During the 1993 nesting season, Swainson's hawks nested in Boulder County at Rock Creek Farm, Gaynor Lakes, near Lagerman Reservoir, along Dillon Road west of South 104th Street, and near Boulder Reservoir. A pair of Swainson's hawks constructed a nest south of Monarch Road and north of Boulder Reservoir in June 1993. This nest was abandoned. A second pair constructed a nest south of Colorado 119 during June, 1993. Success of this nest was undetermined.

Nesting Swainson's hawks are extremely sensitive to human disturbance (Bailey and Niedrach 1965). Swainson's hawk nests should be monitored regularly by Parks and Open Space personnel or volunteers.

Long-billed Curlew

Extirpated in Boulder County

Historical records indicate that long-billed curlews nested in Boulder County prior to 1913 (Betts 1913). Long-billed curlews currently nest in scattered locations throughout eastern Colorado, primarily in midgrass prairies in southeastern Colorado (Andrews and Righter 1992). I observed a long-billed curlew in the Little Dry Creek drainage west of North 51st Street on 26 April, 1993 (Figure 11). Suitable nesting habitat for curlews does exist at Boulder Reservoir. Both the Little Dry Creek and the Dry Creek drainages could serve as potential long-billed curlew reintroduction sites in the future.

Common Barn Owl

III.--Rare and Stable

Common barn owls nest at fewer than four known locations in Boulder County (Boulder County Parks and Open Space 1993). A barn owl was observed at Coot Lake during the 1992 Boulder Audubon Christmas Count. Open Space personnel discovered a barn owl roost in an abandoned farmhouse on the Johnson Farms property during September, 1993 (Mark Gershman, pers. comm.). Barn owls nest in a variety of settings, including caves, earthen banks, and buildings (Ehrlich et. al. 1988), so nest site availability may not be a serious limiting factor to nesting success in Boulder County. Nevertheless, all active barn owl nest sites should be preserved and monitored.

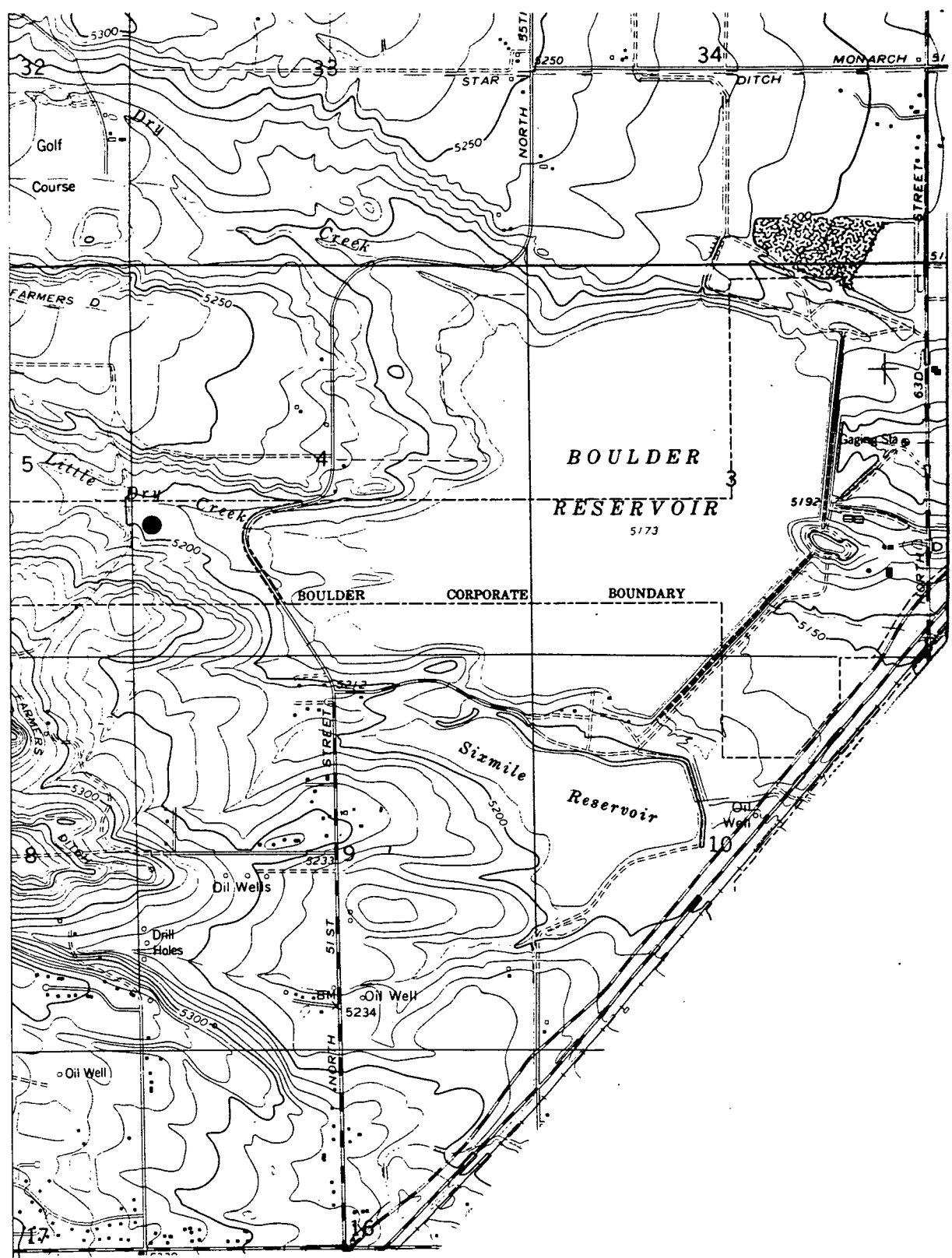


Figure 11. Long-billed Curlew Sighting Location.

Burrowing Owl

I.--Rare and Declining

V.--Isolated and Restricted

Burrowing owls were considered fairly common in Boulder County around the turn of the century (Henderson 1908). Now they are among the rarest birds in the county, with only two known nest locations from 1990-93 (Boulder County Wildlife Inventory 1975-93). Nesting success at these sites has been sporadic at best (Michael Sanders, pers. comm.), so this species must be considered on the verge of extirpation from Boulder County.

Burrowing owls nested within the Boulder Reservoir study area from 1980-89 (Figure 12). The Johnson Farms nest site north of the reservoir (1982-4) was converted to agricultural use. Nest sites west of the reservoir at Boulder Valley Ranch Field #7 and on the Lore and Axelson Properties (1982-87) were abandoned after a bubonic plague epidemic in 1985-86 killed most of the prairie dogs in the area. A nest south of Coot Lake and east of the dam face (1988) fledged at least four young, but this nest was disturbed the following year when the prairie dog colony in which it was located was used as a parking area for the Kinetics Conveyance Race. Since 1989 no burrowing owl observations have been reported within the study area during the typical breeding months of April-July (Boulder County Wildlife Inventory 1975-93, Ann Wichmann, pers. comm.).

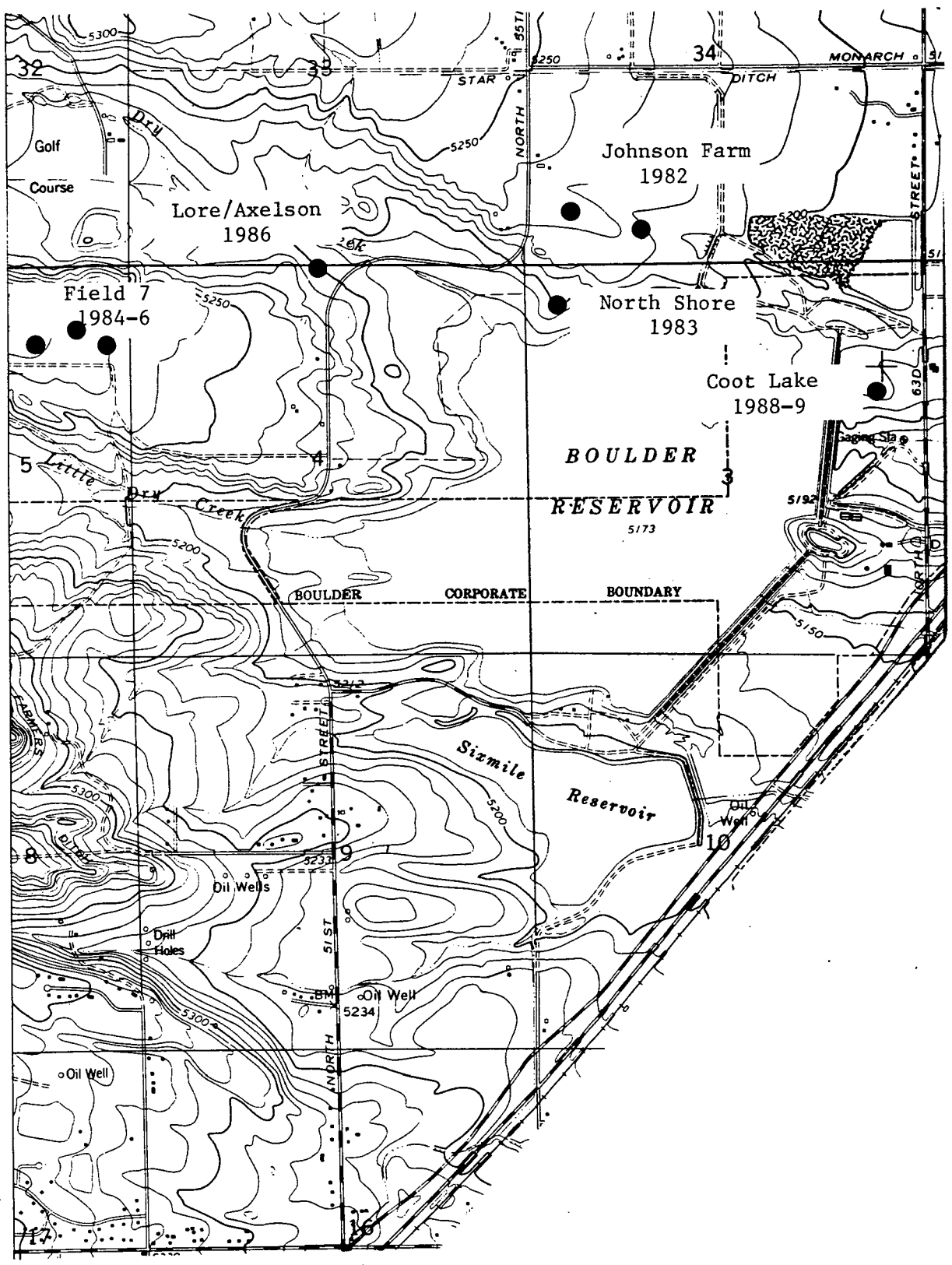


Figure 12. Burrowing Owl Nest Sites, 1982-9.

The disappearance of burrowing owls from the Boulder Reservoir area probably results from a variety of factors:

1. Loss of nesting habitat. Some nesting sites have reverted to agricultural uses, some have been disturbed by recreational activities, and others have been lost due to "natural" causes, such as bubonic plague outbreaks.
2. Winter mortality. Burrowing owls nesting in Boulder County migrate south for the winter. Some may go as far as Mexico, where continued use of DDT and other insecticides on prey populations (grasshoppers and other insects) may threaten burrowing owl wintering populations.
3. Habitat fragmentation. Fragmentation of burrowing owl nest habitat around Boulder Reservoir and throughout Boulder County may lead to increased predation by domestic dogs, as well as coyotes, red foxes, and great-horned owls; and may lead to reduced opportunities for recolonization of historic nesting sites.

Between 1982-89, 11 burrowing owl nests within the study area fledged a total of 29 young, and 2 nests failed (Table 6). The fledge rate of approximately 2.6 fledglings/successful nesting attempt was smaller than that reported for other North American populations (Gleason and Johnson 1985). Only 3 of 11 nest burrows were reused the following year. This compares with nest fidelity rates of over 50% reported by other studies (Zarn 1974). These data suggest that disturbance or fragmentation of nesting habitat may have contributed to the observed decline in burrowing owl populations at Boulder Reservoir. The failure of nesting populations to increase or stabilize after relatively successful nesting years (see 1982-3, 1984-5, and 1988-9) suggests that other factors, such as overwintering mortality, may also have contributed to the decline.

Table 6. Burrowing Owl Nesting Reports, Boulder Reservoir

Year	<u>Nest/Fledged Young</u>						<u>Total</u>
	<u>Johnson Farms</u>	<u>North Shore</u>	<u>Field 7</u>	<u>Lore</u>	<u>Mesa Res.</u>	<u>Coot Lake</u>	
1981	---	---	Active	---	1/--	---	1/-
1982	2/6	Inactive	---	Active	Inactive	---	2/6
1983	Inactive ¹	1/5	Active	---	Inactive	---	1/5
1984	Inactive	Inactive ²	2/6	Inactive	Inactive	---	2/6
1985	Inactive	Inactive	2/4	Inactive	Inactive	Inactive	2/4
1986	Inactive	Inactive	1/0 ³	1/4	Inactive	Inactive	2/4
1987	Inactive	Inactive	Inactive	Inactive ⁴	Inactive	Inactive	0/0
1988	Inactive	Inactive	Inactive	Inactive	Inactive	1/4	1/4
1989	Inactive	Inactive	Inactive	Inactive	Inactive	1/0 ⁵	1/0

--- Not Field Checked

¹Prairie dog colony destroyed. Now a winter wheat field.

²Burrow plugged by prairie dogs. Colony still active.

³Nest abandoned. Colony destroyed by plague.

⁴Colony destroyed by plague.

⁵Nest unsuccessful. Prairie dog colony was used as a parking lot for Kinetics Conveyance Race in May when at least one owl was present.

The Colorado Division of Wildlife, in cooperation with the Birds of Prey Rehabilitation Foundation, has proposed reintroducing burrowing owls at Boulder Reservoir. Without further knowledge of the causes of the original decline, it is impossible to predict whether reintroduction efforts will succeed. At the very least, reintroduction of banded birds should provide information about causes of burrowing owl mortality. This information would be of value to ecologists studying the causes of an observed decline in breeding burrowing owl populations throughout the North American high plains region.

The extirpation of burrowing owls in Boulder County would be a devastating loss. In addition to being a unique and fascinating wildlife species, burrowing owls are a remnant of the native fauna that populated the high plains prior to the destruction of natural ecosystems by European-American settlers. Restoring this species to its native habitat should be a top priority superseding all other uses of Boulder Reservoir. Specific components of a burrowing owl restoration plan should include:

1. Annual monitoring of historic nest sites by Parks and Recreation personnel or volunteers.
2. Protection of all historic nest areas from any disturbance by recreational users.
3. Posting of informational signs concerning burrowing owls at all trailheads.
4. Cooperation with the Colorado Division of Wildlife in reintroduction efforts.

Common Nighthawk

VI.--Audubon Blue List

Common nighthawks nest throughout much of the plains, foothills, and mountains of eastern Colorado (Andrews and Righter). Common nighthawks were observed within the study area during the 1993 breeding season, but there was no evidence of nesting.

Yellow Warbler

VI.--Audubon Blue List

Yellow warblers nest in riparian woodlands throughout Boulder County to approximately 2500 m (Hallock 1987). I observed singing yellow warblers in cottonwoods and willows along Little Dry Creek west of North 51st Street during May, 1993.

Lark Bunting

I.--Rare and Declining

Lark buntings nest in fewer than four known locations in Boulder County (Boulder County Parks and Open Space 1993). The most recent breeding season sighting of lark buntings within the Boulder Reservoir study area is from May, 1984 (Boulder Audubon Society 1984 spring bird count).

Savannah Sparrow

V.--Restricted Population

Savannah sparrows nest in damp meadows and marsh edges throughout much of the plains and mountains of eastern and central

Colorado (Andrews and Righter 1992). ~~I observed~~ singing savannah sparrows in the Dry Creek drainage and in the cattail marsh west of Coot Lake during May and June 1993.

Grasshopper Sparrow

VI.--Audubon Blue List

Grasshopper sparrows nest in grasslands and fallow fields throughout the plains of eastern Colorado (Andrews and Righter 1992). This species nests within the study area in mid-grass prairie habitat on the Boulder Valley Ranch property west of North 51st Street (Thompson and Strauch 1986).

Yellow-headed Blackbird

V.--Restricted Population

Yellow-headed blackbirds nest primarily in cattail marshes containing standing water (Andrews and Righter 1993). They are colonial nesters, often found in large numbers within appropriate nesting habitat. Yellow-headed blackbirds nest within the study area along the shores of Sixmile Reservoir, along the west shore of Boulder Reservoir, and in the cattail marsh west of Coot Lake.

MANAGEMENT RECOMMENDATIONS

MANAGEMENT RECOMMENDATIONS

Management recommendations in this report are directed toward protecting and enhancing wildlife habitat at Boulder Reservoir while providing for continuation of historic recreational uses of the reservoir. Managing an area that receives such heavy recreational use and supports so many sensitive environmental areas will require constant monitoring and communication among agencies and departments. Nest and roost sites for species of special concern should be checked and mapped annually. Annual meetings involving personnel from the Boulder Reservoir Management Staff, the Mountain Park Rangers, the City of Boulder Open Space Rangers, the Colorado Division of Wildlife, the Northern Colorado Water Conservancy District, and interested representatives from local environmental organizations will ensure that all activities at the reservoir are coordinated to provide maximum possible protection for sensitive wildlife areas.

In terms of recreational use and wildlife habitat, the Boulder Reservoir study area can be divided roughly into three regions, or zones:

- I. Critical wildlife habitat. Recreational access is greatly restricted. Sensitive areas are entirely closed to the public.
- II. Wildlife habitat/passive recreational use. Fishing, hiking, jogging, and other low impact recreational activities are permitted. Sensitive wildlife areas are mapped and protected.
- III. Recreational use. High impact recreational activities, including water skiing, kinetics, and beach concerts are permitted. Wildlife populations are monitored, and efforts are made to protect sensitive habitats and breeding locations for species of special concern.

If a zone management approach for Boulder Reservoir is adopted, zone boundaries should be determined only after careful review by all of the agencies and organizations mentioned above. This report includes suggested boundaries only for Zone 1, critical wildlife habitat. Critical wildlife habitat is defined in the Environmental Resources Element of the Boulder County Comprehensive Plan as:

1. Habitats which support federally-listed threatened or endangered species.
2. Habitats which support state-listed threatened or endangered species.
3. Habitats which support a species that is rare in Boulder County (three or fewer well-documented viable sites).
4. Habitats which support a species that has undergone a documented long-term noncyclical population decline.
5. Single habitat types to which a species is totally restricted for at least a portion of its life cycle.
6. Single, identifiable locations that support a significant concentration of a given species' population for at least a portion of its life cycle.
7. Habitats which support an unusually high diversity or density of species, or have exceptional aquatic quality.
8. Habitats that would support the reintroduction of extirpated species.
9. Human-made habitats that support species that would otherwise be extirpated due to loss of native habitat, or would otherwise not be found in Boulder County.

Approximate boundaries of critical wildlife habitat at Boulder Reservoir, as delineated in the Boulder County Comprehensive Plan Environmental Resources Map and as determined by data gathered for

this report, are shown in Figure 13. Critical wildlife habitat at Boulder Reservoir fits the following County criteria:

1. Bald eagle
3. Northern harrier, short-eared owl, burrowing owl, common barn owl.
- 4,9. Northern harrier, burrowing owl.
7. Little Dry Creek, Dry Creek.
8. Burrowing owl, long-billed curlew.

Critical wildlife habitat boundaries must be reviewed and altered periodically to reflect changes in nesting and denning locations of species of concern as well as changes in the structure and composition of wildlife habitat. Management must take into account the fact that some areas are more "active" than others. For example, it may be appropriate to permit passive recreational activities near historic burrowing owl nest sites that have not been occupied for over five years, whereas such activities would not be appropriate near active northern harrier nest sites in sensitive wetlands.

Trails

Current trail alignments around Boulder Reservoir function effectively to keep people away from the most sensitive environmental areas while providing easy access to recreational areas. Realignment of existing trails does not seem necessary.

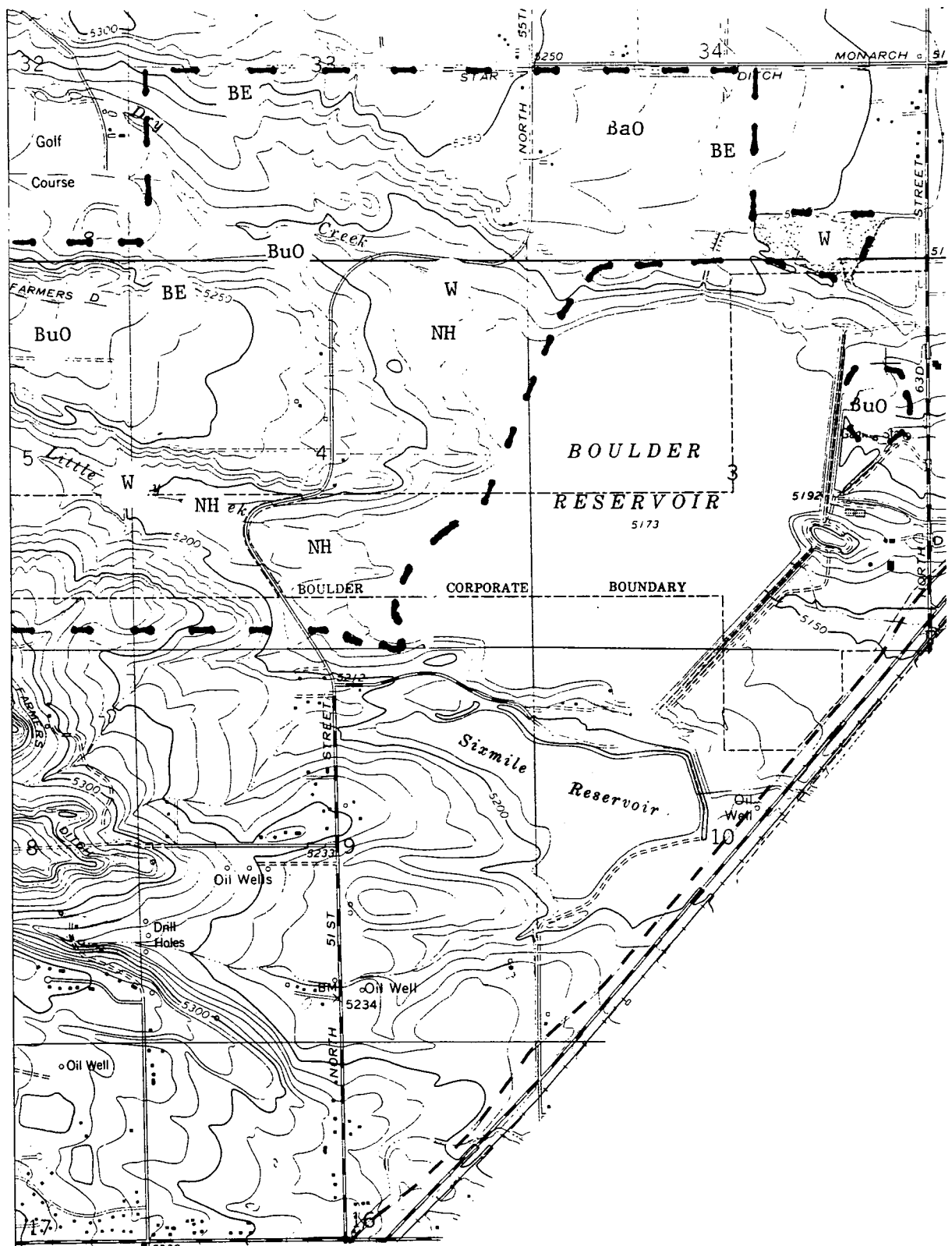


Figure 13. Critical Wildlife Habitat.

- | | |
|--------------------|----------------------|
| BE: Bald Eagle | NH: Northern Harrier |
| BaO: Barn Owl | W: Wetland |
| BuO: Burrowing Owl | |

Management Recommendations:

- (1) Retain existing trail alignments.
- (2) Avoid construction of any new trails in or adjacent to critical wildlife habitat.
- (3) Post informational signs at all trailheads advising the public of the critical wildlife designation, describing the affected species and warning of the dangers posed by off-trail hiking and dogs at large.

Wetlands

The Little Dry Creek, Dry Creek, and Coot Lake wetlands support a high percentage of nesting and wintering birds at Boulder Reservoir. During the 1993 winter and breeding bird seasons, I observed disturbance of nesting or roosting birds by recreational users along the reservoir west shore but not in the wetlands to the west of the reservoir. However, future use of these areas may intensify, and warning or closure signs may need to be posted.

Management Recommendations

1. Retain and maintain barbed wire fences around Little Dry Creek and Dry Creek wetlands west of N. 51st St.
2. Post warning or closure signs around active northern harrier nest sites.
3. Continue weed control program in Coot Lake wetland and initiate weed control program for common teasel in Little Dry Creek wetland.

Prairie Dog Colonies

Existing prairie dog preserves serve as foraging areas for bald eagles, ferruginous hawks, red-tailed hawks, and other raptors; and as breeding areas for burrowing owls, badgers, and other mammals. These colonies should be retained and monitored

annually for presence of burrowing owls. Active burrowing owl nest sites should be closed to public access.

Management Recommendations

1. Retain existing prairie dog colonies.
2. Monitor colonies annually for nesting burrowing owls.
3. Protect historic nest sites from recreational users.
4. Close active nest sites to public access (recommended buffer zone: 100 m).

Aeromodelling

The Boulder Aeromodelling facility is located in the midst of designated critical wildlife habitat northwest of the reservoir. The facility was originally constructed in 1971. Since then approximately \$50,000 has been invested in improvements. Approximately 100 Boulder Aeromodelling Society (BAS) club members use the facility. The facility is open year-round, and some use occurs during most days of the year.

Observers have reported seeing model airplanes from the facility chasing birds of prey. During more than 50 hours of field observation at the reservoir, I observed no instances of model airplanes harrassing flying or perching raptors. Data from this study indicate that raptors tend to avoid the aeromodelling facility area when the facility is in use, but there is no clear evidence that the aeromodelling operation stresses or threatens nesting and wintering raptors.

Beginning in 1991, the BAS received permission from Reservoir staff to conduct "float flies" from the northwest shore of the

reservoir. Float flies are usually held in May, July, and September. Members and guests drive 30 or more vehicles along a primitive dirt road that begins at the aeromodelling facility, crosses an active prairie dog colony and ends near an old water tank 100m south of the point where Dry Creek enters the reservoir. This use is inconsistent with the critical wildlife designation for the affected area. BAS representatives say it would be possible to move the float flies to a less sensitive area, such as the wind surfing or jet skiing beaches on the south side of the Reservoir. They do say that this would cause some inconvenience, and they are concerned about conflicts with other recreational users. Holding the float flies at another time of year is apparently not an option because water levels in late fall and winter (the non-nesting season for birds) are too low.

BAS representatives have expressed an interest in working with Parks and Recreation staff to monitor and protect critical wildlife habitat at the reservoir. They suggest that staff post informational signs with pictures of target species at the facility.

Management Recommendations

1. Post informational signs at the aeromodelling facility advising users of the critical wildlife designation and describing affected species.
2. Move the float flies to a less sensitive area, outside of the critical wildlife habitat.
3. Close the "casual" road from the aeromodelling facility to the reservoir's northwest shore to all motor vehicle use except by Parks personnel.

Waterfowl Nesting and Roosting

The Colorado Division of Wildlife has worked with Parks and Recreation staff to improve waterfowl nesting habitat on the west shore of the reservoir. Parks and Recreation staff have constructed osprey nesting platforms on telephone poles in the Little Dry Creek drainage. Boaters, fishers, hikers, and bird-watchers frequently disturb roosting and nesting waterfowl along the reservoir's west shore (Mt. Park Rangers, pers. comm.). Wave action from power boats and jet skis may destabilize waterfowl nesting habitat along the west shore (Camp, Dresser, and McKee 1986).

Management Recommendations

1. Restrict hikers, joggers, and birdwatchers to existing trails from the jet skiing area north to the fisherman's access point on the north shore.
2. Prohibit operation of jet skis or power boats within 100 m of the west shoreline from the jet ski area to the fisherman's access point on the north shore (see Figure 13). Buoys could be installed across the Little Dry Creek and Dry Creek inlets to further protect these areas.
3. Move the jet skiing area to a less environmentally sensitive region, such as the southeast or east shore.

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APPENDIX A
BREEDING BIRD CODES

The codes used to categorize breeding birds were adapted from the Colorado Breeding Bird Atlas. Birds were listed as "confirmed," "probable," or "possible," based on observed behaviors.

Possible

SPECIES OBSERVED or breeding calls heard in suitable nesting habitat.

SINGING MALE present in suitable nesting habitat during breeding season.

Probable

MULTIPLE MALES: seven different singing males heard in suitable nesting habitat.

PAIR observed in suitable nesting habitat.

TERRITORY presumed through territorial behavior.

COURTSHIP behavior between a male and a female.

AGITATED behavior or anxiety alls of adult.

Confirmed

NEST BUILDING or adult carrying nesting material.

USED NEST or eggshells found.

FLEDGED YOUNG with limited mobility, including young incapable of sustained flight.

OCCUPIED NEST indicated by adult entering or leaving nest site.

FEEDING YOUNG: adult seen carrying food for young.

NEST WITH EGGS.

NEST WITH YOUNG seen or heard.

