Spring Vegetation and Aquatic Invertebrate Survey 2000

Bureau of Land Management
Roswell Field Office

Final Report 2001

New Mexico Natural Heritage Program

The University of New Mexico

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Final Report[1]

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Introduction

The Roswell Field Office of the Bureau of Land Management (BLM) is responsible for the management of several springs and wetlands within the central southeastern section of the state. The Clean Water Act requires the preservation and restoration of aquatic resources, but neither of these goals can be accomplished without baseline data for the establishment of management programs. On behalf of the Roswell Field Office, the New Mexico Natural Heritage Program conducted a survey of aquatic/wetland vegetation and macroinvertebrates within a selected group of freshwater springs under BLM jurisdiction.

Aquatic macroinvertebrates are an important indicator of the health of a system, and have long been used to evaluate water quality. They are present in almost all systems, are habitat specific, relatively easy to collect and identify, and a vital link in the food chain between primary producers and vertebrates. The habitat requirements of many taxa are well known, and this makes them excellent indicators of water quality. The type and condition of vegetation surrounding an aquatic system is another important indicator of system health. Exotic trees, shrubs and herbaceous species can be both agents and indicators of major change in the riparian or aquatic environment. A more native and diverse species composition suggests a more intact and healthy ecosystem. Skilled personnel can obtain a good baseline sample of the vegetation and the macroinvertebrates in one or two visits to a spring. This makes sampling the vegetation and the macroinvertebrates a cost-effective way to get an initial picture of spring condition.

Along with the general vegetation and aquatic sampling, special attention was paid during the surveys to locate threatened and endangered species focusing on *Helianthus paradoxus* (Federally Threatened and State Endangered) which could potentially occur in the vicinity of these springs.

[1] Final report submitted in partial fulfillment of Bureau of Land Management Cooperative Agreement 1422G910A96011 Task Order 13.

This report includes a discussion of the survey results plus reports for each spring containing documentary photographs, precise location maps, summary descriptions, and plant and macro-invertebrate species lists. There are also appendices containing a complete description of the Pecos sunflower (*Helianthus paradoxus*) and comprehensive plant species list.

Methods and Materials

Eighteen spring systems were initially targeted for the survey in 2000, however only fifteen of these contained water at the time of sampling. The distribution of the sampled springs is shown in Figure 1. The survey included a complete list of plants in the vicinity of the spring, an overall description of the spring, and one or more macroinvertebrate samples. A thorough walking survey was done around each spring to catch all plant species in the vicinity. Voucher specimens of all plant species were collected, and identified using the resources of the herbarium of the University of New Mexico. Special effort was made to locate Helianthus paradoxus (Pecos sunflower), which is Federally listed as Threatened and New Mexico state listed as endangered (see Appendix A for a complete description of the species by the New Mexico Rare Plant Council (1999)). A comprehensive plant species list for the survey is given in Appendix B.

Macroinvertebrate samples were collected with a bag made of canvas and netting attached to a 12-inch diameter D-shaped metal ring on a five-foot handle, hereafter referred to as a D-net. The standard procedure was to conduct 10 one-meter sweeps with the D-net at each sample site within a spring. Sweeps were not repeated in the identical location, though for a given sample they were usually located close together. Everything collected in the net was then transferred to labeled vials containing 180-proof ethyl alcohol.

At some springs the shape of the water body being sampled limited either the number or length of non-repetitive sweeps. In these cases sampling methods were modified as appropriate, and these samples were labeled as atypical-quantitative samples. Occasionally, deliberate efforts were made to catch organisms not represented in the quantitative samples. These types of samples were labeled non-quantitative and provide only qualitative information on the macroinvertebrate population of the spring. All the macroinvertebrate samples with their location and sampling information are listed in Table 1.

In the laboratory, plant material and dirt was removed from the samples. The invertebrates were then sorted into isomorphic groups, counted, and placed in vials of 160-proof ethyl alcohol labeled with the sample number. These vials were given to a taxonomic specialist who identified them to the family level where possible. Since the number of individual organisms in each sample was not excessive, samples did not need to be subsampled and all individuals were identified and counted.

The Modified Hilsenhoff Biotic Index (MHBI) was calculated for all of the arthropod samples. All taxa were assigned a tolerance value (TV) from 0, for taxa known to occur only in high quality water, to 10, for taxa known to occur in severely polluted waters (Davis et al. 2001, Vinson 1994). The TV values come from Hilsenhoff (1987 & 1988), Bode (1988) and Davis (2001). The MHBI is calculated by multiplying the TV for each taxon by the

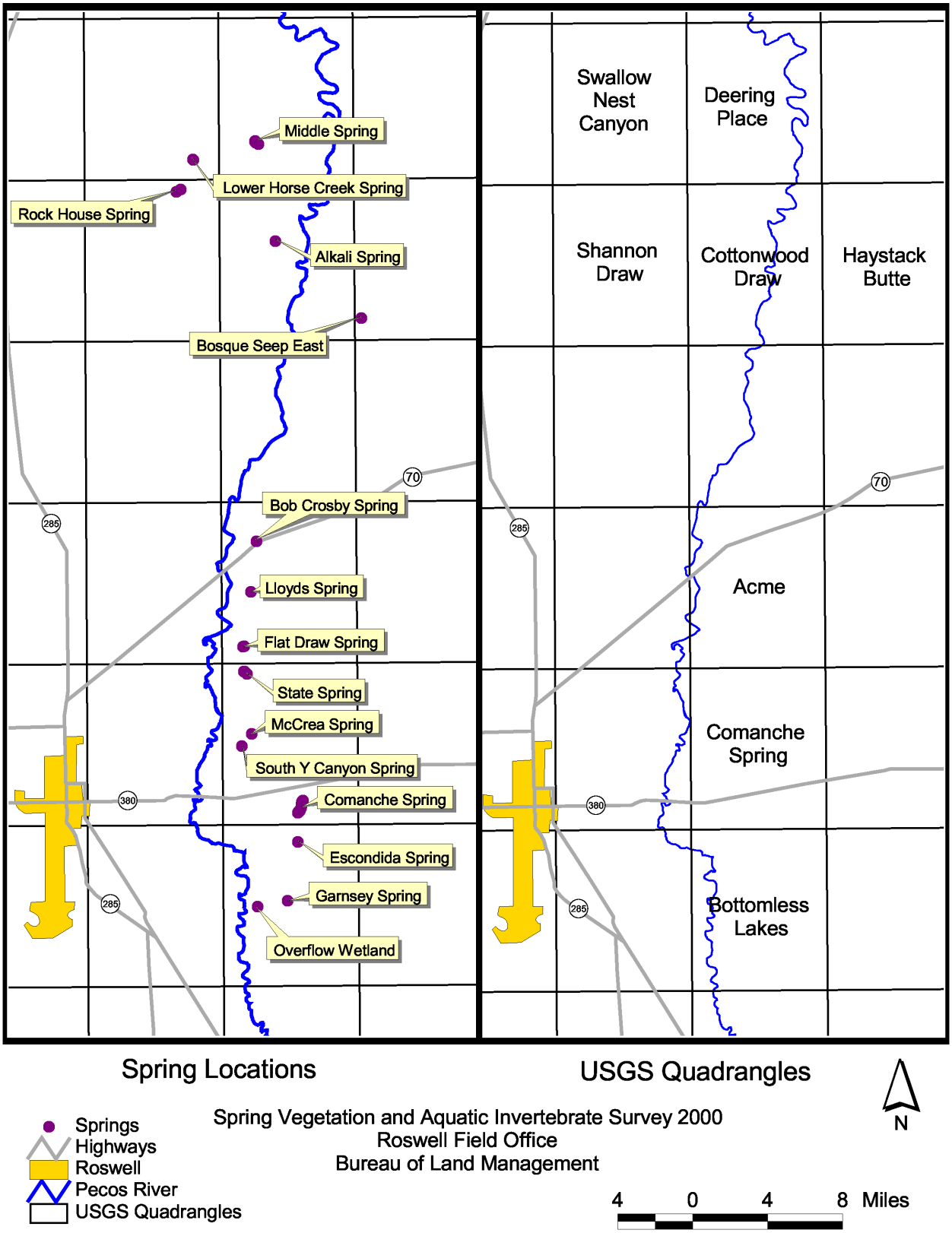

Figure 1: Locations of the sampled springs.

Table 1: Macroinvertebrate sample locations and methods.

SampleID	Sample Location	Northing	Easting	Length (m)	Width (m)	Depth (cm)	Temp	Temp Depth (cm)	Sample Type	Net Type	# of Sweeps	Sweep Length	System Type	Substrate
Alkali Spring														
EM00A0101	Spring source pool.	3742949	562636	20	3	58	27	10	NQ	D-Net	10	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand
Bob Crosby Spring														
EM00B0101	Edge of main pool and marsh area along NW side.	3717173	561011	25	20	300	30	10	Q	D-Net	10	1	Lentic; Pool & marsh	Mud, Silt, Detritus, Sand, Gravel, Bedrock
Bosque Seep East														
EM00B0201	Seep source pools A and B.	3736352	570012	4	1	30			AQ	D-Net	8	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand, Gravel, Cobble
Comanche Spring														
EM00C0101	Upper channel near spring source.	3694855	564938	50	2	65	30	10	AQ	D-Net	10	.5	Lentic; Spring head run	Mud, Silt, Detritus, Sand
EM00C0102	Pool A, largest pool near spring source.	3694789	564905	240	10	200	28	10	Q	D-Net	10	1	Lentic; Pool	Mud, Silt
EM00C0103	Pool B, approx. 1/8 mile S from Pool A.	3693998	564687	140	6	100	29	10	AQ	D-Net	7	1	Lotic; Seep pool	Mud, Silt, Detritus, Sand, Gravel
EM00C0104	Pool C, bottom pool in spring complex.	3693888	564564	50	10	200	28	10	Q	D-Net	10	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand
Escondida Spring														
EM00E0101	Spring source pool.	3691354	564565	10	4	100	18	10	Q	D-Net	10	1	Lentic; Spring head pool	Mud, Silt, Detritus, Sand
Flat Draw Spring														
EM00F0101	Pool C, largest pool in spring complex.	3708185	559946	40	4	70	30	10	Q	D-Net	10	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand, Gravel
EM00F0102	Pool D, bottom pool in spring complex.	3708141	559842	8	1	30	34	10	AQ	D-Net	5	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand
Garnsey Spring														
EM00G0101	Spring source pool.	3686325	563677	2	1	50			NQ	D-Net	10	1	Lentic; Spring head pool	Mud, Silt, Detritus, Sand

Table 1 (cont.): Macroinvertebrate sample locations and methods.

SampleID	Sample Location	Northing	Easting	Length (m)	Width (m)	Depth (cm)	Temp	Temp Depth (cm)	Sample Type	Net Type	# of Sweeps	Sweep Length	System Type	Substrate
Lloyds Spring														
EM00L0101	Pool A, only pool in spring complex with water at time of sampling.	3712830	560549	4	1.5	20	35	10	AQ	D-Net	4	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand
Lower Horse Creek Spring														
EM00L0201	Pool A, first pool in spring complex.	3749987	555545	10	2	20	32	10	AQ	D-Net	5	1	Lentic; Seep	Mud, Silt, Detritus
EM00L0202	Pool C, largest and bottom pool in spring complex.	3749948	555582	20	3	50	26	10	Q	D-Net	10	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand
McCrea Spring														
EM00M0201	Spring source pool.	3700653	560588	1.5	0.7	24	23	10	AQ	D-Net	5	1	Lentic; Seep pool	Mud, Silt, Detritus, Sand, Bedrock
Middle Spring														
EM00M0101	Pool D, first large pool in spring complex.	3751531	560888	20	2.5	30	28	10	Q	D-Net	10	1	Lentic; Seep pool & marsh	Mud, Silt, Detritus, Sand
EM00M0102	Pool F, large marshy pool in middle of spring complex.	3751449	560929	50	7	40	30	10	NQ	D-Net	10	1	Lentic; Seep & marsh	Mud, Silt, Detritus, Sand
Overflow Wetland														
EM00O0101	Large pool in the southwest corner of the wetlands.	3685812	561114	50	10	20	30	10	Q	D-Net	10	1	Lentic; Pool & marsh	Mud, Silt, Detritus
Rock House Spring														
EM00R0101	Pool A, nearly dry pool at upper end of spring complex.	3747199	554138	7	2	7	36	3	AQ	D-Net	4	.5	Lentic; Seep	Mud, Silt, Detritus, Sand
EM00R0102	Pool B, largest pool at bottom of spring complex.	3747401	554487	30	2	10	25	10	AQ	D-Net	5	1	Lentic; Seep pool & marsh	Mud, Silt, Detritus, Sand

Table 1 (cont.): Macroinvertebrate sample locations and methods.

SampleID	Sample Location	Northing	Easting	Length (m)	Width (m)	Depth (cm)	Temp	Temp Depth (cm)	Sample Type	Net Type	# of Sweeps	Sweep Length	System Type	Substrate
South Y Canyon														
EM00S0201	Spring source pool.	3699604	559744	2.5	2.5	23	25	7	Q	D-Net	10	1	Lentic; Seep pool	Mud, Silt, Sand, Gravel, Cobble, Boulder, Bedrock
State Spring														
EM00S0101	Pool B, small pool near top of spring complex.	3705818	560164	15	3.5	50	32	10	Q	D-Net	10	1	Lentic; Pool	Mud, Silt, Detritus, Sand
EM00S0102	Pool D, pool in middle of spring complex.	3705875	560117	30	4	50	32	10	Q	D-Net	10	1	Lentic; Pool	Mud, Silt, Detritus, Sand
EM00S0103	Middle of pool F at bottom of spring complex.	3705986	559987	95	5	100	33	10	Q	D-Net	10	1	Lentic; Pool	Mud, Silt, Detritus, Sand
EM00S0104	Lower end of pool F at bottom of spring complex.	3705986	559961	95	5	100	33	10	Q	D-Net	10	1	Lotic; Pool	Mud, Silt, Detritus, Sand

number of individuals for that taxon within a sample, summing the products and dividing by the total number of individuals in the sample. Taxon without known TV values were excluded from the calculation. The MHBI values for individual samples are given in the spring descriptions, while the overall MHBI value for each spring is listed in Table 2.

The MHBI has been used to detect nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts on freshwater streams. In stream systems waters with MHBI values of 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched, and 7-10 polluted (Vinson 1994.) Although the index was developed for freshwater streams it is still a useful tool for comparing water quality among springs. Seep springs will naturally have higher water temperatures and lower dissolved oxygen than a flowing stream, they will also have more difficulty dissipating sediment and pollution than a flowing system. Thus one would expect to find taxa with higher tolerance values in seep springs. However, comparing the MHBI across spring systems can still indicate which springs have better water quality.

The spring and its surrounding environment was described and photographed. Each photo was scanned into a digital file and archived to compact disk. Invertebrate sample points, as well as pertinent landmarks, were located with a global positioning system.

The vegetation data was entered into NMNHP's Microsoft Access® ecology database. Over the past decade this database has been developed and populated with over 5,000 plot records from around the state and the Southwest. Accordingly, there is a set of data-entry protocols that have been implemented that ensure data quality, including independently proofreading the data for accuracy. A related Access database was developed and populated for the invertebrate sample data. The data from each site has been summarized and incorporated into the spring descriptions. The Access database containing the raw data has been made available on compact disk along with the photo files and this report.

Results & Discussion

The springs were surveyed in late July and early August 2000. At that time the Roswell area had received very little rainfall, which was evident at all the springs surveyed. The water was very low at many of the springs, in some cases only a few centimeters deep, and there was evidence at all the springs of reduced pool size. Three of the springs to be surveyed were completely dry due to the drought, and thus were not sampled. The dry springs were Bosque Seep West, Bosque Spring and Comanche Draw West.

Of the 15 springs surveyed, six were small, single-pool seep systems and nine were larger, multi-pool systems. All were lentic (still water) seep systems and all occurred in arroyo bottoms. The one exception was the Overflow Wetland spring, which is part of a very large wetland adjacent to Lea Lake. The overflow wetlands includes both lentic and lotic (flowing water) areas and lies within the Pecos River floodplain. Complete descriptions of the individual springs are contained in the Spring Descriptions section, which follows the discussion. Each spring description includes directions to the spring, a map, photo, list of plant species and invertebrate sample summaries.

Table 2: Overall Modified Hilsenhoff Biotic Index (MHBI), spring size, amount of drought affect, and livestock access to all springs surveyed.

	Number Individuals per Rank																
SpringName	**NA**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**% Ranked**	**MHBI**	**MHBI Pollution Level**	**Total # Inds**	**Spring Size**	**Drought affect**	**Livestock access**
Alkali Spring	6						3			10	68%	8.3	polluted	19	small	significant	current
Bob Crosby Spring						4		1			100%	5.4	enriched	5	large	slight	unlikely
Bosque Seep East	5					6	1		3	44	92%	8.4	polluted	59	small	extreme	current
Comanche Spring	6					5	17	1		1	80%	6.0	enriched	30	large	slight	yes, but not current
Escondida Spring	10					3	5		133	16	94%	8.0	polluted	71	small	slight	spring fenced
Flat Draw Spring	45					7			49	6	57%	7.8	polluted	59	med	extreme	current
Garnsey Spring	5							1	102		95%	8.0	polluted	5	small	significant	spring fenced
Lloyds Spring	8					7	4		20	13	85%	7.6	polluted	52	small	extreme	current
Lower Horse Creek Spring	21				1	17	7		3	47	78%	7.7	polluted	96	med	significant	current
McCrea Spring	10								114	1	92%	8.0	polluted	125	small	unknown	spring fenced
Middle Spring	23			3		22	11	2		6	65%	5.8	enriched	67	large	slight	current
Overflow Wetland	8					3	23			3	78%	6.2	enriched	37	large	slight/none	excluded
Rock House Spring	11			2		32	2	15	87	15	93%	7.3	polluted	164	med	extreme	current
South Y Canyon	1					1	6				87%	5.9	enriched	8	small	significant	excluded
State Spring	237					5	10		13	35	21%	8.0	polluted	291	large	slight/ significant	current

The springs most obviously affected by drought were Alkali Spring, Bosque Seep East, Flat Draw Spring, Garnsey Spring, Lloyds Spring, Lower Horse Creek Spring, Rock House Spring, and South Y Canyon Spring. All of these springs appeared to be reduced to half or less of their normal volume. McCrea Spring was extremely small, but it was difficult to tell if this was due to drought or it it was the normal size of the spring. Middle Spring, Bob Crosby Spring, and State Spring also showed evidence of reduced volume, but not to the same extent as the previously listed springs.

In many of the drought affected springs the invertebrate sample was skewed due to the reduced pool sizes. While there were certainly large numbers of arthropods in many of the small pools at the time of sampling, the high density was most likely an artifact of the reduced pool volume due to the drought. In the drying pools arthropods were forced to retreat to smaller and smaller areas as the water evaporated. Thus, many more were present per volume of water than in larger pools. In general the D-net produced denser samples from the smaller systems. Besides the increased density of individuals in small pools, small pools also offered less room for the animals to escape the net during sweeps. Thus when comparing arthropod samples it is important to consider the size of the pool as a factor in the sample composition (Table 2).

The majority of the arthropod samples from the small drought-reduced pools had a high Modified Hilsenhoff Biotic Index (MHBI) (Table 2). The only small drought-affected spring that had a relatively low MHBI was South Y Canyon, which, perhaps significantly, was excluded from grazing. None of the springs had an MHBI below 5.4, which may in part be due to the fact that the MHBI was developed for taxa found in streams, which are typically going to have higher dissolved oxygen and lower water temperature than springs. Streams can also more readily dissipate sediment and nutrient enrichment than lentic springs.

Besides drought, the major impact in evidence on the springs was livestock usage, which varied from spring to spring. Three of the springs surveyed were fenced to exclude livestock (Escondida, Garnsey, and McCrea); one was located in an arroyo bottom sink hole (Bob Crosby) that made it difficult, though not impossible, for livestock to access; and two were in areas not currently being grazed (Overflow Wetland and South Y Canyon). The remainder were readily available to livestock. Livestock impacted the springs through cropping of vegetation, trampling of the spring edges and bottoms, and enrichment and pollution of the water with urine, feces, and occasionally carcasses. Of the springs surveyed, only Escondida Spring appeared to have been altered by humans. The springhead and main pool were fenced while a pipe lead from the main pool to a stock tank outside the fence.

All but one of the springs with livestock use had MHBIs above 7.3, indicating detrimental impacts (Table 2). The one exception was Middle Spring, a large, multi-pool system whose size may have dissipated the livestock impact. Livestock access was not the only determiner of water quality however, as the three springs from which livestock had been excluded by fencing all had MHBIs of 8.0. Two of these springs were heavily overgrown with salt cedar and the third had been degraded by drought. Excepting Middle Spring and South Y Canyon, those springs that had the lowest MHBIs were large systems with limited or no livestock access. Middle Spring may gain some protection from livestock impact due to its size,

while South Y Canyon, although small, is completely excluded from livestock use due to its location on the National Guard training lands.

In general the presence of Ephemeropterans (mayflies) is considered an indicator of good water quality. However, though this order was represented at many of the springs, it was usually by genera that will tolerate extremely poor water quality. The vast majority of the mayflies collected were of the genus Callibaetis, which can tolerate very polluted waters (TV=9). Only two individuals were collected from the mayfly genus Baetisca, which tolerates enriched, but not polluted, water (TV=4). These two individuals were collected at Bob Crosby Spring.

Vegetatively, the highest quality springs were Comanche and Middle Springs, both of which had extensive areas of native emergent wetland vegetation, respectively composed of common threesquare (*Schoenoplectus pungens*) and western sedge (*Carex occidentalis*), and common threesquare and beaked spikerush (*Eleocharis rostellata*). Rock House, Lower Horse Creek and Bob Crosby Springs also had significant patches of emergent wetland vegetation composed of common threesquare, beaked spikerush, saltmarsh bulrush (*Schoenoplectus maritimus*) and broadleaf cattail (*Typha latifolia*). Bosque Seep East, although very small, was surrounded by common threesquare, which graded into a bank dominated by alkali muhly (*Muhlenbergia asperifolia*) and Emory's baccharis (*Baccharis emoryi*). Garnsey spring had limited emergent wetland vegetation, but was dominated by an unusual giant sacaton (*Sporobolus wrightii*) and New Mexico olive (*Forestiera pubescens*) community. The majority of the remaining springs were dominated by alkali sacaton (*Sporobolus airoides*), inland saltgrass (*Distichlis spicata*) and salt cedar (*Tamarix ramosissima*).

Salt cedar was present at most of the springs, and could become a threat to all of them in the future. The small McCrea Spring was surrounded by large salt cedars, which formed a closed canopy over it. This thick salt cedar may be affecting both the water quality and availability at this spring. Salt cedars were also particularly dense and may be affecting water quality at Escondida, Flat Draw, Lower Horse Creek and State Springs. In general, salt cedar encroachment may pose a greater threat to the small springs, however it is something that should be monitored closely at all springs.

Careful attention was paid during the survey for the location of populations of the Federally Threatened and Sate Endangered Pecos sunflower (*Helianthus paradoxus*). Both Lloyds and Flat Draw Springs had populations of Pecos sunflower. At Lloyds Spring there were approximately 200 young plants up channel from the only pool with standing water. There were also about 200 young plants at Flat Draw Spring, scattered between the second and fourth pools. These springs are in very similar habitats with apparently alkali soils, and both springs were suffering the effects of drought at the time of the survey.

The springs that were of the overall best condition were, in order of quality, Comanche, Middle, Bob Crosby, Lower Horse Creek, and Rock House. These five springs were among the largest systems, with the best water quality, diverse fauna, and extensive stands of wetland vegetation. Currently none of them is being managed for wetland quality, and Lower Horse Creek especially was being heavily impacted by livestock. Rock House was heavily impacted by drought at the time of survey, and this recommendation is based largely on potential quality

suggested by its wetland vegetation. In all five systems, limiting direct livestock access to the pools and surrounding wetland vegetation would be the most important first step in conservation. With a modest investment of resources the biological value of these springs can be maintained or enhanced.

Flat Draw, Lloyds, and State Springs are all large systems which may need restoration to reach their potential. The water quality at these three springs was lower than at the other large systems, possibly due to drought. However, all three of these springs are in similar alkali soils on the east side of the Pecos, and the difference in their vegetation and water quality may simply be due to their geographic location. Further testing of water and soil chemistry would be necessary to determine this.

Among the smaller spring systems South Y Canyon had the best water quality, and was extensively used by wildlife. All of the small springs are important to wildlife, and management should be oriented towards wildlife habitat improvement. Several are already protected from direct livestock access by fencing, however these small springs are also threatened by salt cedar. Escondida and McCrea Springs are heavily overgrown with salt cedar. Removal and monitoring of the salt cedar may help improve water quality and availability at all springs.

All of the springs surveyed provide important rare habitat for wetland invertebrates and vegetation in an arid environment. The springs are also some of the last shallow freshwater wetlands in the channelized and salt-cedar-dominated Pecos River drainage. In addition, these springs are an important source of water for wildlife of all types. To sustain and enhance these valuable biological resources, the springs will require careful and attentive management. This will involve devising creative strategies that maintain wildlife habitat while meeting the water needs of livestock. Remaining unfenced springs should be fenced and the salt cedar removed from those springs most impacted by it (McCrea, Escondida, Flat Draw, and Lloyds). This will enhance water quality and possibly water quantity. Water resources may need to be partitioned (or others developed) with an allocation to livestock outside the spring areas that is in keeping with upland range capacity, and an allocation within spring areas to wildlife that will insure long-term maintenance of diversity.

Acknowledgements

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Roswell
Spring Vegetation and Aquatic Invertebrate Survey 2000

Spring Descriptions

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Alkali Spring

Figure 2: Alkali Spring

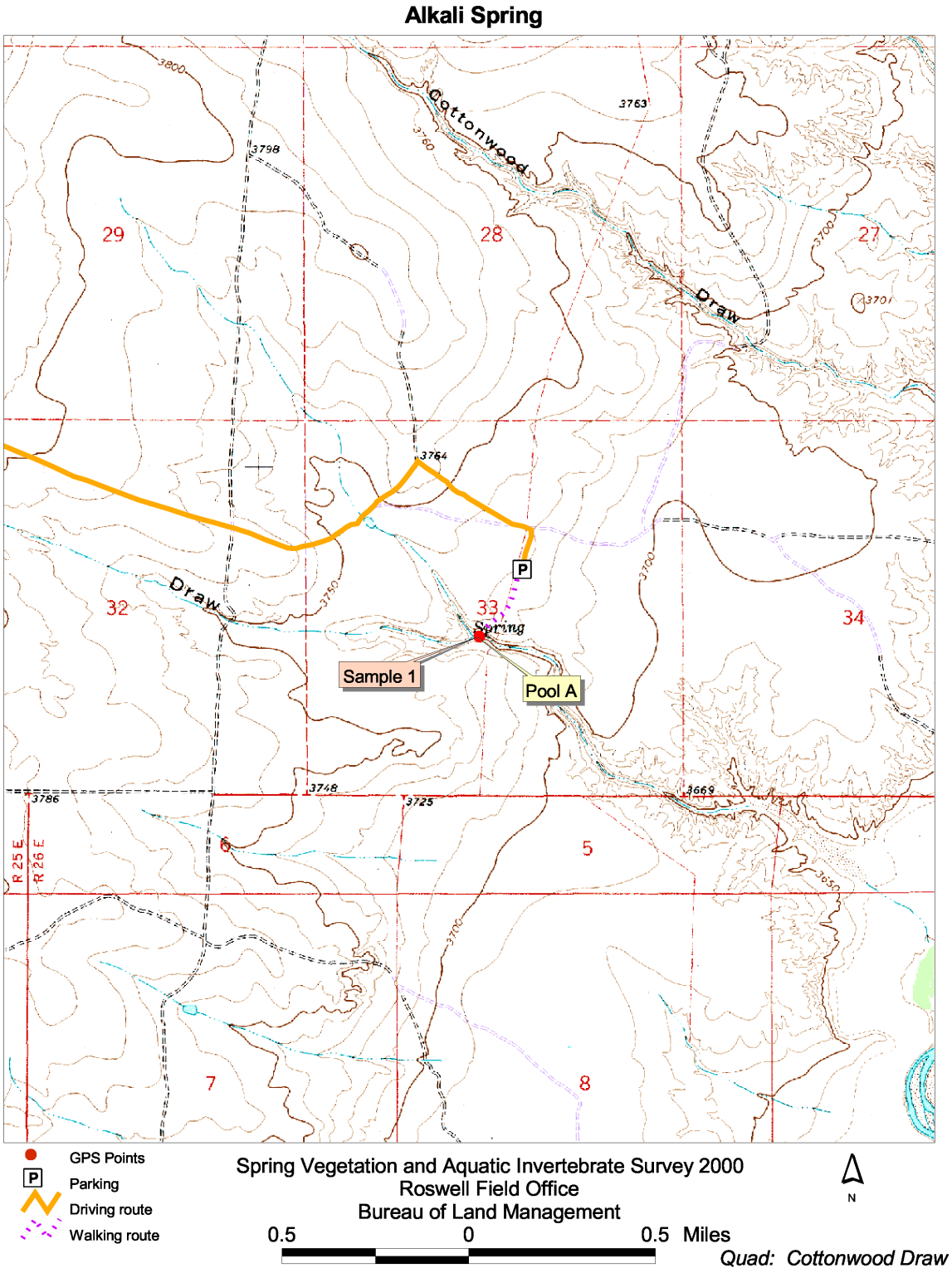

Figure 3: Map of Alkali Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Alkali Spring

NMNHP Plot Number: 00RS004 **NMNHP Spring Sample Number:** EM00A01
Survey Date: 7/29/2000
UTM Location (NAD 27): Easting: 562636 Northing: 3742949

Directions to Plot: Take US 285 approx. 28 mi. N of I-70 junction, and turn E on CR 44 (Dona Ana Rd.) At approx. 7.8 mi., take NE road at fork. Continue for approx. 5 mi., and take SE road towards current Benedict ranch (approx. 1.2 miles) take road S just before ranch and drive approx. 0.5 miles, then take road E for 2 miles to jct. with main N/S road. Drive approx. 2 mi. S, then take road E for approx. 1.5 mi. to fence, follow road on E side of fence S to oil pad. Walk down fence line to draw, then short distance W to spring.

Description: Alkali Spring consisted of a single seep pool in the arroyo bottom, approximately 20 m by 3 m and 60 cm deep. Pool had silty, sedimentary bottom; the water was brownish but had fairly good visibility. Dense inland saltgrass formed a belt around the pool approximately 1-2 m wide. Drainage bottom was dominated by inland saltgrass with some alkali sacaton, and graded into alkali sacaton on the uplands. There were scattered salt cedars along the drainage bottom and at the edge of the pool. Arroyo drains NE/E (74 degrees). There were many gypsum outcrops in the arroyo, both rock and crystal.

Status: The spring did not appear to be currently used by livestock at the time of the survey. The vegetation line and other evidence at the time of the survey indicated that the water level was several inches lower than normal. Many tiger beetles were observed around the pool as well as adult dragonflies and damselflies. Many dragon- and damselfly nymphs and backswimmers were observed in the water. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 8.3, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Allenrolfea occidentalis	pickleweed		
Prosopis glandulosa	honey mesquite	N	FACU
Pseudoclappia arenaria	transpecos false clapberry		
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Limonium limbatum	transpecos sealavender	N	FACW

Invertebrate Sample Taxonomic List

Alkali Spring

SampleID: EM00A0101 **Sample 1** Pool A

Sample type: Non-Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	6	PR	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	4	PR	9
Heteroptera	Nepomorpha	Notonectidae		backswimmer	6	PR	
Diptera	Nematocera	Ceratopogonidae		biting midge	3	PR	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Bob Crosby Spring

Figure 4: Bob Crosby Spring

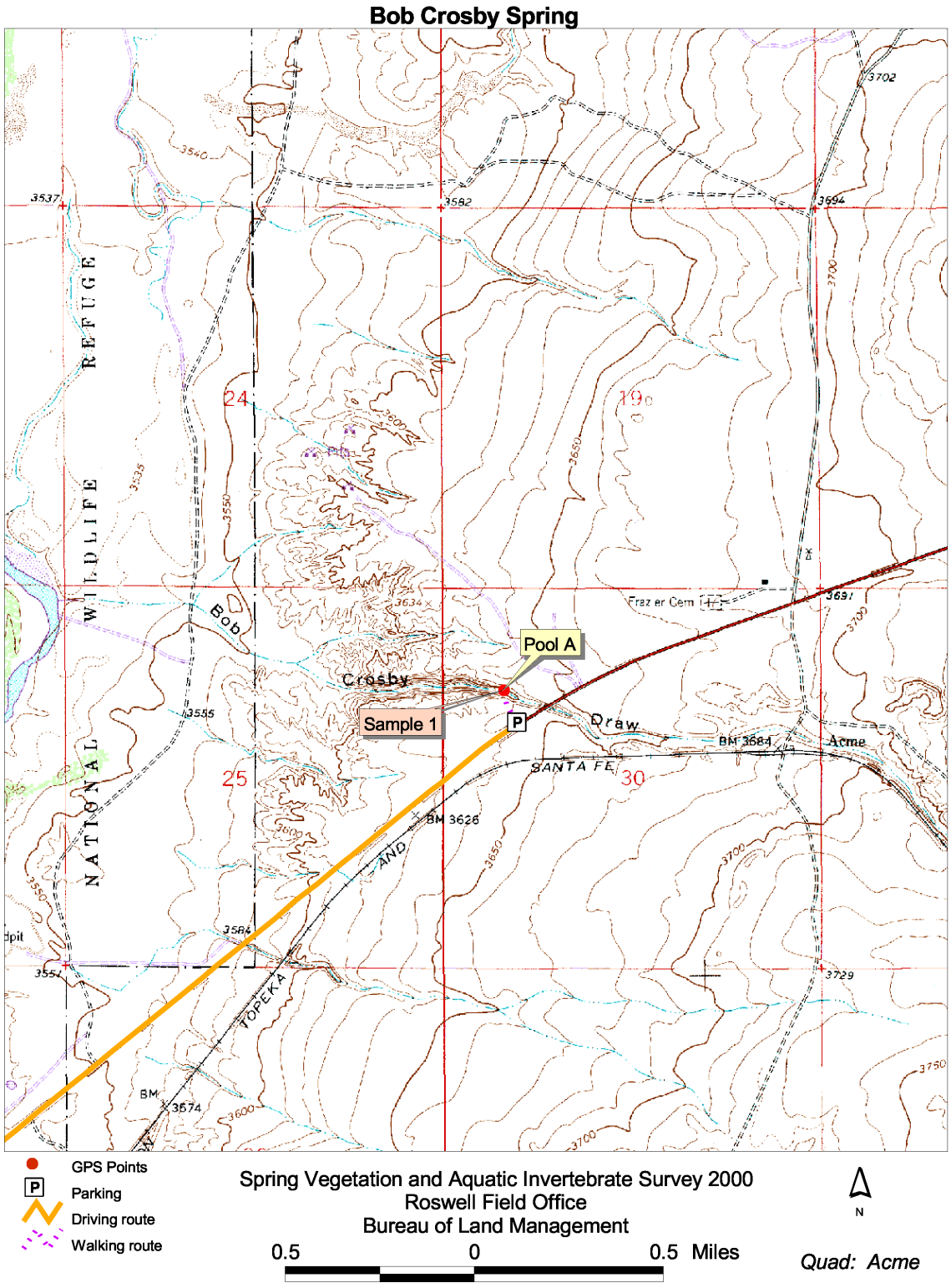

Figure 5: Map of Bob Crosby Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Bob Crosby Spring

NMNHP Plot Number: 00RS008 **NMNHP Spring Sample Number:** EM00B01
Survey Date: 8/2/2000
UTM Location (NAD 27): Easting: 561011 Northing: 3717173

Directions to Plot: Take I-70 E from Roswell. Approx. 2.4 mi. after Bob Crosby Bridge over the Pecos River, park just before the draw and walk N to spring.

Description: The Bob Crosby Spring consisted of a large pool inside a sink hole located in an arroyo, and the associated wetlands inside the arroyo above and below the sinkhole. The sinkhole was approximately 10 m below the surrounding uplands. The pool appeared several meters deep, but was not measured. The east half of the pool was surrounded by a rocky cliff with a hanging garden. Dominant species in the hanging garden included catchfly prairie gentian, limewater brookweed, wormwood and alkali muhly. The drainage to the west of the pool was dominated by dense saltcedar with a scattered broadleaf cattail understory. The drainage above the sinkhole to the east had a large stand of broadleaf cattail and common threesquare with scattered salt cedars.

Status: There was no evidence of livestock use at the spring. The water level was several inches below normal at the time of sampling, but as this was a large deep pool it did not appear to be adversely affecting the fauna. Many vertebrates were observed using the pool including turtles, fish, frogs and birds. A number of adult dragonflies were also observed around the pool. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 5.4, indicating the water was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Rhus trilobata	skunkbush sumac	N	UPL
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Agrostis stolonifera	creeping bentgrass	I	FACW
Elymus canadensis	Canada wildrye	N	FAC
Muhlenbergia asperifolia	alkali muhly	N	FACW
Phragmites australis	common reed	N	FACW+
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Artemisia dracunculus	wormwood	N	NI
Artemisia ludoviciana	Louisiana sagewort	N	UPL
Eustoma exaltatum	catchfly prairie gentian	N	OBL
Gaura parviflora	velvetweed	N	UPL
Heliotropium curassavicum	salt heliotrope	N	
Lactuca serriola	prickly lettuce	I	FAC
Samolus ebracteatus ssp. cuneatus	limewater brookweed	N	OBL
Typha latifolia	broadleaf cattail	N	OBL

Invertebrate Sample Taxonomic List

Bob Crosby Spring
SampleID: EM00B0101 **Sample 1** **Pool A**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	2	SC	8
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Pannota	Baetiscidae	Baetisca	mayfly	2	CG	5
Heteroptera	Gerromorpha	Gerridae	Rheumatobates	water strider	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	1	PR	5
Diptera				unidentified fly pupa	1	UN	7

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Bosque Seep East Spring

Figure 6: Bosque Seep East Spring

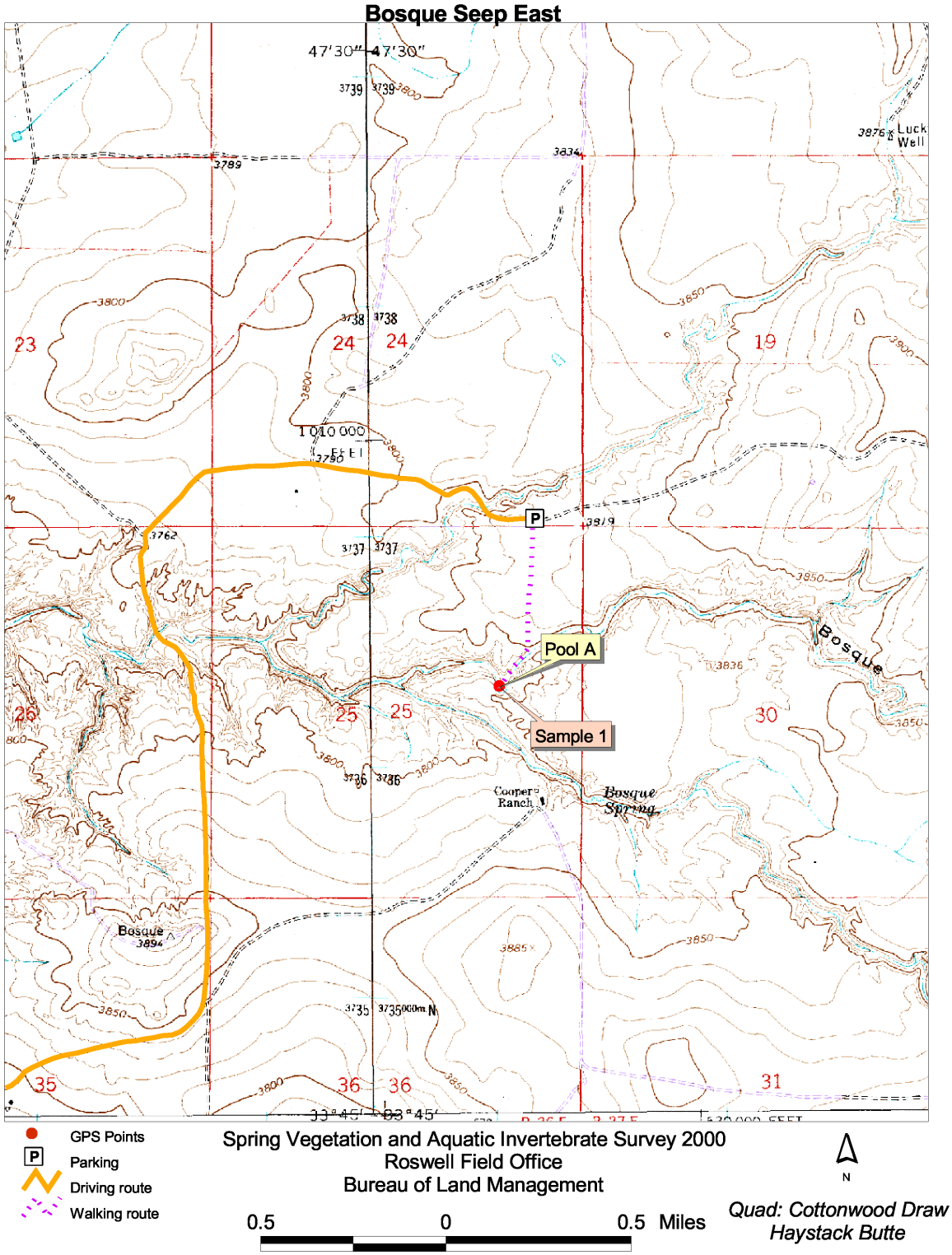

Figure 7: Map of Bosque Seep East Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Bosque Seep East Spring

NMNHP Plot Number: 00RS005 **NMNHP Spring Sample Number:** EM00B02
Survey Date: 7/31/2000
UTM Location (NAD 27): Easting: 570012 Northing: 3736352

Directions to Plot: Take I-70 E from Roswell. Approx. 3 mi. after Bob Crosby Bridge over Pecos R., take road N with Frazier Cemetery and old schoolhouse at NW corner. After approx. 9.4 mi. road will curve to E; approx. 1 mi. beyond curve take N road. Stay on N road for approx. 1 mi., then take NE road toward Cooper Ranch. At approx. 1.1 mi., there will be another intersection, take N fork. Continue approx. 1.25 mi. across Bosque Draw to fork in road. Take E fork approx. 1 mi., park and walk S on cattle trail approx. 0.5 mi. to spring in draw bottom.

Description: Bosque Seep East Spring was composed of two small seep pools on the south side of a bend in an arroyo. In wetter years the two pools would be one, but because the water was several inches lower than normal there was a meter of bare soil between them. The deepest water depth in the pools was 30 cm. The bank edge and area around the pools was dominated by common threesquare with some alkali muhly. On the low terrace south of the pools was a small band of Emory's baccharis that graded into salt cedar and southern jimmyweed up the terrace. The channel bottom was heavily scoured and composed of sand and bedrock. The arroyo bank cut was approximately 12 m. Water in the pools was somewhat murky.

Status: The water level in the pools was several inches below previous water marks. Average depth in both pools was approximately 15 cm. There was evidence of heavy use by livestock, with fresh tracks, trails and dung throughout the area and the pools. A few bank swallow nests were present on the south arroyo bank. Adult tiger beetles and dragonflies were observed around the pools. There were many water striders on the surface of the water. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 8.4, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Isocoma pluriflora	southern jimmyweed	N	NI
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Bothriochloa barbinodis	cane bluestem	N	
Bothriochloa laguroides ssp. torreyana	silver beardgrass	N	NI
Cenchrus spinifex	sandbur	N	NI
Chloris cucullata	hooded windmill grass	N	NI
Muhlenbergia asperifolia	alkali muhly	N	FACW
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus pungens	common threesquare	N	OBL
Setaria leucopila	streambed bristlegrass	N	NI
Sporobolus airoides	alkali sacaton	N	FAC
Sporobolus flexuosus	mesa dropseed	N	FACU-

Sporobolus wrightii	giant sacaton	N	NI
Forbs			
Ambrosia psilostachya	Cuman ragweed	N	FAC
Flaveria campestris	alkali yellowtops	N	FAC
Solanum elaeagnifolium	silverleaf nightshade	N	NI
Xanthium strumarium	rough cocklebur	N	FAC

Invertebrate Sample Taxonomic List

Bosque Seep East

SampleID: EM00B0201 **Sample 1** **Pools A & B**

Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae	Callibaetis	mayfly	43	CG	9
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	1	PR	9
Heteroptera	Nepomorpha	Corixidae		water boatman	2	OM	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	3	PR	
Heteroptera	Gerromorpha	Gerridae	Gerris	water strider	3	PR	5
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	1	PR	5
Coleoptera	Polyphaga	Helophoridae	Helophorus	water scavenger beetle	2	PR	5
Diptera	Nematocera	Culicidae		mosquito	3	CG	8
Diptera	Nematocera	Chironomidae		midge	1	OM	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
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Bosque Seep West Spring

Spring Name: Bosque Seep West Spring

NMNHP Plot Number: 00RS006 **NMNHP Spring Sample Number:**
Survey Date: 7/31/2000
UTM Location (NAD 27): Easting: Northing:

Directions to Plot: Take I-70 E from Roswell. Approx. 3 mi. after Bob Crosby Bridge over Pecos R., take road N with Frazier Cemetery and old schoolhouse at NW corner. After approx. 9.4 mi. road will curve E; approx. 1 mi. beyond curve take N road. Stay on N road for approx. 1 mi., then take NE road toward Cooper Ranch. At approx. 1.1 mi., there will be another intersection, take N fork. Continue approx. 1 mi. to Bosque Draw, park and walk W down draw.

Description: A wide, heavily scoured arroyo (approx. 20 m wide) lined with saltcedar and a few scattered cottonwoods was surveyed for Bosque Seep West Spring. No standing water was found but a small patch of common threesquare (1m x 20m) was found under a large cottonwood on the south side of the arroyo, less than 200 m west of the road crossing. Emory's baccharis was common along bank with scattered grasses and forbs including giant sacaton, mesa dropseed, Canada wildrye, sandbur, cane bluestem, sideoats grama, Hopi tea greenthread, Canadian horseweed, and Cuman ragweed. The surrounding uplands grade into honey mesquite coppice dunes with sand sagebrush.

Status: Arroyo was dry and no spring was located during the survey. Presumed dry.

Species Name	Common Name	Origin	Wetland Status
Trees			
Populus deltoides	eastern cottonwood	N	
Shrubs			
Artemisia filifolia	sand sagebrush	N	NI
Atriplex canescens	fourwing saltbush	N	UPL
Baccharis emoryi	Emory's baccharis	N	FACW
Gutierrezia sarothrae	broom snakeweed	N	NI
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Aristida purpurea	purple threeawn	N	NI
Bothriochloa barbinodis	cane bluestem	N	
Bouteloua curtipendula	sideoats grama	N	NI
Bouteloua gracilis	blue grama	N	NI
Cenchrus spinifex	sandbur	N	NI
Distichlis spicata	inland saltgrass	N	FACW
Elymus canadensis	Canada wildrye	N	FAC
Erioneuron pulchellum	fluffgrass	N	NI

Panicum obtusum	vine mesquite	N	FAC
Pascopyrum smithii	western wheatgrass	N	FAC-
Schoenoplectus pungens	common threesquare	N	OBL
Setaria leucopila	streambed bristlegrass	N	NI
Sporobolus airoides	alkali sacaton	N	FAC
Sporobolus flexuosus	mesa dropseed	N	FACU-
Sporobolus giganteus	giant dropseed	N	UPL
Sporobolus wrightii	giant sacaton	N	NI
Forbs			
Ambrosia psilostachya	Cuman ragweed	N	FAC
Artemisia ludoviciana	Louisiana sagewort	N	UPL
Bahia pedata	bluntscale bahia	N	
Clematis drummondii	Drummond's clematis	N	NI
Conyza canadensis	Canadian horseweed	N	FACU
Dalea candida	slender white prairieclover	N	
Dimorphocarpa wislizeni	spectacle pod	N	NI
Gaillardia multiceps	gypsum blanketflower	N	
Glycyrrhiza lepidota	American licorice	N	FAC+
Heliotropium convolvulaceum	phlox heliotrope	N	
Helianthus petiolaris	prairie sunflower	N	NI
Machaeranthera tanacetifolia	tanseyleaf aster	N	NI
Melampodium leucanthum	plains blackfoot	N	NI
Salsola tragus	prickly Russian thistle	I	
Thelesperma megapotamicum	Hopi tea greenthread	N	NI
Xanthium strumarium	rough cocklebur	N	FAC

Spring Vegetation and Aquatic Invertebrate Survey 2000
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Bosque Spring

Spring Name: Bosque Spring

NMNHP Plot Number: 00RS007 **NMNHP Spring Sample Number:**
Survey Date: 7/31/2000
UTM Location (NAD 27): Easting: Northing:

Directions to Plot: Take I-70 E from Roswell. Turn N on road with old schoolhouse at NW corner, approx. 3 mi. after Bob Crosby Bridge over Pecos R. After approx. 9.4 mi. road will curve to E, approx. 1 mi. beyond curve take N road. Stay on N road for approx. 1 mi., then take NE road toward Cooper Ranch. At approx. 1.1 mi., there will be another intersection, take N fork. Continue approx. 1.25 mi. across Bosque Draw to fork in road. Take E fork approx. 1 mi., park and walk S on cattle trail down through first draw and over hill to second, approx. 0.75 mi., then SE along draw for another 0.5 mi.

Description: A heavily scoured arroyo 8-15 m wide was surveyed for Bosque Spring, but no standing water was discovered. Arroyo bank was lined with saltcedar, and giant sacaton was abundant in patches along the arroyo bottom. Other plants common along the arroyo were rough cocklebur, prairie sunflower, Emory's baccharis, southern jimmyweed and Cuman ragweed.

Status: Arroyo was dry and no spring was located during the survey. Presumed dry.

Species Name	Common Name	Origin	Wetland Status
Trees			
Populus deltoides	eastern cottonwood	N	
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Isocoma pluriflora	southern jimmyweed	N	NI
Salix exigua	coyote willow	N	OBL
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Bothriochloa barbinodis	cane bluestem	N	
Distichlis spicata	inland saltgrass	N	FACW
Panicum obtusum	vine mesquite	N	FAC
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus pungens	common threesquare	N	OBL
Sporobolus airoides	alkali sacaton	N	FAC
Sporobolus wrightii	giant sacaton	N	NI
Forbs			
Ambrosia psilostachya	Cuman ragweed	N	FAC
Helianthus petiolaris	prairie sunflower	N	NI
Lactuca serriola	prickly lettuce	I	FAC
Xanthium strumarium	rough cocklebur	N	FAC

Spring Vegetation and Aquatic Invertebrate Survey 2000
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Comanche Draw West Spring

Spring Name: Comanche Draw West Spring

NMNHP Plot Number: 00RS016 **NMNHP Spring Sample Number:**
Survey Date: 8/1/2000
UTM Location (NAD 27): Easting: Northing:

Directions: Take US 380 E from Roswell approx. 10.5 mi. E of junction with US 285, and turn S on NM 409. Continue for approx. 2.4 mi. to intersection with a dirt road with a locked gate. Turn E through gate and park where road crosses draw, approx. 1/4 mi. Walk up draw approx. 1/2 mi.

Description: Arroyo was surveyed for Comanche Draw West Spring, but no standing water was located. Near the fence line dense saltcedar with an alkali sacaton understory was found in the draw bottom and continued south approx. 200-300 m. The arroyo bank opened up into alkali sacaton flats. In the arroyo to the south there were occasional saltcedars with patches of inland saltgrass. The hills to the north are gypseous.

Status: Arroyo was dry and no spring was located during the survey. Presumed dry.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Artemisia dracunculus	wormwood	N	NI

Spring Vegetation and Aquatic Invertebrate Survey 2000
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Comanche Spring

Figure 8: Comanche Spring

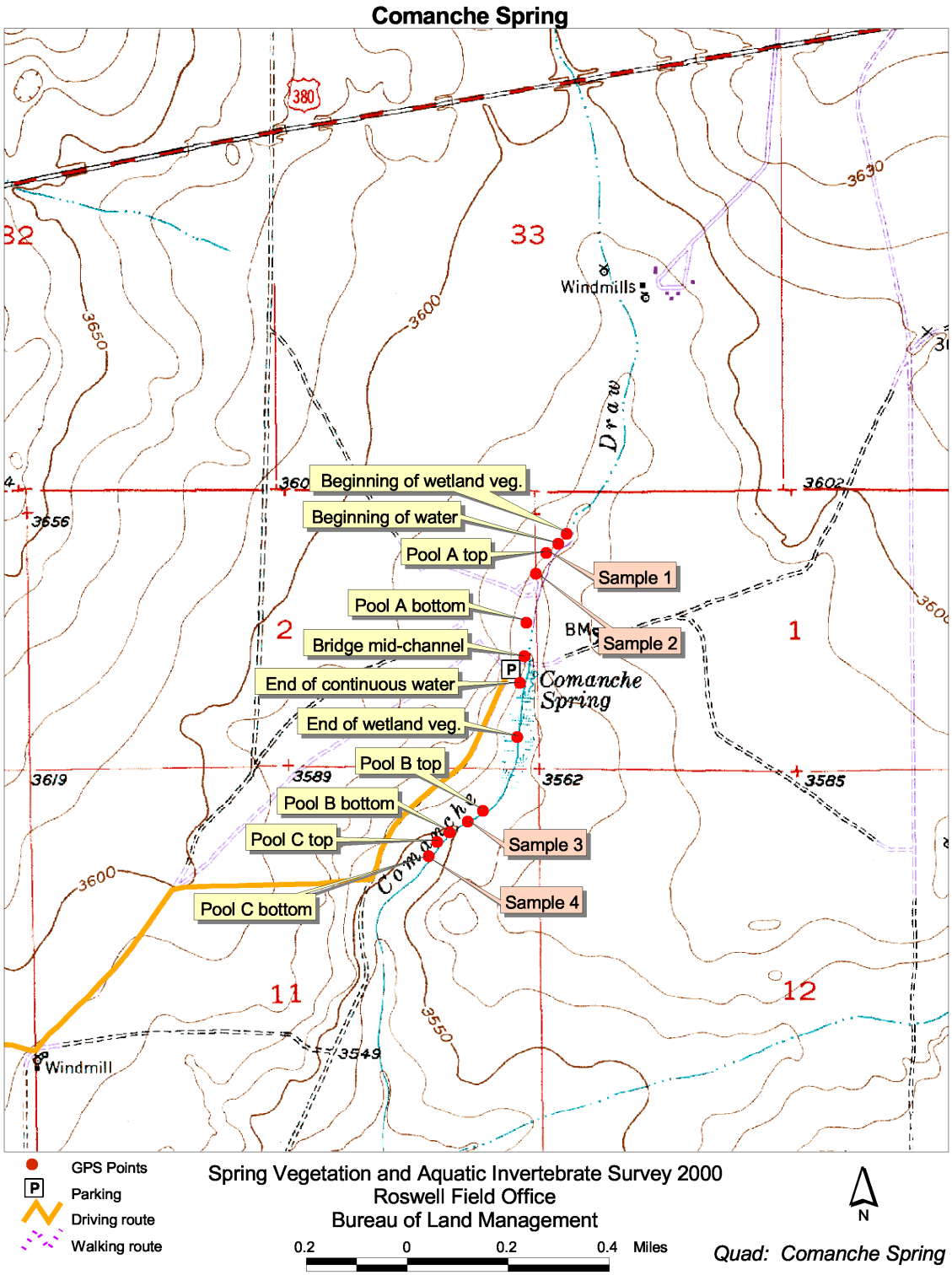

Figure 9: Map of Comanche Spring

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Spring Name: Comanche Spring

NMNHP Plot Number: 00RS014 **NMNHP Spring Sample Number:** EM00C01
Survey Date: 8/1/2000
UTM Location (NAD 27): Easting: 564905 Northing: 3694789

Directions to Plot: Take US 380 E from Roswell approx. 10.5 mi. E of junction with US 285, and turn S on NM 409. Continue for approx. 2.4 mi. to an intersection with a dirt road with a locked gate. Turn E, and once through the gate there is a gravel road heading N. Take road N (becomes old hwy) for approx. 0.9 mi. then take dirt road E and continue until you reach the windmill at approx. 1.5 mi. Take the N road at this fork for approx. 0.4 mi. When you reach the fence line, follow for approx. 0.4 mi. Take road N and park at bridge.

Description: Comanche Spring was a large seep spring system comprised of three long deep-channel pools and some shallower marshy areas. The upper pool complex was the largest and was composed of a narrow shallow channel, approximately 50 m long and 1-2 m wide and less than 40 cm deep. This opened into a wide deep pool (Pool A), 240 m long, 10 m wide and at least 2 m deep, leading into another narrower shallower channel, 200 m long, 1-3 m wide and less than 1 m deep. The entire upper complex had marshy sides, with the upper channel dominated by common threesquare and western sedge. Common threesquare and western sedge continued to be the dominants around the edge of the large pool, with occasional patches of inland saltgrass, alkali muhly, and beaked spikerush. Where the large pool entered into the shallower channel to the south there was a large patch of broadleaf cattail. Common threesquare continued on through the shallower areas of the lower channel to the end of the water. There were a few saltcedars scattered around the main pool, with a large patch on the west side of the channel. The water in the upper complex was clear and contained varying amounts of aquatic plants. The continuous water terminated in a large patch of common threesquare wetland that extended 180 m down channel from the end of the water.

Two hundred and seventy meters down channel from the end of the common threesquare was the second large pool (Pool B). The second pool, 140 m long, 6 m wide and at least 1 m deep, was contained inside a steep sided channel. There was little wetland vegetation surrounding this pool, and no aquatic plants growing in it. The water in this pool was brown and was filled with algae.

Fifty meters beyond the end of the second pool was the third large pool (Pool C), which was 50 m long, 10 m wide and 2 m deep. There was minimal wetland vegetation surrounding the pool, but the water in the pool was clear and it contained large amounts of aquatic plants. There was little riparian vegetation or surface water beyond the third pool.

Status: The pasture in which the spring is located was not being grazed at the time of the survey, and the spring was free of immediate livestock impacts. Large numbers of vertebrates and invertebrates were observed in and around the upper complex. Vertebrates observed included a large turtle, many fish 1-3 inches in length and one 6-8 inches long, several frogs, bank swallows, and barn swallows. Numerous adult dragonflies and damselflies of several different species were observed, some of which were ovapositing. Only frogs and a few dragonfly adults were observed at the second pool. The third pool, however, also had extensive animal life, with many small fish, frogs, aquatic invertebrates, and adult dragonflies and damselflies observed. The average Modified Hilsenhoff Biotic Index for organic

pollution based on the rankings for the arthropods present in the samples was 6.1 for pool A, 6 for pool B and 5.1 for pool C, indicating the water was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Atriplex canescens	fourwing saltbush	N	UPL
Baccharis emoryi	Emory's baccharis	N	FACW
Isocoma pluriflora	southern jimmyweed	N	NI
Pseudoclappia arenaria	TransPecos false clapberry		
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Carex occidentalis	western sedge	N	NI
Distichlis spicata	inland saltgrass	N	FACW
Echinochloa crus-galli	barnyardgrass	I	FACW-
Eleocharis rostellata	beaked spikerush	N	
Hordeum jubatum	foxtail barley	N	FACW-
Muhlenbergia asperifolia	alkali muhly	N	FACW
Panicum obtusum	vine mesquite	N	FAC
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus pungens	common threesquare	N	OBL
Sorghum halepense	johnsongrass	I	FACU+
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Centaurium maryannum	Lady Langford's centaury	N	
Conyza canadensis	Canadian horseweed	N	FACU
Cressa truxillensis	spreading alkaliweed	N	FACW-
Eustoma exaltatum	catchfly prairie gentian	N	OBL
Gaura parviflora	velvetweed	N	UPL
Gaura villosa	wolly gaura	N	
Gutierrezia sphaerocephala	roundleaf snakeweed	N	
Heliotropium curassavicum	salt heliotrope	N	
Kochia scoparia	common kochia	I	FAC
Laennecia coulteri	conyza	N	
Limonium limbatum	transpecos sealavender	N	FACW
Plantago major	common plantain	I	FACW
Salsola tragus	prickly Russian thistle	I	
Samolus ebracteatus ssp. cuneatus	limewater brookweed	N	OBL
Solanum elaeagnifolium	silverleaf nightshade	N	NI
Sphaeralcea angustifolia	copper globemallow	N	NI
Suaeda spp.	seepweed		
Typha latifolia	broadleaf cattail	N	OBL

Invertebrate Sample Taxonomic List

Comanche Spring
SampleID: EM00C0102 **Sample 2** **Pool A**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	2	SC	8
Phylum: Arthropoda							
Class: Arachnida							
				mite	11	PR	
Class: Insecta							
Odonata	Zygoptera			damselfly	3	PR	
Coleoptera	Adephaga	Haliplidae	Haliplus	crawling water beetle	1	MH	7
Diptera	Nematocera	Chironomidae		midge	14	OM	6

Comanche Spring
SampleID: EM00C0104 **Sample 4** **Pool C**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	14	SC	8
Phylum: Arthropoda							
Class: Insecta							
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	3	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Paracymus	water scavenger beetle	2	PR	5
Diptera	Nematocera	Chironomidae		midge	1	OM	6

Comanche Spring
SampleID: EM00C0101 Sample 1 Upper channel
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	23	SC	8
Phylum: Arthropoda							
Class: Arachinada							
Araneae				spider	1	PR	
				mite	5	PR	
Class: Insecta							
Odonata	Anisoptera			dragonfly	2	PR	
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	1	PR	9
Homoptera				Homopteran	1		

Comanche Spring
SampleID: EM00C0103 Sample 3 Pool B
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	15	SC	8
Phylum: Arthropoda							
Class: Insecta							
Diptera	Nematocera	Chironomidae		midge	2	OM	6

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Escondida Spring

Figure 10: Escondida Spring

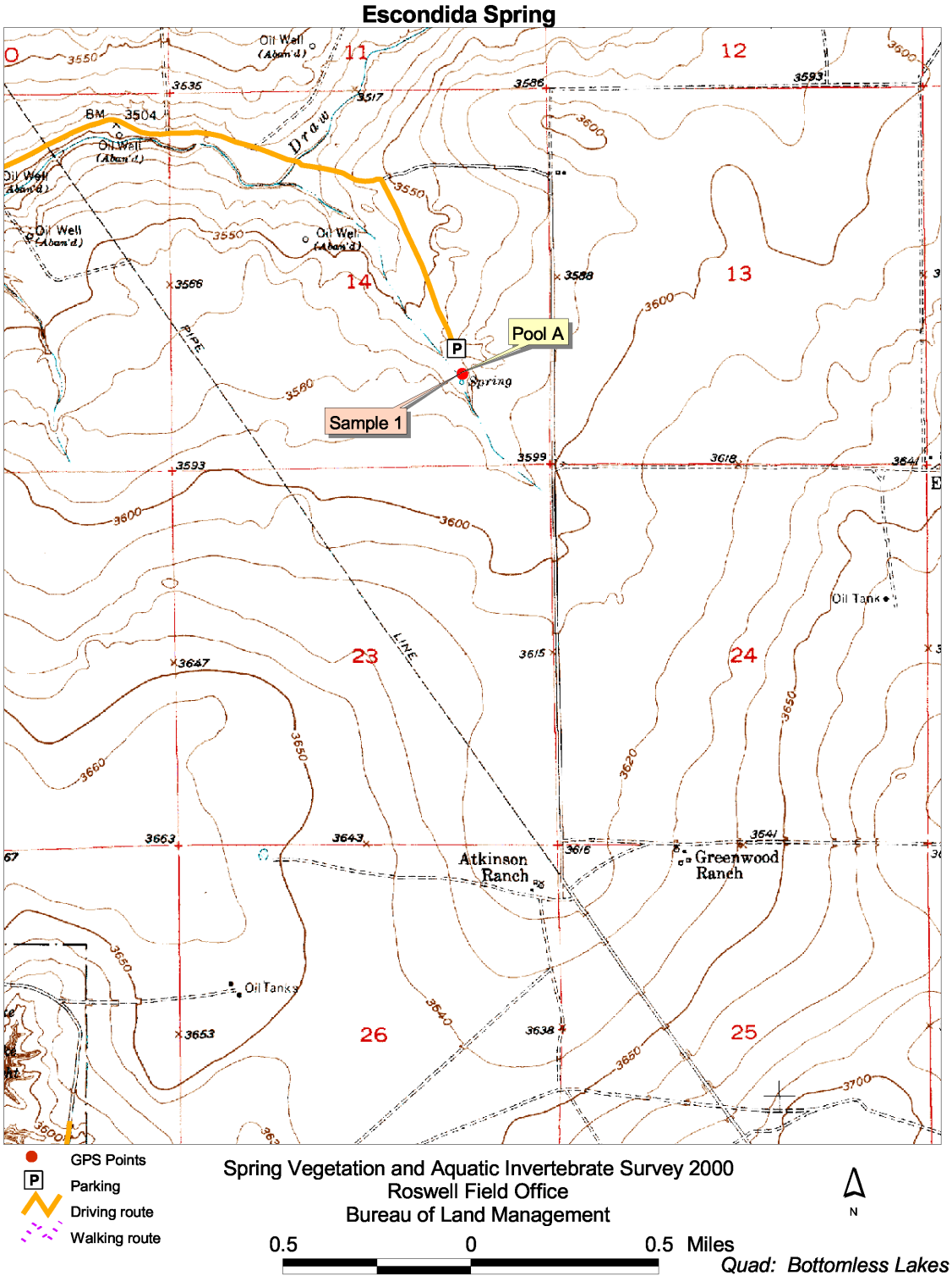

Figure 11: Map of Escondida Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Escondida Spring

NMNHP Plot Number: 00RS017 **NMNHP Spring Sample Number:** EM00E01
Survey Date: 8/1/2000
UTM Location (NAD 27): Easting: 564565 Northing: 3691354

Directions to Plot: Take US 380 E from Roswell approx. 10.5 mi. E of junction with US 285, and turn S on NM 409. Continue for approx. 2.4 mi. to an intersection with a dirt road with a locked gate. Turn E through gate and continue approx. 1.5 mi., at fork take S branch 0.5 mi. to spring.

Description: Escondida Spring consisted of one seep pool approximately 10 m long, 4 m wide and 1 m deep, with clear water. The pool was fenced, with a pipe leading to a small pool for watering livestock outside the enclosure. The spring was surrounded by dense saltcedar. Inland saltgrass was dominant on the pool edge with some creeping bentgrass, saltmarsh bulrush and annual rabbitsfoot grass. The channel below the pool was dominated by saltmarsh bulrush with the bank dominated by inland saltgrass. The uplands surrounding the spring are dominated by alkali sacaton. Below the enclosure the drainage was bare soil to cattle tank.

Status: The spring was fenced off from livestock. Frogs and several different species of adult dragonflies were observed at the spring. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 8.0, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Agrostis stolonifera	creeping bentgrass	I	FACW
Distichlis spicata	inland saltgrass	N	FACW
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Eustoma exaltatum	catchfly prairie gentian	N	OBL
Flaveria campestris	alkali yellowtops	N	FAC
Lactuca serriola	prickly lettuce	I	FAC
Samolus ebracteatus ssp. cuneatus	limewater brookweed	N	OBL
Typha latifolia	broadleaf cattail	N	OBL

Invertebrate Sample Taxonomic List

Escondida Spring
SampleID: EM00E0101 **Sample 1** **Pool A**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	90	SC	8
Phylum: Arthropoda							
Class: Malacostraca							
Amphipoda		Hyallelidae	Hyalella	Amphipod	96	CG	8
Class: Insecta							
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	16	PR	9
Heteroptera				Heteropteran nymph	1	PR	
Heteroptera	Gerromorpha	Veliidae	Microvelia	broad-shouldered water strider	8	PR	
Heteroptera	Gerromorpha	Gerridae	Gerris	water strider	1	PR	5
Homoptera				Homopteran	1		
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Enochrus	water scavenger beetle	1	PR	5
Diptera	Nematocera	Culicidae		mosquito	37	CG	8
Diptera	Nematocera	Chironomidae		midge	5	OM	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Flat Draw Spring

Figure 12: Flat Draw Spring

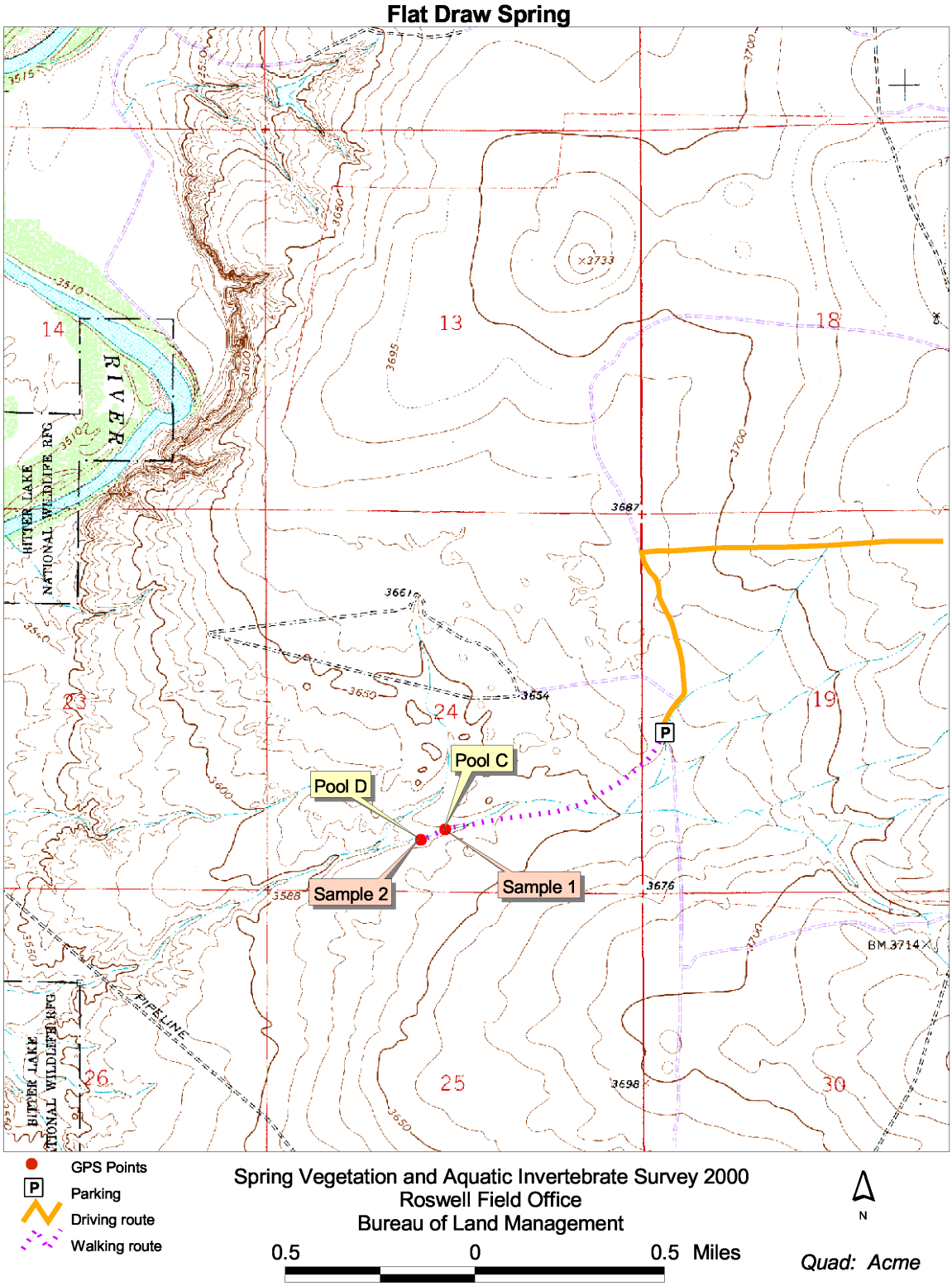

Figure 13: Map of Flat Draw Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Flat Draw Spring

NMNHP Plot Number: 00RS010 **NMNHP Spring Sample Number:** EM00F01
Survey Date: 7/31/2000
UTM Location (NAD 27): Easting: 559946 Northing: 3708185

Directions to Plot: Take I-70 E from Roswell then turn S on dirt road approx. 3 mi. past Bob Crosby Bridge over Pecos R.. At approx. 2.7 mi., turn onto S road (not SE road). After approx. 2.6 mi. turn W on new road. At approx. 1 mi., turn on S road. After approx. 0.6 mi., park and walk W 1/2 mi. to spring.

Description: Flat Draw Spring was a seep spring system comprised of four pools that may be contiguous in wet years. The two upper pools (Pools A & B) were very small and showed evidence of greatly reduced water levels. The third pool (Pool C), the largest in the spring complex, was approximately 40 m long, 4 m wide and 70 cm deep. The forth pool (Pool D) was approximately 8 m by 1 m and only 30 cm deep, with evidence of reduced water level. There were gypsum or salt crystals on the soil around the pools and on exposed aquatic plants. The third pool contained alot of aquatic plants in the lower end and a large patch of common reed at its upper end. The dominant grass around the pools was inland saltgrass, with scattered patches of alkali sacaton. Approximately 200 young (20-30 cm tall) puzzle sunflowers, a Federally Threatened and State Endangered species, were scattered between pools B and D, mostly on the edge of the south bank. Saltcedars were scattered throughout the drainage. The upper drainage and the flats to the east were dominated by alkali sacaton. Coppice dunes dominated by sand sagebrush and honey mesquite surrounded the lower drainage where the spring was located.

Status: At the time of sampling water levels were well below normal at all the pools. There was significant evidence of livestock impact on the spring with a cow carcass lying in Pool B and lots of cattle tracks and dung in Pool D. Frogs and sandpipers were observed at the third pool. Many tiger beetles and diving beetles were observed at the fourth pool. The spring had a sizable population of puzzle sunflowers. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the samples was 7.6 for Pool C and 7.6 for Pool D, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Allenrolfea occidentalis	pickleweed		
Atriplex canescens	fourwing saltbush	N	UPL
Isocoma pluriflora	southern jimmyweed	N	NI
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Phragmites australis	common reed	N	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Helianthus paradoxus	puzzle sunflower	N	
Limonium limbatum	transpecos sealavender	N	FACW
Salsola tragus	prickly Russian thistle	I	

Invertebrate Sample Taxonomic List

Flat Draw Spring
SampleID: EM00F0101 **Sample 1** **Pool C**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	11	SC	8
Phylum: Arthropoda							
Class: Malacostraca							
Amphipoda		Hyallelidae	Hyalella	Amphipod	23	CG	8
Class: Insecta							
Heteroptera	Nepomorpha	Corixidae		water boatman	12	OM	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	16	PR	
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	4	PR	5
Diptera	Nematocera	Culicidae		mosquito	1	CG	8

Flat Draw Spring
SampleID: EM00F0102 **Sample 2** **Pool D**
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Malacostraca							
Amphipoda		Hyallelidae	Hyalella	Amphipod	25	CG	8
Class: Insecta							
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	6	PR	9
Heteroptera	Nepomorpha	Corixidae		water boatman	2	OM	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	15	PR	
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Tropisternus	water scavenger beetle	2	PR	5

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Garnsey Spring

Figure 14: Garnsey Spring

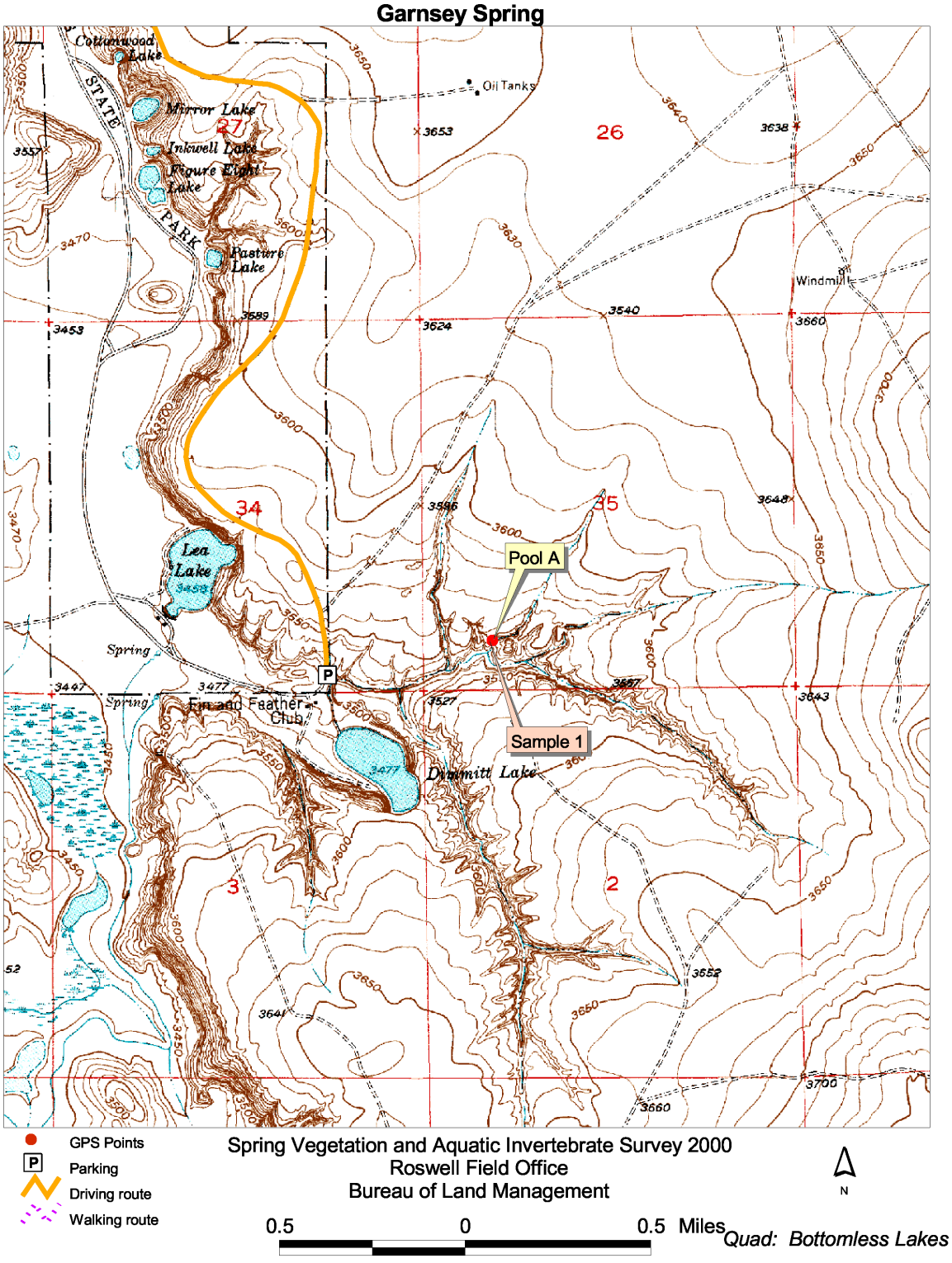

Figure 15: Map of Garnsey Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Garnsey Spring

NMNHP Plot Number: 00RS018 **NMNHP Spring Sample Number:** EM00G01
Survey Date: 7/28/2000
UTM Location (NAD 27): Easting: 563677 Northing: 3686325

Directions to Plot: Take US 380 E from Roswell approx. 10.5 mi. E of US 285 junction, and turn S on NM 409. Park where NM 409 curves back W toward Lea Lake, approx. 6 mi. Walk E up draw approx. 0.5 mi. to spring.

Description: Garnsey Spring was composed of two small seep pools. Both pools emerged from under a gypsum outcrop and were approximately 2 m by 1 m and less than 50 cm deep. In wet years they are probably contiguous. Wet soil with occasional very shallow (less than 1 cm deep) pools of surface water extended for approximately 15 m below the pools. The area surrounding the spring was dominated by giant sacaton with many large New Mexico olives and one small netleaf hackberry. There were several large saltcedar snags in the vicinity of the spring.

Status: A porcupine was observed approaching the spring during the survey. Adult dragonflies and damselflies of several different species were also present. A twenty-square-meter area around the spring was fenced. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 8.0, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Trees			
Celtis laevigata var. reticulata	netleaf hackberry	N	FACU
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Forestiera pubescens	New Mexico olive	N	FACU
Lycium spp.	wolfberry	N	
Prosopis glandulosa	honey mesquite	N	FACU
Graminoids			
Muhlenbergia asperifolia	alkali muhly	N	FACW
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Sporobolus wrightii	giant sacaton	N	NI
Forbs			
Pluchea odorata var. odorata	sweetscent	N	FACW+
Solanum elaeagnifolium	silverleaf nightshade	N	NI

Invertebrate Sample Taxonomic List

Garnsey Spring

SampleID: EM00G0101 **Sample 1** **Pool A**

Sample type: Non-Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	4	SC	8
Phylum: Arthropoda							
Class: Malacostraca							
Amphipoda		Hyallelidae	Hyalella	Amphipod	102	CG	8
Class: Insecta							
Heteroptera				Heteropteran nymph	3	PR	
Heteroptera	Gerromorpha	Veliidae	Microvelia	broad-shouldered water strider	2	PR	
Diptera				unidentified fly pupa	1	UN	7

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Lloyds Spring

Figure 16: Lloyds Spring

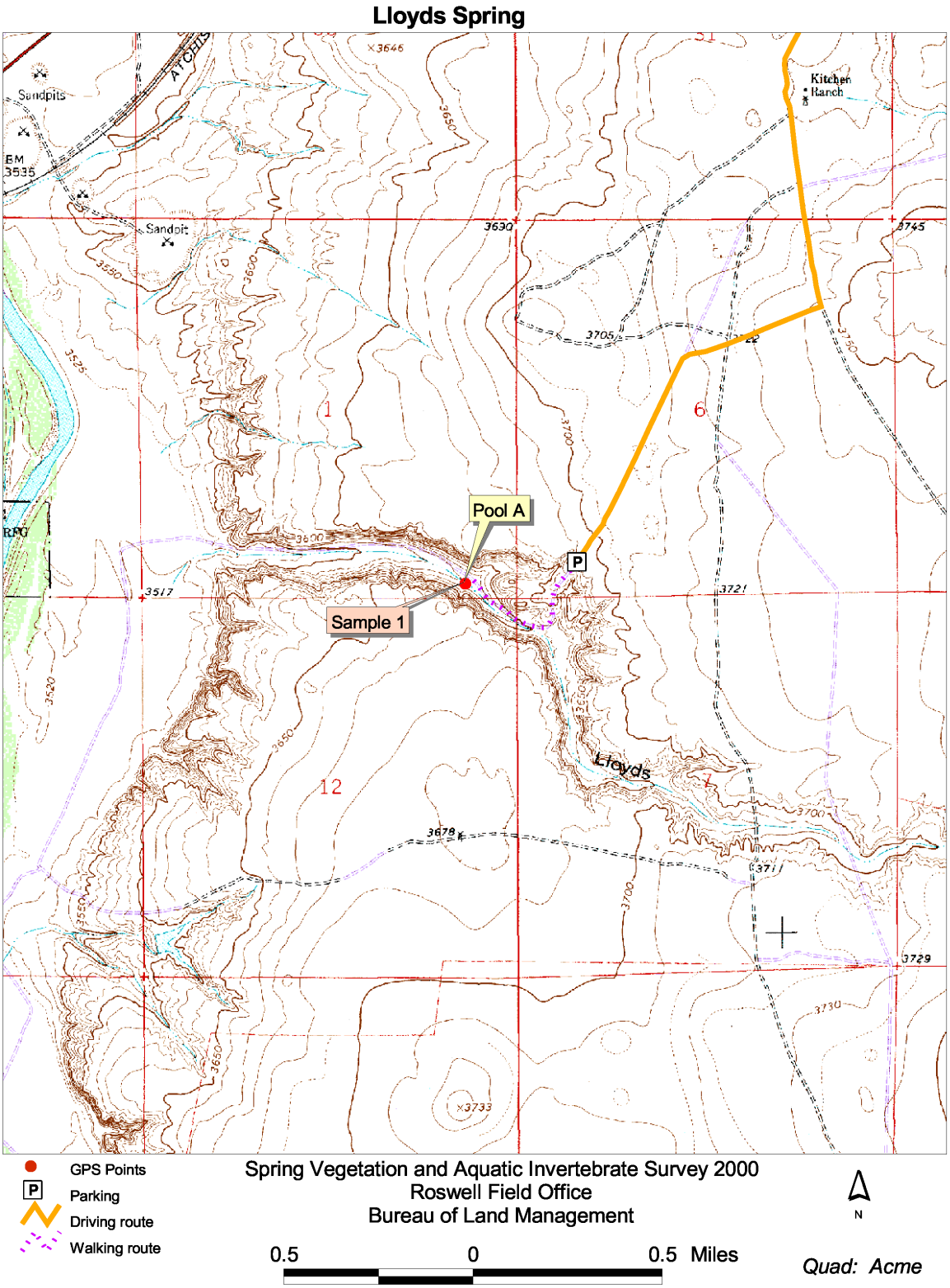

Figure 17: Map of Lloyds Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Lloyds Spring

NMNHP Plot Number: 00RS009 **NMNHP Spring Sample Number:** EM00L01
Survey Date: 8/2/2000
UTM Location (NAD 27): Easting: 560549 Northing: 3712830

Directions to Plot: Take I-70 E from Roswell. Approx. 3 mi. after Bob Crosby Bridge over Pecos R., take road S (old school house and Frazier Cemetery at NW corner of intersection). Continue for approx. 2.35 mi., and turn on SW road. At approx. 0.3 mi. road intersects with a N-S road, but continue heading SW for approx. 0.1 mi., and turn on SSW road towards Lloyds Canyon. Park at gate and walk down hill to spring.

Description: Lloyds Spring consisted of a small seep pool 4 m by 1.5 m and 20 cm deep in a channel bottom. There was evidence of greatly reduced water level. The drainage bottom was dominated by inland saltgrass with the bank and upper terrace dominated by alkali sacaton. There were scattered saltcedars along the drainage with occasional dense patches. There was a large common reed marsh above the pool that was dry at the time of sampling. There were approximately 200 young puzzle sunflowers scattered between the dry marsh and the sampled pool.

Status: Cattle were present in the vicinity of the spring, but impact evidence was minimal. The water level was very low in the only existing pool at the time of sampling. A dry marsh and several other dry pools were observed upstream from the sampled pool. The spring had a small population of puzzle sunflowers. Turtles, adult dragonflies, and tiger beetles were observed in and around the existing pool. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 7.6, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Phragmites australis	common reed	N	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Helianthus paradoxus	puzzle sunflower	N	

Invertebrate Sample Taxonomic List

Lloyds Spring

SampleID: EM00L0101 Sample 1 Pool A

Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	9	PR	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	4	PR	9
Heteroptera	Nepomorpha	Corixidae		water boatman	6	OM	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	2	PR	
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	7	PR	5
Diptera	Nematocera	Culicidae		mosquito	20	CG	8
Diptera	Nematocera	Chironomidae		midge	4	OM	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Lower Horse Creek Spring

Figure 18: Lower Horse Creek Spring

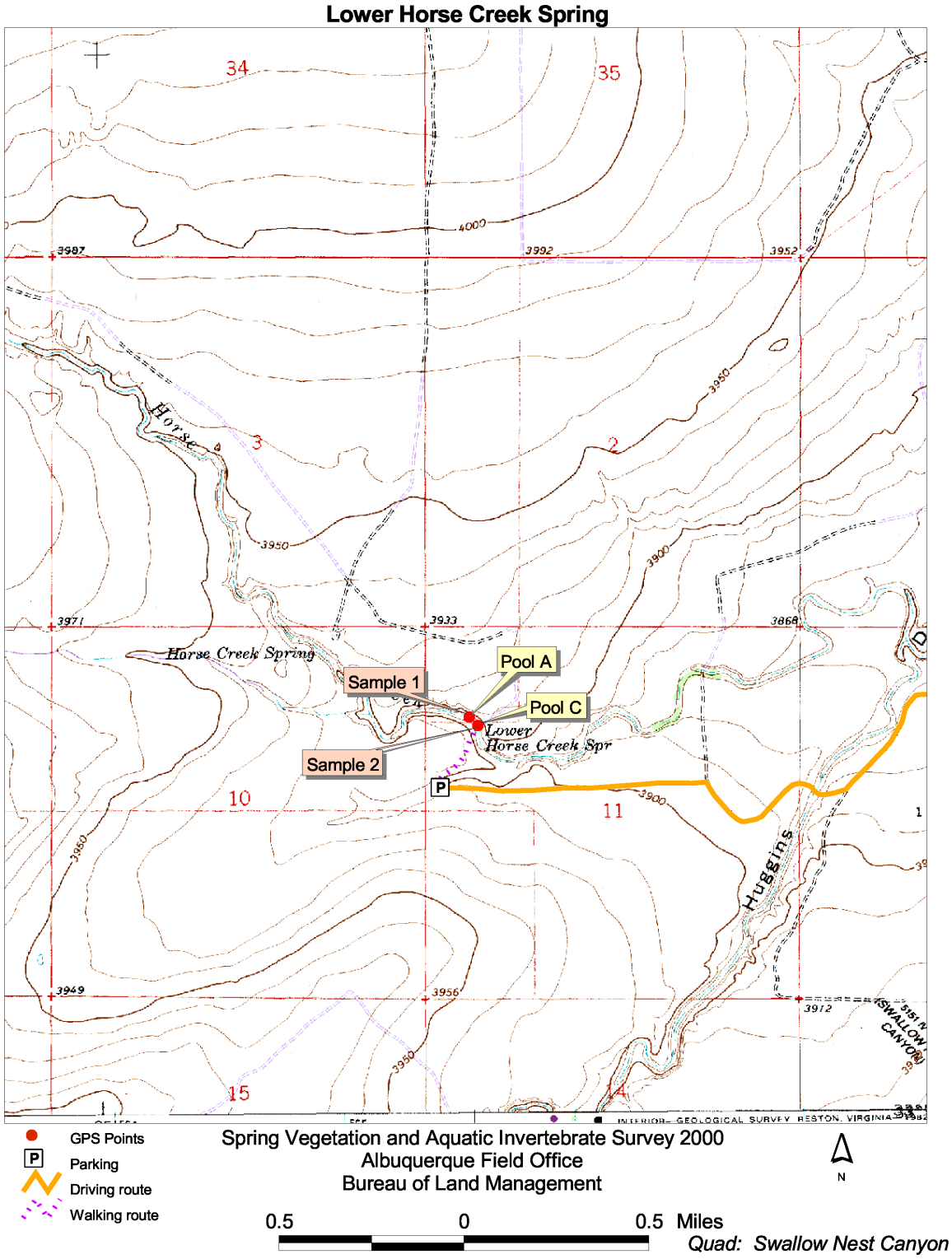

Figure 19: Map of Lower Horse Creek Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Lower Horse Creek Spring

NMNHP Plot Number: 00RS002 **NMNHP Spring Sample Number:** EM00L02
Survey Date: 7/29/2000
UTM Location (NAD 27): Easting: 555582 Northing: 3749948

Directions to Plot: Take US 285 approx. 28 mi. N of I-70 junction, and turn E on CR 44 (Dona Ana Rd.) At approx. 7.8 mi., take NE road at fork. At approx. 7 mi., take road W along Huggins Draw. At approx. 1.5 mi., take NW road across Huggins Draw toward Lower Horse Creek. Park at oil pad and walk N to spring.

Description: Lower Horse Creek Spring was a seep spring system consisting of three pools. The upper pool (Pool A) was 10 m by 2 m and 20 cm or less in depth. The second and third pools (Pools B & C) were about 20 m down channel from Pool A, and separated from each other by only a meter. In wetter periods they are probably contiguous. They were larger and deeper than the first pool. Pool B was approximately 20 m by 2 m and 50 cm deep, and Pool C was 20 m by 3 m and 50 cm deep. Sparse knotgrass in the bottom of Pool A grades into salt cedar and alkali sacaton on the upper terrace. There was some inland saltgrass along the edge of the pool and in the drainage bottom between pools. Pools B and C had small clumps of beaked spikerush along their edges. Common threesquare was scattered along pools B and C and down the channel for another 20 m.

Status: Evidence at all pools indicated the water levels were lower than usual. All pools also showed evidence of livestock use, but the upper pool was especially impacted with lots of tracks and dung in the pool. Water in the upper pool was murky and there were many crayfish and no fish in this pool. The two lower pools also had somewhat murky water, but there were fish in both of them. Many damsel and dragonflies were observed around the pools, several of which were ovapositing. Tiger beetles, diving beetles, and tadpoles were also observed. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the samples was 8.7 for Pool A and 5.3 for Pool C, indicating the water in Pool A was organically polluted and the water in Pool C was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Gutierrezia sarothrae	broom snakeweed	N	NI
Opuntia imbricata	tree cholla	N	NI
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	saltcedar	I	FACW
Yucca glauca	soapweed yucca	N	
Graminoids			
Bothriochloa laguroides ssp. torreyana	silver beardgrass	N	NI
Distichlis spicata	inland saltgrass	N	FACW
Eleocharis rostellata	beaked spikerush	N	
Juncus mexicanus	Mexican rush	N	
Paspalum distichum	knotgrass	N	OBL
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+

Schoenoplectus pungens	common threesquare	N	OBL
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Asclepias subverticillata	whorled milkweed	N	FACU
Chamaesyce albomarginata	whitemargin sandmat	N	
Flaveria campestris	alkali yellowtops	N	FAC
Gaura villosa	wolly gaura	N	

Invertebrate Sample Taxonomic List

Lower Horse Creek Spring
SampleID: EM00L0202 Sample 2 Pool C
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	10	SC	8
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae		mayfly	1	CG	4
Heteroptera	Nepomorpha	Corixidae		water boatman	1	OM	
Heteroptera	Gerromorpha	Gerridae	Gerris	water strider	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	12	PR	5
Diptera	Nematocera	Culicidae		mosquito	2	CG	8
Diptera	Nematocera	Chironomidae		midge	7	OM	6

Lower Horse Creek Spring
SampleID: EM00L0201 Sample 1 Pool A
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	3	SC	8
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae	Callibaetis	mayfly	47	CG	9
Odonata	Anisoptera			dragonfly	3	PR	
Heteroptera	Nepomorpha	Corixidae		water boatman	17	OM	
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	1	PR	5
Coleoptera	Adephaga	Dytiscidae	Rhantus	predaceous diving beetle	1	PR	5
Coleoptera	Adephaga	Dytiscidae	Thermonectus	predaceous diving beetle	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Tropisternus	water scavenger beetle	1	PR	5
Diptera	Nematocera	Culicidae		mosquito	1	CG	8

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

McCrea Spring

Figure 20: McCrea Spring

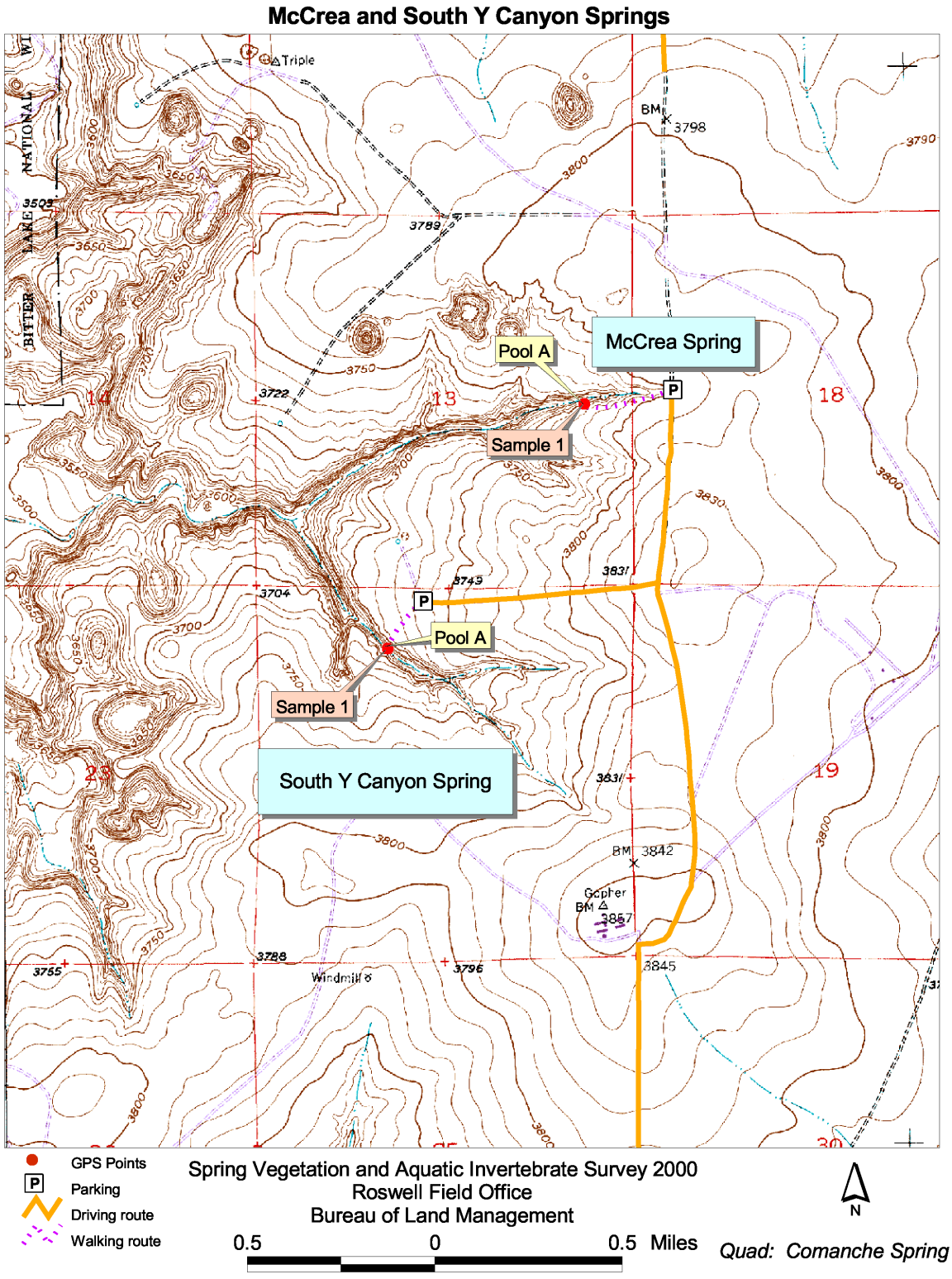

Figure 21: Map of McCrea Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: McCrea Spring

NMNHP Plot Number: 00RS012 **NMNHP Spring Sample Number:** EM00M02
Survey Date: 7/28/2000
UTM Location (NAD 27): Easting: 560588 Northing: 3700653

Directions to Plot: Take US 380 E from Roswell approx. 10.5 mi. E of intersection with US 285. Turn N on NM 409 and continue for approx. 1.75 mi. Take E fork in road, which will shortly curve to N. At 1.15 mi., there is a cattle guard. Park after 0.5 mi.; spring will be approx. 0.25 mi. W down drainage.

Description: McCrea Spring consisted of a single seep pool 1.5 m by 0.7 m and 24 cm deep, under a dense saltcedar canopy. The water was clear. Saltcedar surrounded the spring, with a very sparse understory. There was a small patch of alkali sacaton, inland saltgrass and saltmarsh bulrush at the spring. Southwest of spring down the drainage alkali sacaton and giant sacaton were dominant with scattered saltcedars.

Status: The spring was surrounded by a pole enclosure. The water in the spring was clear, but the saltcedar encroachment was severely limiting riparian diversity and probably effecting water availability. Coyotes and adult dragonflies were observed near the spring. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 8.0, indicating the water was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Brickellia californica	California brickellbush	N	FACU+
Opuntia phaeacantha	tulip pricklypear	N	NI
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Setaria leucopila	streambed bristlegrass	N	NI
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Lepidium alyssoides	mesa pepperwort	N	NI
Solanum elaeagnifolium	silverleaf nightshade	N	NI

Invertebrate Sample Taxonomic List

McCrea Spring

SampleID: EM00M0201 Sample 1 Pool A

Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	1	PR	9
Homoptera				Homopteran	10		
Diptera	Nematocera	Culicidae		mosquito	114	CG	8

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Middle Spring

Figure 22: Middle Spring

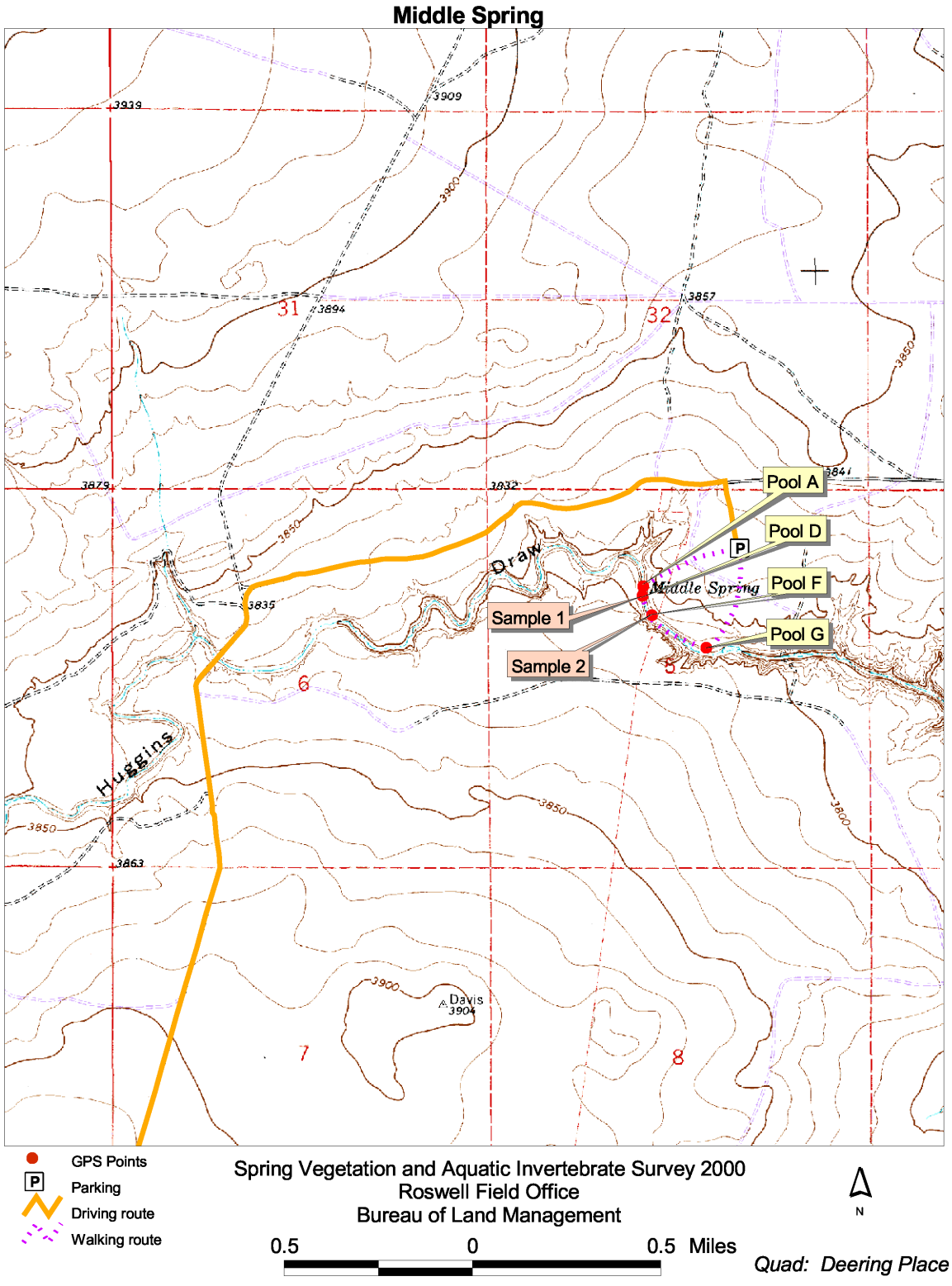

Figure 23: Map of Middle Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Middle Spring

NMNHP Plot Number: 00RS001 **NMNHP Spring Sample Number:** EM00M01
Survey Date: 7/29/2000
UTM Location (NAD 27): Easting: 560929 Northing: 3751449

Directions to Plot: Take US 285 approx. 28 mi. N of I-70 junction, and turn E on CR 44 (Dona Ana Rd.) At approx. 7.8 mi., take NE road at fork. Continue for approx. 7.6 mi. across Huggins Draw then take E road toward old Benedict Ranch. On E side of holding pens, at approx. 1.3 mi., take S road. 0.25 mi. Park and walk 0.25 mi. W to spring.

Description: Middle Spring was a large seep system consisting of seven pools and extensive areas of riparian and persistent emergent wetland vegetation which extended over half a kilometer. The upper portion of the spring complex contained three very small and shallow pools (Pools A, B and C) and was dominated by vine mesquite, inland saltgrass, alkali muhly, common threesquare, and beaked spikerush.

The middle portion of the complex also contained three pools, but these were larger and deeper. The fourth pool (Pool D) was 20 m by 2.5 m and 30 cm deep. There was a large patch of narrowleaf cattail in the south end of Pool D and its banks were thickly lined with common threesquare and beaked spikerush. The fourth pool (Pool E) was similar to Pool D, but lacking narrowleaf cattail. The sixth pool (Pool F) was the largest in the spring complex, at 50 m by 7 m and 40 cm deep. Pool F was shallow and marshy with little open water and large amounts of persistent emergent wetland vegetation dominated by beaked spikerush, common threesquare, rushes, and narrowleaf cattail.

The bottom portion of the complex consisted of the seventh pool (Pool G) which was 15 m by 2 m and approximately 30 cm deep. It was 250 m down channel from the end of Pool F. Pool G was surrounded by vine mesquite and alkali sacaton and had very little persistent emergent vegetation. The channel between Pool F and Pool G was dominated by alkali sacaton. A pair of plains cottonwoods were located about 50 m upstream from Pool G. Alkali sacaton and scattered salt cedars surrounded the entire spring complex.

Status: There was evidence of livestock use, with tracks, trails, and dung all present. However, the size of the spring complex reduced the level of impact for individual pools. Many different species of adult dragon and damselflies were observed throughout the spring complex, several of which were ovapositing. Tiger beetles were also numerous. Fish were present in Pool F. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the samples was 5.7 for pool D and 5.8 for pool F, indicating the water was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Bothriochloa laguroides ssp. torreyana	silver beardgrass	N	NI
Distichlis spicata	inland saltgrass	N	FACW
Eleocharis rostellata	beaked spikerush	N	

Elymus canadensis	Canada wildrye	N	FAC
Muhlenbergia asperifolia	alkali muhly	N	FACW
Panicum obtusum	vine mesquite	N	FAC
Panicum virgatum	switchgrass	N	FAC+
Schoenoplectus pungens	common threesquare	N	OBL
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Chamaesyce albomarginata	whitemargin sandmat	N	
Flaveria campestris	alkali yellowtops	N	FAC
Gaura villosa	wolly gaura	N	
Typha angustifolia	narrowleaf cattail	N	

Invertebrate Sample Taxonomic List

Middle Spring

SampleID: EM00M0101 **Sample 1** **Pool D**

Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	2	SC	8
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae	Callibaetis	mayfly	6	CG	9
Odonata	Anisoptera	Aeshnidae		darner (dragonfly)	3	PR	3
Heteroptera	Nepomorpha	Belostomatidae		giant water bug	1	PR	
Heteroptera	Nepomorpha	Corixidae		water boatman	2	OM	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	20	PR	
Heteroptera	Gerromorpha	Gerridae	Gerris	water strider	5	PR	5
Coleoptera	Adephaga	Haliplidae	Haliplus	crawling water beetle	2	MH	7
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	2	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	2	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Tropisternus	water scavenger beetle	11	PR	5
Diptera	Nematocera	Chironomidae		midge	1	OM	6

Middle Spring

SampleID: EM00M0102 **Sample 2** **Pool F**

Sample type: Non-quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	4	SC	8
Phylum: Arthropoda							
Class: Insecta							
Heteroptera	Gerromorpha	Gerridae	Gerris	water strider	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	1	PR	5
Diptera	Nematocera	Ceratopogonidae		biting midge	10	PR	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Overflow Wetland Spring

Figure 24: Overflow Wetland Spring

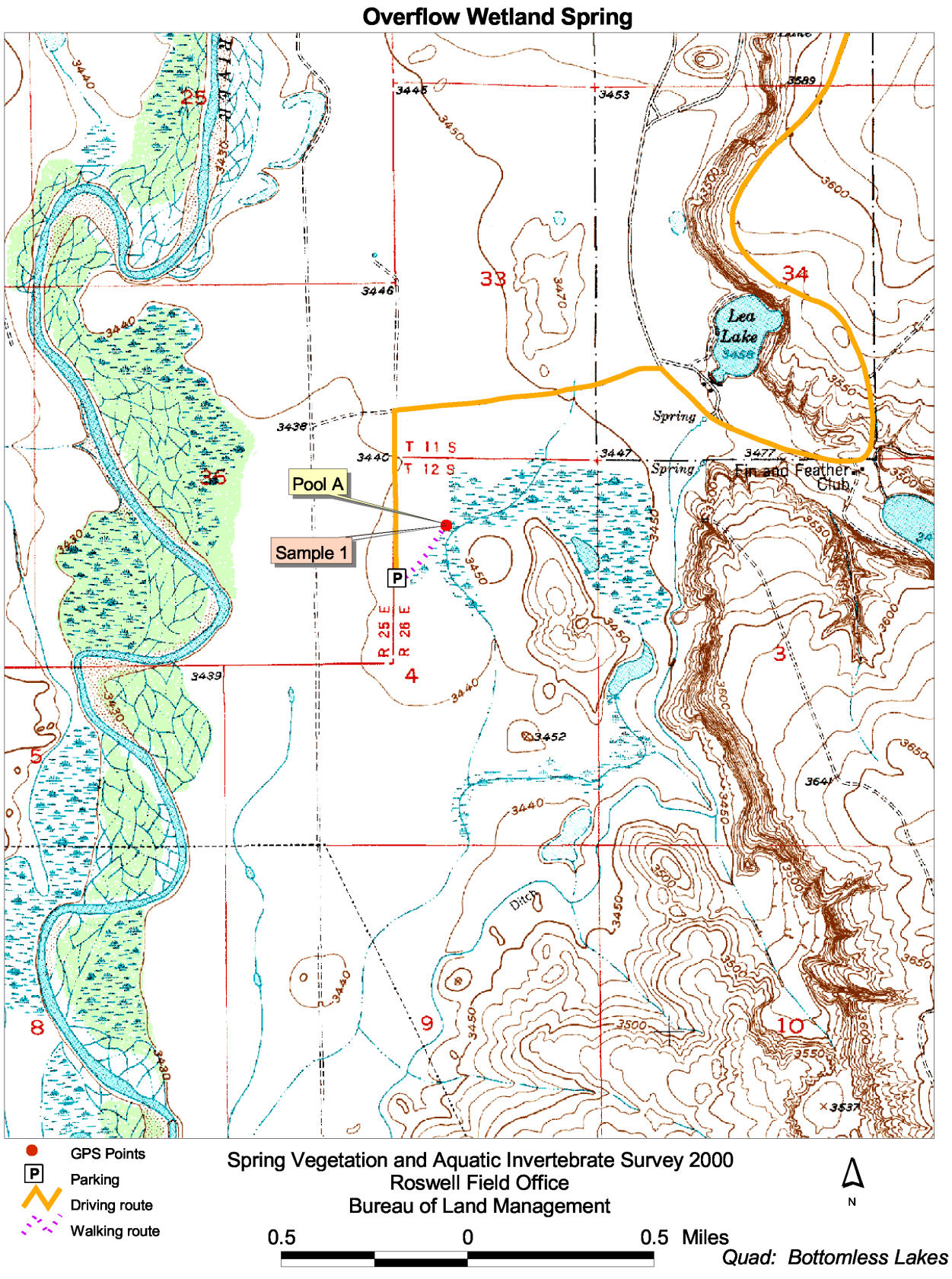

Figure 25: Map of Overflow Wetland Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Overflow Wetland Spring

NMNHP Plot Number: 00RS019 **NMNHP Spring Sample Number:** EM00O01
Survey Date: 7/30/2000
UTM Location (NAD 27): Easting: 561114 Northing: 3685812

Directions to Plot: From junction with US 285 take US 380 E from Roswell approx. 10.5 mi. Turn S on NM 409. At approx. 6 mi., road will turn W; follow around Lea Lake approx. 0.5 mi. to dirt road heading W. Take dirt road 0.75 mi., to just before fence, turn down S branch and drive approx. 0.5 mile to small parking lot. Walk NE approx. 0.5 mi. through marsh to large pool.

Description: The Overflow Wetland Spring was located inside a large wetland area (over one-half square mile) created by overflow from Lea Lake. This area was a vast network of riparian vegetation surrounding interconnected pools and channels of open water. The sampled pool was 50 m by 10 m by 20 cm deep and was on the west side of the Overflow Wetland. Inland saltgrass was dominant throughout the area and persisted into the shallow water on the edges of the pool. In the wetter areas there were scattered patches of transpecos sealavender, Utah glasswort, and saltcedar. In the drier areas to the west, pickleweed and spreading alkaliweed were the common associates of the still dominant inland saltgrass.

Status: The entire Overflow Wetlands area has been excluded from grazing for some time. Many small fish, damselflies, and water striders were observed in the sampled pool. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 6.2, indicating the water was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Allenrolfea occidentalis	pickleweed		
Tamarix ramosissima	saltcedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Forbs			
Cressa truxillensis	spreading alkaliweed	N	FACW-
Limonium limbatum	transpecos sealavender	N	FACW
Sarcocornia utahensis	Utah glasswort	N	FACW

Invertebrate Sample Taxonomic List

Overflow Wetland Spring
SampleID: EM00O0101 **Sample 1** **Pool A**
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Arachnida							
Araneae				spider	1	PR	
Class: Insecta							
Odonata	Anisoptera			dragonfly	1	PR	
Odonata	Zygoptera			damselfly	1	PR	
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	3	PR	9
Heteroptera	Nepomorpha	Notonectidae		backswimmer	6	PR	
Coleoptera	Polyphaga	Hydrophilidae	Tropisternus	water scavenger beetle	3	PR	5
Diptera	Nematocera	Chironomidae		midge	23	OM	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Rock House Spring

Figure 26: Rock House Spring

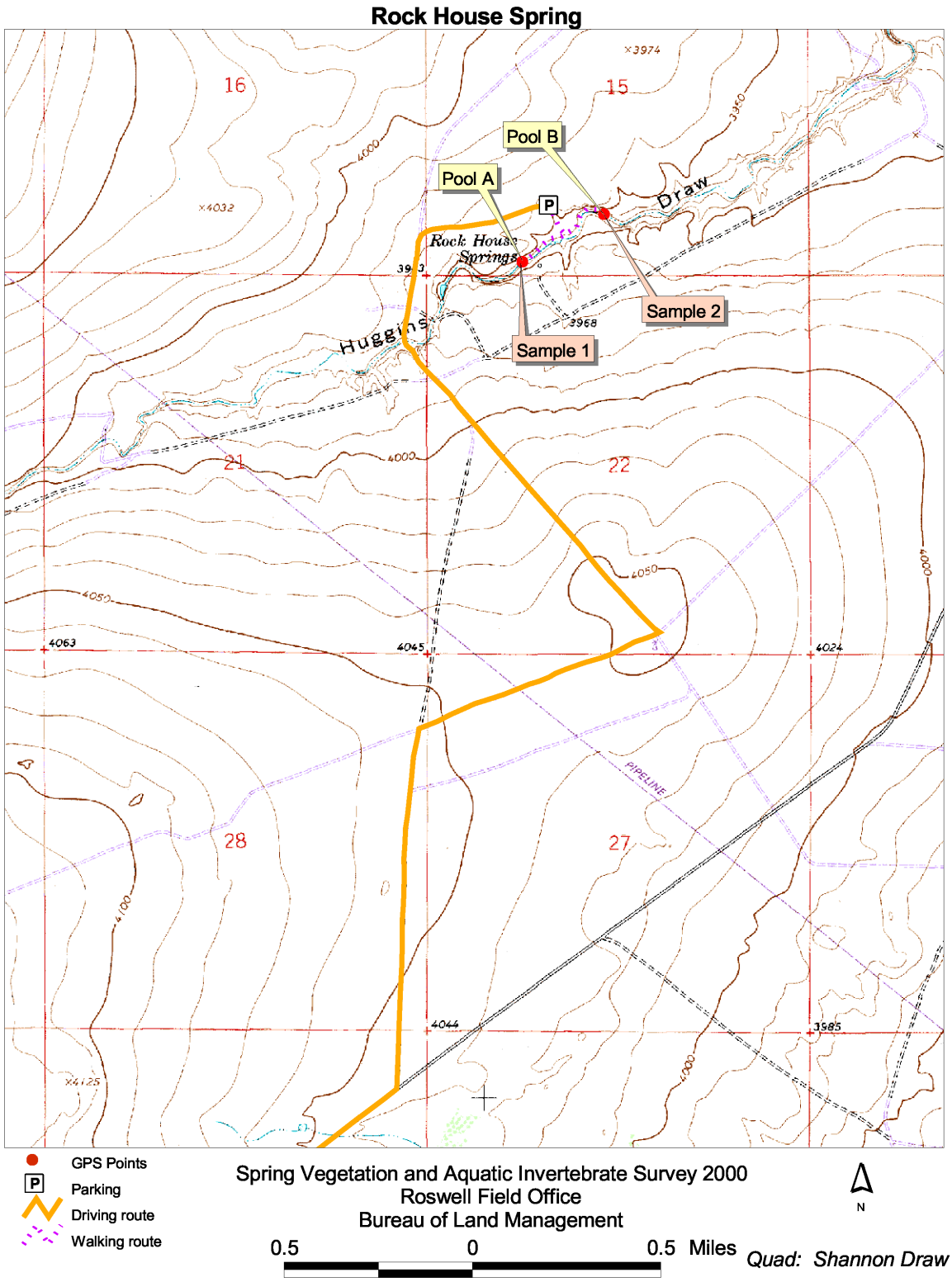

Figure 27: Map of Rock House Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: Rock House Spring

NMNHP Plot Number: 00RS003 **NMNHP Spring Sample Number:** EM00R01
Survey Date: 7/28/2000
UTM Location (NAD 27): Easting: 554487 Northing: 3747401

Directions to Plot: Take US 285 approx. 28 mi. N of I-70 junction. Turn E on CR 44 (Dona Ana Rd.). Continue for approx. 7.6 mi., take NE road at fork 1.5 mi. to road heading N. At approx. 1 mi. take fork to NE, follow approx. 0.75 mi. then take fork NW. After approx. 1 mi., cross draw and continue up hill to road heading NE, follow approx. 0.5 mi., then take road SE approx. 0.25 mi. to oil well. Park and walk S up draw to first pool or N down draw to second pool.

Description: In wetter years Rock House Spring would be a large system consisting of many pools extending over nearly a kilometer, but at the time of sampling drought had dried up most of the pools and only two still had standing water in them. The first pool (Pool A) was in the upper part of the system, near the old rock house. It was nearly dry, the area of surface water being 7 m by 2 m by 7 cm at the deepest, and covered in algae. The existing pool was bordered by bare soil grading into saltmarsh bulrush and common threesquare at what would typically be the edge of a moderately large pool. The bank edges beyond the pool were dominated by inland saltgrass that graded into alkali sacaton on the upper bank and terrace. In the drainage above and below this pool were several smaller completely dry pools that were lined in common threesquare, beaked spikerush, and rushes.

The second pool (Pool B) was at the lower end of the spring system, 450 m down channel from Pool A. This pool was long and narrow (30 m by 2 m) and contained within a steep-sided channel. It also showed evidence of abnormally low water levels, with 10 cm of water at the deepest point. The water surface was coated with algae. Saltmarsh bulrush and common threesquare lined the edge of Pool B grading into alkali sacaton on the upper banks. There was a small stand of narrowleaf cattail at the upper end of the pool. Inland saltgrass, alkali sacaton, and some knotgrass dominated the drainage bottom between the pools and above Pool A. There were occasional patches of saltcedar along the bank. The surrounding uplands were dominated by honey mesquite and alkali sacaton.

Status: At the time of the survey the spring did not appear to be being used by livestock. Many tiger beetles and adult dragon and damselflies of several different species were observed at both pools. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the samples was 5.0 for Pool A and 7.8 for Pool B, indicating the water in Pool A was organically enriched and the water in Pool B was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Gutierrezia sarothrae	broom snakeweed	N	NI
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Eleocharis rostellata	beaked spikerush	N	

Hordeum jubatum	foxtail barley	N	FACW-
Juncus mexicanus	Mexican rush	N	
Paspalum distichum	knotgrass	N	OBL
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Schoenoplectus pungens	common threesquare	N	OBL
Sporobolus airoides	alkali sacaton	N	FAC
Tridens albescens	white tridens	N	FACU
Forbs			
Conyza canadensis	Canadian horseweed	N	FACU
Flaveria campestris	alkali yellowtops	N	FAC
Gaura villosa	wolly gaura	N	
Glycyrrhiza lepidota	American licorice	N	FAC+
Lactuca serriola	prickly lettuce	I	FAC
Laennecia coulteri	conyza	N	
Solanum elaeagnifolium	silverleaf nightshade	N	NI
Typha angustifolia	narrowleaf cattail	N	
Verbena bracteata	bigbract verbena	N	FAC

Invertebrate Sample Taxonomic List

Rock House Spring
SampleID: EM00R0101 Sample 1 Pool A
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	45	SC	8
Phylum: Arthropoda							
Class: Insecta							
Heteroptera				Heteropteran nymph	2	PR	
Heteroptera	Nepomorpha	Notonectidae		backswimmer	1	PR	
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	3	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	25	PR	5

Rock House Spring
SampleID: EM00R0102 Sample 2 Pool B
Sample type: Atypical quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Odonata	Anisoptera			dragonfly	1	PR	
Odonata	Anisoptera	Aeshnidae		darner (dragonfly)	2	PR	3
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	2	PR	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	13	PR	9
Heteroptera	Nepomorpha	Belostomatidae		giant water bug	7	PR	
Coleoptera	Adephaga	Haliplidae	Haliplus	crawling water beetle	15	MH	7
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	2	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Tropisternus	water scavenger beetle	2	PR	5
Diptera	Nematocera	Culicidae		mosquito	87	CG	8
Diptera	Nematocera	Chironomidae		midge	2	OM	6

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

South Y Canyon Spring

Figure 28: South Y Canyon Spring

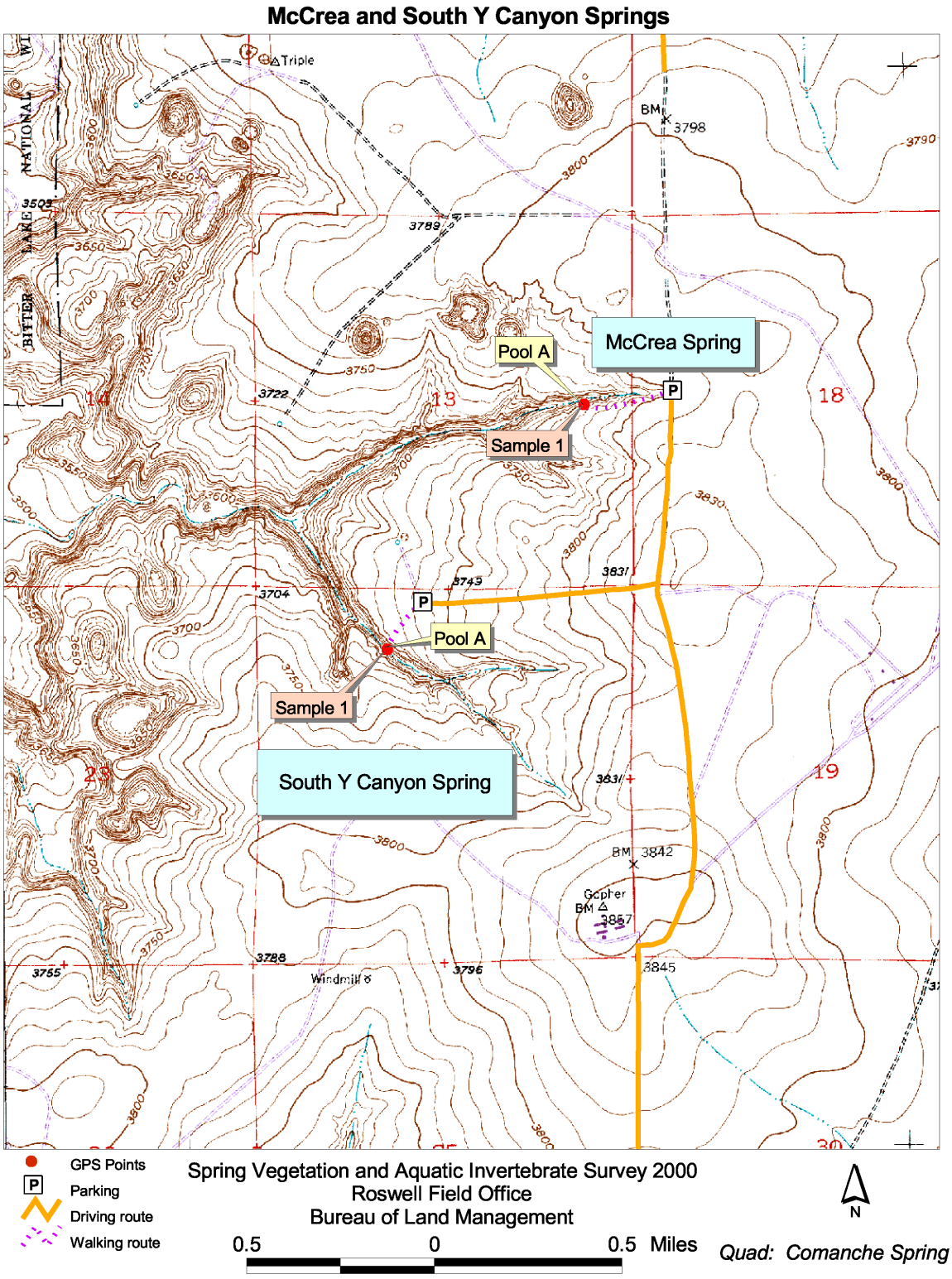

Figure 29: Map of South Y Canyon Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: South Y Canyon Spring

NMNHP Plot Number: 00RS013 **NMNHP Spring Sample Number:** EM00S02
Survey Date: 7/28/2000
UTM Location (NAD 27): Easting: 559744 Northing: 3699604

Directions to Plot: From intersection with US 285 take US 380 E from Roswell approx. 10.5 mi. Turn N on NM 409 and continue for approx. 1.75 mi. Take E fork in road, which will shortly curve to N. After 1.15 mi., turn W on road just before cattle guard. After 0.75 mi. park and walk 0.25 mi. W to spring.

Description: South Y Canyon Spring was a small seep pool approximately 3 m by 3 m in the bottom of a rocky and deep arroyo. The spring emerged from the base of a rock outcrop within the channel. The drainage bottom dropped 4-5 m from the top of the rocky outcrop to the spring below. On the east and north sides the spring was bounded by bare soil and rock. The drainage bottom was dominated by alkali sacaton with patches of inland saltgrass. Six mature saltcedars and many small sprouts were growing near the spring. Approximately 25 m to the NW giant sacaton was dominant in the drainage bottom. The arroyo bank cut was approximately 10 m on the north side and 17 m on the south side.

Status: The water was murky and 10-30 cm below the previous waterline. This spring is on National Guard land and had no signs of livestock use. However, there was abundant evidence of use by wildlife. There were deer and raccoon tracks around the spring and an owl flew off as the spring was approached. Two small snakes, several adult frogs, and many tadpoles were observed in the water. Adult dragonflies and butterflies were observed around the pool. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the sample was 5.9, indicating the water was organically enriched.

Species Name	Common Name	Origin	Wetland Status
Trees			
Celtis laevigata var. reticulata	netleaf hackberry	N	FACU
Shrubs			
Atriplex canescens	fourwing saltbush	N	UPL
Brickellia californica	California brickellbush	N	FACU+
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Elymus canadensis	Canada wildrye	N	FAC
Hordeum jubatum	foxtail barley	N	FACW-
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Setaria leucopila	streambed bristlegrass	N	NI
Sporobolus airoides	alkali sacaton	N	FAC
Sporobolus wrightii	giant sacaton	N	NI
Forbs			
Artemisia ludoviciana	Louisiana sagewort	N	UPL
Centaurium maryannum	Lady Langford's centaury	N	
Cirsium spp.	thistle	N	

Convolvulus arvensis	field bindweed	I	NI
Lepidium alyssoides	mesa pepperwort	N	NI
Samolus ebracteatus ssp. cuneatus	limewater brookweed	N	OBL
Sonchus asper	spiny sowthistle	I	FACW

Invertebrate Sample Taxonomic List

South Y Canyon

SampleID: EM00S0201 Sample 1 Pool A

Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	12	SC	8
Phylum: Arthropoda							
Class: Insecta							
Heteroptera	Nepomorpha	Corixidae		water boatman	1	OM	
Coleoptera	Adephaga	Dytiscidae	Laccophilus	predaceous diving beetle	1	PR	5
Diptera	Nematocera	Chironomidae		midge	6	OM	6
Phylum: Chordata							
Class: Amphibia							
				tadpole	3		

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

State Spring

Figure 30: State Spring

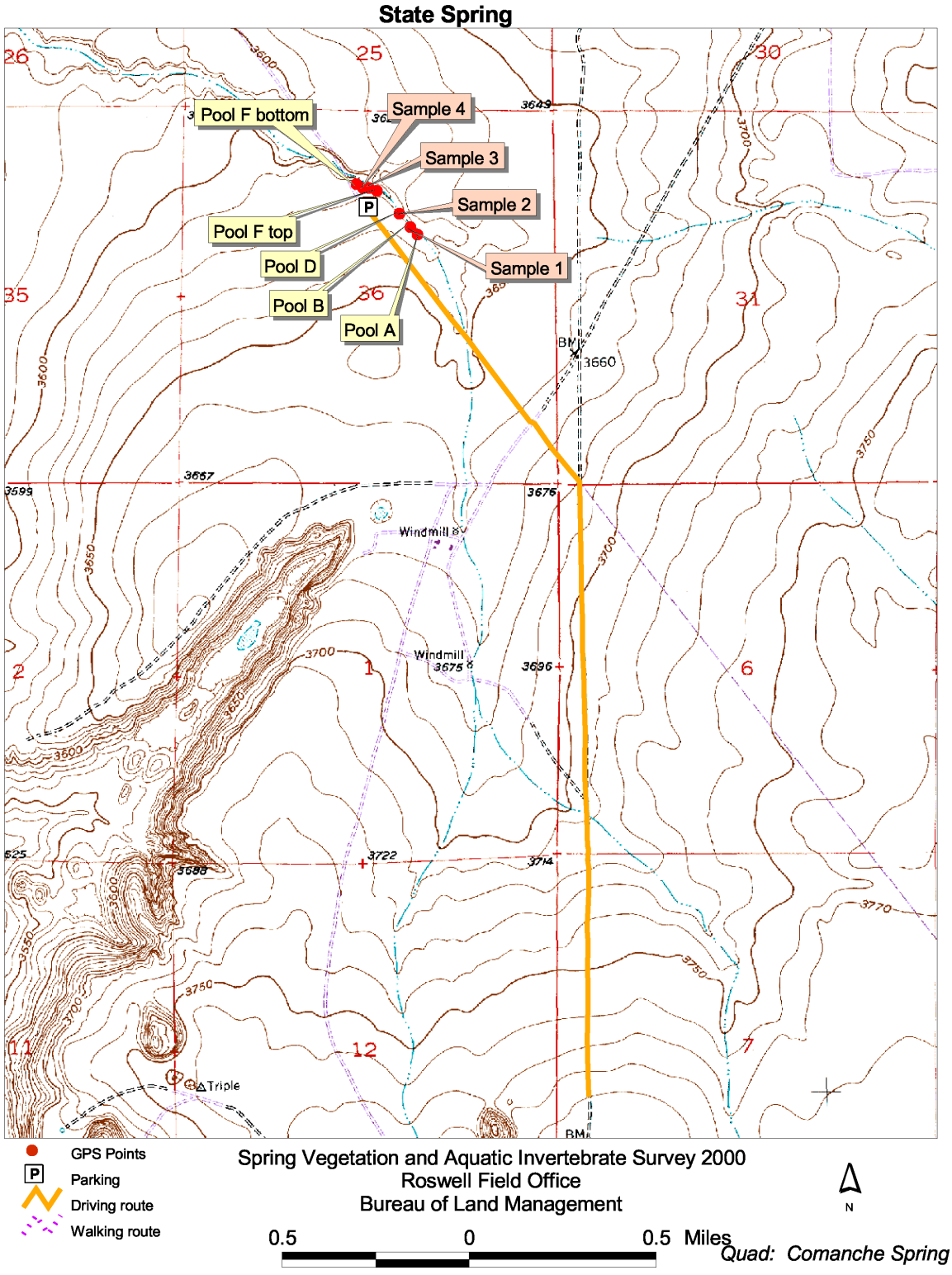

Figure 31: Map of State Spring

Spring Vegetation and Aquatic Invertebrate Survey 2000
Spring Report

Spring Name: State Spring

NMNHP Plot Number: 00RS011 **NMNHP Spring Sample Number:** 00RS011
Survey Date: 7/28/2000
UTM Location (NAD 27): Easting: 559987 Northing: 3705986

Directions to Plot: From intersection with US 285 take US 380 E from Roswell approx. 10.5 mi. Turn N on NM 409 and continue for approx. 1.75 mi. Take E fork in road, which will shortly curve to N. Two roads intersect and head NE, one at 0.3 mi and at 0.5 mi. Stay on the N-bound road for approx. 4.1 mi. Take NE road along gas line approx. 0.75 mi. where road crosses drainage park and walk E to spring.

Description: State Spring was a large seep system consisting of six pools which extended over 350 m along an arroyo bottom. The pools in the upper drainage were small, close together, and rather stagnant. Progressing down the drainage the pools got larger and less stagnant. The first pool (Pool A) was approximately 7 m by 2 m and was extremely stagnant, with many aquatic plants and algae. The second pool (Pool B), 45 m down channel from Pool A, was 15 m by 3.5 m and 50 cm deep. It was also very stagnant, with aquatic plants and algae covering approximately 70% of its surface. The third pool (Pool C) was just 4 m beyond Pool B, and was 30 m by 3 m. Approximately 15% of its surface was covered with aquatic plants and algae. The fourth pool (Pool D) was 18 m below Pool C. It was approximately 35 m by 5 m and 50 cm deep, with approximately 90% of its water surface was covered in aquatic plants. Twenty meters below Pool D was the fifth pool (Pool E), which was 30 m by 4 m. The sixth pool (Pool F) was approximately 40 m down channel from Pool E. It was the largest and freshest of the pools in the complex, at 95 m by 5 m and over 50 cm deep. Approximately 10% of its surface was covered in aquatic plants.

The drainage bottom around the pools was dominated by inland saltgrass with some alkali sacaton. Catchfly prairie gentian was common near the pools. The second pool had common reed, common threesquare, and beaked spikerush on its border. Clumps of saltcedar were scattered throughout the drainage.

Status: There was evidence of livestock use at Pool F, with many tracks and some dung. The water in all the pools was murky, and was below previous water marks. Turtles and leopard frogs were present in Pool F. A northern harrier, Say's phoebe, and orioles were observed around the spring. Many different types of adult dragon and damselflies, diving beetles, and butterflies were observed at the pools. The average Modified Hilsenhoff Biotic Index for organic pollution based on the rankings for the arthropods present in the samples was 7.8 for Pool B, 7.2 for Pool D, and 8.5 for Pool F, indicating the water in all three was organically polluted.

Species Name	Common Name	Origin	Wetland Status
Shrubs			
Baccharis emoryi	Emory's baccharis	N	FACW
Prosopis glandulosa	honey mesquite	N	FACU
Tamarix ramosissima	salt cedar	I	FACW
Graminoids			
Distichlis spicata	inland saltgrass	N	FACW
Eleocharis rostellata	beaked spikerush	N	

Phragmites australis	common reed	N	FACW+
Polypogon monspeliensis	annual rabbitsfoot grass	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	N	
Schoenoplectus pungens	common threesquare	N	OBL
Sporobolus airoides	alkali sacaton	N	FAC
Forbs			
Eustoma exaltatum	catchfly prairie gentian	N	OBL
Gaura villosa	wooly gaura	N	
Samolus ebracteatus ssp. cuneatus	limewater brookweed	N	OBL

Invertebrate Sample Taxonomic List

State Spring
SampleID: EM00S0101 Sample 1 Pool B
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	15	SC	8
Phylum: Arthropoda							
Class: Ostracoda							
				Ostracod	9	CG	8
Class: Insecta							
Heteroptera	Nepomorpha	Corixidae		water boatman	1	OM	
Diptera	Nematocera	Culicidae		mosquito	4	CG	8
Diptera	Brachycera	Ephydridae		shore fly	1	CG	6

State Spring
SampleID: EM00S0102 Sample 2 Pool D
Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Mollusca							
Class: Gastropoda							
Limnophila		Physidae	Physella	snail	9	SC	8
Phylum: Arthropoda							
Class: Insecta							
Odonata	Anisoptera			dragonfly	1	PR	
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	1	PR	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	7	PR	9
Heteroptera	Nepomorpha	Notonectidae		backswimmer	54	PR	
Coleoptera	Adephaga	Dytiscidae	Eretes	predaceous diving beetle	1	PR	5
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	1	PR	5
Diptera	Nematocera	Chironomidae		midge	8	OM	6

State Spring

SampleID: EM00S0103 Sample 3 Pool F

Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae	Callibaetis	mayfly	6	CG	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	12	PR	9
Heteroptera	Nepomorpha	Notonectidae		backswimmer	80	PR	
Coleoptera	Polyphaga	Hydrophilidae	Berosus	water scavenger beetle	3	PR	5
Diptera	Nematocera	Chironomidae		midge	1	OM	6

State Spring

SampleID: EM00S0104 Sample 4 Pool F

Sample type: Quantitative

Order	SubOrder	Family	Genus	Common Name	# Inds	FFG	TV
Phylum: Arthropoda							
Class: Insecta							
Ephemeroptera	Schistonota	Baetidae	Callibaetis	mayfly	2	CG	9
Odonata	Anisoptera	Libellulidae		common skimmer (dragonfly)	2	PR	9
Odonata	Zygoptera	Coenagrionidae		narrow-winged damselfly	5	PR	9
Heteroptera	Nepomorpha	Notonectidae		backswimmer	101	PR	

Appendix A: Description of *Helianthus paradoxus*, New Mexico Rare Plant Technical Council (1999) home page.

Helianthus paradoxus
(Pecos sunflower)

Family: Asteraceae
Scientific Name: *Helianthus paradoxus* Heiser
Synonyms: None
Vernacular Name: Pecos sunflower
R-E-D Code: 1-2-2

Description: Annual, 1-2 m tall, branched above, stem glabrous to hispid; leaves opposite below, alternate above, up to 17.5 cm long by 8.5 cm wide, lanceolate with 3 prominent veins, base tapering to a short petiole, margins entire except for a few prominent teeth on larger leaves, surface scabrous; flower heads solitary, terminating branches, 3-5 cm across including ray flowers; ray flowers 12-20, yellow; phyllaries 15-25, 3-4 mm wide, oblong-lanceolate, acuminate, hispid, margins ciliate; pales glabrous at tips; achenes 3-4 mm long, glabrous. Flowers August to October.
Similar Species: *Helianthus paradoxus* is intermediate between *H. annuus* and *H. petiolaris*. It differs from *H. annuus* in having narrower leaves, fewer hairs on the stems and leaves, smaller flower heads, narrower less abruptly acuminate phyllaries, and later flowering. It differs from *H. petiolaris* in having shorter petioles and no hairs at the tips of the pales of the flower head.

Distribution: New Mexico, Cibola, Valencia, Guadalupe, and Chaves counties; Texas, Pecos and Reeves counties.
Habitat: Saturated saline soils of desert wetlands. Usually associated with desert springs (cienegas) or the wetlands created from modifying desert springs; 1,000-2,000 m (3,300-6,600 ft). *Helianthus paradoxus* is a true wetland species that requires saturated soils; adult plants still grow well when inundated.
Remarks: *Helianthus paradoxus* is a species of hybrid origin with the parents being *H. annuus* and probably *H. petiolaris* (Rieseberg *et al.* 1990). It is intermediate between its parents in morphology, but not in habitat preference likely indicating a long period of independent evolution after its origin. *Helianthus paradoxus* hybridizes with *H. annuus*; the offspring, which have low fertility, could backcross to *H. paradoxus.*
This species is known from about 25 sites in 5 general areas. Sites in New Mexico are near Grants, along the lower part of the Rio San Jose, around Santa Rosa, and near the Pecos River from just north of Roswell to near Dexter. Sites in Texas are near Fort Stockton and Balmorhea.
Conservation Considerations: This species grows only in wetland habitats. Some activities that degrade or destroy wetlands include erosion leading to stream entrenchment, groundwater depletion, water diversions, filling, and *Tamarix* spp. (saltcedar) invasion. Livestock will eat *H. paradoxus* (especially the flower heads) when other green forage is scarce. Disturbance may facilitate hybridization.
Important Literature (*Illustration):

*Heiser, C.B. 1958. Three new annual sunflowers (*Helianthus*) from the southwestern United States. Rhodora 60:272-283.
*Heiser, C.B., D.M. Smith, S.B. Clevenger, and W.C. Martin. 1969. The North American sunflowers (*Helianthus*). Memoirs of the Torrey Botanical Club 22(3):1-220.
*New Mexico Native Plants Protection Advisory Committee. 1984. A handbook of rare and endemic plants of New Mexico. University of New Mexico Press, Albuquerque.
Rieseberg, L.H., R. Carter, and S. Zona. 1990. Molecular tests of the hypothesized hybrid origin of two diploid *Helianthus* species (Asteraceae). Evolution 44(6):1498-1511.
Information Compiled By: Charlie McDonald, 1999

Appendix B: Plant species list for the Roswell Spring Vegetation and Aquatic Invertebrae Survey 2000. Origin refers to native (N) or introduced (I) species. Acronyms are the NM Natural Heritage program codes used in the associated database. Wetland Status indicates wetland species status as defined by Reed (1977):

Obligate wetland plants (OBL) - occur almost always in wetlands (estimated probability of >99%)

Facultative wetland plants (FACW) – usually occur in wetlands (estimated probability of 67 to 99%)

Facultative plants (FAC) - share an equal likelihood of occurring in either wetlands or non-wetlands (estimated probability 33 to 67%)

Facultative upland plants (FACU) – usually occur in non-wetlands (estimate probability 67 to 99%)

Obligate upland plants (UPL) – occur almost always in non-wetlands (estimate probability >99%)

Non-indicators (NI) – not indicative or not yet evaluated

Species Name	Common Name	NMNHP Acronym	Origin	Wetland Status
Trees				
Celtis laevigata var. reticulata	netleaf hackberry	CELLAER	N	FACU
Populus deltoides	eastern cottonwood	POPDEL	N	
Shrubs				
Allenrolfea occidentalis	pickleweed	ALLOCC		
Artemisia filifolia	sand sagebrush	ARTFIL	N	NI
Atriplex canescens	fourwing saltbush	ATRCAN	N	NI
Baccharis emoryi	Emory's falsewillow	BACEMO	N	FACW
Brickellia californica	California brickellbush	BRICAL	N	FACU+
Forestiera pubescens	New Mexico olive	FORPUB	N	FACU
Gutierrezia sarothrae	broom snakeweed	GUTSAR	N	NI
Isocoma pluriflora	southern jimmyweed	ISOPLU	N	NI
Lycium spp.	wolfberry	LYCIUM	N	
Opuntia imbricata	tree cholla	OPUIMB	N	NI
Opuntia phaeacantha	tulip pricklypear	OPUPHA	N	NI
Prosopis glandulosa	honey mesquite	PROGLA	N	NI
Pseudoclappia arenaria	TransPecos false clapberry	PSEARE		
Rhus trilobata	skunkbush sumac	RHUTRI	N	NI
Salix exigua	coyote willow	SALEXI	N	OBL
Tamarix ramosissima	salt cedar	TAMRAM	I	NI
Yucca glauca	soapweed yucca	YUCGLA	N	
Graminoids				
Agrostis stolonifera	creeping bentgrass	AGRSTO	I	NI
Aristida purpurea	purple threeawn	ARIPUR	N	NI
Bothriochloa barbinodis	cane bluestem	BOTBAR	N	
Bothriochloa laguroides ssp. torreyana	silver beardgrass	BOTLAGT	N	NI
Bouteloua curtipendula	sideoats grama	BOUCUR	N	NI
Bouteloua gracilis	blue grama	BOUGRA	N	NI
Carex occidentalis	western sedge	CAROCC	N	NI

Species Name	Common Name	NMNHP Acronym	Origin	Wetland Status
Graminoids cont.				
Cenchrus spinifex	sandbur	CENSPI	N	NI
Chloris cucullata	hooded windmill grass	CHLCUC	N	NI
Distichlis spicata	inland saltgrass	DISSPI	N	FACW
Echinochloa crus-galli	barnyardgrass	ECHCRU	I	FACW-
Eleocharis rostellata	beaked spikerush	ELEROS	N	
Elymus canadensis	Canada wildrye	ELYCAN	N	FAC
Erioneuron pulchellum	fluffgrass	ERIPUL	N	
Hordeum jubatum	foxtail barley	HORJUB	N	NI
Juncus mexicanus	Mexican rush	JUNMEX	N	
Muhlenbergia asperifolia	alkali muhly	MUHASP	N	OBL
Panicum obtusum	vine mesquite	PANOBT	N	FAC
Panicum virgatum	switchgrass	PANVIR	N	FAC+
Pascopyrum smithii	western wheatgrass	PASSMI	N	NI
Paspalum distichum	knotgrass	PASDIS	N	OBL
Phragmites australis	common reed	PHRAUS	N	FACW+
Polypogon monspeliensis	annual rabbitsfoot grass	POLMON	I	FACW+
Schoenoplectus maritimus	saltmarsh bulrush	SCHMAR	N	
Schoenoplectus pungens	common threesquare	SCHPUN	N	OBL
Setaria leucopila	streambed bristlegrass	SETLEU	N	NI
Sorghum halepense	johnsongrass	SORHAL	I	FACU+
Sporobolus airoides	alkali sacaton	SPOAIR	N	FAC
Sporobolus flexuosus	mesa dropseed	SPOFLE	N	FACU-
Sporobolus giganteus	giant dropseed	SPOGIG	N	NI
Sporobolus wrightii	giant sacaton	SPOWRI	N	NI
Tridens albescens	white tridens	TRIALB	N	NI
Forbs				
Ambrosia psilostachya	Cuman ragweed	AMBPSI	N	FAC
Artemisia dracunculus	wormwood	ARTDRA	N	NI
Artemisia ludoviciana	Louisiana sagewort	ARTLUD	N	NI
Asclepias subverticillata	whorled milkweed	ASCSUB	N	FACU
Bahia pedata	bluntscale bahia	BAHPED	N	
Centaurium maryannum	Lady Langford's centaury	CENMAR	N	
Chamaesyce albomarginata	whitemargin sandmat	CHAALB	N	
Cirsium spp.	thistle	CIRSIU	N	
Clematis drummondii	Drummond's clematis	CLEDRU	N	NI
Convolvulus arvensis	field bindweed	CONARV	I	NI
Conyza canadensis	Canadian horseweed	CONCAN	N	FACU
Cressa truxillensis	spreading alkaliweed	CRETRU	N	
Dalea candida	slender white prairieclover	DALCAN	N	
Dimorphocarpa wislizeni	spectacle pod	DIMWIS	N	NI
Eustoma exaltatum	catchfly prairie gentian	EUSEXA	N	OBL
Flaveria campestris	alkali yellowtops	FLACAM	N	FAC
Gaillardia multiceps	gypsum blanketflower	GAIMUL	N	
Gaura parviflora	velvetweed	GAUPAR	N	NI
Gaura villosa	wooly gaura	GAUVIL	N	
Glycyrrhiza lepidota	American licorice	GLYLEP	N	FAC+
Gutierrezia sphaerocephala	roundleaf snakeweed	GUTSPH	N	

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Forbs cont.				
Helianthus paradoxus	puzzle sunflower	HELPAR	N	
Helianthus petiolaris	prairie sunflower	HELPET	N	NI
Heliotropium convolvulaceum	phlox heliotrope	HELCON	N	
Heliotropium curassavicum	salt heliotrope	HELCUR	N	
Kochia scoparia	common kochia	KOCSCO	I	FAC
Lactuca serriola	prickly lettuce	LACSER	I	FAC
Laennecia coulteri	conyza	LAECOU	N	
Lepidium alyssoides	mesa pepperwort	LEPALY	N	
Limonium limbatum	Transpecos sealavender	LIMLIM	N	FACW
Machaeranthera tanacetifolia	tanseyleaf aster	MACTAN	N	NI
Melampodium leucanthum	plains blackfoot	MELLEU	N	
Plantago major	common plantain	PLAMAJ	I	FACW
Pluchea odorata var. odorata	sweetscent	PLUODOO	N	OBL
Salsola tragus	prickly Russian thistle	SALTRA	I	
Samolus ebracteatus ssp. cuneatus	limewater brookweed	SAMEBRC	N	OBL
Sarcocornia utahensis	Utah glasswort	SARUTA	N	FACW
Solanum elaeagnifolium	silverleaf nightshade	SOLELA	N	NI
Sonchus asper	spiny sowthistle	SONASP	I	NI
Sphaeralcea angustifolia	copper globemallow	SPHANG	N	
Suaeda spp.	seepweed	SUAEDA		
Thelesperma megapotamicum	Hopi tea greenthread	THEMEG	N	NI
Typha angustifolia	narrowleaf cattail	TYPANG	N	
Typha latifolia	broadleaf cattail	TYPLAT	N	OBL
Verbena bracteata	bigbract verbena	VERBRA	N	FAC
Xanthium strumarium	rough cocklebur	XANSTR	N	NI