Classification of Lacustrine Water Bodies
and Associated Ecological Communities
of the Bureau of Land Management
Roswell Resource Area

Report for

Bureau of Land Management
Roswell Resource Area
Drawer 1857
Roswell, New Mexico 88202

Submitted by

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INTRODUCTION

Playas, often referred to as lacustrine water bodies, are internally drained basins occurring in areas where surface drainage is poor due to the impervious clay soils, but evaporation rates are high. Most playas are classed as ephemeral or permanent lakes depending on the water depth and persistence, and on the presence of aquatic vegetation (Nelson, et.al 1983a). They are dependent upon surface runoff from rainfall or (occasionally) snowmelt. Playas are found in natural surface depressions of arid Southwest states, and are common to the Southern Great Plains of eastern New Mexico, southeastern Colorado and the panhandle regions of adjacent Texas and Oklahoma. Playas are extremely important aquatic habitats in an otherwise arid landscape. They are unique habitats for plants and animals which may be restricted in their overall distribution. They are important stopover and wintering sites for migratory waterfowl and shorebirds, and they can provide important nesting sites for waterfowl. Playas can be critical water sources for terrestrial wildlife needing a source of water in their home range, and they are islands of aquatic and riparian vegetation. Playa basins, if uncultivated and ungrazed, support a richer, denser vegetative cover and greater faunal diversity than surrounding areas of the Southern Great Plains (Scribner and Warren, 1990).

The objective of this study is to render a clear understanding of the ecology of lacustrine water bodies of eastern New Mexico particularly in the BLM Roswell Resource Area. The management of playas and alkaline lakes has important ramifications for agriculture, wildlife, and aquifer recharge. Information gathered from this study will provide area land managers with a better understanding of playas and will aid in making sound management decisions essential to the maintenance of playas. Establishing baselines for water quality, faunal and floral occurrence and condition, and natural community occurrence and condition will also provide the groundwork for ongoing monitoring of these critical sites in the future.

ENVIRONMENTAL SETTING

The distribution of playas in this study was limited to the BLM Roswell Resource Area of southeastern New Mexico (Figure 1). The numbers associated with the dots in Figure 1 refer to the site locations. Seven playa basins were visited and evaluated with respect to criteria that the BLM proposed for protection evaluation (Nelson, et.al., 1983b):

- Permanent surface water;
- Undisturbed with good natural stands of vegetation;
- Generally 10 acres or larger;
- Playa watershed of at least 100 acres;
- Clay bottom of at least 25 acres;
- Riparian plant community occupying at least one-third of the basin.

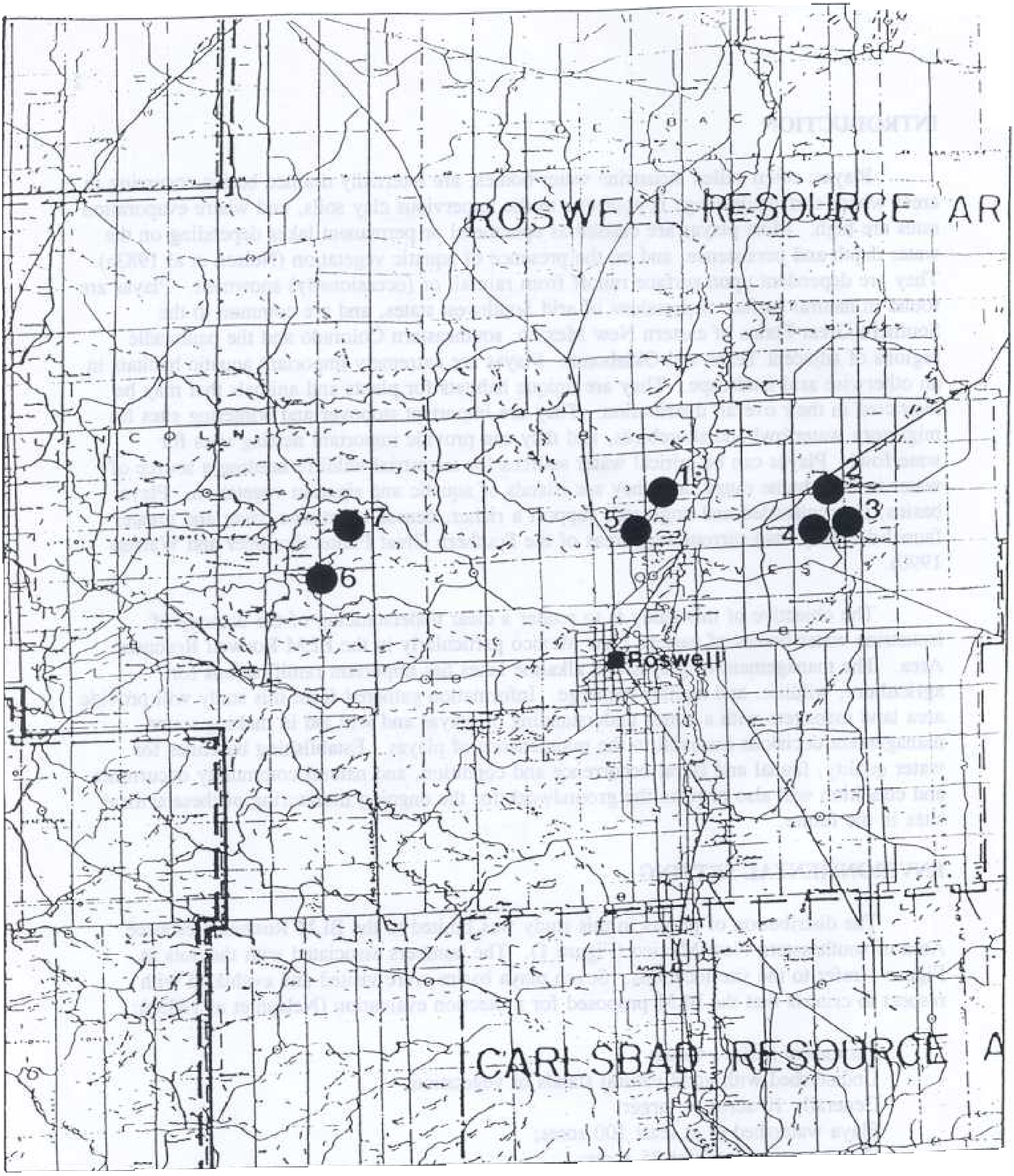

Figure 1: General location of the study area within the BLM Roswell Resource Area. See Table 1 for precise locations.

Playas were distributed in both Chaves and Lincoln Counties on land managed by the Bureau of Land Management (BLM) Roswell Resource Area. Elevations within the study area ranged from approximately 3600 feet to 5400 feet. Dick-Peddie (1993) has typed the vegetation in the region surrounding the playas as Plains-Mesa Grasslands merging with Desert Grasslands at the lowest elevations and Juniper Savanna Woodlands at the highest elevations.

METHODS

General Sampling Design. The characterization of ecological communities associated with playas in the Roswell Resource Area is based on site surveys of each water body using methods developed by the Soil Conservation Service and BLM for Ecological Site Inventory (ESI) of wetland vegetation. These methods included assessing community and ecosystem conditions; measuring water quantity, including total surface and watershed areas, and identifying potential sources of pollution and degradation.

Low-level aerial photographs and airborne videos at a 1:24,000 scale were taken of the BLM Roswell Resource Area to aid in the overall sampling design. Sample sites were selected on the basis of size and significant extant vegetation.

At each playa, one cross-section transect was extended from the beginning of the upland slope towards the bottom of the basin to standing water. Zones of homogeneous vegetation were identified along the cross-section. Cross-sections were surveyed using a transit level and stadia rod. Soil and vegetation plots were placed along the transect in each zone. Vegetation plot sizes were 400 m^2 and included one soil pit. The soil profile was fully described from a 1m deep by 1m wide pit following Soil Conservation Service guidelines (SCS 1991), and two samples from each horizon were collected for later analysis.

Plant species composition was recorded in each plot for determination of ecological community types. Vegetation was stratified by tree, shrub, graminoid (grass and grasslike plants) and forb layers with independent cover estimates in each layer. Total cover within a plot could exceed 100% because of overlapping plant canopies. Community Types were designated according to the New Mexico Natural Heritage Program's statewide vegetation community classification database protocols and procedures.

All plant species were evaluated for wetland status and categorized into one of the following five wetland groups as defined in the 1987 Wetland Delineation Manual, and listed in the National List of Plant Species that Occur in Wetlands (Reed 1988):

- * *obligate wetland plants* (OBL) occur almost always (estimated probability >99%) in wetlands, but occasionally are found in nonwetlands (estimated probability <1%);
- * *facultative wetland plants* (FACW) usually occur in wetlands (estimated probability 67% to 99%), but occasionlly are found in nonwetlands (estimated probability 1% to 33%);
- * *facultative plants* (FAC) share an equal likelihood (estimated probability 33% to 67%) of occurring in either wetlands or nonwetlands;
- * *facultative upland plants* (FACU) usually occur in nonwetlands (estimated probability 67% to 99%), but occasionally are found in wetlands (estimated probability 1% to <33%);
- * *obligate upland plants* (UPL) occur almost always (estimated probability >99%) in nonwetlands.

Soils were classified to the family level of the Soil Taxonomy (Soil Survey Staff 1992). Electrical conductivity was measured from a mixed sample of the top 20 cm of soil.

Additionally, 35 mm photographs were taken at each site and in each plot to represent a given ecological community or any significant site feature.

The standing water at each playa was described with respect to temperature, pH, and electrical conductivity. The conductivity measures account for maximum compensation for the effect of temperature. Standing water and basin sizes were approximated using USGS 7.5' quadrangle maps and aerial photographs. The basins included all surface water inputs into the playa, excepting those that would only occur in the rarest flood event. Basins with very gentle slopes tended to have surface depressions within a contour that would functionally limit inputs into the playa.

A preliminary assessment of aquatic macroinvertebrate fauna diversity was made by sampling with dip net sweeps. A 0.5 mm mesh dip net was inserted into the bottom sediments about 1 inch deep. A 15 foot sweep was made through the water prodding the bottom sediments often. When the water was deeper than the dip net, a few shorter sweeps were made above it to sample surface water. Samples were identified to family except for one to order (Podocopa) and most to genus. Vouchers were preserved in 70% Isopropyl alcohol and will be stored at the University of New Mexico Museum of Southwestern Biology. A list of aquatic macroinvertebrates present was compiled, sorted by site, and is presented in Appendix C.

RESULTS

An aerial video of the entire BLM Roswell Resource Area was produced and has been delivered to the BLM Roswell office. Aerial photographs were interpreted to evaluate which playas met the established guidelines for sampling. Seven playas were visited and sampled over a five day period in August (Figure 1). The weather conditions were clear and hot, with temperatures averaging approximately 37°C, with no precipitation.

Vegetation. Six of the seven playas sampled contained plant species that are considered to be wetland plants in this region and fall into one of three of categories - obligate wetland plants (OBL), facultative wetland plants (FACW), and facultative plants (FAC) as previously defined (Reed 1988). Table 1 summarizes this data listing those playas having wetland species present, the plant species, and the wetland category.

Table 1. Plant species considered to be regional wetland species by site and by their wetland category (Reed 1988). All other species can be presumed to be either facultative upland plants (FACU) or obligate upland plants (UPL).

Playa Name	**Plant Species**	**Wetland Category**
Cocklebur Lakes East	*Eleocharis macrostachya* (longstem spikerush)	obligate wetland plants (OBL)
	Helianthus ciliaris (blueweed sunflower)	facultative plants (FAC)
	Phyla cuneifolia (wedge-leaf frogfruit)	facultative wetland plants (FACW)
Salt Lake	*Cressa truxillensis* (spreading alkali-weed)	facultative wetland plants (FACW)
	Distichlis stricta (inland saltgrass)	facultative wetland plants (FACW)
	Sporobolus airoides (alkali sacaton)	facultative plants (FAC)
Curlew Lake	*Eleocharis macrostachya* (longstem spikerush)	obligate wetland plants (OBL)
	Iva axillaris (poverty sumpweed)	facultative plants (FAC)
	Panicum obtusum (vine-mesquite)	facultative plants (FAC)
North Ballard Hill	*Helianthus ciliaris* (blueweed sunflower)	facultative plants (FAC)
	Panicum obtusum (vine-mesquite)	facultative plants (FAC)
	Sporobolus airoides (alkali sacaton)	facultative plants (FAC)
Archuleta Creek	*Eleocharis macrostachya* (longstem spikerush)	obligate wetland plants (OBL)

Arroyo Serrano	*Helianthus ciliaris* (blueweed sunflower)	facultative plants (FAC)
	Panicum obtusum (vine-mesquite)	facultative plants (FAC)
	Phyla cuneifolia (wedge-leaf frogfruit)	facultative wetland plants (FACW)

Ten vegetation communities were described in detail for the study area on the basis of 10 plots. Plant voucher specimens were collected for verification, and will be stored at the University of New Mexico Herbarium for future reference. Community Types were designated by breaks in plant associations along the cross-section. Vegetation within each plot was classified to plant association (Community Type) levels. An ordered Floristic Stand Table and Plant Species List (Appendix A) of these plots was developed and provides the quantitative foundation for the community descriptions based on percent canopy cover. Grouping stands of species into types based on floristic composition and density, allows for more detailed analyses/comparisons with other types (Dick-Peddie 1993). Table 2 lists for each playa Plant Community Types and the soil taxons associated with each type.

Table 2: Classification of Ecological Community Types of Lacustrine Waters in the BLM Roswell Resource Area By Site Location.

SURVEY SITE **Plot Numbers** **Location**	**PLANT COMMUNITY TYPES** **Common Name (Acronym)**	**SOILS** **Order** **Type**
1) East Cocklebur Lake (93NR001) T07SR25E sect. 28 33°40'27"N, 104°25'51"W	*Sporobolus cryptandrus/Gutierrezia sarothrae c.t.* (sand dropseed/broom snakeweed) (SPCR/GUSA)	Aridisols Typic Camborthid
East Cocklebur Lake (93NR002) T07SR25E sect. 28 33°40'27"N, 104°25'51"W	*Eleocharis macrostachya/Helianthus ciliaris c.t.* (longstem spikerush/blueweed sunflower) (ELMA/HECI)	Vertisols Typic Haplotorrert
East Cocklebur Lake (93NR003) T07SR25E sect. 28 33°40'27"N, 104°25'51"W	*Eleocharis macrostachya/Sida leprosa c.t.* (longstem spikerush/scurfy sida) (ELMA/SILE)	Vertisols Typic Haplotorrert
2) Salt Lake (93NR004) T07SR30E sect. 18 33°42'12"N, 103°55'27"W	*Tamarix pentandra/Sporobolus airoides c.t.* (salt cedar/alkali sacaton) (TAPE/SPAI)	Aridisols Aquic Camborthid
3) Curlew Lake (93NR005) T08SR30E sect. 05 33°38'31"N, 103°53'59"W	*Eleocharis macrostachya-Panicum obtusum/Iva axillaris c.t.* (longstem spikerush-vine mesquite/poverty sumpweed) (ELMA-PAOB/IVAX)	Vertisols Typic Haplotorrert
4) Presler Lake (93NR006) T09SR30E sect. 18 33°32'14"N, 103°54'59"W	*Sporobolus cryptandrus/Chrysothamnus viscidiflorus c.t.* (sand dropseed/Douglas rabbitbrush) (SPCR/CHVI)	Entisols Typic Torrifluvent
5) North Ballard Hill Lake (93NR007) T08SR24E sect. 13 33°37'37"N, 104°27'22"W	*Tamarix pentandra/Buchloe dactyloides c.t.* (salt cedar/buffalograss) (TAPE/BUDA)	Vertisols Typic Haplotorrert
North Ballard Hill Lake (93NR008) T08SR24E sect. 13 33°37'37"N, 104°27'22"W	*Sporobolus airoides/Buchloe dactyloides c.t.* (alkali sacaton/buffalograss) (SPAI/BUDA)	Aridisols Typic Camborthid
6) Archuleta Lake (93NR009) T09SR18E sect. 01 33°33'30"N, 105°06'30"W	*Eleocharis macrostachya/Schedonnardus paniculatus c.t.* (longstem spikerush/tumblegrass) (ELMA/SCPA)	Vertisols Typic Haplotorrert
7) Arroyo Serrano Lake (93NR010) T08SR19E sect. 04	*Panicum obtusum/Helianthus ciliaris c.t.* (vine mesquite/blueweed sunflower) (PAOB/HECI)	Vertisols Typic Haplotorrert

33°38'52"N, 105°03'28"W

Soils. The classification of soils to order and family levels is informative in our understanding of the ecology of playas. However, the electrical conductivity and alkalinity properties of soils are equally important, especially in arid regions where playas occur. High alkalinity and electrical conductivity can severely limit plant growth or influence the vegetation to only those species especially adapted to saline or alkaline conditions (U.S. Salinity Laboratory Staff 1969). Complete soil profile descriptions of each playa are presented in Appendix B.

Electrical conductivity was tested in the laboratory from soil samples collected in the field from the top horizon of every plot. The conductivity of soils has been scaled according to plant productivity or yield (Table 3). Values along this scale range from 0mS to 16mS. Salinity effects are mostly negligible between 0 and 2. Yields of very sensitive crops are restricted between 2 and 4. Yields of many crops are restricted between 4 and 8, while only crops tolerant to highly saline conditions yield satisfactorily between 8 and 16. The salinity values we found ranged from .64mS (the only Entisol) at Presler Lake to 12.03mS (an Aridisol) at Salt Lake. In general, the salinity of playas decreases along a gradient from the exterior towards the interior and can be directly correlated to a moisture regime where the interior of the playa is wetter than outside and water is often pooled or ponded. An excellent example is Cocklebur Lakes East. The conductivity of the soil in the outside plot was 3.68mS. This soil was also classified as an Aridisol. Plant species present in this zone included stands of salt cedar and grasses and shrubs more adaptive to drier habitats. Salinity levels decreased towards the interior zone of the playa as the moisture regime became wetter with values of 2.48mS to 1.50mS. These soils were classified as Vertisols.

Table 3: Soil Alkalinity and Conductivity Values Relative to Site, Plant Response, and Moisture Regime

SURVEY SITE PLOT NUMBER	SOIL CONDUCTIVITY (upper 20cm)	PLANT RESPONSE*	pH (upper 20cm)	EVIDENCE OF MOISTURE	FAMILY CLASS
Cocklebur Lakes East (93NR001)	3.68	B	7.88	none	coarse-loamy; mixed calcareous, thermic
Cocklebur Lakes East (93NR002)	2.48	B	7.75	plot in playa floodplain	very fine; mixed calcareous, therm
Cocklebur Lakes East (93NR003)	1.50	A	7.81	horizon moist throughout	very fine; mixed calcareous, thermic
Salt Lake (93NR004)	12.03	D	8.53	reduced matrix at 85 cm	coarse-loamy, over very fine, over coarse-loamy, over very fine; mixed, thermic
Curlew Lake (93NR005)	7.88	C	8.17	standing water 10m from plot	very fine; mixed calcareous, thermic
Presler Lake (93NR006)	0.64	A	8.06	pit next to upland drainage	coarse-loamy; mixed calcareous, thermic
N. Ballard Hill (93NR007)	2.85	B	7.79	plot in playa floodplain	very fine; mixed calcareous, thermic
N. Ballard Hill (93NR008)	2.28	B	7.81	none	fine-loamy; mixed calcareous, thermic
Archuleta Creek (93NR009)	0.92	A	7.40	plot in playa floodplain	very fine; mixed, mesic
Arroyo Serrano (93NR010)	0.84	A	7.40	gley mottles in A1 horizon	very fine; mixed, mesic

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             A         B          C                D
* 0---------------2---------------4--------------8---------------16
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Scale of Conductivity (mS)

From 0 to 2 mS, salinity effects mostly negligible.
From 2 to 4 mS, very sensitive species may be restricted.
From 4 to 8 mS, many species restricted.
From 8 to 16 mS, only saline tolerant species produce satisfactorily.

* Source: U.S. Salinity Laboratory Staff. 1969.

Water and Invertebrates. Measures of water pH varied from 7.58 (30.4°C) at Arroyo Serrano Lake to 9.25 (22.6°C) at Salt Lake. The lowest temperature recorded was 19.2°C at Archuleta Lake. Electrical conductivity values were lowest at Archuleta Lake (0.07 mV) and highest at Salt Lake (86.6 mV). These measurements were not taken at North Ballard Hill Lake because of equipment malfunction. The number of invertebrate taxa present was lowest in the two playas with the highest electrical conductivity levels (Salt Lake and Presler Lake).

Table 4 summarizes data collected from each playa with regard to basin sizes, water conditions, and the number of invertebrate taxa collected at each playa. Examples of invertebrates collected include crustaceans - tadpole shrimp (Order Notostraca), fairy shrimps (Order Anostraca), clam shrimps (Order Conchostraca), and insects - water boatmen (Order Heteroptera) and mayflies (Order Ephemeroptera). A complete list of aquatic macroinvertebrate fauna encountered was compiled, and sorted by site in Appendix C.

Table 4: Summary table on the condition of water in playas as assessed for BLM Lacustrine Survey 1993 in Southeastern New Mexico. Includes electrical conductivity (with maximum compensation for temperature), pH, and temperature of the standing water; the number of invertebrate taxa as listed in Appendix C; total watershed, basin and water surface areas.

Playa Name	**Conductivity (mV)**	**pH**	**Temp (^0C)**	**Invert. taxa**	**Watershed area (ac)**	**Playa area (ac)**	**Water Surface area (ac)**
East Cocklebur	0.28	8.00	32.0	11	9,750	43	1.5
Salt Lake	86.60	9.25	22.6	3	11,030	172	86.0
Curlew Lake	0.40	8.37	33.3	6	15,900	201	42.0
Presler Lake	58.60	9.15	27.7	1	13,430	59	37.0
N. Ballard Hill	*	*	*	6	945	11	0.1
Archuleta Creek	0.07	7.75	19.2	6	900	5	0.2
Arroyo Serrano	0.24	7.82	27.5	5	100	4	3.0

Site Descriptions of Playa Ecological Community Types. Each site description includes a summary of the distribution of community types, the watershed size, the basin size, permanance of water, sources of degradation or pollution, community descriptions, and comments.

Each site description is also accompanied with cross-sectional diagrams showing the distribution of soil/vegetation plots along as well as vegetation maps showing existing vegetation associated with each playa. Cross-Sections schematically represent the distribution of soil/vegetation plots by diagrams using the software program XSPRO (Grant et.al. 1992). The Cross-Sections derived from the transect data relate the position of plots along the playa basin. Note that each Cross-Section has a different scale corresponding to the maximum width and height of each cross-section. Each plot is labeled with the plot number, the community type acronym, the soil taxon acronym, as well as the soil electrical conductivity levels. The vegetation maps illustrate soil/vegetation positions as well, but from an aerial viewpoint with topographic contours. All maps have been photo interpreted and drawn to scale. Additionally, the vegetation maps identify community types, plot numbers, and outline open water or playa beaches where appropriate.

The following key identifies cover adjectives and nouns used to characterize the vegetation in the Community Descriptions which follow:

ABSENT - cannot be found in stand (opp = present);
ACCIDENTAL - individuals very infrequent, occasional, or limited to
ABUNDANT - canopy coverage > 25%;
COMMON - canopy coverage > 1% (opp = scarce);
DOMINANT - density or cover is as great as, or greater than, any other
LUXURIANT - canopy coverage > 50%;
POORLY REPRESENTED - canopy coverage < 5% (opp = well-represented);
PRESENT - individuals can be found in the stand (opp = absent);
REGENERATION - understory trees as established seedlings, saplings, or
SCARCE - canopy coverage < 1% (opp = common);
WELL-REPRESENTED - canopy coverage >5% (opp = poorly represented).

Site Description

Cocklebur Lakes East

This playa located in Chaves County (T07SR25E sect. 28) can be characterized by three definable vegetation zones bordered by a mesquite/alkali sacaton (*Prosopis glandulosa/Sporobolus airoides*) bottomland community in the Prosopis Glandulosa Series typical of this region. Cross-Section No. 1 depicts the distribution of plots from the exterior to the interior of the basin. Community Types, Soil Types, and Soil Conductivity Values are also represented, as well as the water's edge. The periphery of the playa basin is dominated by a graminoid-shrub zone mixed with abundant forbs in what was the driest zone. The diversity of species decreases as the wetness of the playa increases towards the interior and the playa becomes dominated by a nearly monotypic stand of longstem spikerush (*Eleocharis macrostachya*), an obligate wetland plant (OBL). The Vegetation Map outlines Community Types of the playa and indicates the surveyed plot locations. Aquatic invertebrate diversity is high.

Watershed Size: 9,750 acres
Playa Size: 43 acres
Permanance of Water: ephemeral
Sources of Degradation or Pollution: Disturbance from grazing is moderate particularly on the periphery, and relatively low towards the interior of the playa. It appears that the road which intersects this playa from the adjacent playa may have altered the hydrology of the basin.

Community Descriptions:

1. ***Sporobolus cryptandrus/Gutierrezia sarothrae c.t.*** **(sand dropseed/broom snakeweed)**

Environmental Setting: This type is a herbaceous dominated community with a low shrub layer located on the driest zone of the playa. The elevation is 3600 ft with a flat slope situated in a wide valley that is rarely inundated for a significant period of time. Soils are classified as Aridisols and Typic Camborthids with a coarse-loamy profile. These soils are alkaline and calcareous. Electrical conductivity is low to moderate; 3.68 mS. This community type is likely to occur elsewhere in the Southern Great Plains.

Vegetation: This type is graminoid dominated with sand dropseed (*Sporobolus cryptandrus*) abundant and the dominant. Vine mesquite (*Panicum obtusum*), a facultative plant (FAC), and species of *Aristida* and *Setaria* are also common. The shrub broom snakeweed (*Gutierrezia sarothrae*) is also abundant and dominates the shrub layer. Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) is present in the shrub layer as well. Common dominant forbs include upland species, such as scarlet gaura (*Gaura coccinea*) and blueweed sunflower (*Helianthus ciliaris*). One other notable species present is wedge-leaf frogfruit (*Phyla cuneifolia*) which is considered to be a facultative wetland plant (FACW) in this region.

2. ***Eleocharis macrostachya/Helianthus ciliaris c.t.*** **(longstem spikerush/blueweed sunflower)**

Environmental Setting: This type represents that part of the playa where the moisture regime exerts greater influence upon the species composition. The site is wetter than the previous and is probably frequently flooded. The elevation is 3600 ft with a flat slope situated in a wide valley. This type is herbaceous dominated with no shrub layer present. Soils are classified as Vertisols and Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline, calcareous, and meet the criteria for hydric soils as defined by standards outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation 1989). Electrical conductivity is low; 2.48 mS. This community type is likely to occur elsewhere in the Southern Great Plains.

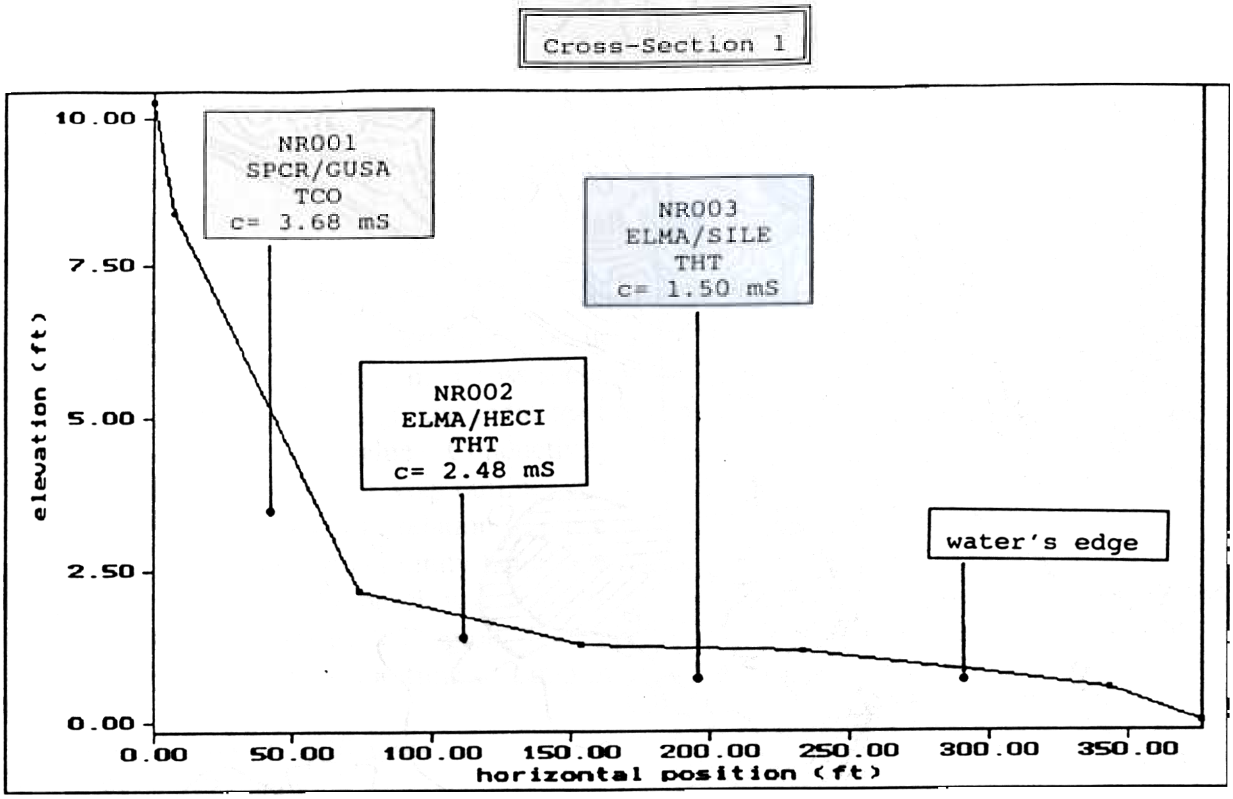
Vegetation: This type is forb dominated where blueweed sunflower (*Helianthus ciliaris*), a facultative plant (FAC), is luxurient and the dominant. Scurfy sida (*Sida leprosa*) and wedge-leaf frogfruit (*Phyla cuneifolia*), a facultative wetland plant (FACW), are present, but scarce. Longstem spikerush (*Eleocharis macrostachya*), an obligate wetland plant (OBL), is abundant and dominates the graminoid layer. Other species present include buffalograss (*Buchloe dactyloides*) and vine mesquite (*Panicum obtusum*), a facultative plant (FAC).

3. *Eleocharis macrostachya/Sida leprosa c.t.* (longstem spikerush/scurfy sida)

Environmental Setting: This type represents the innermost zone of the playa where standing water is present much of the year and the moisture regime exerts the primary influence upon the species composition. It is herbaceous dominated with no shrub layer present. The elevation is 3600 ft with a flat slope situated in a wide valley. Soils are classified as Vertisols and Typic Haplotorrerts with a very fine texture. These soils are moist and clayey throughout the profile. They are frequently flooded, alkaline, calcareous and electrical conductivity is very low; 1.50 mS. These soils meet the criterion for hydric soils (Federal Interagency Committee for Wetland Delineation 1989). This type is likely to occur elsewhere in the Southern Great Plains.

Vegetation: This type is represented by a nearly monotypic, luxurient stand of longstem spikerush (*Eleocharis macrostachya*), an obligate wetland plant (OBL). Scurfy sida (*Sida leprosa*) is well-represented and codominates this community type in the forb layer. Blueweed sunflower (*Helianthus ciliaris*), a facultative plant (FAC), is present.

Comments: The first community type occupying the exterior zone of the playa represents a grazing disclimax where the species composition is heavily influenced by cattle grazing. Common ruderal species present here include broom snakeweed (*G. sarothrae*) and silverleaf nightshade (*Solanum elaeagnifolium*), early successional species commonly associated with intensive disturbances. Species composition changes significantly towards the interior zones of the playa as the moisture regime becomes wetter. Plant species associated with wetlands become apparent and are well-represented. The soils are hydric soils. Disturbance from grazing becomes insignificant towards the interior of the playa as well. Exotic species present include salt cedar (*Tamarix pentandra*), restricted to clumps around the periphery of the playa. Regeneration of salt cedar was absent. One other notable species present includes two mature individuals of Fremont's cottonwood (*Populus fremontii*) located at Cocklebur Lakes West. Cottonwood regeneration was absent.

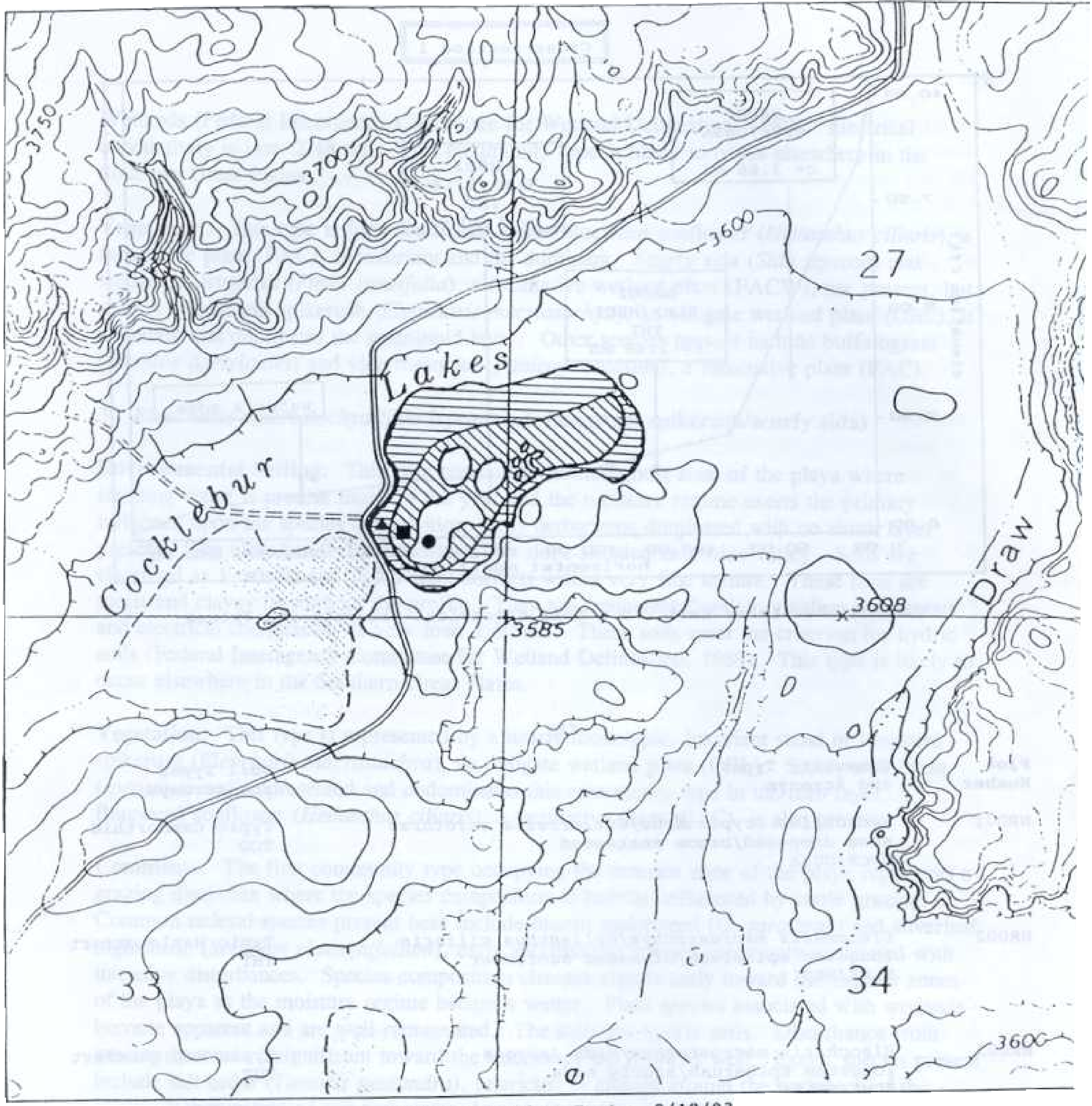


Cocklebur Lakes East. c = Soil Electrical Conductivity Values

KEY

Plot Number	Community Types and Acronym	Soil Types and Acronym
NR001	*Sporobolus cryptandrus/Gutierrezia sarothrae* sand dropseed/broom snakeweed SPCR/GUSA	Typic Camborthid TCO
NR002	*Eleocharis macrostachya/Helianthus ciliaris* longstem spikerush/blueweed sunflower ELMA/HECI	Typic Haplotorrert THT
NR003	*Eleocharis macrostachya/Sida leprosa* longstem spikerush/scurfy sida ELMA/SILE	Typic Haplotorrert THT

Vegetation Map   Community Types and Plot Location - Cocklebur Lakes East



Cocklebur Lakes East: 8/18/93
T07SR25E sect.28

N

KEY	Community Types	Plots
□	longstem spikerush/scurfy sida (ELMA/SILE)	93NR001 ●
▨	longstem spikerush/blueweed sunflower (ELMA/HECI)	93NR002 ■
▤	sand dropseed/broom snakeweed (SPCR/GUSA)	93NR003 ▲

Scale 1:12,000

Site Description

Salt Lake

One of two highly alkaline playas visited, this site is located in Chaves County (T07SR30E sect. 18). The shoreline is occupied by a narrow band of bottomland vegetation on flat to gently sloping terrain. Cross-Section No. 2 shows the location of the sampled plot in relation to the water's edge and indicates the Community Type, Soil Type, the Plot Number, and the Soil Conductivity Value. Conductivity of the soil sampled here was the highest of all the playas. The Vegetation Map outlines the Community Type sampled at Salt Lake and indicates the plot location in relation to the water and beach. Bordering the basin is a mesquite/alkali sacaton community belonging to the Prosopis Glandulosa Series typical of this region. Emerging on the beach was spreading alkali-weed (*Cressa truxillensis)*, a facultative wetland plant (FACW) in this region. We felt this species was too undeveloped to classify into a community type at the time of sampling. Aquatic invertebrate diversity is low.

Watershed Size: 11,030 acres
Playa Size: 172 acres
Permanance of Water: permanent
Sources of Degradation or Pollution: Disturbance from grazing is moderate.

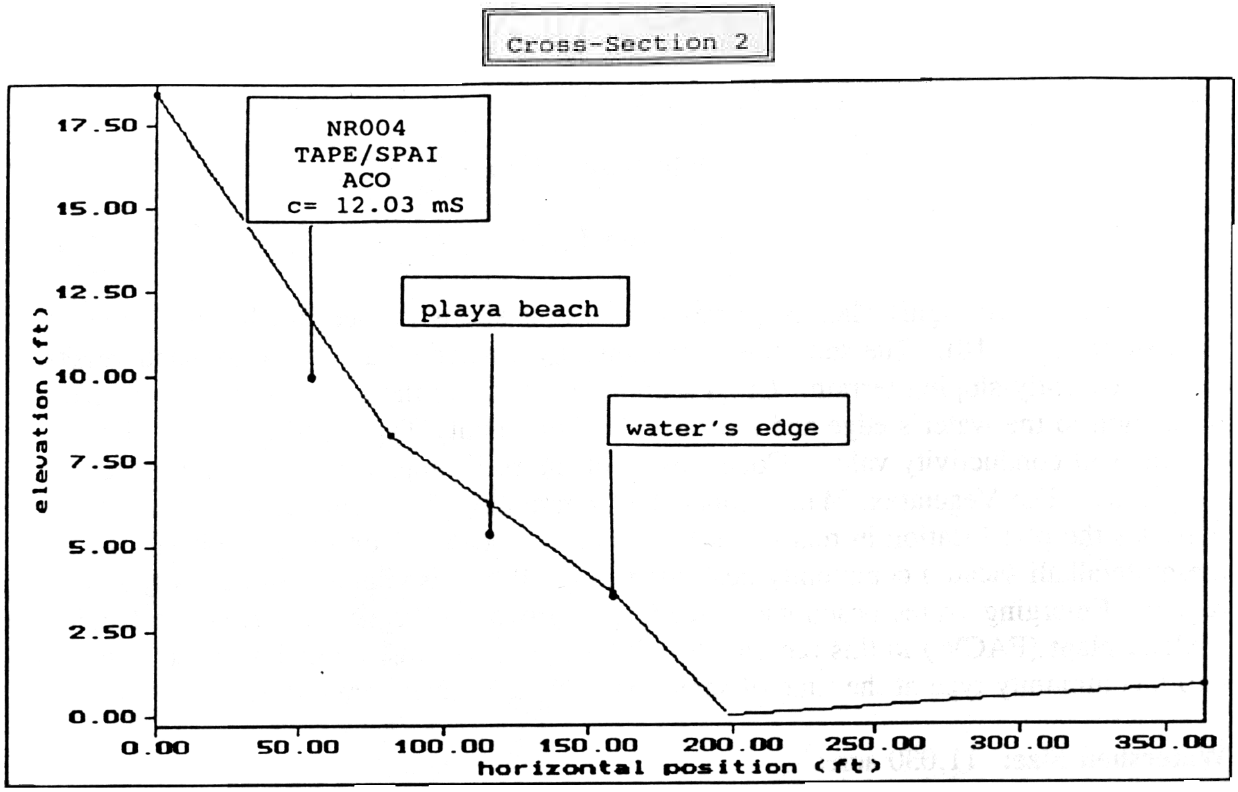
Community Descriptions:

1. *Tamarix pentandra/Sporobolus airoides c.t.* (salt cedar/alkali sacaton)

Environmental Setting: This type is represented by a shrub dominated community with an abundant herbaceous layer. The site is dry and sandy. The elevation is approximately 4050 ft. Soils are classified as Aridisols and Aquic Camborthids with coarse-loamy textured horizons over a clayey horizon. These soils are fully base saturated and calcareous. Electrical conductivity is very high; 12.03 mS. This type is likely to occur elsewhere in the Southern Great Plains.

Vegetation: This type is shrub dominated with the aggressive and weedy salt cedar (*Tamarix pentandra*) abundant and the dominant. Alkali sacaton (*Sporobolus airoides*), a facultative plant (FAC), is also abundant and dominates this community type in the graminoid layer. Inland saltgrass (*Distichlis stricta*), a facultative wetland plant (FACW), is another important species and well-represented at this site.

Comments: The distribution of salt cedar here is limited to two groups situated adjacent to upland drainages. The stands are well-established but regeneration is scarce. One notable forb species present here is spreading alkali-weed (*Cressa truxillensis*), a facultative wetland plant (FACW) in this region. Present also is the ruderal silverleaf nightshade (*Solanum elaeagnifolium*).

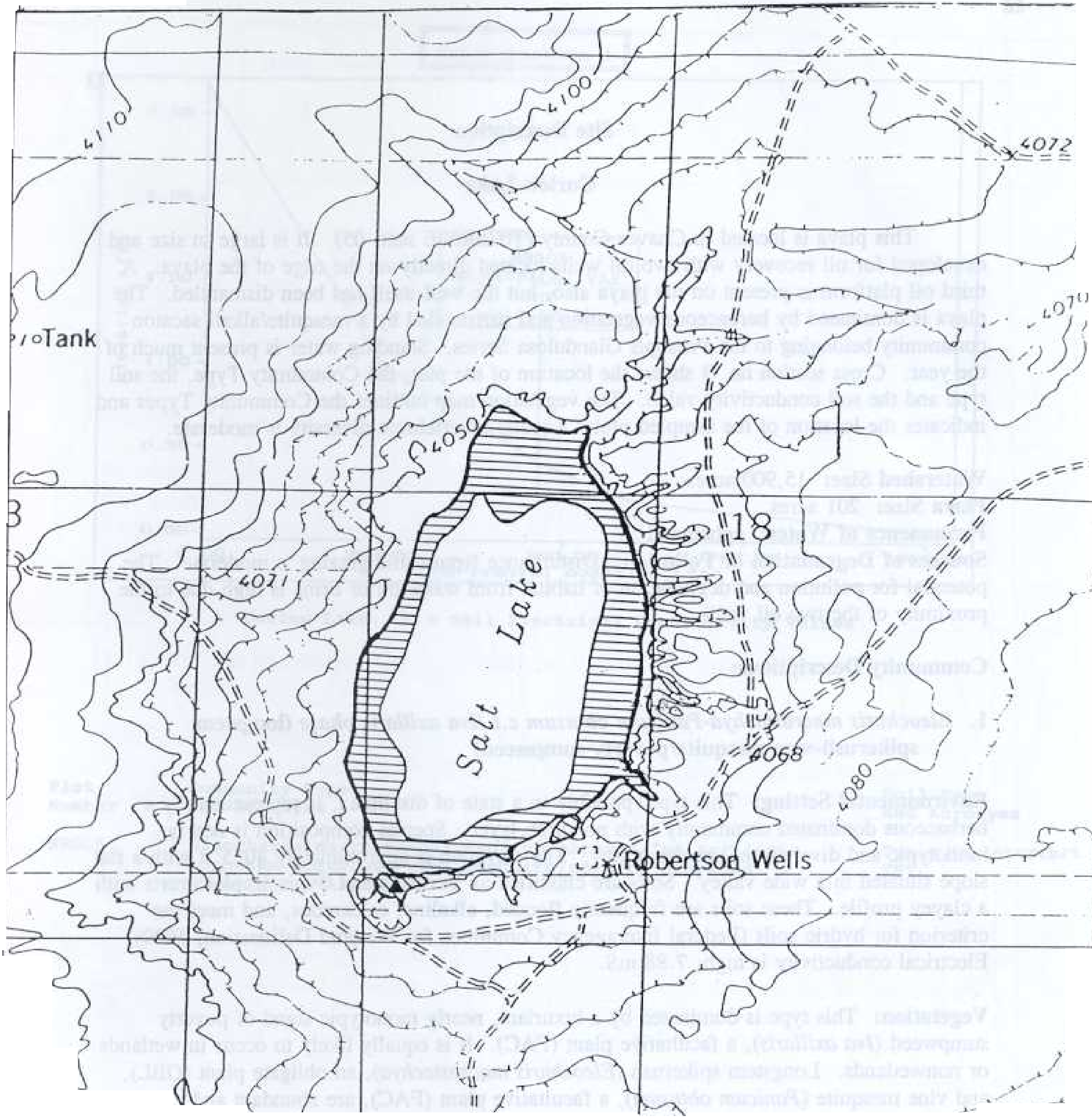


Salt Lake. c = Soil Electrical Conductivity Values

KEY

Plot Number	**Community Type and Acronyms**	**Soil Type and Acronyms**
NR004	*Tamarix pentandra/Sporobolus airoides* salt cedar/alkali sacaton TAPE/SPAI	Aquic Camborthid ACO

Vegetation Map Community Types and Plot Location - Salt Lake



Salt Lake: 8/19/93
T07SR30E sect. 18

N

KEY	Community Types	Plots
▨	salt cedar/alkali sacaton (TAPE/SPAI)	93NR004 ▲
▤	playa beach	
☐	open water	

Scale 1:12,000

Site Description

Curlew Lake

This playa is located in Chaves County (T08SR30E sect. 05). It is large in size and developed for oil recovery with two oil wells located directly on the edge of the playa. A third oil platform is present on the playa also, but the well itself has been dismantled. The playa is dominated by herbaceous vegetation and surrounded by a mesquite/alkali sacaton community belonging to the Prosopis Glandulosa Series. Standing water is present much of the year. Cross-Section No. 3 shows the location of the plot, the Community Type, the Soil Type and the Soil Conductivity value. The Vegetation Map outlines the Community Types and indicates the location of the sampled plot. Aquatic invertebrate diversity is moderate.

Watershed Size: 15,900 acres
Playa Size: 201 acres
Permanance of Water: ephemeral
Sources of Degradation or Pollution: Disturbance from cattle grazing is moderate. The potential for pollution and degradation of habitat from waste oil or brine is high due to the close proximity of the two oil wells.

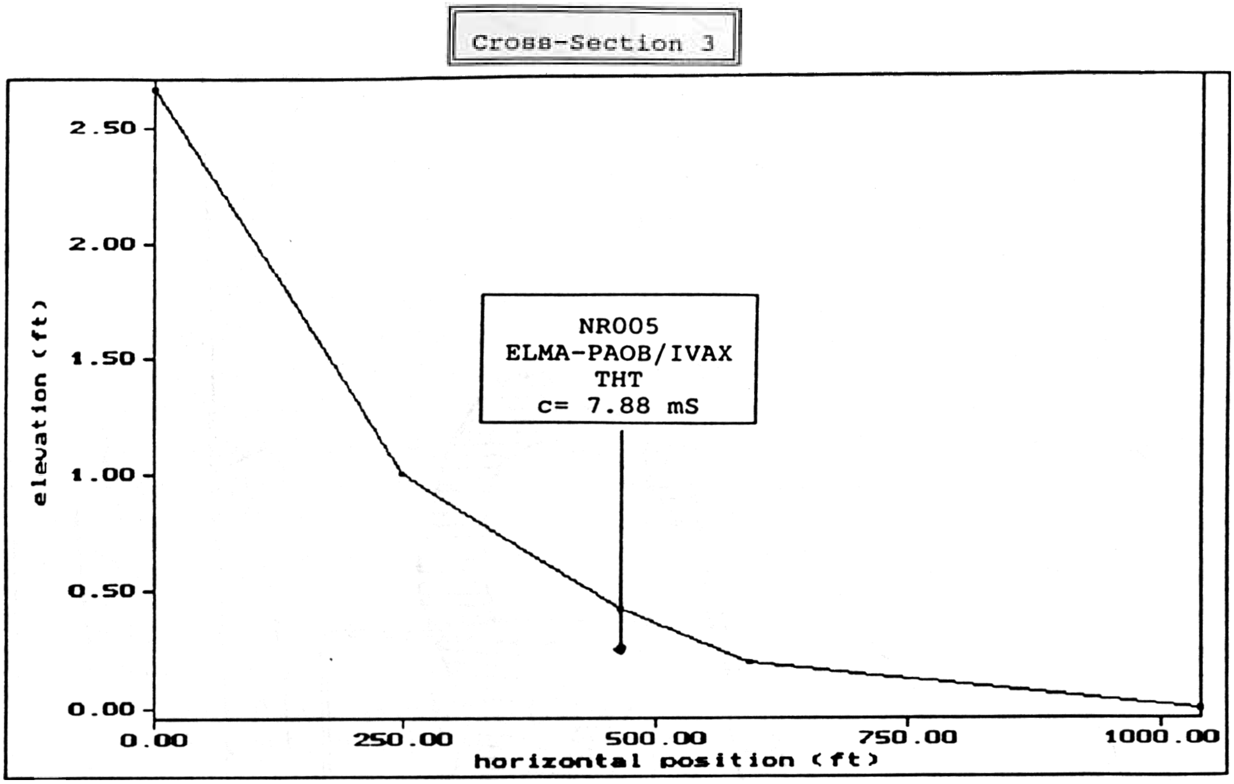
Community Descriptions:

1. ***Eleocharis macrostachya-Panicum obtusum c.t./Iva axillaris phase*** **(longstem spikerush-vine mesquite/poverty sumpweed)**

Environmental Setting: This type possibly in a state of disclimax is represented by an herbaceous dominated community with no shrub layer. Species composition is nearly monotypic and diversity of species is low. The elevation is approximately 4025 ft with a flat slope situated in a wide valley. Soils are classified as Vertisols and Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline, calcareous, and meet the criterion for hydric soils (Federal Interagency Committee for Wetland Delineation (1989). Electrical conductivity is high; 7.88 mS.

Vegetation: This type is dominated by a luxurient, nearly monotypic stand of poverty sumpweed (*Iva axillaris*), a facultative plant (FAC). It is equally likely to occur in wetlands or nonwetlands. Longstem spikerush (*Eleocharis macrostachya*), an obligate plant (OBL), and vine mesquite (*Panicum obtusum*), a facultative plant (FAC), are abundant and codominate the graminoid layer.

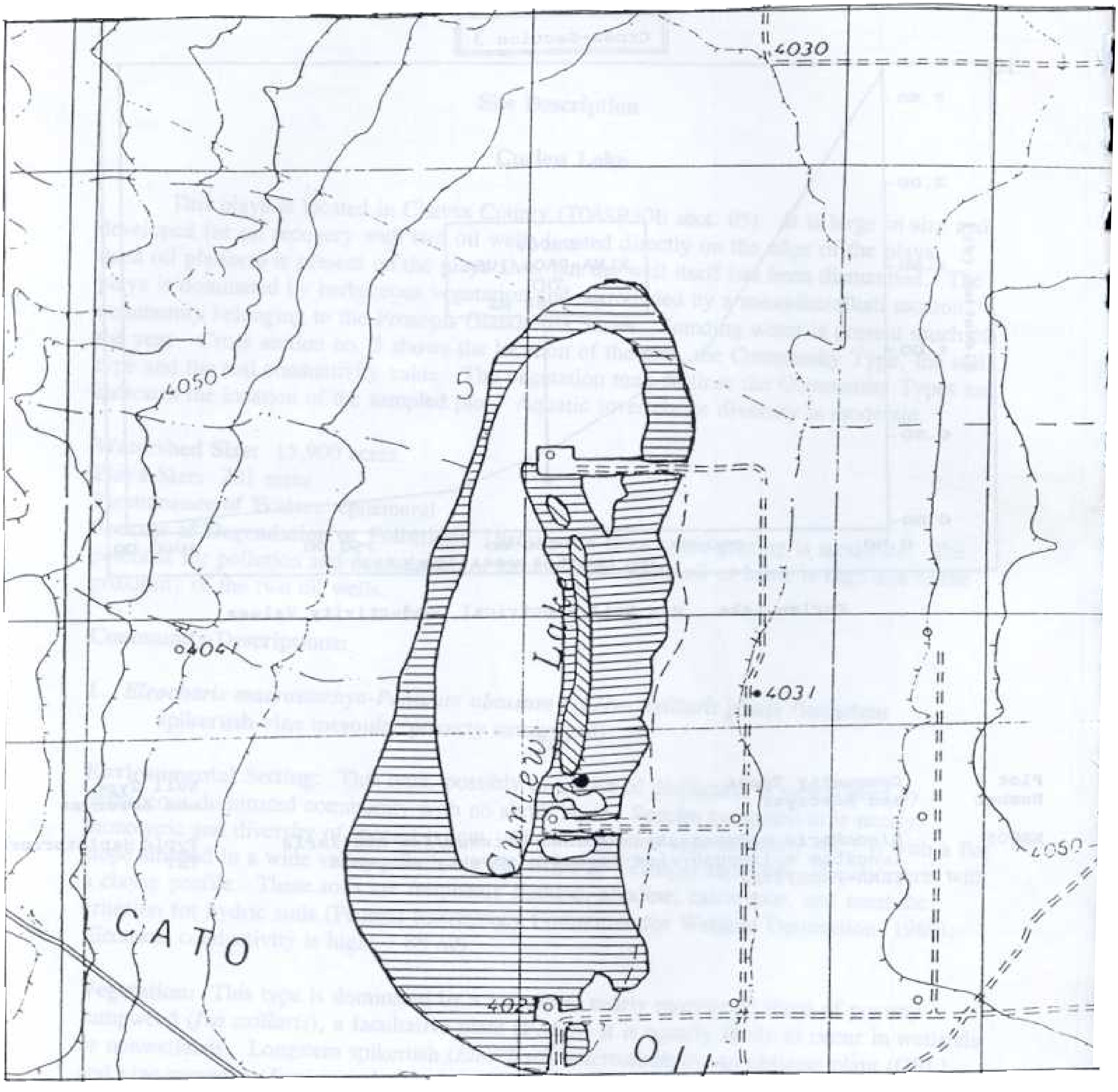
Comments: Studies in NW Colorado (Baker 1984, and Kittel and Lederer 1993) recognize *Iva axillaris* as a Community Type in a transitional phase. Its dominance could be attributed to disturbance, alkaline soil conditions, and a drier than normal monsoonal season. No other studies of the *Iva axillaris* c.t. have been reported in New Mexico. Correll and Johnston (1979) describe this species as being in and about playas of the Texas Panhandle.



Curlew Lake. c = Soil Electrical Conductivity Values

KEY

Plot Number	Community Types and Acronyms	Soil Type and Acronyms
NR005	*Eleocharis macrostachya-Panicum obtusum/Iva axillaris* longstem spikerush-vine mesquite/poverty sumpweed ELMA-PAOB/IVAX	Typic Haplotorrert THT



Curlew Lake: 8/19/93
T08SR30E sect. 05

KEY	**Community Types**	**Plots**
▤	longstem spikerush-vine mesquite/poverty sumpweed (ELMA-PAOB/IVAX)	93NR005 ●
▧	sporobolus cryptandrus/mesquite (SPCR/PRGL	no plot
□	open water	

N

Scale 1:12,000

Site Description

Presler Lake

The second of two highly alkaline playas, this site is located in Chaves County (T09SR30E sect. 18). It is large in size with a broad beach and bordered by sand dunes stabilized by bottomland vegetation. Surrounding the lake basin is a mesquite/alkali sacaton community belonging to the Prosopis Glandulosa Series common to this region. Cross-Section No. 4 shows the distribution of the Community Type, the Soil Type, the Plot Number, and the Soil Conductivity Value in relation to the water's edge and the playa beach. The Vegetation Map outlines the Community Type and indicates the location of the plot as well as distribution of two stands of salt cedar. Aquatic invertebrate diversity is low.

Watershed Size: 13,430 acres
Playa Size: 59 acres
Permanance of Water: permanent
Sources of Degradation or Pollution: Disturbance from grazing is minimal.

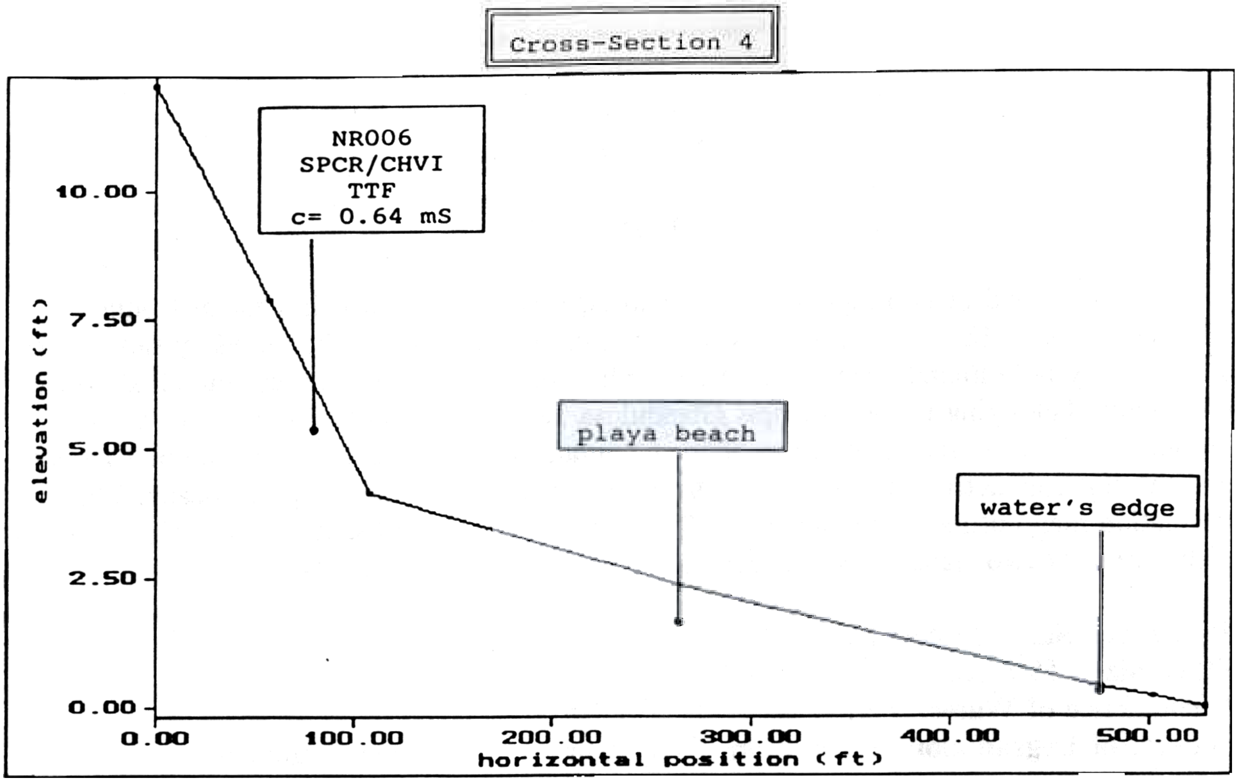
Communities Descriptions:

1. *Sporobolus cryptandrus/Chrysothamnus viscidiflorus c.t.* (sand dropseed/Douglas rabbitbrush)

Environmental Setting: This type is represented by a herbaceous dominated community with a tall to medium sized shrub layer. The site is dry and sandy with flat to gently undulating slopes situated in a wide valley. The elevation is approximately 3970 ft. Soils are classified as Entisols and Typic Torrifluvents with a coarse-loamy profile. These soils are alkaline and calcareous. Electrical conductivity is very low; 0.64 mS. This type is likely to occur elsewhere in the Southern Great Plains.

Vegetation: Sand dropseed (*Sporobolus cryptandrus*) is luxurient and the dominant species of this community type. The topography is dune-like and sand dropseed seems to act as an important soil stabilizer. Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) is common and codominates this community type in the shrub layer. This species is present in other types within this study. Other graminoids and forbs present tend to be weedy and include field sandbur (*Cenchrus incertus*), silverleaf nightshade (*Solanum elaeagnifolium*), and russian thistle (*Salsola kali*).

Comments: At the mouths of two drainages is the weedy shrub salt cedar (*Tamarix pentandra*). Two small stands are present and regenerating along the playa beach. Juveniles appear to be migrating towards the water's edge. Other notable species present include four-wing saltbush (*Atriplex canescens*).

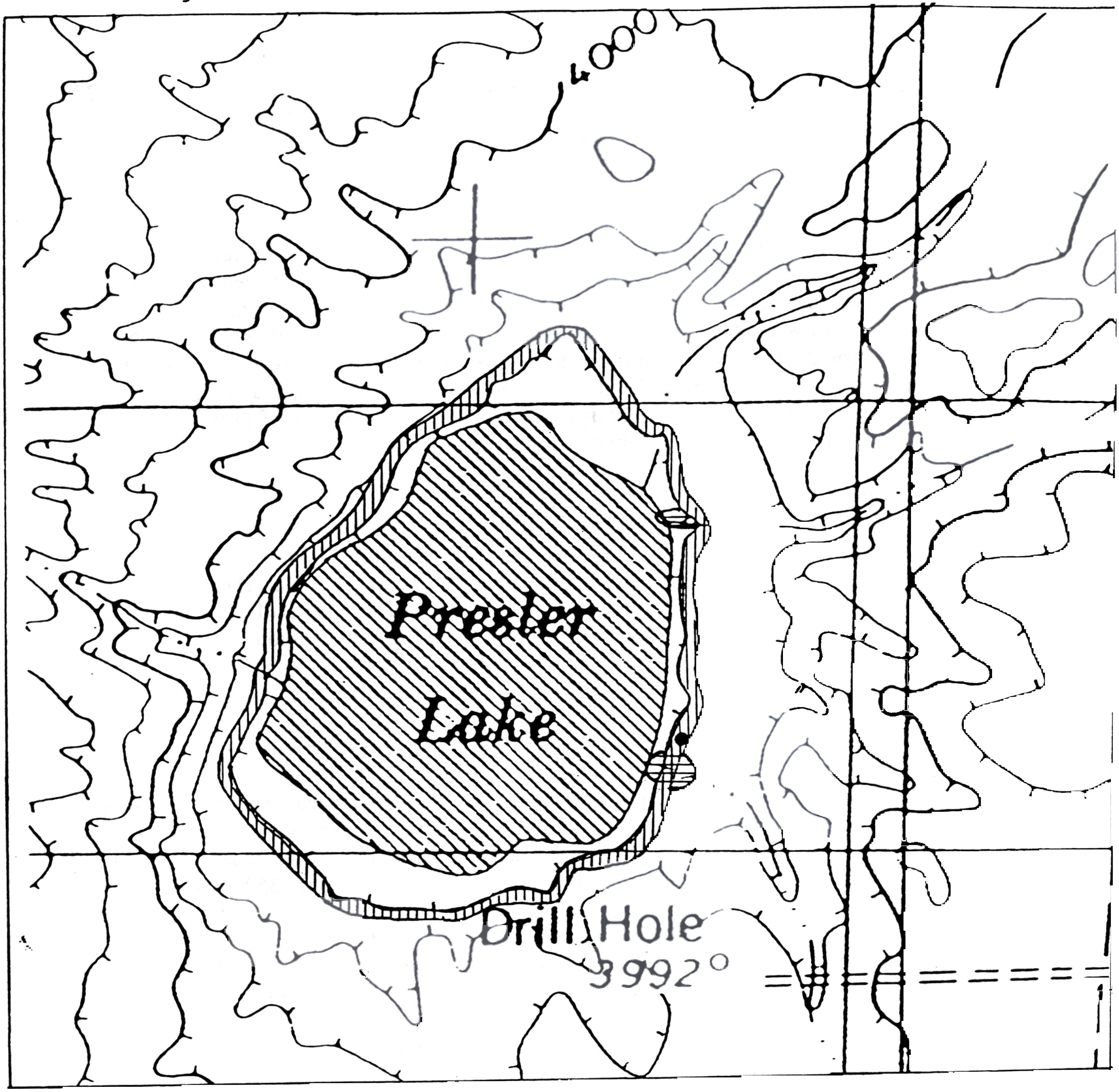


Presler Lake. c = Soil Electrical Conductivity Values

KEY

Plot Number	Community Type and Acronyms	Soil Type and Acronyms
NR006	*Sporobolus cryptandrus/Chrysothamnus viscidiflorus* sand dropseed/Douglas rabbitbrush SPCR/CHVI	Typic Torrifluvent TTF

Community Types and Plot Location - Presler Lake



Presler Lake: 8/20/93
T09SR30E sect. 18

N

KEY	Community Types	Plots
▥	sand dropseed/Douglas rabbitbrush (SPCR/CHVI)	93NR006 ●
▤	salt cedar (TAPE)	no plot
▧	open water	
☐	playa beach	

Scale 1:6,000

Site Description

North Ballard Hill Lake

This playa is located in Chaves County (T08SR24E sect. 13). It is a relatively small basin that may be in a state of disclimax due to grazing. It is shrub dominated with an abundance of salt cedar. Bordering the basin is a mesquite/alkali sacaton community belonging to the Prosopis Glandulosa Series common to this region. Cross-Section No. 5 depicts the distribution of plots from the water's edge to the top of the basin. Community Types, Soil Types, Plot Numbers, and Soil Conductivity Values are indicated as well. The Vegetation Map outlines the Community Types and indicates the location of the plots in relation to the water. Aquatic invertebrate diversity is moderate.

Watershed Size: 945 acres
Playa Size: 11 acres
Permanance of Water: ephemeral
Sources of Degradation or Pollution: Disturbance from grazing is high. The source of salt cedar establishment is unknown, but removal of salt cedar and limiting cattle grazing would likely encourage and restore the vegetation back to a more natural condition.

Community Descriptions:

1. *Tamarix pentandra/Buchloe dactyloides c.t.* (salt cedar/buffalograss)

Environmental Setting: This type is represented by a shrub dominated community with a graminoid underlayer located towards the interior of the playa. The moisture regime is frequently flooded and sustains a stable and regenerating population of salt cedar. Diversity of species is low but plant cover is high. The elevation is approximately 3590 ft with a flat to gently undulating slope. Soils are classified as Vertisols and Typic Haplotorrerts with a clayey profile. These soils are alkaline, calcareous and meet the criteria for hydric soils (Federal Interagency Committee for Delineating Wetlands 1989). Electrical conductivity is low; 2.85 mS. This type may occur elsewhere in the Southern Great Plains.

Vegetation: Salt cedar (*Tamarix pentandra*) is well-represented and dominates the shrub layer in this community type. Buffalograss (*Buchloe dactyloides*) is luxurient and codominates this community type in the graminoid layer. Vine mesquite (*Panicum obtusum*), a facultative plant (FAC) is present. Other species present here and which have also been encountered at other sites include blueweed sunflower (*Helianthus ciliaris*), a facultative plant (FAC), and silverleaf nightshade (*Solanum elaeagnifolium*), a ruderal species.

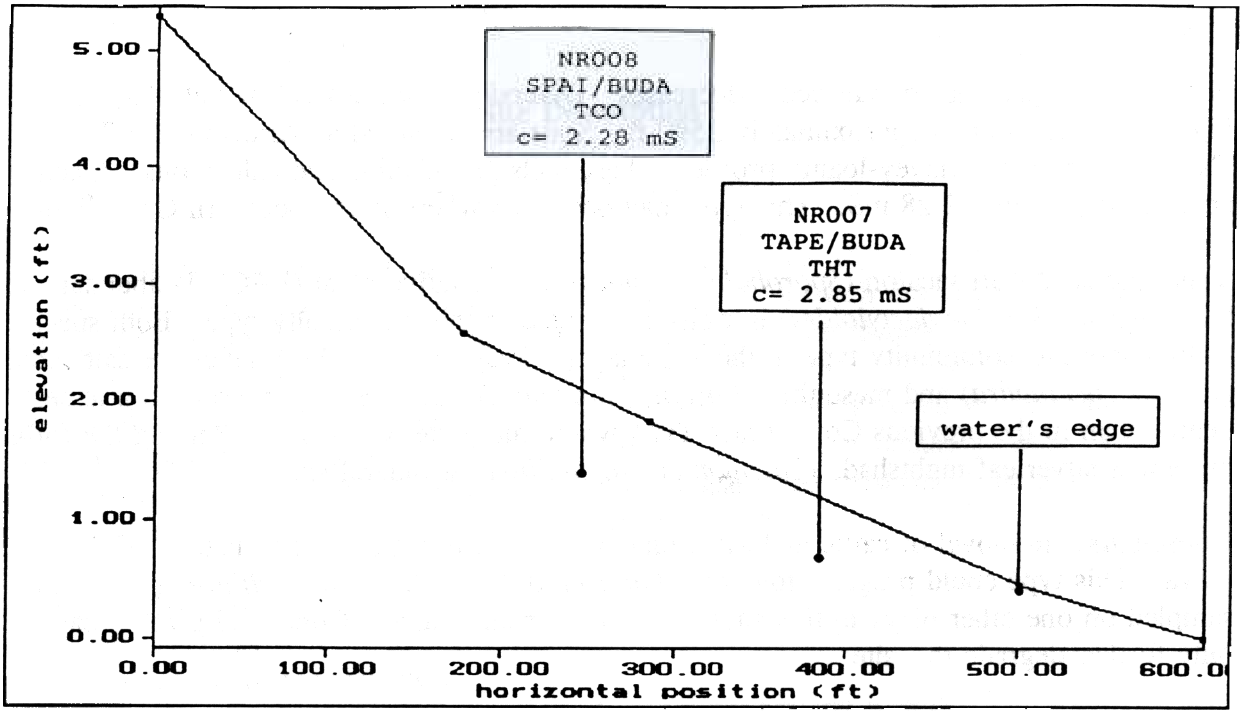
2. *Sporobolus airoides-Buchloe dactyloides c.t.* (alkali sacaton-buffalograss)

Environmental Setting: This type is represented by an herbaceous dominated community with a tall shrub layer located along the outer zone of the playa. The moisture regime is drier, and the presence of salt cedar decreases. Diversity of species is low but plant cover is high. The elevation is approximately 3590 ft. Soils are classified as Aridisols and Typic Camborthids with a clayey-loamy profile. These soils are alkaline and calcareous. Electrical conductivity is low; 2.28 mS. This type may occur elsewhere in the Southern Great Plains.

Vegetation: Alkali sacaton (*Sporobolus airoides*), a facultative plant (FAC), is abundant and buffalograss (*Buchloe dactyloides*) is well-represented in this community type. Both species codominate this community type in the same layer. Present in the shrub layer are salt cedar (*Tamarix pentandra*) and mesquite (*Prosopis glandulosa*). Salt cedar is present to a lesser degree than in the previous community type in which mesquite was absent. Among the forbs present is silverleaf nightshade (*Solanum elaeagnifolium*), a ruderal species.

Comments: Removal of cattle and salt cedar would improve the wetland habitat of this playa. This type could progress towards a *Panicum obtusum/Helianthus ciliarus c.t.* as was sampled on one other playa in this study (Arroyo Serrano Lake). Continued grazing can only further degradate this site.

Cross-Section 5

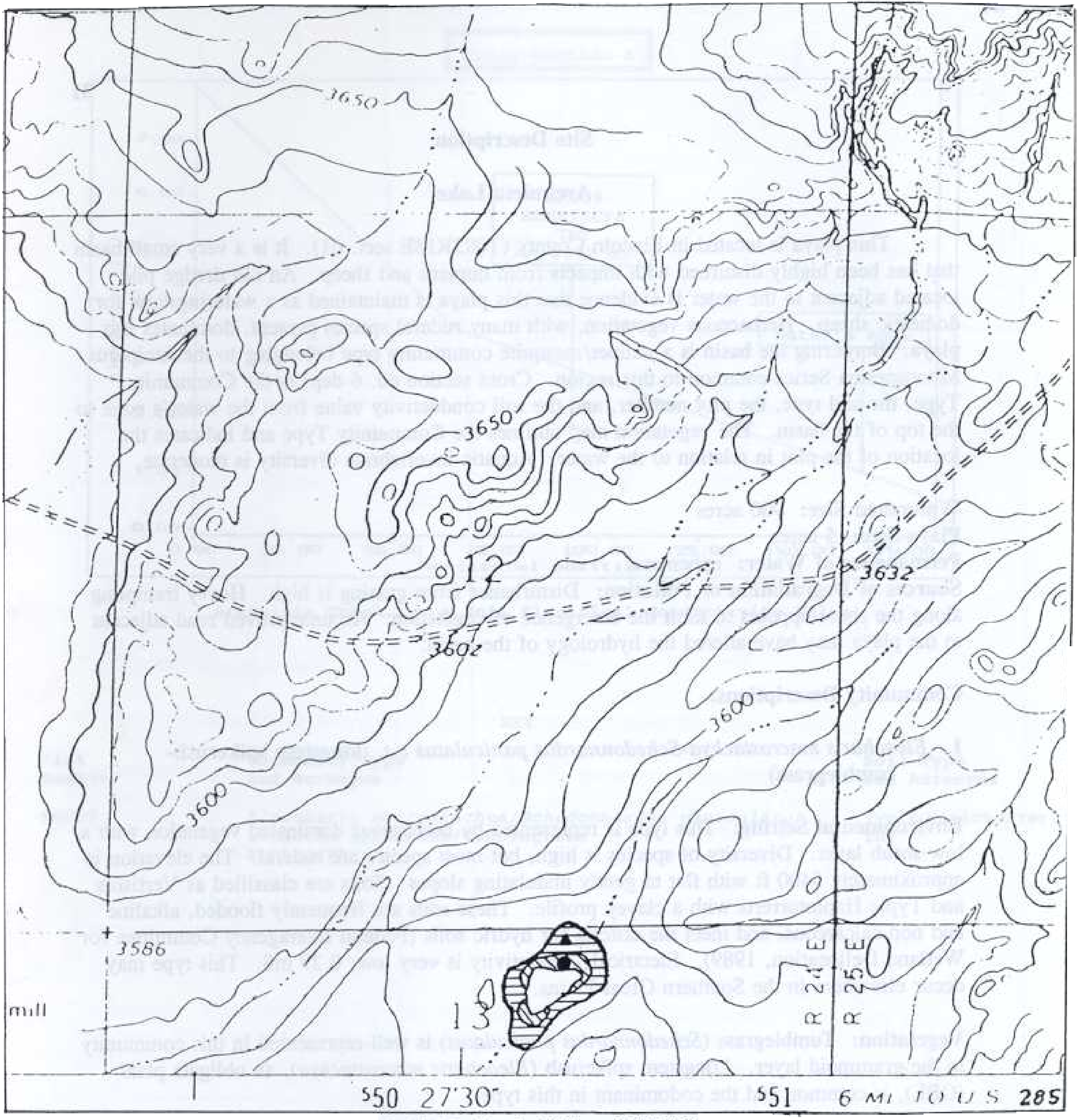


North Ballard Hill. c = Soil Electrical Conductivity Values

KEY

Plot Number	**Community Types and Acronyms**	**Soil Types and Acronyms**
NR007	*Tamarix pentandra/Buchloe dactyloides* salt cedar/buffalograss TAPE/BUDA	Typic Haplotorrert THT
NR008	*Sporobolus airoides/Buchloe dactyloides* alkali sacaton/buffalograss SPAI/BUDA	Typic Camborthid TCO

Vegetation Map Community Types and Plot Location - North Ballard Hill



North Ballard Hill: 8/20/93
T08SR24E sect. 13

↑
N

KEY	Community Types	Plots
▨	salt cedar/buffalograss (TAPE/BUDA)	93NR007 ●
▤	alkali sacaton/buffalograss (SPAI/BUDA)	93NR008 ▲
□	open water	

Scale 1:12,000

Site Description

Archuleta Lake

This playa is located in Lincoln County (T09SR18E sect. 01). It is a very small basin that has been highly disturbed with impacts from humans and sheep. An old dredge pile located adjacent to the water is evidence that this playa is maintained as a watering tank for domestic sheep. Herbaceous vegetation, with a heavy weedy presence, dominate this playa. Bordering the basin is a juniper/mesquite community type belonging to the Juniperus Monosperma Series common to this region. Cross-Section No. 6 depicts the Community Type, the Soil Type, the Plot Number, and the Soil Conductivity Value from the water's edge to the top of the basin. The Vegetation Map outlines the Community Type and indicates the location of the plot in relation to the water. Aquatic invertebrate diversity is moderate.

Watershed Size: 900 acres
Playa Size: 5 acres
Permanance of Water: ephemeral
Sources of Degradation or Pollution: Disturbance from grazing is high. Heavy trampling along the shore appears to limit the emergence of vegetation. An unimproved road adjacent to the playa may have altered the hydrology of the basin.

Community Descriptions:

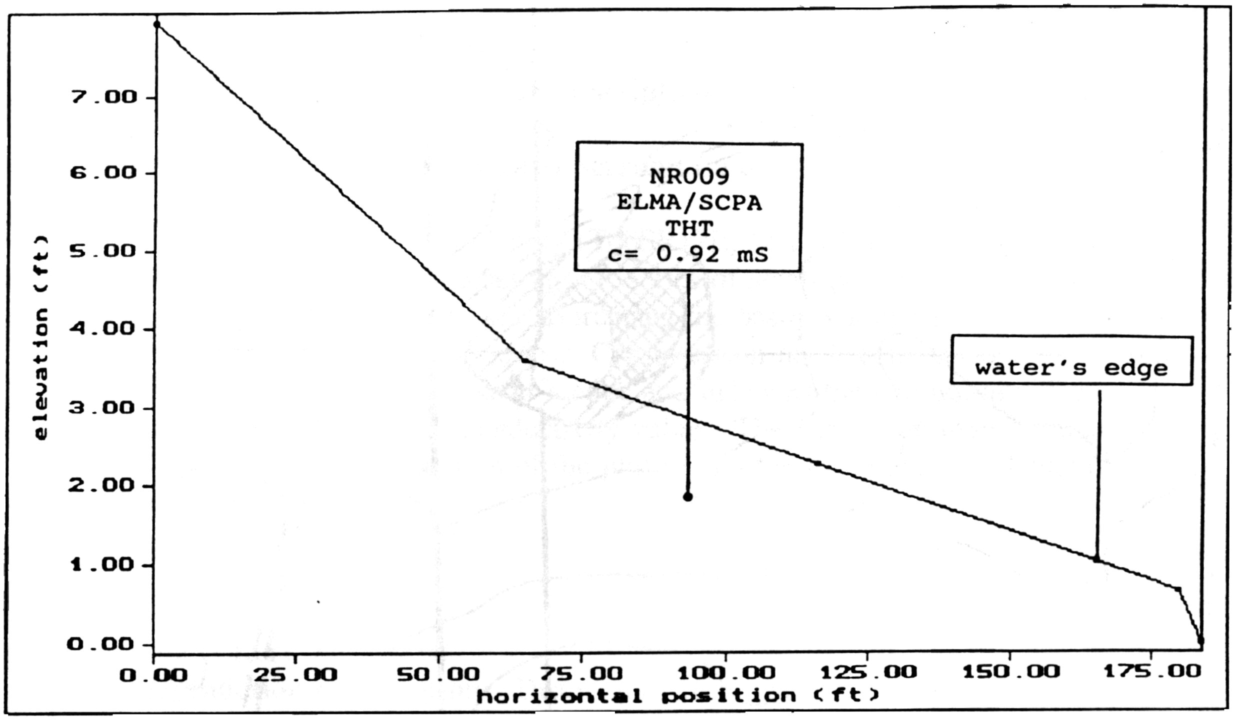
1. *Eleocharis macrostachya-Schedonnardus paniculatus c.t.* (longstem spikerush-tumblegrass)

Environmental Setting: This type is represented by herbaceous dominated vegetation with a low shrub layer. Diversity of species is high but weedy. The elevation is approximately 5400 ft with flat to gently undulating slopes. Soils are classified as Vertisols and Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline and non-calcareous, and meet the criteria for hydric soils (Federal Interagency Committee for Wetland Delineation 1989). Electrical conductivity is very low; 0.29 mS. This type may occur elsewhere in the Southern Great Plains.

Vegetation: Tumblegrass (*Schedonnardus paniculatus*) is well-represented in this community in the graminoid layer. Longstem spikerush (*Eleocharis macrostachya*), an obligate plant (OBL) is common and the codominant in this type.

Comments: Species composition appears to be influenced by grazing. Ruderal species common at this playa include broom snakeweed (*Gutierrezia sarothrae*), buffalobur (*Solanum rostratum*), silverleaf nightshade (*Solanum elaeagnifolium*), redroot pigweed (*Amaranthus retroflexus)*, and stinking cucumber (*Cucurbita foetidissima*). In a less disturbed situation this site could progress towards a more monotypic stand of *E. macrostachya* alone.

Cross-Section 6

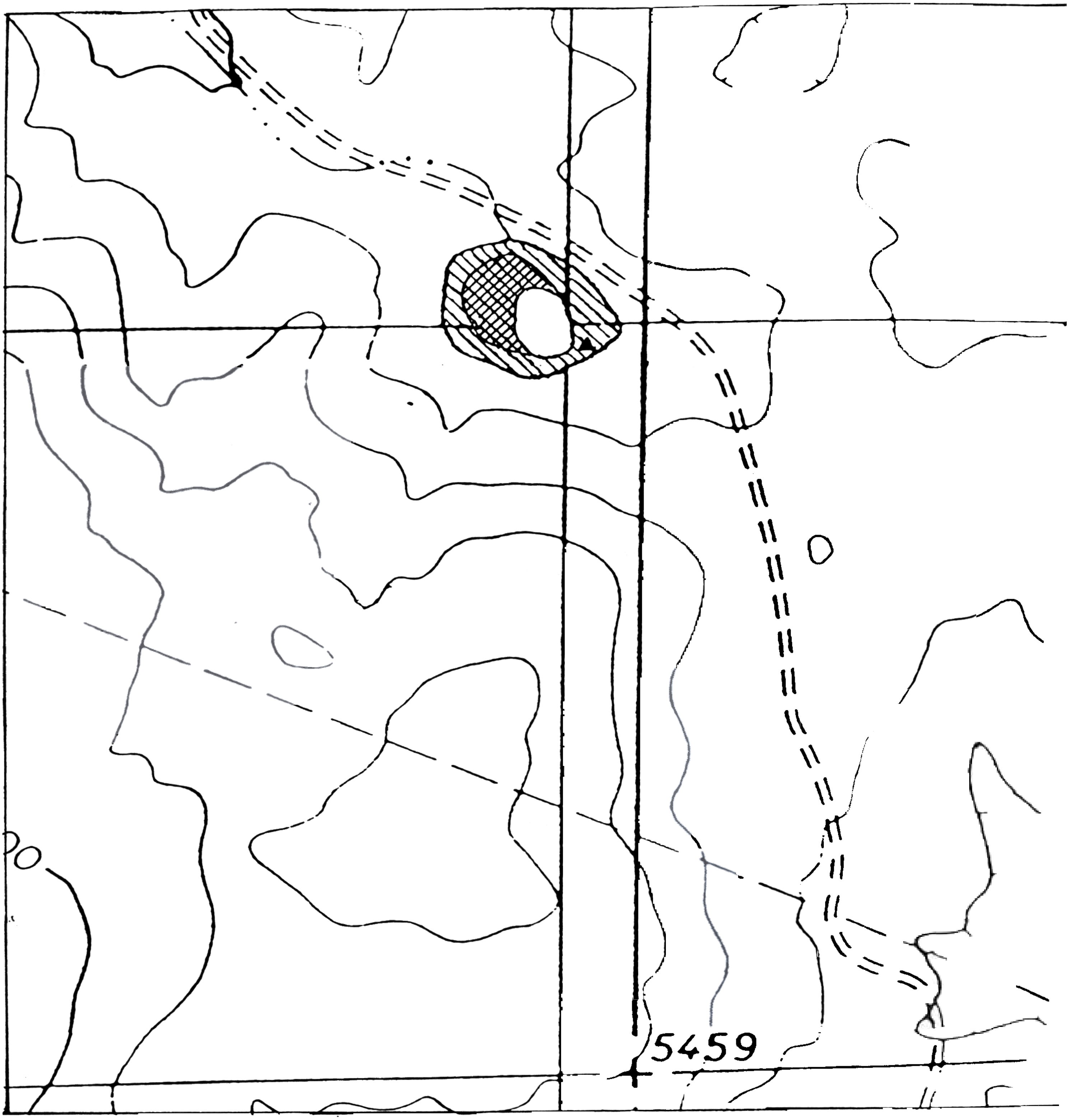


Archuleta Creek. c = Soil Electrical Conductivity Value

KEY

Plot Number	**Community Type and Acronyms**	**Soil Type and Acronyms**
NR009	*Eleocharis macrostachya/Schedonnardus paniculatus* longstem spikerush/tumblegrass ELMA/SCPA	Typic Haplotorrert THT

Vegetation Map Community Types and Plot Location - Archuleta Creek



Archuleta Creek: 8/21/93
T09SR18E sect. 01

N

KEY	Community Types	Plots
▨	longstem spikerush/tumblegrass (ELMA/SCPA)	93NR009 ▲
▩	non-vegetated	no plot
☐	open water	

Scale 1:6,000

Site Description

Arroyo Serrano Lake

This playa located in Lincoln County (T08SR19E) is a relatively small and remote basin moderately disturbed by cattle grazing. A series of small ponds and herbaceous dominated islands characterize this basin. Bordering the basin is a mesquite community belonging to the Prosopis Glandulosa Series. Cross-Section No. 7 depicts the location of the plot from the top of the basin to the water's edge and indicates the Community Type, the Soil Types, the Plot Number, and the Soil Conductivity Value. The Vegetation Map outlines the Community Types showing the location of the plot in relation to the water. Aquatic invertebrate diversity is moderate.

Watershed Size: 100 acres
Playa Size: 4 acres
Permanance of Water: ephemeral
Sources of Degradation or Pollution: Disturbance from grazing is moderate. The size of the plant community appears to be limited by grazing. Cover for nesting could be improved if cattle were removed from the site.

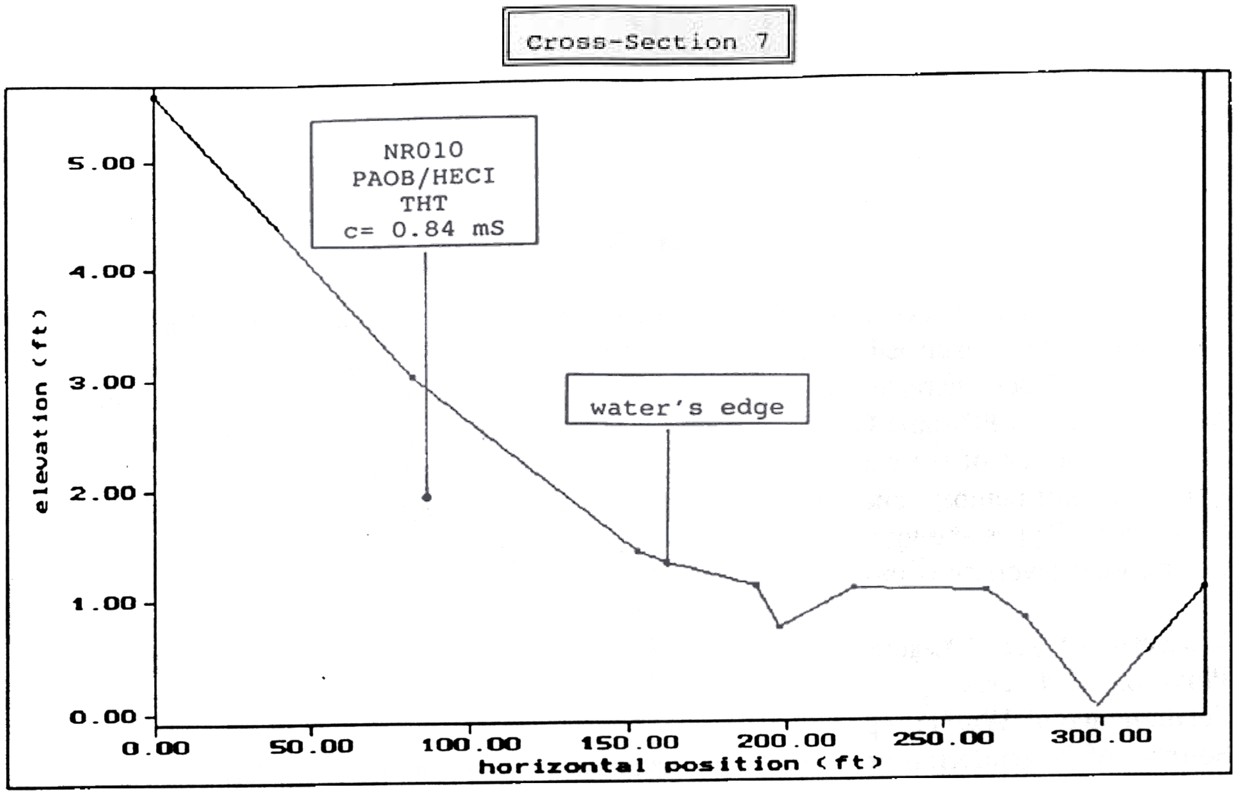
Community Descriptions:

1. *Panicum obtusum/Helianthus ciliaris c.t.* (vine mesquite/blueweed sunflower)

Environmental Setting: This type is represented by herbaceous dominated vegetation. Species composition appears to be influenced by grazing where the size of the community may be suppressed from such disturbance. The elevation is approximately 4920 ft with flat to gently undulating slopes. Soils are classified as Vertisols and Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline, non-calcareous, and meet the criteria for hydric soils (Federal Interagency Committee for Wetland Delineation 1989). Electrical conductivity is very low; 0.84 mS. This type is likely to occur elsewhere in the Southern Great Plains.

Vegetation: Vine mesquite (*Panicum obtusum*), a facultative plant (FAC), is luxurient and dominates this community type in the graminoid layer. Blueweed sunflower (*Helianthus ciliaris*), a facultative plant (FAC), is well-represented and codominates this type in the forb layer.

Comments: Notable species present at this playa include longstem spikerush (*Eleocharis macrostachya*), an obligate plant (OBL), and wedgeleaf frogfruit (*Phyla cuneifolia*) a facultative wetland plant (FACW). Silverleaf nightshade (*Solanum elaeagnifolium*), a ruderal species is also present.

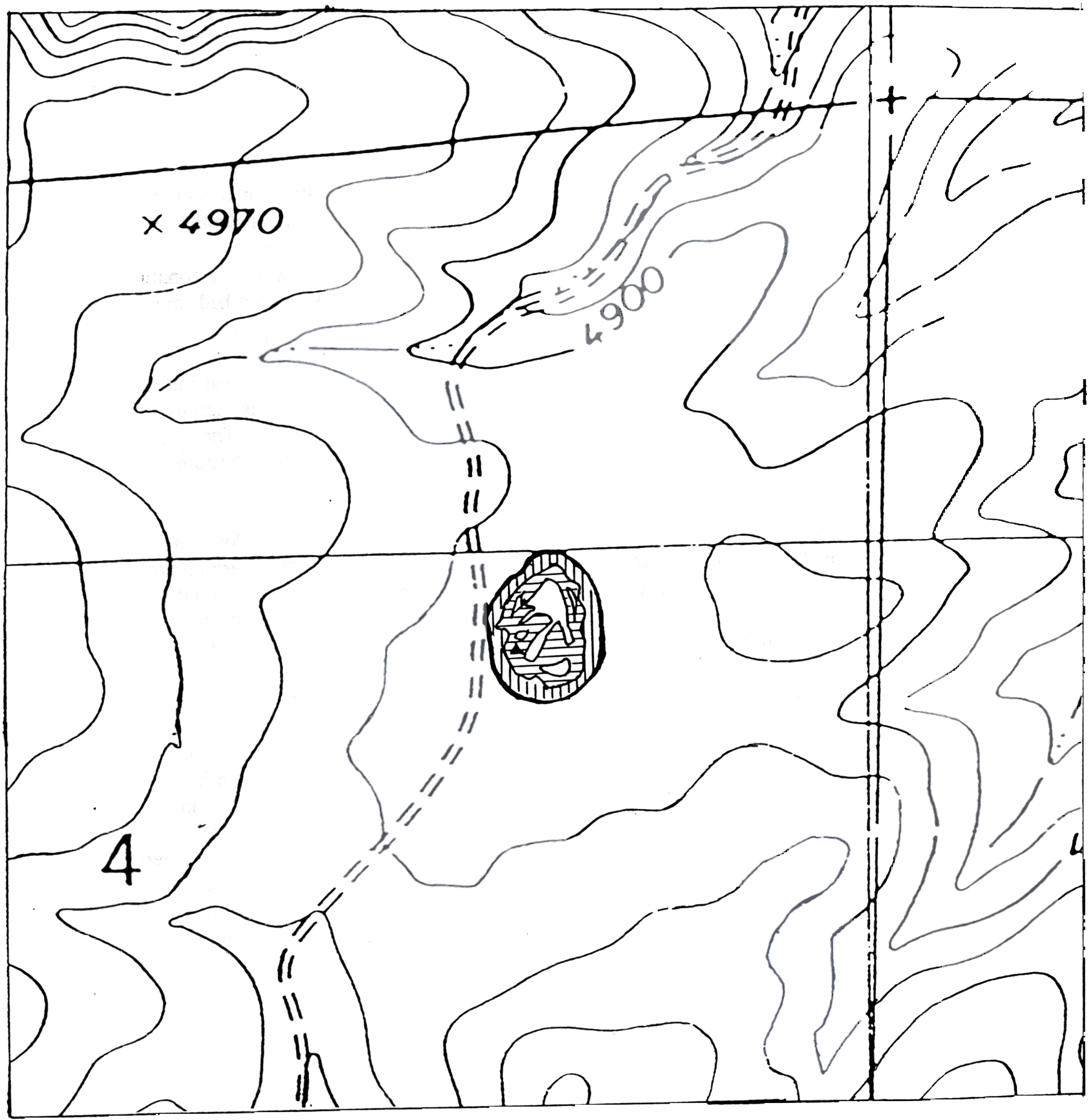


Arroyo Serrano. c = Soil Electrical Conductivity Values

KEY

Plot Number	**Community Type and Acronyms**	**Soil Type and Acronyms**
NR010	*Panicum obtusum/Helianthus ciliaris* vine mesquite/blueweed sunflower PAOB/HECI	Typic Haplotorrert THT

Vegetation Map Community Types and Plot Location - Arroyo Serrano



Arroyo Serrano: 8/21/93
T08SR19E sect. 04

N

KEY	Community Types	Plots
▤	vine mesquite/blueweed sunflower (PAOB/HECI)	93NR010 ▲
▥	upland	no plot
□	open water	

Scale 1:6,000

DISCUSSION

Vegetation. Playa basins may produce vegetative zonation (communities) in concentric bands from the basin center to the perimeter in response to decreasing water depths or soil moisture levels, but such zonation is not typical of all playa basins (Nelson, et.al. 1983a). We found the playas sampled in this investigation tended to show this concentric zonation pattern, but with some nonconformities. For example, Cocklebur Lakes East had three clear zonations that reflect changes in the moisture regime. The interior of the playa was covered by a monotypic stand of longstem spikerush broken up only by ponding water. Species diversity and composition changed towards the exterior of the playa, and a second middle zone dominated by a longstem spikerush/blueweed sunflower community was identified. A third zone occupied the periphery where the moisture regime was the driest. The vegetation changed from herbaceous to shrubby, and was dominated by a sand dropseed/broom snakeweed community.

Due to the ephemeral nature of playas, the floristic composition is seldom stable and may vary seasonally or from year to year. For example, we found newly emerging wetland species (spreading alkali-weed) on the playa beach at Salt Lake. Its emergence could have been delayed due to the season or moisture regime. Nelson (1983a), and Kindscher and Lauver (1993) found this to be true in their studies of playas in Texas and Kansas.

The use of playa basins for grazing of livestock is widespread, and where playas are surrounded by rangeland they may be grazed during the growing season thereby limiting the growth of emergent vegetation (Nelson, et.al. 1983a). The floristic composition of playas may also be altered by livestock grazing (Guthery, et.al., 1982). Their research in North-Central Texas found that grazing of playas promoted an increase of buffalograss and other shortgrass associates, and a decrease of western wheatgrass. The North Ballard Hill playa had a high coverage of buffalograss, and cattle tracks could clearly be seen from the aerial photographs, but the abundance of buffalograss in relation to grazing at this playa is inconclusive. Other sites were dominated by ruderal species that are commonly associated with intensive grazing. The best example is the abundance of the shrubby broom snakeweed (*Gutierrezia sarothrae*) at Cocklebur Lakes East.

The vegetation of the playas were evaluated for the presence of wetland species. Our results indicate that of the seven playas sampled six playas had wetland vegetation present. Only the Presler Lake playa did not have wetland vegetation present at the time of sampling. It is possible that emergence was delayed due to the late monsoonal rains or that grazing could have affected emergence.

Other impacts on the vegetation of the playas include building roads adjacent to or through playas (Cocklebur Lakes East and Archuleta Creek) which may alter the hydrology of the playas by diverting surface water runoff that would normally drain into the playa from an upland source. Additional potential degradational impacts include oil drilling which is present at Curlew Lake. Pollution from brine wastes can have detrimental impacts upon playas by contaminating the water with dissolved solids, chlorides, hydrocarbons, acids, and heavy metals, and thereby destroy an important habitat (Nelson 1983a). Nelson (1983a) also documents reports of waterfowl losses due to oil field brine disposal in five playas of the Texas High Plains.

Soils. The soils were dominated by Vertisols within the playas, and with Aridisols or Entisols bordering the playas. Soils were also evaluated for meeting hydric criteria to determine wetland status. Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season for usually one week or more; thus enabling them to support hydrophytic vegetation (Federal Interagency Committee for Wetland Delineation 1989). The National Technical Committee for Hydric Soils (NTCHS) has developed criteria for hydric soils. According to the Federal Interagency Committee for Wetland Delineation (1989), any area that meets the NTCHS criteria for hydric soils is a wetland. Five of the seven playas had soils that met the criteria. Hydric soils were not established at Salt Lake and Presler Lake, and may have been due to the location of the soil and vegetation plot. However, had the plot at Salt Lake been located on the beach where spreading alkali-weed (*Cressa truxillensis*), a facultative wetland plant (FACW), was beginning to emerge, we believe that hydric soils may have been sampled and established at that site. The beach at Presler Lake was much like that at Salt Lake, however there was no evidence of hydrophytic vegetation at Presler Lake at the time of sampling. Wetland determination for Presler Lake remains inconclusive.

Soils belonging to the order Vertisols are those in which their development is influenced by changes in the moisture regime. They are fine-textured soils where shrinking and swelling properties often cause the surface of the soil to undulate (termed gilgai). When the soil dries and shrinks deep cracks develop and a constant mixing of soil minerals occurs as the fine topsoil falls into the cracks. The deep cracks allow water to infiltrate the soil profile and the soil remoistens and swells (Soil Survey Staff 1988). The organic matter content of Vertisols is low. Their minerology is predominantly montmorillonitic. They are alkaline, thermic and their salinity content is generally low. Discharge of water is primarily through evapotranspiration. Leaching occurs but is extremely slow due to the high clay content. The primary origin of these soils is believed to be either eolian deposits and/or upland surface runoff (Gile, et.al. 1981). Vertisols were found at six playas.

Aridisols are drier and tend to be saltier than other soils, unless they are irrigated. They are mineral soils with a xeric moisture regime. The water available for plant growth is low due either to tension, salinity, or both. Vegetation is usually sparse and those species that are present are adaptive to xeric and/or saline conditions, such as mesquite *Prosopis glandulosa* and saltbush *Atriplex canescens*. Absorbtion of water in these soils is slow and most of the precipitation runs off. Pedogenic horizons develop in these soils because they are not exposed to the same disturbances (mainly flooding) as Vertisols (Soil Survey Staff 1988). Aridisols were found at two playas (Salt Lake and North Ballard Hill).

Entisols for various reasons have little or no evidence of development of pedogenic horizons. They may be new alluvial deposits, or on actively eroding slopes, or they may be very old sandy soils. They are mineral soils and may have any moisture or temperature regime. Vegetation may be typical of a riparian forest with cottonwoods dominating, or grassy and more typical of sand dunes with dropseed or sacaton acting as soil stabilizers (Soil Survey Staff 1988). Entisols were found at one playa (Presler Lake).

Invertebrates. Invertebrate production in playa basins is important to the basic food chains of resident wildlife and migratory waterfowl and shorebirds that visit the playas, and the variety of species and their abundance is as diverse as the playas, depending on the character of playa vegetation (Nelson et.al., 1983a). The invertebrate fauna of playas of the Southwest has been incompletely studied (MacKay et. al. 1990). The taxa collected in this study are similar to previous findings in Texas and New Mexico (Merickel and Wangberg 1981, MacKay et.al. 1990, and Nelson et.al. 1983a).

The most well-known invertebrate produced in playas is the mosquito (Order Diptera). The warm shallow water of playa basins provide superior breeding habitat for mosquitos (Nelson, et.al., 1983a). According to Nelson (1983a) thousands of waterfowl are lost each year from diseases endemic to playas and carried by invertebrates like the mosquito. The most notable disease being encephalitis. Though no mosquitos were collected, they were observed to be present. A more thorough understanding of the invertebrate species composition of playas of eastern New Mexico will render a more complete ecological study.

RECOMMENDATIONS

The following are recommendations that we feel would be beneficial based on our results from this investigation:

1 complete existing project by evaluating the remaining playas in the BLM Roswell Resource Area;

2 collaborate with the New Mexico Environment Department to include measures of water quality relating to pollution;

3 classify the deep soils of the playa bottoms. Our preliminary work shows that often they are Vertisols which may have similar properties to Randall clays. However Nelson (1983a) suggests in his report of playas of the Texas panhandle that it is unlikely that Randall clays occur as far West into New Mexico as Chaves and Lincoln Counties. He also reports that there is no evidence of Randall clays in the New Mexico counties adjacent to Texas; and

4 analyze the invertebrates of the remaining playas in the Roswell Resource Area to greater depths to complete the investigation of playas to assist in our understanding of the ecology of playas.

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APPENDIX A

Appendix A. BLM Lacustrine Survey -- 1993 Plant Species List And Floristic Stand Table. Species names follow Martin and Hutchins (1980), and Correll and Johnston (1979); common names follow Beetle (1970); Rows are species ordered by trees, shrubs, graminoids, and forbs. Columns are plots ordered numerically. Values in the table are scalars of species percent canopy cover using the Domin-Krajina scale as follows:

Scaler to Percent Cover Conversions

P = +0 (Present in the stand)

+ = <0.1 % (Solitary, with insignificant cover)

1 = 0.1 TO 0.4% (Seldom, with insignificant cover)

2 = 0.5 TO 0.9% (Very scattered, with small cover)

3 = 1 TO 4% (Scattered cover)

4 = 5 TO 9%

5 = 10 TO 24%

6 = 25 TO 32%

7 = 33 TO 49%

8 = 50 TO 74%

9 = 75% OR GREATER

Appendix A (Contiued).

BLM Lacustrine Survey -- 1993 Plant Species List And Floristic Stand Table.

Scientific Name	Common Names	Plot Number 1 1234567890
- - TREES - -		
Populus fremontii - mature	Fremont's cottonwood	P.........
- - SHRUBS - -		
Atriplex canescens	fourwing saltbush	.....P....
Chrysothamnus viscidiflorus	Douglas rabbitbrush	3..1.3....
Gutierrezia sarothrae	broom snakeweed	6..1...131
Juniperus monosperma - adv regen	oneseeded juniper	........P.
Opuntia kleiniae	candle cholla	........P1
Prosopis glandulosa	mesquite	PPPPPP33..
Tamarix pentandra	salt cedar	PPP7.354..
- - GRAMINOIDS - -		
Aristida divaricata	poverty threeawn	........3.
Aristida purpurea	purple threeawn	3.........
Aristida ternipes var hamulosa	spider threeawn	.....P....
Bothriochloa saccharoides	silver bluestem	...1.P.1..
Bouteloua barbatus	sixweeks grama	4.........
Bouteloua curtipendula	sideoats grama	........3.
Bouteloua gracilis	blue grama	...1....3.
Buchloe dactyloides	buffalograss	.4.P3.95..
Cenchrus pauciflorus	field sandbur	.....1....
Chloris cucullata	hooded windmillgrass	...2.1....
Chloris verticillata	tumble windmillgrass	...2......
Cyperus uniflorus	oneflower flatsedge	.....1....
Distichlis stricta	inland saltgrass	...5......
Eleocharis macrostachya	longstem spikerush	.39.3...33
Eragrostis cilianensis	stinking lovegrass	33.....11.
Leptoloma cognatum	fall witchgrass	...1......
Muhlenbergia arenicola	sand muhly	........P.
Panicum hallii	Hall's panicgrass	........1.
Panicum obtusum	vine mesquite	33..3.3118
Schedonnardus paniculatus	tumblegrass	........5.
Setaria leucopila	tall bristlegrass	3.........
Sporobolus airoides	alkali sacaton	3..7P.37.3
Sporobolus contractus	spike dropseed	.....3....
Sporobolus cryptandrus	sand dropseed	7...38..3.
Tridens muticus	slim tridens	....1.....
- - FORBS - -		
Amaranthus retroflexus	redroot pigweed	...3....2.
Scutellaria tessellata	skullcap	........1.

Artemisia ludoviciana	Louisiana sagewort	........P.
Asclepias subverticillata	western whorled milkweed	3..1...1..
Calylophus hartwegii	evening primrose	3.........
Cassia roemeriana	senna	........P.
Cirsium neomexicanum	New Mexico thistle	........1.
Conyza canadensis	Canada horseweed	.4........
Cressa truxillensis	spreading alkali-weed	...P......
Cucurbita foetidissima	stinking cucumber	........1.
Cuscuta cuspidata	dodder	....1.....
Euphorbia dentata	toothed spurge	3.........
Euphorbia micromera	littleleaf spurge	.....3....

Appendix A (Contiuned).

BLM Lacustrine Survey -- 1993 Plant Species List And Floristic Stand Table.

Scientific Name	Common Names	Plot Number
		1
		1234567890
Euphorbia prostrata	prostrate spurge	3.........
Euphorbia seriophyle	spurge	....4..32.
Gaillardia pulchella	blanketflower	.....P....
Gaura coccinea	scarlet gaura	4.......P.
Greggia camporum	mustard	3.........
Elymus canadensis	Canada wildrye	........1.
Helianthus ciliaris	blueweed sunflower	381...3..4
Hoffmanseggia densiflora	indian rushpea	111112
Iva axillaris	poverty sumpweed	....9.....
Kallstroemia parviflora	caltrop	+.........
Lepidium montanum	peppergrass	43.....1..
Melampodium leucanthum	plains blackfoot	1
Oxytropis sericea	silky locoweed	........1.
Phyla cuneifolia	wedge-leaf frogfruit	33.......2
Portulaca oleracea	purslane	13
Proboscidea parviflora	New Mexico devilsclaws	........1.
Ratibida tagetes	prairie coneflower	3.....4..3
Salsola kali	russian thistle	.....3....
Salvia reflexa	lanceleaf sage	........1.
Sida leprosa	scurfy sida	.55.3.....
Solanum elaeagnifolium	silverleaf nightshade	3..3.3231P
Solanum rostratum	buffalobur	....1...4.
Sphaeralcea angustifolia	narrowleaf globemallow	........2.
Verbascum thapsus	common mullein	........1.
Verbena bracteata	bracted vervain	.3......1.
Xanthium strumarium	cocklebur	....1.....

APPENDIX B

Appendix B: Descriptions of Playa Soil Profiles

Plot No.: 93NR001
Cross Section: Survey Site 1
Plant Association: sand dropseed/broom snakeweed (SPCR/GUSA)
Location: Cocklebur Lakes East
Classification: Typic Camborthid; coarse-loamy, mixed, calcareous, thermic

Oi: 0 to 1 cm; coarse organic matter.

A1: 0 to 33 cm; light brown to brown (7.5YR 5.5/4 ped/dry); sandy loam (16% clay), brown (7.5YR 4/4 rub/moist); many fine prominent, white (7.5YR 8/1 moist) mottles; medium weak subangular blocky; soft (dry), very friable (moist), and sticky (wet); many very fine, common fine, common medium, and few coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 7.88; conductivity 3.68 mS; gradual wavy boundary.

C1: 33 to 81 cm; reddish yellow to strong brown (7.5YR 5.5/6 ped/dry); sandy loam (12% clay), strong brown (7.5YR 5/6 rub/moist); many fine distinct, pink (7.5YR 7/3 moist) mottles; very weak coarse platy; hard (dry), friable (moist), and slightly-plastic (wet); few very fine, few fine, common medium, and few coarse pores; common very fine, common fine, few medium, and few coarse roots; pH 7.92; medium effervescence; clear smooth boundary.

C2: 81 to 96 cm; yellowish red (5YR 5/6 ped/dry); loamy sand (7% clay), strong brown (7.5YR 5/6 rub/moist); many fine prominent pink (5YR 7/3 moist) mottles; very weak coarse platy; very hard (dry), friable (moist), and sticky (wet); common very fine, few fine, few medium, few coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 7.75; medium effervescence.

Plot No: 93NR002
Cross Section: Survey Site 1
Plant Association: longstem spikerush/blueweed sunflower (ELMA/HECI)
Location: Cocklebur Lakes East
Classification: Typic Haplotorrert; very fine, mixed, calcareous, thermic

Oi: 0 to 1 cm; litter

C1: 0 to 89 cm; brown (7.5YR 4/2 rub/moist); clayey (70% clay); common medium faint, brown (7.5YR 4/4 moist) and common fine prominent, pinkish white (7.5 YR 8/2 moist) mottles; massive; very hard (dry), very friable (moist), and very plastic (wet); many very fine, common fine, common medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.75; conductivity 2.48 mS; medium effervescence.

Plot No: 93NR003
Cross Section: Survey Site 1
Plant Association: longstem spikerush/scurfy sida (ELMA/SILE)
Location: Cocklebur Lakes East
Classification: Typic Haplotorrert; very fine, mixed, calcareous, thermic

C1: 0 to 81 cm; dark reddish brown (5YR 3/3 rub/moist); clayey (80% clay); massive; very hard (dry), very friable (moist), and very plastic (wet); many very fine, many fine, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.81; conductivity 1.5 mS; medium effervescence.

Horizon moist but not saturated.

Plot No: 93NR004
Cross Section: Survey Site 2
Plant Association: salt cedar/alkali sacaton (TAPE/SPAI)
Location: Salt Lake
Classification: Aquic Camborthid; coarse-loamy over very fine over coarse-loamy over very fine, mixed, nonacid, thermic

A1: 0 to 41 cm; yellowish red (5YR 4/6 rub/moist); loamy sand (7% clay); fine weak subangular blocky; soft (dry), loose (moist), and non-plastic (wet); many very fine, many fine, many medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.53; conductivity 12.03 mS; medium effervescence; clear smooth boundary.

Bs1: 41 to 58 cm; red (2.5YR 4/6 rub/moist); sandy clay (50% clay); massive; soft (dry), loose (moist), and slightly plastic (wet); many very fine, many fine, common medium, and few coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 8.37; medium effervescence; gradual wavy boundary.

C1: 58 to 68 cm; yellowish red (5YR 5/8 ped/moist); loamy sand (5% clay), red (2.5YR 4.5/6 rub/moist); fine weak sub-angular blocky; soft (dry), very friable (moist), and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; pH 8.43; no effervescence; gradual wavy boundary.

C2: 68 to 85 cm; red (2.5YR 4/6 ped/moist); sandy loam (12% clay); weak medium sub-angular blocky; slightly hard (dry), friable (moist), and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.28; no effervescence; broken irregular boundary.

Cg1: 85 to 106 cm; light yellowish brown (2.5YR 6/3 ped/moist); clayey (60% clay), light olive brown (2.5Y 5/3 rub/moist); common medium distinct, light gray to gray (N6.5/1 rub/moist) mottles; massive; hard (dry), very friable (moist), and very plastic (wet); few very fine, few fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 8.21; medium effervescence.

Matrix color in C3 is affected by uncoated grains.
Dark reddish brown (2.5YR 3.5/4 ped/moist) clay lamellae common in C3.
Ant pores common in C1.

Plot No: 93NR005
Cross Section: Survey Site 3
Plant Association: longstem spikerush-vine mesquite/poverty sumpweed (ELMA-PAOB/IVAX)
Location: Curlew Lake
Classification: Typic Haplotorrert; very fine, mixed, calcareous, thermic

Css1: 0 to 94 cm; reddish brown (5YR 4/4 rub/moist); clayey (75% clay); few fine prominent white (5YR 8/1) mottles; medium fine sub-angular blocky; very hard (dry), firm (moist), and sticky (wet); common very fine, common fine, few medium, and few coarse roots; many very fine, few fine, few medium, and few coarse pores; pH 8.17; conductivity 7.88 mS; medium effervescence.

Extensive oil development.

Plot No: 93NR006
Cross Section: Survey Site 4
Plant Association: sand dropseed/Douglas rabbitbrush (SPCR/CHVI)
Location: Presler Lake
Classification: Typic Torrifluvent; coarse-loamy, mixed, calcareous, thermic

C1: 0 to 80 cm; strong brown (7.5YR 5/6 ped/moist); loamy sand (4% clay), brown (7.5YR 5/4 rub/moist); many medium faint reddish yellow (7.5YR 6/6) mottles; single grain; loose (dry), loose (moist), and non-plastic (wet); many very fine, many fine, common medium, and few coarse roots; few very fine, few fine, common medium, and few coarse pores; pH 8.06; conductivity .64 mS; medium effervescence; irregular wavy boundary.

C2: 80 to 85 cm; dark brown (7.5YR 3/4 rub/moist); silt loam (15% clay); massive; hard (dry), very friable (moist), and sticky (wet); many very fine, many fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 8.08; medium effervescence; gradual wavy boundary.

C3: 85 to 124 cm; brown (7.5YR 4.5/4 ped/moist); loamy sand (4% clay); single grain; loose (dry), loose (moist), and non-plastic (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, few fine, common medium, and few coarse pores; pH 8.30; medium effervescence; gradual smooth boundary.

C4: 124 to 137 cm; brown (7.5YR 4/4 rub/moist); sandy loam (8% clay); weak fine sub- angular blocky; soft (dry), friable (moist), and slightly plastic (wet); few very fine, few fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.34; medium effervescence.

Uncoated grains in C1, C2, and C4 affect matrix color.
Pit next to upland drainage.

Plot No: 93NR007
Cross Section: Survey Site 5
Plant Association: salt cedar/buffalograss (TAPE/BUDA)
Location: North Ballard Hill
Classification: Typic Haplotorrert; very fine, mixed, calcareous, thermic

C1: 0 to 16 cm; brown (7.5YR 4/4 rub/moist); clayey (80% clay); massive; hard (dry), firm (moist), and plastic (wet); many very fine, common fine, few medium, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.85; conductivity 2.85 mS; medium effervescence; clear smooth boundary.

C2: 16 to 95 cm; brown (7.5YR 4/3 rub/moist); clayey (55% clay); many medium prominent, pink (7.5YR 8/3) mottles; weak medium sub-angular blocky; hard (dry), very friable (moist), and sticky (wet); many very fine, common fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.72; medium effervescence.

Plot No: 93NR008
Cross Section: Survey Site 5
Plant Association: alkali sacaton/buffalo grass (SPAI/BUDA)
Location: North Ballard Hill
Classification: Typic Camborthid; fine-loamy, mixed, calcareous, thermic

A1: 0 to 17 cm; light brown (7.5YR 6/4 ped/moist); silt loam (10% clay), brown (7.5YR 5/4 rub/moist); single grain; loose (dry), friable (moist), and slightly plastic (wet); common very fine, many fine, few medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; pH 7.91; conductivity 2.28 mS; medium effervescence; abrupt smooth boundary.

C1: 17 to 78 cm; strong brown (7.5YR 5/6 ped/moist); silt loam (8% clay), brown (7.5YR 5/4 rub/moist); many medium distinct, brown (7.5YR 4/3) and many fine distinct, pinkish white (7.5YR 8/2) mottles; weak medium platy; soft (dry), friable (moist), and slightly plastic (wet); common very fine, common fine, few medium, and few coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 7.71; medium effervescence.

C1 layer very difficult to excavate.
Two pink (7.5YR 7/3) lenses occur in A1.

Plot No: 93NR009
Cross Section: Survey Site 6
Plant Association: longstem spikerush/tumblegrass (ELMA/SCPA)
Location: Archuleta Creek
Classification: Typic Haplotorrert; very fine, mixed, nonacid, mesic

Css1: 0 to 25 cm; dark brown (7.5YR 3/2 ped/moist); clayey (60% clay), brown to dark brown (7.5YR 3.5/2 rub/moist); massive; hard (dry), very friable (moist), and sticky (wet); few very fine, few fine, few medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; trace of cobbles; pH 7.42; conductivity .92 mS; no effervescence; diffuse smooth boundary.

C1: 25 to 85 cm; dark brown (7.5YR 3/2.5 ped/moist); clayey (60% clay), dark brown to brown (7.5YR 3.5/2 rub/moist); many, medium, prominent, pink (7.5YR 8/3) mottles; weak fine platy; very hard (dry), firm (moist), and sticky (wet); few very fine, few fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; trace of gravel; pH 7.37; no effervescence.

Cobbles and stones are common in playa floodplain.

Plot No: 93NR010
Cross Section: Survey Site 7
Plant Association: vine mesquite/blueweed sunflower (PAOB/HECI)
Location: Arroyo Serrano
Classification: Typic Haplotorrert; very fine, mixed, nonacid, mesic

Oi: 0 to 3 cm; organic matter
A1: 0 to 7 cm; brown (7.5YR 4/3 ped/moist); clayey (50% clay), dark brown to brown (7.5YR 3.5/2 rub/moist); common medium distinct, very dark gray (7.5YR 3/1) mottles; massive; soft (dry), very friable (moist), and very plastic (wet); many very fine, many fine, few medium, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.31; conductivity .84 mS; traces of gravel and cobbles; no effervescence; and gradual smooth boundary.

C1: 7 to 102 cm; brown (7.5YR 4/2 ped/moist); clayey (70% clay), brown (7.5YR 4/3) rub/moist weak fine sub-angular blocky; hard (dry), firm (moist), and plastic (wet); many very fine, many fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.48; no effervescence.

Playa surface undulating.

APPENDIX C

Appendix C. List of invertebrate taxa collected from playa lakes in the BLM Roswell Resource Area of Southeastern New Mexico. Taxa are grouped by local.

East Cocklebur Lake
- Order Coleoptera
  - Family Hydrophilidae (adult and larvae)
  - Family Hydrophilidae (larva of *Berosus sp.*)
  - Family Dytiscidae (adult and larvae, two different taxa)
- Order Heteroptera
  - Family Corixidae
- Order Ephemeroptera
  - Family Baetidae
- Order Odonata
  - Family Aeschniidae
- Order Podocopa (Subclass Ostracoda)
- Order Conchostraca
  - Family Caenestheriidae (*Eocyzicus sp.*)
  - Family Limnadiidae
  - Family Leptestheriidae (*Leptestheria compleximanus*)

Salt Lake
- Order Coleoptera
  - Family Hydrophilidae (larvae, *Berosus sp.*)
- Order Anostraca
  - Family Artemiidae (*Artemia salina*)
- Order Trichoptera
  - Family Glossosomatidae (larva, specimen damaged)

Curlew Lake
- Order Coleoptera
  - Family Dytiscidae (larva)
  - Family Hydrophilidae (larva, *Berosus sp.*)
  - Family Hydrophilidae (adult, tentative identification-*Helochares sp.*)
- Order Conchostraca
  - Family Leptesteriidae (*Leptestheria compleximanus*)
  - Family Caenesteriidae (*Eocyzicus digueti*)
- Order Notostraca
  - Family Triopsidae (*Triops longicaudatus*)

Presler Lake
- Order Anostraca
  - Family Artemiidae (*Artemia salina*)

North Ballard Hill Lake
- Order Heteroptera
  - Family Corixidae
- Order Coleoptera
  - Family Dytiscidae (adults and larvae, possibly two different taxa)

- Family Hydrophilidae (adults and larvae, two taxa)

Order Ephemeroptera
- Family Baetidae

Order Conchostraca
- Family Limnadiidae (*Eulinmadia sp.*)

Appendix C. List of invertebrate taxa by local (continued)

Archuleta Lake

Order Coleoptera
 Family Hydrophilidae (adult and larva of *Berosus sp.*)
Order Hemiptera
 Family Corixidae
Order Anostraca
 Family Streptocephalidae (*Streptocephalus dorothrae*)
 Family Thamnocephalidae (*Thamnocephalus platyurus*)
Order Notostraca
 Family Triopsidae (*Triops longicaudatus*)
Order Eucopepoda (Suborder Calanoida)

Arroyo Serrano Lake

Order Anostraca
 Family Thamnocephalidae (*Thamnocephalus platyurus*)
 Family Streptocephalidae (*Streptocephalus dorothrae*)
Order Conchostraca
 Family Leptestheriidae (*Leptestheria compleximanus*)
 Family Caenestheriidae (*Eocyzicus digueti*)
Order Notostraca
 Family Triopsidae (*Triops longicaudatus*)