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ANNUAL MONITORING REPORT FOR THE GUNNISON, COLORADO WETLANDS MITIGATION PLAN

October 1995

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**ANNUAL MONITORING REPORT FOR THE GUNNISON, COLORADO
WETLANDS MITIGATION PLAN**

October 1995

**Prepared for
U.S. Department of Energy
Environmental Restoration Division
UMTRA Project Team
Albuquerque, New Mexico**

**Prepared by
Jacobs Engineering Group Inc.
Albuquerque, New Mexico**

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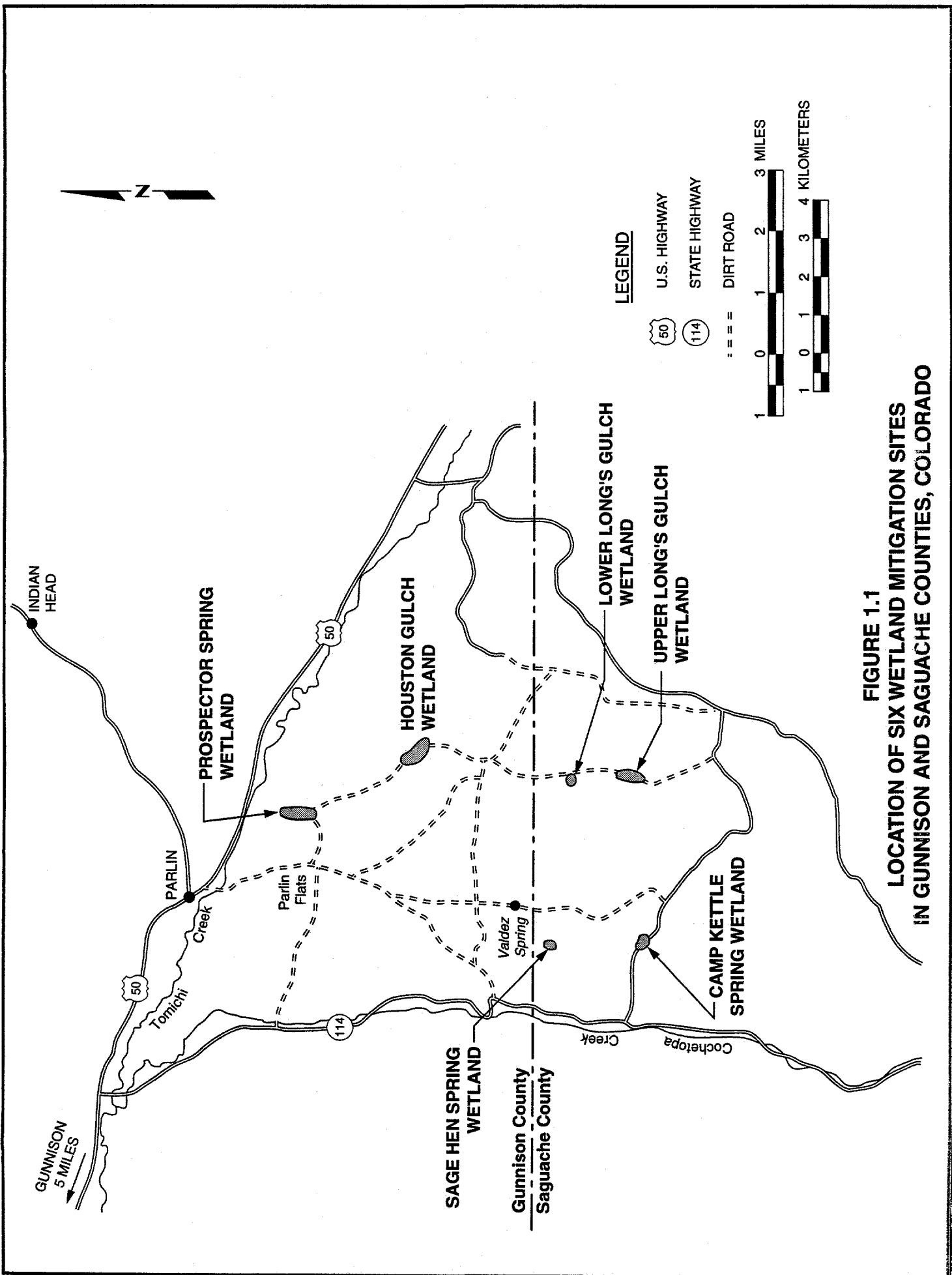
LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
BLM	Bureau of Land Management
DOE	U.S. Department of Energy
EA	environmental assessment
USACE	U.S. Army Corps of Engineers
UMTRA	Uranium Mill Tailings Remedial Action

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) administers the Uranium Mill Tailings Remedial Action (UMTRA) Project to clean up uranium mill tailings and other surface contamination at 24 abandoned uranium mill sites in 10 states. One of these abandoned mill sites is near the town of Gunnison, Colorado; surface remediation and the environmental impacts of remedial action are described in the Gunnison environmental assessment (EA) (DOE, 1992). Remedial action resulted in the elimination of 4.3 acres (ac) (1.7 hectares [ha]) of wetlands and mitigation of this loss of wetlands is being accomplished through the enhancement of 18.4 ac (7.5 ha) of riparian plant communities in six spring feed areas on Bureau of Land Management (BLM) land (Figure 1.1). The description of the impacted and mitigation wetlands is provided in the *Mitigation and Monitoring Plan for Impacted Wetlands at the Gunnison UMTRA Project Site, Gunnison, Colorado* (DOE, 1994), which is attached to the U.S. Army Corps of Engineers (USACE) Section 404 Permit.

As part of the wetlands mitigation plan, the six mitigation wetlands were fenced in the fall of 1993 to exclude livestock grazing. Baseline of grazed conditions of the wetlands vegetation was determined during the summer of 1993 (DOE, 1994). A 5-year monitoring program of these six sites has been implemented to document the response of vegetation and wildlife to the exclusion of livestock. This annual monitoring report provides the results of the first year of the 5-year monitoring period.



2.0 METHODS AND STUDY SITES

Wildlife surveys of the six sites were conducted in June 1994. These surveys consisted of traversing the sites and recording all wildlife heard or observed. At least one early morning survey was conducted at each site. Qualitative observations of aquatic organisms were also conducted. Quantitative vegetation sampling was conducted at the six mitigation sites in August 1994. The methods used for surveys, observations, and sampling are described in the mitigation plan (DOE, 1994). See Table 2.1 for the scientific and common names of plants observed at the six sites along with abbreviations and wetland status of each plant.

Table 2.1 Plant species observed and wetland status along 16 transects in six wetlands in Gunnison and Saguache Counties, Colorado

Scientific name (abbreviation)	Common name	Wetland status ^a
<i>Achillea millefolium</i> (Acmi)	Common yarrow	FACU
<i>Agropyron smithii</i> (Agsn)	Western wheatgrass	FACU
<i>Agropyron trachycaulum</i> (Agtr)	Slender wheatgrass	FACU
<i>Agrostis alba</i> (Agal)	Red top	FACW
<i>Agrostis stolonifera</i> (Agst)	Spreading bentgrass	FACW
<i>Alopecurus aequalis</i> (Alae)	Short-awn foxtail	OBL
<i>Amaranthus graeciezans</i> (Amgr)	Tumbleweed amaranth	NA
<i>Antennaria parvifolia</i> (Anpa)	Pussytoes	NA
<i>Arabis</i> sp. (Arsp)	Rockcress	NA
<i>Arnica chamissonis</i> (Arch)	Meadow arnica (leafy arnica)	FACW
<i>Artemisia frigida</i> (Arfr)	Fringed sagebrush (fringed wormwood)	UPL
<i>Artemisia tridentata</i> (Artr)	Big sagebrush	UPL
<i>Aster occidentalis</i> (Asoc)	Western mountain aster	FAC
<i>Astragalus agrestis</i> (Asag)	Field milkvetch	FAC
<i>Astragalus lentiginosus</i> (Asle)	Specklepod milkvetch	NA
<i>Astragalus leptaleus</i> (Asle)	Park milkvetch	NA
<i>Astragalus pattersonii</i> (Aspa)	Patterson milkvetch	NA
<i>Brachyactis frondosa</i> (Brfr)	Gray riparian aster	NA
<i>Carex aquatilis</i> (Caaq)	Water sedge	OBL
<i>Carex douglasii</i> (Cado)	Douglas' sedge	FACU
<i>Carex nebrascensis</i> (Cane)	Nebraska sedge	OBL
<i>Carex</i> sp. (Casp)	Blue carex	OBL(?)
<i>Chenopodium berlandieri</i> (Chbe)	Weedy lamb's quarter	NA
<i>Chenopodium capitatum</i> (Chea)	Strawberry blite	NA
<i>Chenopodium fremontii</i> (Chfr)	Fremont's goosefoot	FACU
<i>Chrysothamnus nauseosus</i> (Chna)	Rubber rabbitbrush	UPL
<i>Chrysothamnus viscidiflorus</i> (Chvi)	Green rabbitbrush	NA
<i>Cirsium arvense</i> (Ciar)	Canada thistle (creeping thistle)	FACU
<i>Cirsium</i> sp. (Cisp)	Thistle	NA
<i>Crepis acuminata</i> (Crac)	Hawksbeard	NA

Table 2.1 Plant species observed and wetland status along 16 transects in six wetlands in Gunnison and Saguache Counties, Colorado (Continued)

Scientific name (abbreviation)	Common name	Wetland status ^a
<i>Cryptantha watsonii</i> (Crwa)	Watson cryptantha	NA
<i>Deschampsia cespitosa</i> (Dece)	Tufted hairgrass	FACW
<i>Descurainia pinnata</i>	Tansy mustard	NA
<i>Dracocephalum parviflorum</i> (Drpa)	Dragonhead mint (American dragonhead)	FACU
<i>Eleocharis palustris</i> (Elpa)	Creeping spikerush	OBL
<i>Epilobium adenocaulon</i> (Epad)	Willow-herb	OBL(?)
<i>Equisetum arvense</i> (Eqar)	Field horsetail	FAC +
<i>Glaux maritima</i> (Glma)	Sea milkwort	OBL
<i>Glyceria striata</i> (Glst)	Fowl manna grass	OBL
<i>Hordeum brachyantherum</i> (Hobr)	Meadow barley	FACW
<i>Hordeum jubatum</i> (Hoju)	Foxtail barley	FAC
<i>Iris missouriensis</i> (Iirmi)	Rocky Mountain iris	OBL
<i>Juncus balticus</i> (Juba)	Baltic rush	FACW
<i>Lappula occidentalis</i> (Laoc)	Stickseed	NA
<i>Lemna</i> sp. (Lesp)	Duckweed	OBL
<i>Lepidium densiflora</i> (Lede)	Denseflower peppergrass	FACU
<i>Lepidium perfoliatum</i> (Lepe)	Clasping peppergrass	FACU
<i>Lupinus argenteus</i> (Luar)	Silvery lupine	NA
<i>Muhlenbergia andina</i> (Muan)	Foxtail muhly	FACW
<i>Nasturtium officinale</i> (Naof)	True watercress	OBL
<i>Panicum capillare</i> (Paca)	Witchgrass	FACU
<i>Plantago major</i> (Plma)	Common plantain	FAC
<i>Poa palustris</i> (Popa)	Fowl bluegrass	FACW
<i>Polygonum aviculare</i> (Poav)	Prostrate knotweed	NA
<i>Potentilla anserina</i> (Poan)	Silverweed	OBL
<i>Potentilla fruticosa</i> (Pofr)	Shrubby cinquefoil	FACW
<i>Ranunculus repens</i> (Rare)	Creeping buttercup	FACW
<i>Rorippa islandica</i> (Rois)	Yellow cress	OBL
<i>Rosa woodsii</i> (Rowo)	Wood's rose	FAC-
<i>Rumex crispus</i> (Rucr)	Curly dock	FACW
<i>Salix geyerana</i> (Sage)	Geyer willow	OBL
<i>Sitanion hystrix</i>	Squirrel-tail	NA

Table 2.1 Plant species observed and wetland status along 16 transects in six wetlands in Gunnison and Saguache Counties, Colorado (Concluded)

Scientific name (abbreviation)	Common name	Wetland status ^a
<i>Sphenopholis obtusata</i> (Spob)	Prairie wedgegrass	FACW
<i>Taraxacum officinale</i> (Taof)	Common dandelion	FACU
<i>Trifolium hybridum</i> (Trhy)	Alsike clover	FAC
<i>Trifolium longipes</i> (Trlo)	Rydberg clover (longstalk clover)	FACU
<i>Trifolium repens</i> (Trre)	White clover	FACU
<i>Triglochin palustre</i> (Trpa)	Marsh arrowgrass	OBL
<i>Veronica americana</i> (Veam)	American speedwell	OBL
<i>Veronica peregrina</i> (Vepe)	Purslane speedwell	FACW
<i>Viola nephrophylla</i> (Vine)	Northern bog violet	FACW

^aFrom *National List of Plant Species That Occur in Wetlands: Intermountain (Region 8)* (Reed, 1988).

OBL = Obligate plant species that occur in wetlands 99 percent of the time.

FACW = Facultative wetland plant species that usually occur in wetlands (67 to 99 percent of the time).

FAC = Facultative plant species that are equally likely to occur in wetlands or nonwetlands.

FACU = Facultative upland plant species that usually occur in nonwetlands (67 to 99 percent of the time).

UPL = Upland plant species that occur in uplands (nonwetlands) 99 percent of the time.

NA = Not given in Reed (1988); probably UPL species because Reed (1988) does not list all UPL species.

+ species tends toward the next wettest category.

- species tends toward the next driest category.

? status unknown.

3.0 RESULTS

This section provides a general description of the six mitigation sites as they appeared in 1994 and the results of the wildlife, aquatic life, and vegetation sampling. It also provides brief comparisons to grazed conditions of these wetlands as they appeared in 1992 and 1993 (DOE, 1994).

3.1 GENERAL OBSERVATIONS

Prospector Spring

Observations in June and August 1994 indicated that Prospector Spring was drier than observed in previous years. The stock ponds at both ends of this site were dry and there was no water in the stream that drains the sedge wetlands plant community; water had been noted in previous years in the upper stock pond and the stream (DOE, 1994). A stock tank was placed outside the fenced area and received water from a spring to the south (Figure 3.1). The outflow of this tank was to a drainage inside the fenced area. The tank overflow pipe was clogged in June; this pipe was unclogged and water once again flowed into the mitigation wetland.

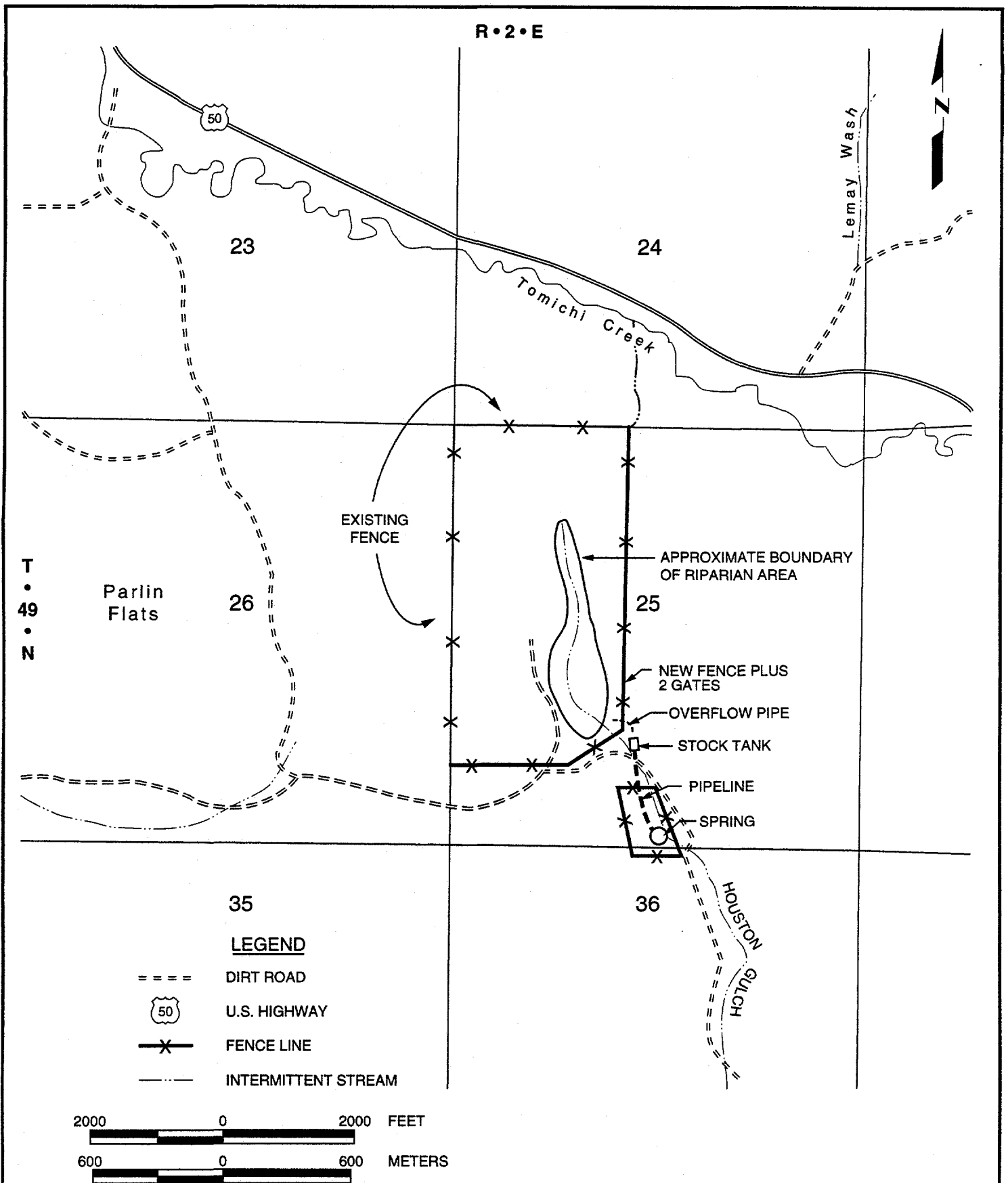
Houston Gulch

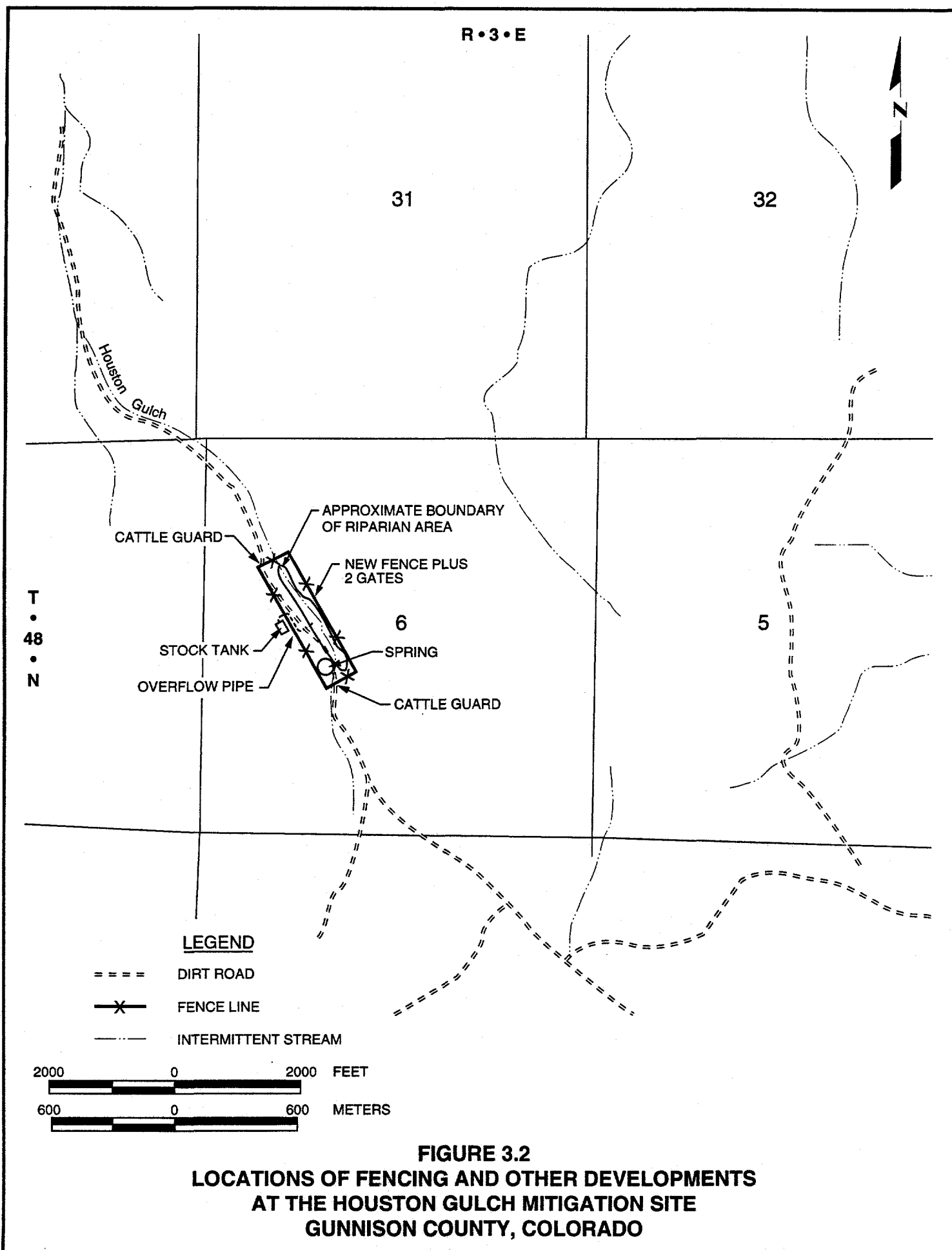
A stock tank had also been constructed outside the fenced area at this site and the overflow was connected to a pipe that went underground and discharged into the mitigation wetland (Figure 3.2). Observations in June and August showed that water was spilling over the sides of the tank and little water, if any, was reaching the mitigation site. BLM personnel were informed of this and restored flow into the mitigation site. As a result of the lack of water flowing into this site and drought conditions, the site was drier than was observed in previous years.

During site visits, it became apparent that cattle had grazed inside the fence. It was later determined that at least 10 head of cattle had been grazing within the fenced site for about one week in May and that the site had been heavily to severely grazed (Hayes, 1994); therefore, 1994 is not a recovery year for the Houston Gulch site and the biological data collected in 1994 represent grazed conditions.

Upper Long's Gulch

Conditions at Upper Long's Gulch also seemed drier than in previous years. There was standing water in the sedge plant community at the south end of the site but much less water in the stream draining this plant community than in previous years (DOE, 1994).





Lower Long's Gulch

There was a good flow of water entering this site from a stock tank outside the fence on the south side. This water was flowing through the stand of willows but did not reach the lower riparian grassland plant community at the eastern edge of the site.

Sage Hen Spring

Water was flowing well at this spring although there seemed to be less water in the sedge plant communities and there was no water in the stream that drains the site.

Camp Kettle Spring

As with the other sites, there seemed to be less water at this site than in previous years. There was standing water at the pond at the upper end of this site but the stock tank outside the south fence was dry. The sedge plant community was wet but there was no water in the stream draining this plant community as had been seen in 1993.

3.2 AQUATIC AND TERRESTRIAL WILDLIFE OBSERVATIONS

Qualitative observations of aquatic life and terrestrial wildlife were made at the six mitigation sites in June 1994 (TAC, 1994).

Prospector Spring

Very limited aquatic habitat existed at Prospector Spring in 1994 and no aquatic organisms were observed. A pond just upstream from the stock tank and outside of the fenced area contained duckweed (*Lemna* sp.), dragonfly nymphs, and numerous diving water beetles.

Surveys of nesting birds indicate that western meadowlark, mourning dove, robin, green-tailed towhee, and vesper sparrow may nest in or near this site (Table 3.1). Meadowlarks were heard singing at two different locations in the riparian area, robins were observed foraging in the area, and the other species were noted within the site and/or in the sagebrush plant community just outside of the riparian plant communities.

Houston Gulch

There was very little standing water in the Houston Gulch enclosure; most of the water was overflowing the stock tank and flowing along the side of the road. No observations for aquatic organisms were made in this area.

Six species of birds were recorded from Houston Gulch. It is believed that most of these birds nested either in the sagebrush plant community directly adjacent to the riparian or in the small stands of Douglas fir near the site. Sage grouse droppings were observed but no birds were seen.

Table 3.1 Birds observed at or near the six mitigation wetlands sites in Gunnison and Saguache Counties, Colorado, June 1994

Species	Mitigation site					
	Prospector Spring	Houston Gulch	Upper Long's Gulch	Lower Long's Gulch	Sage Hen Spring	Camp Kettle Spring
Golden eagle	0	0	1	0	0	0
Western meadowlark	2	0	0	0	0	1
Sage grouse	0	X ^a	18	0	0	0
Broad-tailed hummingbird	0	0	0	1	1	1
Mourning dove	1	2	2	0	0	1
Common flicker	0	1	1	1	1	1
Yellow-billed magpie	0	0	2	X ^b	0	0
Black-capped chickadee	0	0	0	0	1	0
Mountain bluebird	0	1	0	0	0	0
Robin	4	1	3	1	1	1
Sage thrasher	0	1	0	1	0	1
Green-tailed towhee	2	0	1	1	2	3
Vesper sparrow	1	0	0	0	0	0
Sage sparrow	0	0	0	0	0	2

^aSage grouse sign observed only.^bFeathers and nest observed.

Upper Long's Gulch

Standing water was observed in the sedge plant community at the upper end of the site and at two stock tanks outside of the fenced area. The water at the sedge plant community contained green filamentous algae, duckweed, mosquito larvae, and numerous diving water beetles. The sediments revealed the presence of oligochaete and chironomid worms; numerous clams that were 0.1 to 0.2 inches (2 to 5 millimeters [mm]) long and had flesh colored shells; and one case-making (sand) caddis fly larva.

Seven species of birds were recorded at this site (Table 3.1). Most of these species likely nested on the site because the willow thickets provided nesting locations. One yellow-billed magpie nest with one almost fully grown young was observed. Eighteen sage grouse were flushed from this location; 1 female with a brood of 5, 1 female with a brood of 6, another female that acted as if it had a brood nearby, and four other grouse. These birds all flew into the nearby sagebrush plant community and landed. One golden eagle in immature plumage was observed flying fairly low overhead.

Lower Long's Gulch

A small pond of water had developed where the polyvinyl chloride pipe from the stock tank discharged into the site. Numerous brown leaches were observed clustered together under the rocks in this pond; they were 0.2 to 0.4 inches (5 to 10 mm) long. Numerous case-making caddis flies were also attached to the underside of the rocks.

A broad-tailed hummingbird was observed putting on an aerial display which consisted of flying high into the air and diving towards earth at full speed and pulling out about 5 feet (ft) (1.5 meters [m]) above the ground. It was also observed perched on top of one of the willows at this site. Five other species of birds were recorded at this site (Table 3.1).

Sage Hen Spring

There was some standing water where overflow from a stock tank discharged into this site. A few snails, diving water beetles, and numerous chironomid larvae were observed.

Five species of birds were observed at or near the site (Table 3.1). A woodpecker of unidentified species was heard tapping on a tree in a stand of Douglas fir near the site; a flicker was also observed in this stand. A broad-tailed hummingbird flew out of a juniper on the site and acted as if had a nest in this tree. The green-tailed towhee likely nests on the site while the black-capped chickadee and the robin could nest on the site or in nearby trees.

Camp Kettle Spring

The major area of standing water at this site is a pond at the north end. This circular pond had a diameter of 35 ft (11 m); the water was about 1 ft (0.3 m) deep. A thick growth of emergent aquatic vegetation dominated by meadow arnica grew in this pond. Damselflies were numerous and cladocerans and amphipods were common in the shallow water around the pond's edge.

Eight species of birds were observed at this site (Table 3.1). Species such as the sage sparrow and sage thrasher probably nested in the adjacent sagebrush plant community and visited the riparian area to obtain food and water. The flicker probably nested in the nearby stand of Douglas fir. The other species may have nested at the site.

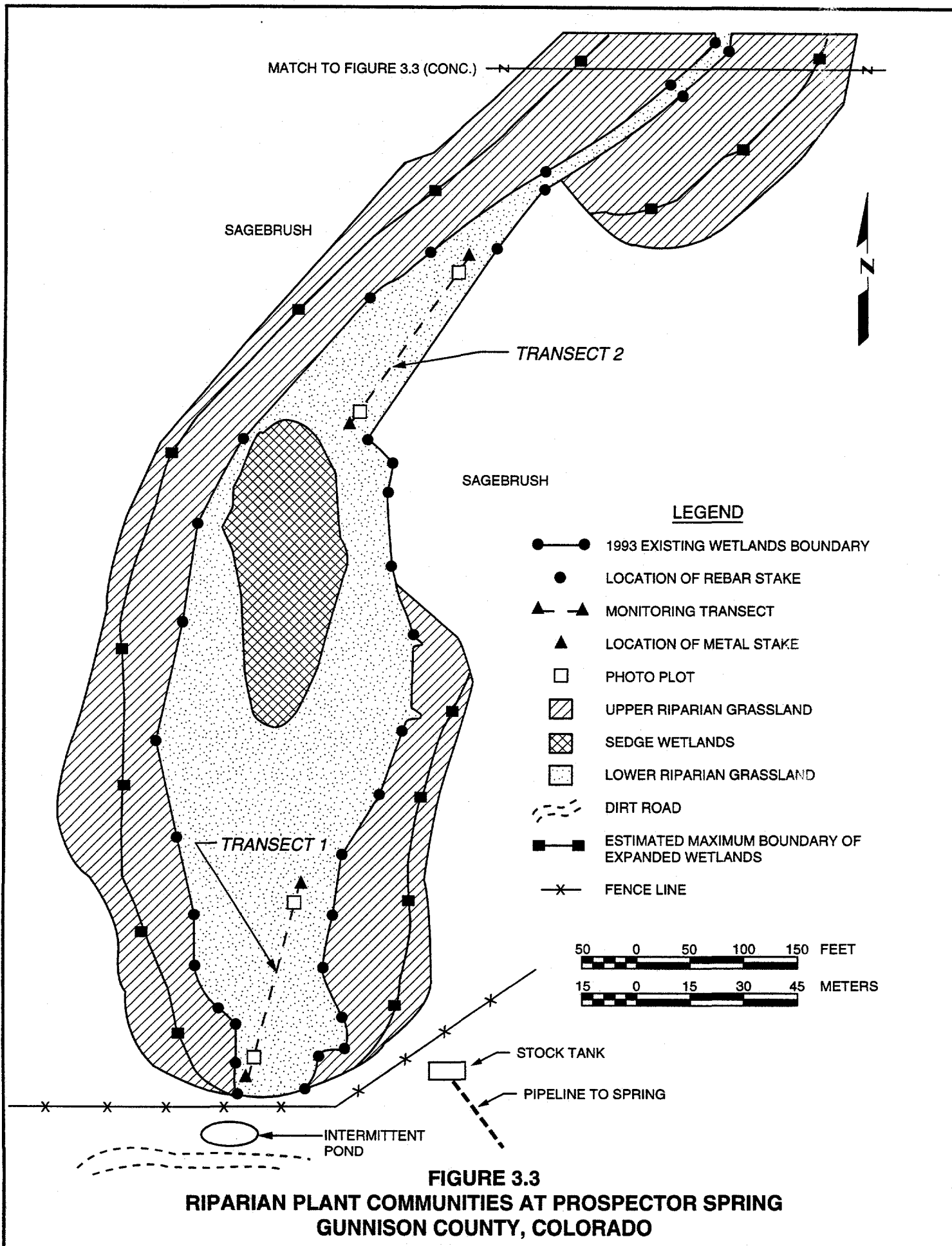
3.3 VEGETATION ANALYSIS

As indicated above, vegetation analysis methods were the same as those used in 1993. In addition, the transects used in 1993 were marked with stakes and the same transects and photo points were used in 1994. Drought conditions have occurred in the Gunnison area for the past few years; the study sites experienced moderate to severe drought conditions throughout the 1994 growing season. The BLM monitors soil moisture and ground water and determined that the soil was very dry and that water flow to some springs had decreased (Hayes, 1994). This decrease in the flow of water was observed at all six study sites.

Prospector Spring

Transect 1 is in the upper riparian grassland plains community at the south end of Prospector Spring (Figure 3.3). This area is dominated by Baltic rush (Juba) and foxtail barley (Hoju); these species accounted for about 70 percent of the plant cover both years (Table 3.2) (see Table B.2 in DOE, 1994). From 1993 to 1994, the percent cover of Baltic rush decreased by 6 percent while foxtail barley decreased by over 10 percent. Species observed in 1994 but not 1993 were meadow barley (Hobr), tufted hairgrass (Dece), and Douglas sedge (Cado). Over all, from 1993 to 1994, the vegetative cover decreased from 77 to 59 percent while bare ground increased from 9 to 13 percent. There was a slight height increase of Baltic rush which averaged 9 inches (22 centimeters [cm]) in 1993 and 10 inches (25 cm) in 1994. A decrease in plant height in foxtail barley was noted from 9 inches (22 cm) in 1993 to 7 inches (18 cm) in 1994 (Table 3.3) (see Table B.3 in DOE, 1994).

Transect 2 is in the lower riparian grassland plant community along a channel that drains the sedge plant community (Figure 3.3). This area was mostly dry in 1994 although damp soil was observed a few inches down in some of the cattle tracks. Creeping spikerush (Elpa) was the most common species in this transect both years; vegetative cover decreased for this species from 33 to 12 in 1994 (Table 3.4) (see Table B.4 in DOE, 1994). This was likely due to the drought conditions because this wetland obligate species requires an adequate water



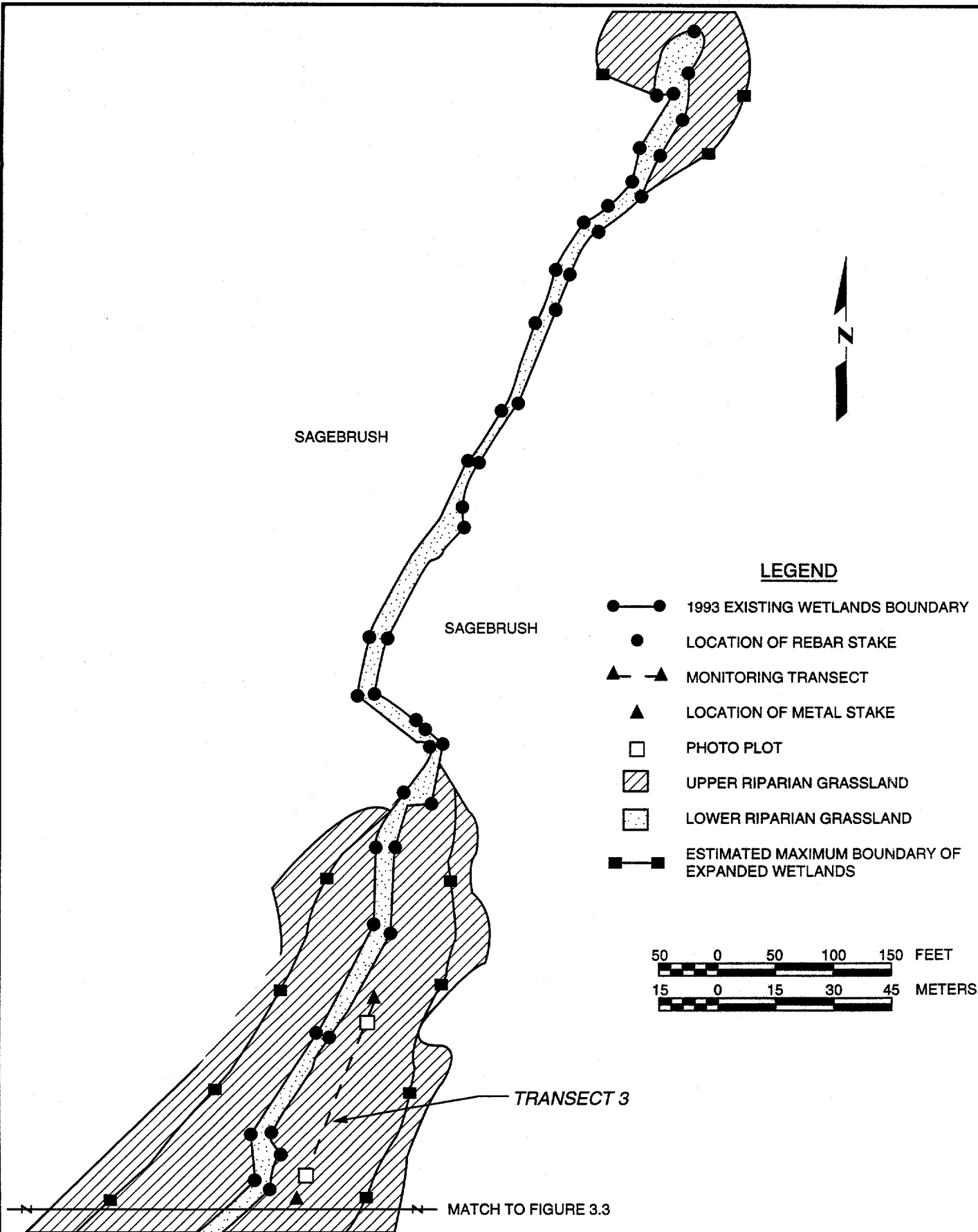


FIGURE 3.3 (CONCLUDED)
RIPARIAN PLANT COMMUNITIES AT PROSPECTOR SPRING
GUNNISON COUNTY, COLORADO

Table 3.2 Plant species percent cover in 40 sample plots in transect 1 at Prospector Spring in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Juba	6	13	12	6	1		28	47.3
Hoju	6	26	3				13	22.0
Popa	10	10	1				5	8.4
Hobr	1	3	3				4	6.8
Dece	2	7					3	5.1
Cado	9	5					2	3.4
Poan	11	2					1	1.7
Agtr		3					1	1.7
Rucr	2	1					0.5	0.8
Taof	4						0.3	0.5
Acmi	2						0.1	0.2
Agsm	1						0.1	0.2
Muan	1						0.1	0.2
Trre	1						0.1	0.2
Unknown	8		1				1	1.7
Total	NA	NA	NA	NA	NA	NA	59.2	100.2
Bare ground	15	19	5				13	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.3 Plant species frequency of occurrence and plant height in 40 sample plots in transect 1 at Prospector Spring in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Juba	93	38	4-14	10
Hoju	88	35	4-12	7
Popa	55	21	4-13	7
Hobr	18	7	7-13	11
Dece	23	9	4-14	8
Cado	35	14	3-13	8
Poan	33	13	1-6	3
Agtr	8	3	-	-
Rucr	8	3	-	-
Taof	10	4	-	-
Acmi	5	2	-	-
Agsm	3	1	-	-
Muan	3	1	-	-
Trre	3	1	-	-
Unknown	23	9	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

N = Sample size.

Table 3.4 Plant species percent cover in 40 sample plots in transect 2 at Prospector Spring in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Elpa	4	18	5				12	26
Cane	10	11	6				10	22
Juba	12	7	4	2			10	22
Poan	18	7					4	9
Glst	14	3	1				3	7
Dece	15	3					2	4
Rare	9						0.6	1
Hoju	8						0.5	1
Rucr	1	1					0.4	0.9
Naof	1	1					0.4	0.9
BrFr	4						0.3	0.7
Paca	5						0.3	0.7
Popa	5						0.3	0.7
Trre	3						0.2	0.4
Spob	3						0.2	0.4
Cado	3						0.2	0.4
Poav	2						0.1	0.2
Toaf	1						0.1	0.2
Chsp	1						0.1	0.2
Epad	1						0.1	0.2
Asoc	2						0.1	0.2
Unknown	2	1					0.5	1
Total	NA	NA	NA	NA	NA	NA	45.4	99.1
Bare ground	13	9	9	5	1		23	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

supply. Tufted hair grass decreased from 5 to 2 percent cover over the same time period. Species that showed an increase were Nebraska sedge (Cane) (7 to 10 percent) (called *Carex rostrata* in 1993), Baltic rush (2 to 10 percent), and silverweed (Poan) (3 to 4 percent). From 1993 to 1994, there was an overall decrease in vegetative cover from 62 to 45 percent while the percent bare ground increased from 21 to 23 percent. Even though the vegetative cover decreased in 1994, there was an overall increase in plant height in 1994 (Table 3.5) when compared to 1993 (see Table B.5 in DOE, 1994). For example, spikerush increased from 4 inches (10 cm) to 6 inches (15 cm), silverweed from less than 1 inch (3 cm) to 5 inches (15 cm), Nebraska sedge from 8 inches (20 cm) to 13 inches (33 cm), and Baltic rush from 11 inches (28 cm) to 13 inches (33 cm).

Transect 3 is in the upper riparian grassland plant community toward the south end of the site (Figure 3.3). Baltic rush was the dominate species in this transect during both years; from 1993 to 1994, cover for this species decreased from 45 in 1993 to 37 percent in 1994 (Table 3.6) (see Table B.6 in DOE, 1994). The species diversity in this transect was similar for both years and the percent cover of the other species showed little variation. The total percent plant cover (72 percent in 1993 and 69 percent in 1994) and percent bare ground (4 percent in 1993 and 5 percent in 1994), were similar. Most plant species showed an increase in plant height from 1993 to 1994 such as Baltic rush increasing from 7 inches (18 cm) to 12 inches (30 cm), Douglas sedge increasing from 4 inches (10 cm) to 8 inches (20 cm) (referred to as *Carex* sp. in 1993), and specklepod milkvetch (*Asle*) increasing from 2 inches (5 cm) to 5 inches (13 cm) (Table 3.7) (see Table B.7 in DOE, 1994). The other common species showed only a slight or no increase in height.

Houston Gulch

As indicated in Section 3.1, heavy cattle grazing took place in Houston Gulch in 1994 so the data collected are representative of grazed baseline conditions. In addition, water that normally flowed into this site was flowing down a road next to the site for much of the summer, resulting in abnormally dry conditions at this site.

Transect 1 is in the upper riparian grassland plant community (Figure 3.4) and exhibited a sharp decline in percent plant cover and increase in percent bare ground in 1994 (Table 3.8) relative to 1993 (see Table B.8 in DOE, 1994). Fowl bluegrass was the dominant species in 1993 (54 percent cover) but accounted for only 4 percent of the vegetative cover in 1994. Percent cover of other species such as common dandelion (*Taof*) and clover (*Trre*) declined in 1994 while an increase in percent cover of Baltic rush and western mountain aster (*Asoc*) was observed. An increase in plant height for fowl bluegrass (1 to 3 inches [3 to 8 cm]) and Baltic rush (4 to 6 inches [10 to 15 cm]) occurred from 1993 to 1994 while the height of other abundant species such as common dandelion and western mountain aster remained the same (Table 3.9) (see Table B.9 in DOE, 1994).

Table 3.5 Plant species frequency of occurrence and plant height in 40 sample plots in transect 2 at Prospector Spring in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Elpa	68	27	3-18	6
Cane	68	25	5-20	13
Juba	63	25	6-18	13
Poan	63	25	1-14	5
Glst	45	18	6-29	16
Dece	45	18	3-13	12
Rare	23	9	1-3	2
Hoju	20	8	4-12	6
Rucr	5	2	-	-
Naof	5	2	-	-
BrFr	10	4	2-5	4
Paca	13	5	3-8	5
Popa	13	5	6-10	7
Trre	8	3	-	-
Spob	8	3	-	-
Cado	8	3	-	-
Poav	5	2	-	-
Taof	3	1	-	-
Chsp	3	1	-	-
Epad	3	1	-	-
Asoc	5	2	-	-
Unknown	8	3	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

Table 3.6 Plant species percent cover in 40 sample plots in transect 3 at Prospector Spring in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Juba	2	6	20	9	1		37	54
Asle	2	5	4				6	9
Cado	13	11					5	7
Agtr	8	4	1	1			5	7
Taof	23	8					4	6
Asoc	19	1	2				3	4
Acmi	7	5					2	3
Huju	14	4					2	3
Paca	12	4					2	3
Poan	10	2					1	1
Trhy	3	1					0.6	0.9
Cisp	8						0.5	0.7
Rare	2						0.1	0.1
Dece	2						0.1	0.1
Anpa	2						0.1	0.1
Glst	1						0.1	0.1
Agsp	1						0.1	0.1
BrFr	1						0.1	0.1
Total	NA	NA	NA	NA	NA	NA	68.7	99.2
Bare ground	31	8					5	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

Table 3.7 Plant species frequency of occurrence and plant height in 40 sample plots in transect 3 at Prospector Spring in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Juba	95	39	6-16	12
Asle	28	11	1-21	5
Cado	60	24	3-14	8
Agtr	35	14	3-17	12
Taof	78	31	1-4	2
Asoc	55	22	1-4	2
Acmi	30	12	1-8	5
Hoju	45	18	4-10	7
Paca	40	16	2-6	4
Poan	30	12	1-6	3
Trhy	10	4	1-1	1
Cisp	20	8	1-2	2
Rare	5	2	-	-
Dece	5	2	-	-
Anpa	5	2	-	-
Glst	3	1	-	-
Agsp	3	1	-	-
BrFr	3	1	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

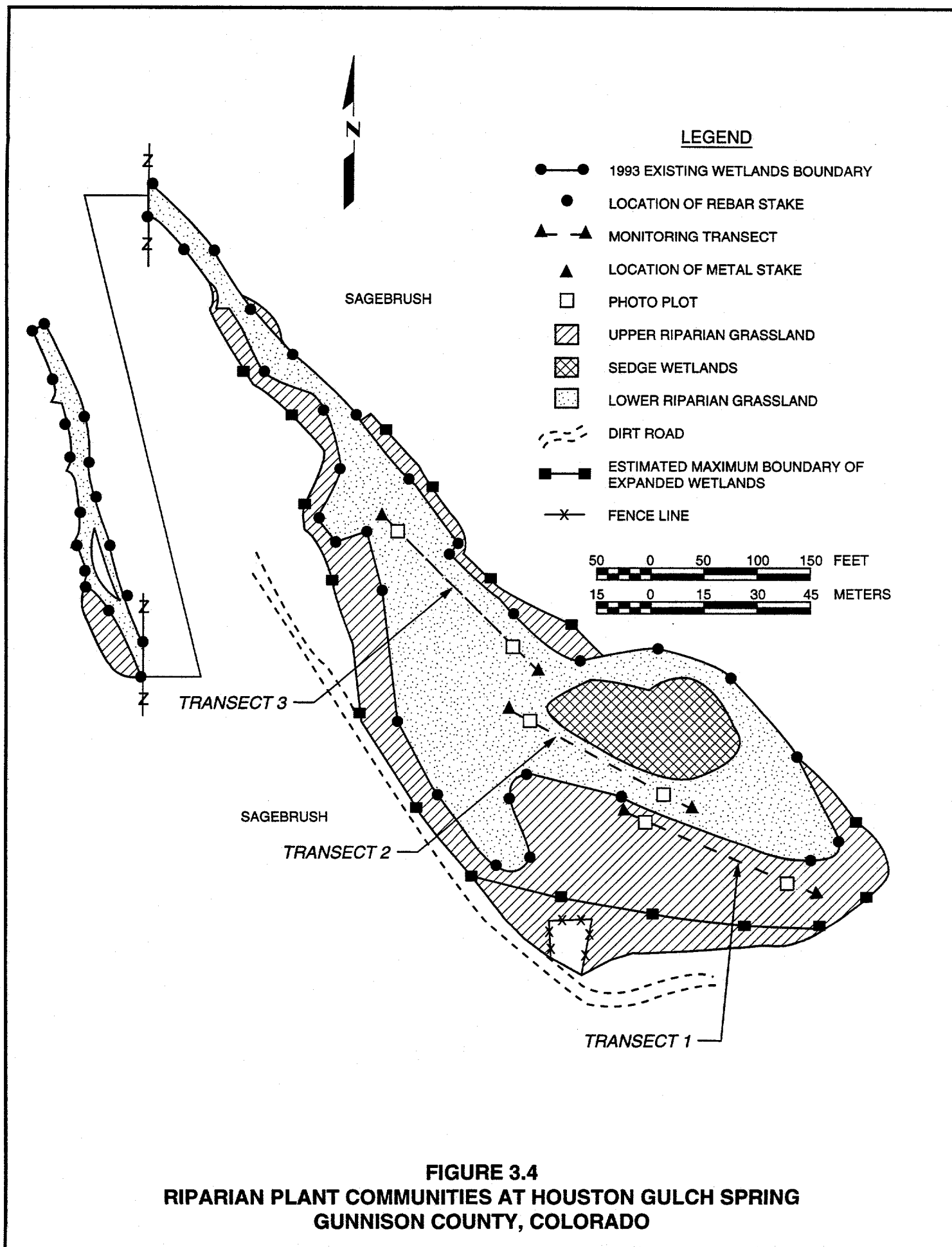


Table 3.8 Plant species percent cover in 40 sample plots in transect 1 at Houston Gulch in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Juba	6	30	4				15	39
Muan	3	11	1	1			7	18
Popa	12	8					4	10
Taof	24	8					5	13
Asoc	14	6					3	8
Irmi	2	2					0.9	2
Cado	11						0.7	2
Acmi	9						0.6	2
Asle	6						0.4	1
Arfr		1					0.4	1
Trhy	5						0.3	0.8
Hoju	3						0.2	0.5
Paca	1						0.1	0.3
BrFr	1						0.1	0.3
SiHy	1						0.1	0.3
Poan	2						0.1	0.3
Agtr	1						0.1	0.3
Rare	1						0.1	0.3
Cisp	1						0.1	0.3
Total	NA	NA	NA	NA	NA	NA	0.1	0.3
Bare ground	1	6	24	4	3		38.2	
							37	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.
NA - not applicable.

Table 3.9 Plant species frequency of occurrence and plant height in 40 sample plots in transect 1 at Houston Gulch in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	N	Plant height (inches)	
			Range	Mean
Juba	100	39	2-10	6
Muan	40	34	1-4	2
Popa	50	19	1-5	3
Taof	80	36	<1-2	1
Asoc	50	29	1-2	1
Irmf	10	4	4-11	6.0
Cado	28	31	1-6	3
Acmi	23	13	1-2	1
Asle	9	6	1-1	1
Arfr	3	1	-	-
Trhy	13	4	<1-1	1
Hoju	8	3	-	-
Paca	3	1	-	-
BrFr	3	1	-	-
Sihy	3	1	-	-
Poan	5	2	-	-
Agtr	3	1	-	-
Rare	3	1	-	-
Cisp	3	1	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

Transect 2 is in the lower riparian grassland plant community just above the sedge community (Figure 3.4). The soil was very dry and there was a reduction in plant cover from 47 percent in 1993 to 44 percent in 1994 and an increase in percent bare ground from 23 to 32 percent (Table 3.10) (see Table B.10 in DOE, 1994). There was little change in the percent cover of the common species over a year's time except for the disappearance of spreading bent grass (Agst) (10 percent cover in 1993) and emergence of mannagrass (Glst) (9 percent cover in 1994). There was also little variation in height of the common species from year to year (Table 3.11) (see Table B.11 in DOE, 1994).

Transect 3 is in the lower riparian grassland plant community in a drainage below the sedge type (Figure 3.4). This location showed an increase in both percent vegetation cover (37 percent in 1993 to 42 percent in 1994) and bare ground (30 percent in 1993 to 40 percent in 1994) (Table 3.12) (see Table B.12 in DOE, 1994). Note the change in dominant species: tufted hair grass was dominant in 1993 (20 percent), while mannagrass was dominant in 1994 (18 percent). From 1993 to 1994, there was a reduction in fowl bluegrass and an increase in Baltic rush, foxtail barley, prostrate knotweed (Poav), and Nebraska sedge. There was a 20 to 100 percent increase from 1993 to 1994 in plant height for most species in this transect (Table 3.13) (see Table B.13 in DOE, 1994).

Upper Long's Gulch

Transect 1 at Upper Long's Gulch is the upper riparian grassland plant community at the southern end of the site (Figure 3.5). From 1993 to 1994 there was a decrease in plant cover (51 to 38 percent) and an increase in bare ground (39 to 42 percent) (Table 3.14) (see Table B.14 in DOE, 1994). There was a large decrease in the percent cover of fowl bluegrass (41 to 14 percent) while an increase in western mountain aster and prostrate knotweed was noted. All species showed an increase in height in 1994; the height of the dominant species increased from 2 to 7 inches (6 to 18 cm) (Table 3.15) (see Table B.15 in DOE, 1994).

Transect 2 at Upper Long's Gulch is in the lower riparian grassland plant community at the south end of the site (Figure 3.5). This transect contained the largest number of plant species; 28 were recorded (Table 3.16). A shift in dominant plant species was observed. Fowl bluegrass, dominant in 1993 (accounting for 18 percent of the vegetative cover), was reduced to 10 percent in 1994 (see Table B.16 in DOE, 1994). The dominant species in 1994 was aquatic sedge (19 percent) which accounted for only 8 percent cover in 1993. A marked increase in plant height was noted from 1993 to 1994 (Table 3.17) (see Table B.17 in DOE, 1994). For example, the average height of fowl bluegrass increased from 3 to 14 inches (8 to 36 cm) and aquatic sedge increased from 4 to 13 inches (10 to 33 cm).

Transect 3 is in the upper riparian grassland plant community in the middle of the site (Figure 3.5). From 1993 to 1994 this transect showed an overall decrease in percent vegetative cover (62 to 51 percent) and an increase in bare ground (17 to 36 percent) (Table 3.18) (see Table B.18 in DOE, 1994). Fowl bluegrass remained

Table 3.10 Plant species percent cover in 40 sample plots in transect 2 at Houston Gulch in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Glst	6	4	4	2			9	21
Popa	8	14		1			8	18
Dece	8	6	4				7	16
Hoju	12	10	2				5	11
Taof	25	3	1				4	9
Acmi	17	3					2	5
Cane	10	3					2	5
Juba	10	2					1	2
Muan	4	3					1	2
Popr	4	3					1	2
Hobr	6	2					1	2
Trhy	6	1					1	2
Poan	5	1					0.8	2
BrFr	1	1					0.7	2
Asoc	3	1					0.4	0.5
Spob	2						0.2	0.5
Poav	2						0.1	0.2
Rois	2						0.1	0.2
Lede	1						0.1	0.2
Asle	1						0.1	0.2
Irmi	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	43.7	
Bare ground	3	12	16	8			32	99.2

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA = not available

Table 3.11 Plant species frequency of occurrence and plant height in 40 sample plots in transect 2 at Houston Gulch in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Glst	40	15	9-18	14
Popa	83	23	1-10	5
Dece	45	18	4-16	10
Hoju	60	24	3-17	9
Toaf	73	29	1-3	1
Acmi	50	20	1-5	2
Cane	33	13	2-15	5
Juba	30	12	3-10	7
Muan	18	7	2-3	3
Popr	18	7	6-12	8
Hobr	20	8	5-12	9
Trhy	18	7	1-1	1
Poan	15	6	1-5	3
BrFr	5	2	-	-
Asoc	8	3	-	-
Spob	5	2	-	-
Poav	5	2	-	-
Rois	5	2	-	-
Lede	3	1	-	-
Asle	3	1	-	-
Irmi	3	1	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

Table 3.12 Plant species percent cover in 40 sample plots in transect 3 at Houston Gulch in Gunnison County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Glst	9	19	8	2			18	43
Juba	7	15	1				7	17
Hoju	10	8	1	1			6	14
Poav	18	3					3	7
Cane	3	1		1			2	5
Dece	1	3					1	2
Popr	5	3					1	2
Popa	7	1					0.8	2
Asoc	13						0.8	2
Poan	9						0.6	1
Acmi	4	1					0.6	1
Hobr	3						0.2	0.5
Rois	3						0.2	0.5
Taof	2						0.1	0.2
Muan	1						0.1	0.2
BrFr	1						0.1	0.2
Spob	1						0.1	0.2
Rare	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	41.7	100
Bare ground	2	8	15	12	2		40	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = \sum (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.13 Plant species frequency of occurrence and plant height in 40 sample plots in transect 3 at Houston Gulch in Gunnison County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Glst	95	38	6-19	13
Juba	58	23	5-14	9
Hoju	50	20	6-15	9
Poav	55	22	1-5	2
Cane	13	5	3-7	5
Dece	10	4	9-15	12
Popr	20	8	3-10	6
Popa	20	8	4-7	5
Asoc	33	13	1-6	3
Poan	23	9	1-5	2
Acmi	13	5	1-6	3
Hobr	8	3	-	-
Rois	8	3	-	-
Taof	5	2	-	-
Muan	3	1	-	-
BrFr	3	1	-	-
Spob	3	1	-	-
Rare	3	1	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

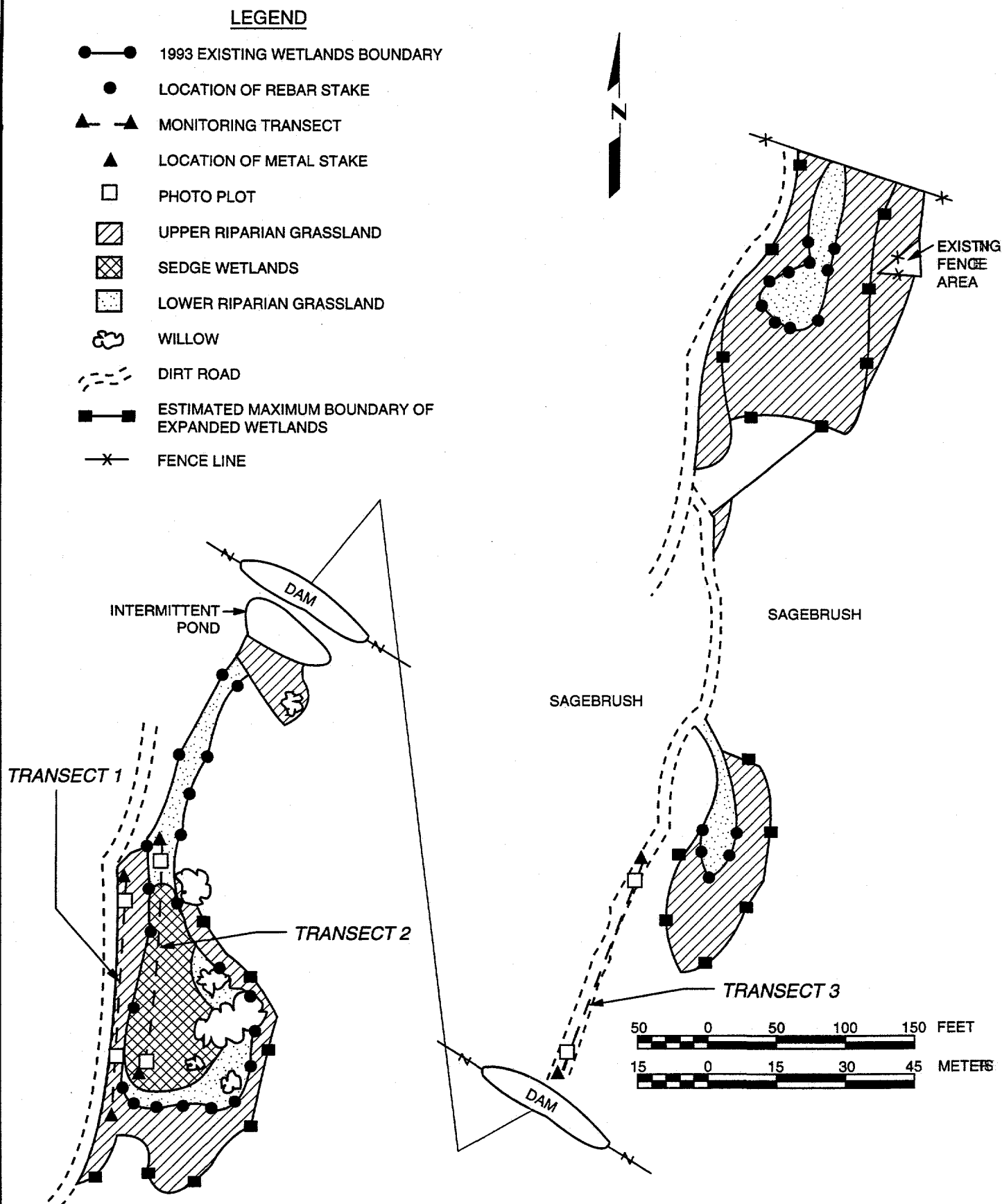


FIGURE 3.5
RIPARIAN PLANT COMMUNITY TYPES IN UPPER LONG'S GULCH SPRING
SAGUACHE COUNTY, COLORADO

Table 3.14 Plant species percent cover in 40 sample plots in transect 1 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	7	16	5	2			14	37
Asoc	8	16	5	1			13	34
Taof	26	5					4	10
Agsm	9	7					3	8
Poav	10						2	5
Juba	3	1					0.6	2
Acmi	2	1					0.5	1
Crac	1	1					0.4	1
Trlo	5						0.3	0.7
Asle	1						0.1	0.3
Amisp	1						0.1	0.3
Lede	1						0.1	0.3
Unknown grass							0.1	0.3
Total	NA	NA	NA	NA	NA	NA	38.2	99.9
Bare ground	1	6	18	12	2		42.2	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.
NA - not applicable.

Table 3.15 Plant species frequency of occurrence and plant height in 40 sample plots in transect 1 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	75	30	1-12	5
Asoc	75	30	1-5	3
Taof	78	32	1-4	2
Agsm	40	16	2-13	7
Poav	28	11	1-4	2
Juba	10	4	4-10	6
Acmi	8	3	-	-
Croc	5	2	-	-
Trlo	13	5	1-1	1
Asle	3	1	-	-
Amsp	3	1	-	-
Lede	3	1	-	-
Unknown grass	5	2	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

Table 3.16 Plant species percent cover in 40 sample plots in transect 2 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Caaq	2	8	7	3	1		19	32
Popa	8	13	4				10	17
Agal	18	7	1				5	9
Elpa	2	5		1			4	7
Poan	15	4	1				4	7
Juba	9	7					4	7
Asoc	13	5					3	5
Poav	5	2		1			3	5
Trhy	2		2				1	2
Gist	3		1				1	2
Epad	5	1						1
Taof	11						0.8	1
Cado	2	1					0.8	1
Plma	1	1					0.6	1
Rare	5						0.5	0.9
BrFr	4						0.4	0.7
Paca	3						0.3	0.5
Veam	2						0.2	0.3
Hobr	2						0.1	0.2
Alae	2						0.1	0.2
Hoju	1						0.1	0.2
Rois	1						0.1	0.2
Acmi	1						0.1	0.2
Irmi	1						0.1	0.2
Glma	1						0.1	0.2
Dece	2						0.1	0.2
Spob	2						0.1	0.2
Rowo	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	58.7	100.6
Bare ground	7	11	13	3	1		26.9	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1 (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.17 Plant species frequency of occurrence and plant height in 40 sample plots in transect 2 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Caaq	60	21	5-24	13
Popa	71	25	5-24	14
Agal	74	26	2-24	13
Elpa	23	8	5-14	9
Poan	57	18	2-9	4
Juba	46	16	5-18	9
Asoc	51	18	1-12	5
Poav	23	10	1-10	3
Trhy	11	-	-	-
Glst	11	-	-	-
Epad	17	7	2-12	9
Taof	31	11	1-6	3
Cado	9	-	-	-
Plma	6	-	-	-
Rare	14	5	2-6	3
BrFr	11	-	-	-
Paca	9	-	-	-
Veam	6	-	-	-
Hobr	6	-	-	-
Alae	6	-	-	-
Hoju	3	-	-	-
Rois	3	-	-	-
Acmi	3	-	-	-
Irm	3	-	-	-
Glma	3	-	-	-
Dece	6	-	-	-
Spob	6	-	-	-
Rowo	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

Table 3.18 Plant species percent cover in 35 sample plots in transect 3 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	13	10	7	3	1		21	41
Juba	9	7	6				10	19
Taof	19	12					7	14
Asoc	21	9	1				6	12
Acmi	18	4					3	6
Ttre	8	3					2	4
Trhy	9	1					1	2
Anpa		1					0.4	0.8
Agsm	4						0.3	0.6
Poan	3						0.2	0.4
Luar	3						0.2	0.4
Cisp	1						0.1	0.2
BrFr	1						0.1	0.2
Clover sp.	1						0.1	0.2
Asle	2						0.1	0.2
Casp	1						0.1	0.2
Chsp	1						0.1	0.2
Arsp	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	51.8	101.6
Bare ground	3	10	14	9			35.6	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

the dominant species but declined from 37 to 21 percent cover. Common dandelion and white clover also declined while western mountain aster, Baltic rush, and yarrow (*Acmi*) increased in 1994. There was a height increase for all species with the most common (fowl bluegrass) increased from 2 to 7 inches (5 to 18 cm) (Table 3.19) (see Table B.19 in DOE, 1994).

Lower Long's Gulch

Only one transect was sampled in Lower Long's Gulch (Figure 3.6). The area of this transect had been affected by runoff from a storm the day before sampling took place. This runoff resulted in the deposit of debris and creation of bare ground along the transect. From 1993 to 1994 there was a decrease in percent vegetative cover (68 to 62 percent) and an increase in bare ground (21 to 31 percent) (Table 3.20) (see Table B.20 in DOE, 1994). Fowl bluegrass continued to be the dominant species although a slight decrease in cover from 44 percent in 1993 to 39 percent in 1994 was noted. Common dandelion and tufted hairgrass showed a decrease while Baltic rush increased in percent cover in 1994. A general increase in plant height was noted for all species in 1994; the average height of the dominant fowl bluegrass increased from 2 to 5 inches (5 to 15 cm) (Table 3.21) (see Table B.21 in DOE, 1994).

Sage Hen Spring

Conditions in all plant communities were drier in 1994 than in 1993 at Sage Hen Spring. Transect one is in the upper riparian grassland plant community (Figure 3.7) and the percent vegetative cover in 1993 (45 percent) decreased in 1994 (35 percent) while the percent bare ground increased (38 percent in 1993 versus 61 percent in 1994) (Table 3.22) (see Table B.22 in DOE, 1994). A marked decline in percent cover for fowl bluegrass was observed (33 to 12 percent) while all other species increased in percent cover. All species except western wheatgrass increased in height in 1994 (Table 3.23) (see Table B.23 in DOE, 1994).

Transect 2 is in an area that was once a wetland but dried out when the water was diverted about three years ago. It is now dominated by weedy species and fringed sage. From 1993 to 1994 the cover decreased (41 to 36 percent) and bare ground increased (44 to 60 percent) (Table 3.24) (see Table B.24 in DOE, 1994). The number of species recorded increased in 1994 (13 to 20 species) and prostrate knotweed, which was dominant in 1993 (20 percent), decreased in 1994 (0.2 percent). Other species such as stickseed (*Laoc*), fringed sage (*Arfr*), Nebraska sedge, and thistle (*Ciar*) became dominant in 1994. A slight increase in height for most species was observed in 1994 (Table 3.25) (see Table B.25 in DOE, 1994).

Transect 3 at Sage Hen Spring follows a drainage just north of the sedge plant community (Figure 3.6). This area was quite dry in 1994 and the reduction from 19 plant species in 1993 to 15 in 1994, percent plant cover (73 percent in 1993 to 55 percent in 1994), and increase in bare ground (9 percent in 1993 to 36 percent in 1994) reflect the dry conditions (Table 3.26) (see Table B.26 in DOE, 1994). Fowl bluegrass, foxtail barley, Baltic rush, and Nebraska sedge continued to be the

Table 3.19 Plant species frequency of occurrence and plant height in 35 sample plots in transect 3 at Upper Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	97	34	3-12	7
Juba	63	22	3-12	7
Taof	89	31	1-4	2
Asoc	89	31	1-6	2
Acmi	63	22	1-6	2
Trre	31	11	1-4	1
Trhy	29	10	1-3	1
Anpa	3	-	-	-
Agsm	11	-	-	-
Poan	9	-	-	-
Luar	9	-	-	-
Cisp	3	-	-	-
BrFr	3	-	-	-
Clover sp.	3	-	-	-
Asle	6	-	-	-
Casp	3	-	-	-
Chsp	3	-	-	-
Arsp	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

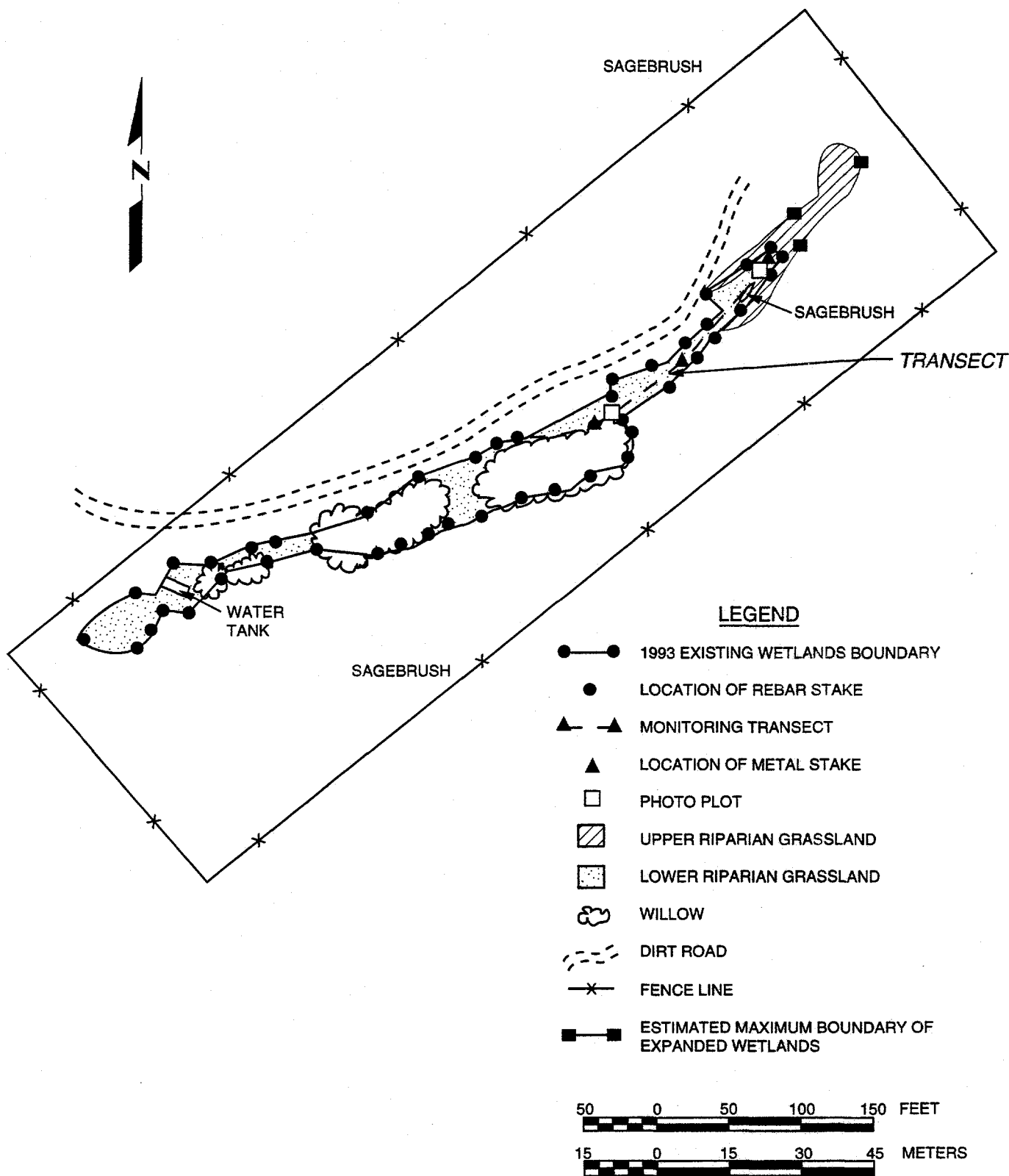


FIGURE 3.6
RIPARIAN PLANT COMMUNITIES IN LOWER LONG'S GULCH SPRING
SAGUACHE COUNTY, COLORADO

Table 3.20 Plant species percent cover in 35 sample plots in transect 1 at Lower Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	2	8	11	9	3		39	63
Sage						2	6	10
Alae	2		1	2			5	8
Juba	3	8					4	6
Taof	14	6					4	6
Hobr	1			1			2	3
Cado	5	1					1	2
Hoju		1					0.4	0.6
Poav	3						0.2	0.3
Luar	3						0.2	0.3
Rare	1						0.1	0.1
Asoc	2						0.1	0.1
Acmi	2						0.1	0.1
Camsp	1						0.1	0.1
Rowo	1						0.1	0.1
Total	NA	NA	NA	NA	NA	NA	62.4	99.8
Bare ground	6	8	17	2	2		30.5	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.21 Plant species frequency of occurrence and plant height in 35 sample plots in transect 1 at Lower Long's Gulch in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	94	33	2-10	5
Sage	6	-	-	-
Alae	14	5	4-9	6
Juba	31	11	6-10	8
Taof	57	20	1-2	1
Hobr	6	-	-	-
Cado	17	6	4-7	5
Hoju	3	-	-	-
Poav	9	-	-	-
Luar	9	-	-	-
Rare	3	-	-	-
Asoc	6	-	-	-
Acmi	6	-	-	-
Camsp	3	-	-	-
Rowo	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

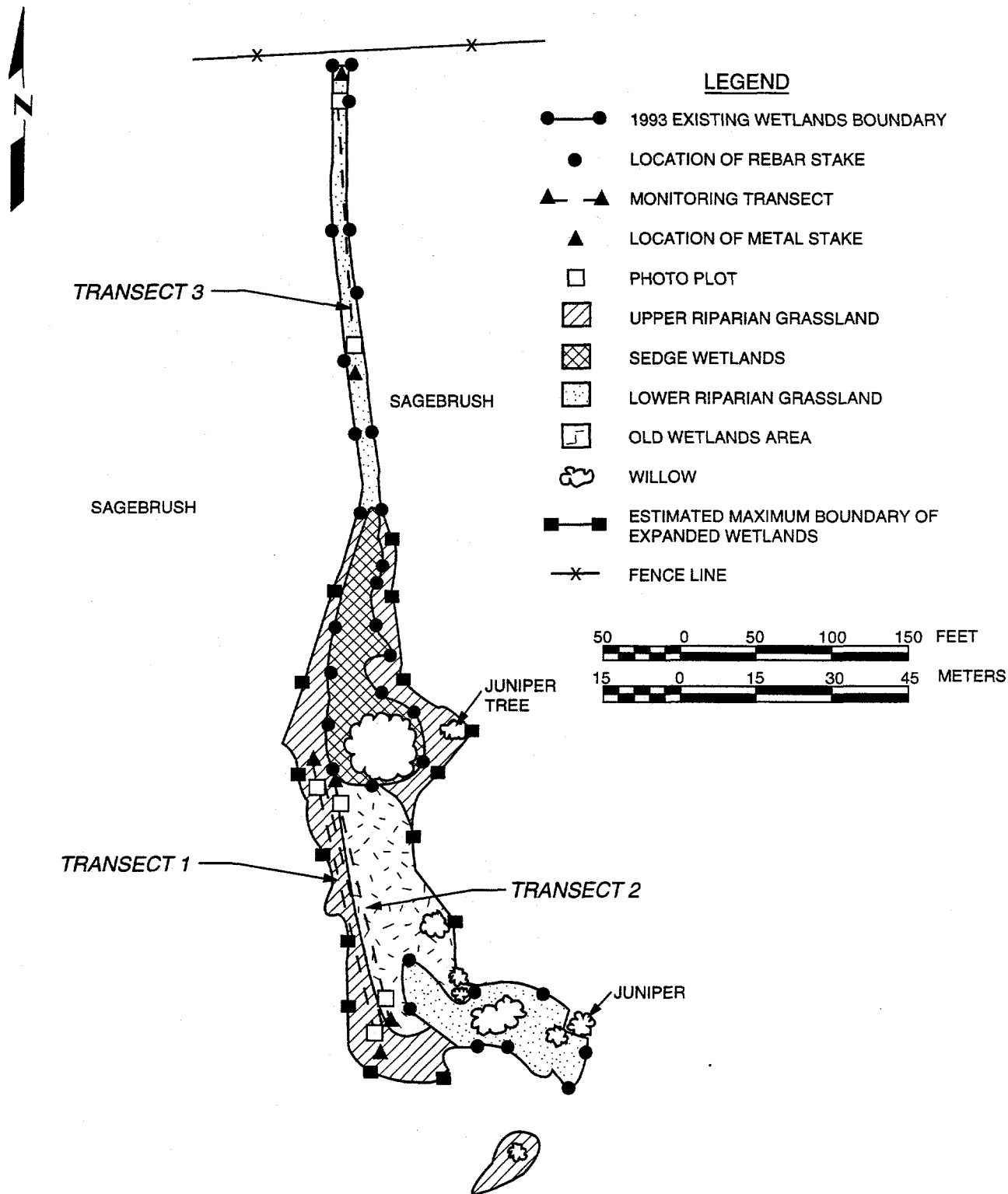


FIGURE 3.7
RIPARIAN PLANT COMMUNITIES IN SAGE HEN SPRING
SAGUACHE COUNTY, COLORADO

Table 3.22 Plant species percent cover in 40 sample plots in transect 1 at Sage Hen Spring in Saguache County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	11	21	4				12	35
Asoc	14	11	5				10	29
Agsm	13	11	2				7	20
Juba	5	2	1				2	6
Taof	1	2					1	3
Laoc	7	1					1	3
Chbe			1				1	3
Ciar	1	1					0.4	1
Acmi	1						0.1	0.3
Eqar	1						0.1	0.3
Artr	1						0.1	0.3
Total	NA	NA	NA	NA	NA	NA	34.7	100.9
Bare ground			12	18	9	1	60.9	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.23 Plant species frequency of occurrence and plant height in 40 sample plots in transect 1 at Sage Hen Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	90	36	2-6	3
Asoc	75	30	1-6	3
Agsm	65	26	2-7	4
Juba	20	8	3-8	6
Taof	8	-	-	-
Laoc	20	8	1-10	5
Chbe	3	-	-	-
Clar	5	-	-	-
Acmi	3	-	-	-
Eqar	3	-	-	-
Artr	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

Table 3.24 Plant species percent cover in 30 sample plots in transect 2 at Sage Hen Spring in Saguache County, Colorado,
August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Laoc	9	8	5				11	31
Arfr	3	4	5	1			11	31
Cane	1	2	3				5	14
Ciar	1	4	1				3	8
Depi +	3	2					1	3
Popa	1	1					0.6	2
Lepe +	7						0.6	2
Taof	6						0.5	1
Crwa +		1					0.5	1
Kochia sp.		1					0.5	1
Irm		1					0.5	1
Chbe	4						0.3	0.8
Chca +	2						0.2	0.6
Sihv	2						0.2	0.6
Poav	2						0.2	0.6
Eqar	1						0.1	0.3
Agsm	1						0.1	0.3
Amgr +	1						0.1	0.3
Huju	1						0.1	0.3
Chfr +	1						0.1	0.3
Total	NA	NA	NA	NA	NA	NA	35.6	99.1
Bare ground		3	5	10	10	1	60.2	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.25 Plant species frequency of occurrence and plant height in 30 sample plots in transect 2 at Sage Hen Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Laoc	73	22	2-15	7
Arfr	43	13	2-17	9
Cane	20	6	2-9	6
Ciar	20	6	10-16	12
Depi	17	5	10-18	15
Popa	7	-	-	-
Lepe	23	8	3-8	5
Taof	20	7	1-2	1
Crwa	3	-	-	-
Kochia sp.	3	-	-	-
Irmi	3	-	-	-
Chbe	13	4	4-9	6
Chca	7	-	-	-
Sihy	7	-	-	-
Poav	7	-	-	-
Eqar	3	-	-	-
Agsm	3	-	-	-
Amgr	3	-	-	-
Hoju	3	-	-	-
Chfr	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) × 100.
Dash indicates sample size too small to calculate statistics.

Table 3.26 Plant species percent cover in 40 sample plots in transect 3 at Sage Hen Spring in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	7	10	12	7	1		29	52
Juba	8	10	6	2			13	23
Cane	9	7	2	1			7	13
Hoju	8		1				2	4
Poan	2		1				1	2
Dece	2	2					0.9	2
Hobr	2	1					0.5	0.9
Acmi	5	1					0.5	0.9
Agst		1					0.4	0.7
Poav	7						0.4	0.7
Taof	5						0.3	0.5
Asoc	2						0.1	0.2
Agsp	2						0.1	0.2
Agsm	2						0.1	0.2
Plma	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	55.4	100.5
Bare ground	9	4	14	9	3		35.6	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

dominant species in this community. A slight reduction in plant height for fowl bluegrass and foxtail barley was observed in 1994 while Baltic rush and Nebraska sedge increased in height (Table 3.27) (see Table B.27 in DOE, 1994).

Camp Kettle Spring

Transect 1 is in the upper riparian grassland plant community at the east end of the site (Figure 3.8). The percent vegetative cover decreased from 64 percent in 1993 to 55 percent in 1994 while percent bare ground increased from 28 to 40 percent (Table 3.28) (see Table B.28 in DOE, 1994). Fowl bluegrass was the dominant species in 1993 (35 percent cover) but was reduced in 1994 (12 percent cover). Codominant species with fowl bluegrass in 1994 were white mountain aster (14 percent cover) and Baltic rush (13 percent). An increase in height was noted for all species in this transect (Table 3.29) (see Table B.29 in DOE, 1994).

Transect 2 is in the lower-lying section of the upper riparian grassland plant community than transect 1 (Figure 3.8). There was a marked decrease in vegetative cover from 1993 to 1994 (95 percent to 49 percent) and an increase in bare ground (3 percent to 44 percent) (Table 3.30) (see Table B.30 in DOE, 1994). This reduction in plant cover was not due to the drought conditions but to an intense rainstorm that deposited silt over the length of the transect. This storm took place the day before sampling and 3 to 6 inches (8 to 18 cm) of silt was deposited, covering much of the vegetation. Fowl bluegrass, silverweed, and dandelion were the dominant species in 1993 and all these were reduced substantially in vegetative cover in 1994. Much of the reduction in the low-growing silverweed and common dandelion was likely due to being covered by silt rather than disappearing. An increase in foxtail barley, Baltic rush, and *Carex* sp. was observed in 1994. In addition, tufted hairgrass appeared in the transect in 1994 and accounted for 8 percent vegetative cover. A substantial increase in plant height from 1993 to 1994 was noted in this transect for fowl bluegrass (3 to 7 inches [8 to 18 cm]), foxtail barley (3 to 10 inches [8 to 25 cm]), and Baltic rush (5 to 7 inches [13 to 18 cm]) (Table 3.31) (see Table B.31 in DOE, 1994).

Transect 3 is in a drainage below the sedge plant community (Figure 3.8). This drainage is dominated by *sedge* sp. and the cover for this species increased from 47 to 88 percent from 1993 to 1994 (Table 3.32) (see Table B.32 in DOE, 1994). There was an overall increase in percent vegetation from 63 percent in 1993 to 104 percent in 1994. Percent bare ground was essentially zero in 1994. The average height of *Carex* sp. showed a substantial increase from 1993 to 1994 (4 inches [11 cm] to 13 inches [31 cm]) (Table 3.33) (see Table B.33 in DOE, 1994).

Table 3.27 Plant species frequency of occurrence and plant height in 40 sample plots in transect 3 at Sage Hen Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	93	36	3-20	8
Juba	65	24	3-17	11
Cane	48	19	2-12	6
Hoju	23	9	4-12	9
Poan	8	7	1-3	1
Dece	10	4	2-19	10
Hobr	8	-	-	-
Acmi	2	5	1-5	3
Agst	3	-	-	-
Poav	18	-	-	-
Taof	13	5	1-2	1
Asoc	5	-	-	-
Agsp	5	-	-	-
Agsm	5	-	-	-
Plma	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.
Dash indicates sample size too small to calculate statistics.

LEGEND

- 1993 EXISTING WETLANDS BOUNDARY
- LOCATION OF REBAR STAKE
- ▲—▲ MONITORING TRANSECT
- ▲ LOCATION OF METAL STAKE
- PHOTO PLOT
- ▨ UPPER RIPARIAN GRASSLAND
- ▩ SEDGE WETLANDS
- ░ LOWER RIPARIAN GRASSLAND
- ESTIMATED MAXIMUM BOUNDARY OF EXPANDED WETLANDS
- X— FENCE LINE

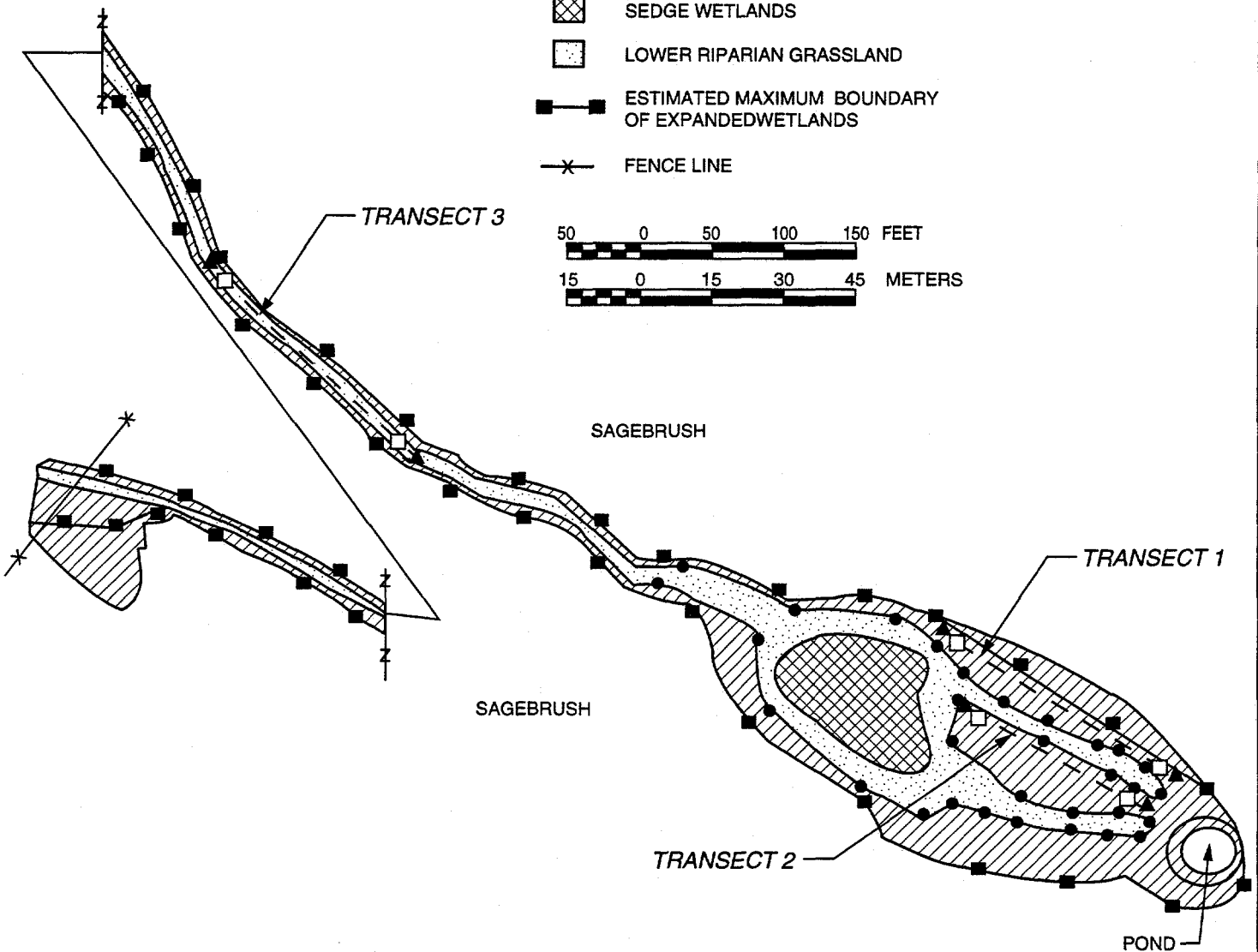
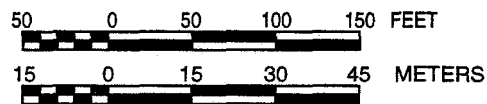


FIGURE 3.8
RIPARIAN PLANT COMMUNITIES AT CAMP KETTLE SPRING
SAGUACHE COUNTY, COLORADO

Table 3.28 Plant species percent cover in 40 sample plots in transect 1 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Asoc	13	10	8	1			14	26
Juba	4	13	6	1			13	24
Popa	13	18	4				12	22
Eqar	9	1		1			3	5
Aspa	1	2				1	3	5
Hoju	5	4					2	4
Acmi	5	3					1	2
Asle			1				1	2
Ciar	5	2					1	2
Chvi		3					1	2
Taof	13						0.8	1
Cado		2					0.8	1
Dece	2	1					0.5	0.9
Poan	2	1					0.5	0.9
Asag		2					0.08	1.4
Brfr	1						0.1	0.2
Agtr	2						0.1	0.2
Paca	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	54.7	99.8
Bare ground	1	8	20	7	3		40.2	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.

NA - not applicable.

Table 3.29 Plant species frequency of occurrence and plant height in 40 sample plots in transect 1 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	N	Plant height (inches)	
			Range	Mean
Asoc	80	33	1-7	3
Juba	60	25	5-12	7
Popa	88	36	2-6	6
Eqar	28	11	2-10	5
Aspa	10	-	-	-
Hoju	23	9	5-10	7
Acmi	20	9	1-6	3
Asle	3	-	-	-
Ciar	18	7	1-6	3
Chvi	8	-	-	-
Taof	33	13	1-3	2
Cado	5	-	-	-
Dece	8	-	-	-
Poan	8	-	-	-
Asag	3	-	-	-
BrFr	3	-	-	-
Agtr	3	-	-	-
Paca	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

Table 3.30 Plant species percent cover in 30 sample plots in transect 2 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Popa	10	15	1				10	20
Juba	4	10	4				10	20
Dece	3	11	2				8	16
Hoju	10	8		1			7	14
Casp	3	3	4				7	14
Asoc	5	3	1				3	6
Taof	4	4					2	4
Poan	8	1					1	2
Plma		1					0.5	1
Glst	2						0.2	0.4
Agst	1						0.1	0.2
Rare	1						0.1	0.2
Total	NA	NA	NA	NA	NA	NA	48.9	97.8
Bare ground	2	4	12	9	3		44.4	

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.
NA - not applicable.

Table 3.31 Plant species frequency of occurrence and plant height in 30 sample plots in transect 2 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	Plant height (inches)		
		N	Range	Mean
Popa	87	26	2-12	7
Juba	60	18	2-11	7
Dece	53	16	4-16	10
Hoju	63	19	4-15	10
Casp	34	10	4-10	6
Asoc	30	9	1-4	2
Taof	27	8	1-2	2
Poan	30	10	1-10	2
Plma	3	-	-	-
Glst	7	-	-	-
Agst	3	-	-	-
Rare	3	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

Table 3.32 Plant species percent cover in 40 sample plots in transect 3 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Canopy cover classes						Canopy coverage (%) ^b	Species composition (%) ^c
	Class 1 0 to 5%	Class 2 5 to 25%	Class 3 25 to 50%	Class 4 50 to 75%	Class 5 75 to 95%	Class 6 95 to 100%		
Casp			3	3	8	26	88	83
Rare	29	5					4	4
Poan	14	5					3	3
Glst	23	3					3	2
Juba	5	1	1				2	2
Popa	3	1	1				1	1
Asoc	2	1	1				1	1
Trre	9	1					0.9	0.9
Elpa	2	2					0.9	0.9
Taof	3						0.2	0.2
BrFr	3						0.2	0.2
Poav	3						0.2	0.2
Asmi	2						0.1	0.1
Dece	2						0.1	0.1
Hoju	2						0.1	0.1
Total	NA	NA	NA	NA	NA	NA	104.2	99.7

^aSee Table 2.1 for definition of abbreviations.^bCanopy coverage = Σ (number of plants in Class 1) (midpoint percent of Class 1 - 2.5 percent) + (number plants in Class 2) (midpoint percent in Class 2 - 15 percent) + ... + (number of plants in Class 6) (midpoint in Class 6 - 97.5 percent)/number of frames sampled.^cSpecies composition = percent canopy coverage by species/total canopy coverage.
NA - not applicable.

Table 3.33 Plant species frequency of occurrence and plant height in 40 sample plots in transect 3 at Camp Kettle Spring in Saguache County, Colorado, August 1994

Plant species ^a	Frequency (%) ^b	N	Plant height (inches)	
			Range	Mean
Casp	100	40	4-17	13
Rare	85	33	1-2	1
Poan	48	20	1-3	2
Glst	65	26	2-25	17
Juba	18	7	5-12	7
Popa	13	5	10-25	15
Asoc	10	4	2-3	3
Trre	25	10	1-2	1
Elpa	10	4	4-5	5
Taof	8	-	-	-
BrFr	8	-	-	-
Poav	8	-	-	-
Asmi	5	-	-	-
Dece	5	-	-	-
Hoju	5	-	-	-

^aSee Table 2.1 for definition of abbreviations.^bFrequency = (number of frames in which a species occurs ÷ number of frames sampled) x 100.

Dash indicates sample size too small to calculate statistics.

4.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this report.

Name	Contribution
C. Burt	Data collection and report preparation
K. Heil, W. Hopkins	Data collection and plant identification
WordCenter, Inc.	Text processing
D. Kahl	Technical editing
B. Harvey	Graphics

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