UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: Salt Meadow (SD-3, SD-2)

Site ID: R042XB028NM

Major Land Resource Area: 042 - Southern Desertic Basins, Plains, and Mountains

Physiographic Features

The topography is level to gently sloping with slopes up to 3 percent. The average slope is 1 percent or less. Elevations range from about 3,300 feet to 4,300 feet above sea level.

Land Form:
(1) Basin floor
(2) Playa
(3) Flood plain

	Minimum	Maximum
Elevation (feet):	3300	4300
Slope (percent):	0	3
Water Table Depth (inches):	24	36
Flooding:		
Frequency:	Rare	Occasional
Duration:	Extremely brief	Very brief
Ponding:		
Depth (inches):	N/A	N/A
Frequency:	N/A	N/A
Duration:	None	None
Runoff Class:	Low	High
Aspect:	No Influence on this site	

Climatic Features

Annual average precipitation ranges from 8 to 13 inches. Wide fluctuations from year to year are common, ranging from a low of about 2 inches to a high of over 20 inches. At least one-half of the annual precipitation comes in the form of rainfall during July, August, and September. Precipitation in the form of snow or sleet averages less than 4 inches annually. The average annual air temperature is about 61 degrees F. Summer maximums usually exceed 100 degrees F., and winter minimums can go below zero. The average frost-free season exceeds 200 days and extends from April 1 to November 1. Both the temperature regime and rainfall distribution favor warm-season perennial plants on this site. Spring moisture conditions are only occasionally adequate to cause significant growth during this period of the year. High winds from the west and southwest are common from March to June, which further tends to create poor soil moisture conditions in the springtime.

	Minimum	Maximum
Frost-free period (days):	179	212
Freeze-free period (days):	200	233
Mean annual precipitation (inches):	8.0	10.5

Monthly precipitation (inches) and temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Min.	0.37	0.36	0.23	0.18	0.29	0.57	1.42	1.92	1.53	1.01	0.48	0.57
Precip. Max.	0.54	0.39	0.27	0.36	0.45	0.64	1.9	2.2	1.66	1.07	0.58	0.78
Temp. Min.	20.8	25.5	31.2	38.0	46.4	54.3	61.1	59.1	51.5	39.8	28.8	22.3
Temp. Max.	58.1	63.8	71.0	79.3	87.4	96.4	95.5	92.7	87.5	78.7	67.2	58.8

Climate Stations:
(1) NM3855, Hatch. Period of record 1961 - 1990
(2) NM8387, Socorro. Period of record 1961 - 1990

Influencing Water Features

This site is primarily found in the floodplains of the Rio Grande and Pecos rivers. Water tables are generally shallow but fluctuate within reach of deep rooted plants, and in most places are high enough that salts accumulate on the surface of the soil. The general aspect of this site is that of a wet, grassy meadow. This site is characterized by plants tolerant to saline or alkaline and to wet soil conditions.

Wetland Description:	System	Subsystem	Class
(Cowardin System)	Riverine	Lower Perennial	Unconsolidated Bottom

Representative Soil Features

The soils of this site are alluvial. They have surface and sub-soil textures that generally are fine to moderately coarse-textured and are primarily found in the floodplains of the Rio Grande and Pecos river. Water tables are generally shallow but fluctuate within reach of deep rooted plants, and in most places are high enough that salts accumulate on the surface of the soil

Predominant Parent Materials:
Kind: Marine deposits
Origin: Gypsum

Surface Texture:	(1)	Coarse sand
	(2)	Silt
	(3)	Clay
Subsurface Texture Group:		Loamy
Surface Fragments <=3" (% Cover):		0
Surface Fragments > 3" (% Cover):		0
Subsurface Fragments <=3" (% Volume):		9
Subsurface Fragments > 3" (% Cover):		0
Drainage Class:		Somewhat poorly drained To Poorly drained
Permeability Class:		Moderately slow To Very slow

	Minimum	Maximum
Depth (inches):	4	60
Electrical Conductivity (mmhos/cm):	4	16
Sodium Absorption Ratio:	N/A	N/A
Calcium Carbonate Equivalent (percent):	N/A	N/A
Soil Reaction (1:1 Water):	7.9	9.0
Soil Reaction (0.01M CaCl2):	N/A	N/A
Available Water Capacity (inches):	3.0	5.0

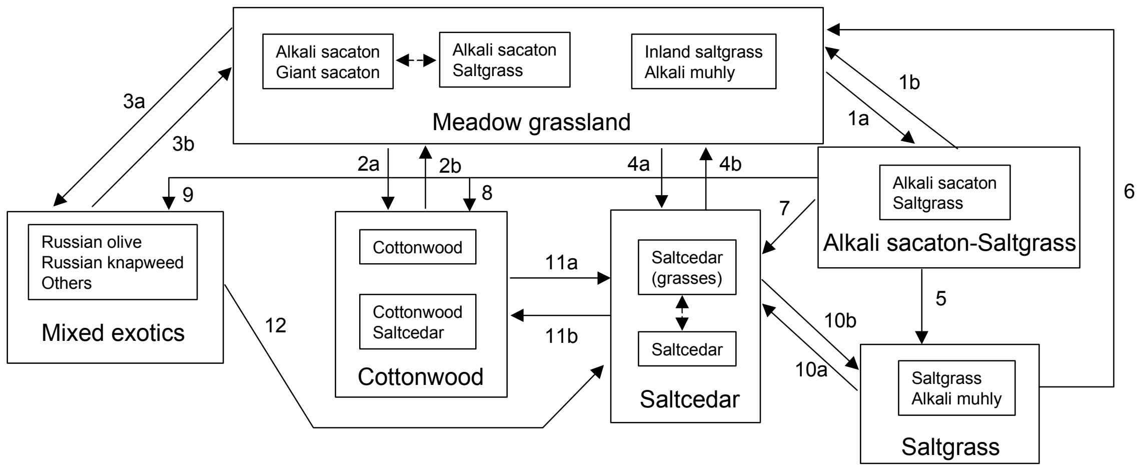
Plant Communities

Ecological Dynamics of the Site

Overview

The historic plant community type of this site is dominated by alkali sacaton (*Sporobolus airoides*) and giant sacaton (*Sporobolus wrightii*). Inland saltgrass (*Distichlis spicata*) dominates secondarily, often in discrete patches. Sedges and rushes are common and screwbean mesquite (tornillo; *Prosopis pubsecens*) may be an important woody species. On the banks of the Rio Grande river, this site probably existed in a broad-scale, shifting mosaic with cottonwoods (*Populus deltiodes* var. *wislizeni*), mesquite stands (*Prosopis* spp.), and salty bottomland grasslands determined by changes in the river course. The grassland community is supported in areas where the depth to the water table is shallow and where flooding and drainage may stabilize salinity levels. Grazing may reduce both giant and alkali sacaton and increase the proportional representation of saltgrass. As salinity increases due to reductions of flood frequency, flood volume, or changes to soils or water table depth, a critical value may be crossed such that giant sacaton cannot survive. With continued overgrazing, changes in hydrology and increased salinity, or mechanical disturbance, saltgrass may become established (or vegetatively expand) and become dominant. Alternatively, fire or disturbance, perhaps in the context of dry soils, may produce a state dominated by exotics such as Russian olive *(Elaeagnus angustifolia)* or Russian knapweed (*Acroptilon repens)* as well as native species characteristic of more arid habitats. Periodic river floods may cover grassland areas with sediments on which cottonwood trees establish. Any state may be colonized by saltcedar (tamarisk; *Tamarix ramosissima*) once propagules are available. This transition may be favored by reduced flooding frequencies, disturbance, drier soils, or increases in salinity. Saltcedar invasion may cause severe ecosystem changes including vegetation structure, increases in fire frequency, and greatly increased salinity at the surface of the soil. Once it has invaded, this plant often progresses to extreme dominance. Mechanical removal measures and herbicides applied to exotic species may be used to recover grassland and cottonwood states.

State-Transition model: MLRA 42, SD-2, Saline lowland site group: Salt Meadow



1a. Decrease in flooding, increasing salt concentration, soil drying?, grazing. **1b**. Flushing of salts?
2a, 8. Flooding and sediment deposition. **2b**. Tree removal
3a, 9. Propagules, fire/disturbance with soil drying. **3b**. Herbicide, fire, mechanical removal, irrigation
4a, 7,10a,12. Propagules introduced, possibly favored in low flooding, high salinity, disturbed setting
4b. Herbicide, fire, mechanical removal, irrigation/elevated water table, seeding
5. Mechanical disturbance, overgrazing
6. Removal of saltgrass?, flushing of salts?, seeding
10b. Herbicide, fire, mechanical removal of exotics.
11a. Tree removal and colonization. **11b.** Herbicide, fire, mechanical removal, irrigation, plantings

MLRA 42; SD-2; Salt meadow

Alkali sacaton-saltgrass state

- Alkali sacaton, inland saltgrass cattails, rushes. No giant sacaton.
- Abundant cover, wet soil
- Rio Grande floodplain, Socorro Co.

Saltgrass state (Tamarisk state background)

- Inland saltgrass, alkali muhly, tamarisk in background
- Salt accumulation visible, soil dry
- Rio Grande floodplain, Socorro Co.

Tamarisk state

- Tamarisk, saltgrass, alkali muhly, right
- No grass, abundant leaf litter inside tamarisk patch.
- Burned tamarisk, resprouting, left
- Rio Grande floodplain, Socorro Co.

Cottonwood bosque

- Cottonwoods, willows
- No grass, abundant leaf litter
- May be interspersed with salt meadow site.
- Rio Grande floodplain, Socorro Co.

Plant Community Name: Historic Climax Plant Community

Plant Community Sequence Number: 1 Narrative Label: HCPC

Plant Community Narrative:

State Containing Historic Climax Plant Community

Meadow Grassland Plant Community

The historic plant community is dominated by giant sacaton and alkali sacaton and harbors several other grass species including vine mesquite (*Panicum obtusum*) and tobosa (*Pleuraphis mutica*). Sedges and rushes are also common. Inland saltgrass and alkali muhly (*Muhlenbergia asperifolia*) often occur in flooded patches, perhaps were salts accumulate due to poor drainage or due to disturbance. Little is known about the environmental variables along which grass species segregate. Reductions in the sacaton species, particularly giant sacaton, may occur with grazing pressure or perhaps due to reduction in the water table. These communities used to occur alongside meadow communities on low salinity soils in the Rio Grande valley, but the non-saline communities have been largely eliminated by agriculture (Fosberg 1940).

Diagnosis: Giant sacaton and alkali sacaton are co-dominant. Sedges and rushes present.

Ground Cover (Average Percent of Surface Area).	
Grasses & Forbs	45
Bare ground	25
Surface gravel	1
Surface cobble and stone	0
Litter (percent)	29
Litter (average depth in cm.)	4

Plant Community Annual Production (by plant type):

Plant Type	Annual Production (lbs/ac) Low	RV	High
Grass/Grasslike	975	1300	1625
Forb	180	240	300
Tree/Shrub/Vine	345	460	575
Lichen			
Moss			
Microbiotic Crusts			
Totals	1500	2000	2500

Shrub and half shrub canopy on this site averages 15%. In addition, there may be an overstory of scattered cottonwood and/or willow trees, usually having a conopy of less than 20%.

Meadow Grassland Plant Community Plant Species Composition: Plant species are grouped by annual production **not** by functional groups.

Group	Grass/Grasslike Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
1	alkali sacaton	*Sporobolus airoides*	600	800
	giant sacaton	*Sporobolus wrightii*		
2	inland saltgrass	*Distichlis spicata*	200	300
3	sedge	*Carex*	100	200
	rush	*Juncus*		
4	vine mesquite	*Panicum obtusum*	20	100
5	common reed	*Phragmites australis*	20	60
6	tobosagrass	*Pleuraphis mutica*	20	60
7	Grass, perennial		20	100

Group	Shrub/Vine Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
8	iodinebush	*Allenrolfea occidentalis*	160	240
	seepwillow	*Baccharis salicifolia*		
	pickleweed	*Salicornia spp.*		
	screwbean mesquite	*Prosopis pubescens*		
9	Fremont cottonwood	*Populus fremontii*	0	60
10	arrowweed	*Pluchea sericea*	20	100
	willow	*Salix*		

Group	Forb Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	High
11	desert seepweed	*Suaeda suffrutescens*	60	160
12	Forb, perennial		100	200

Plant Growth Curve:

Growth Curve Number: NM2515

Growth Curve Name: Meadow Grassland State Plant Community

Growth Curve Description: SD-2 Warm Season Sub-irrigated site.

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	10	15	25	20	10	5	0	0

Additional States:

Transition to alkali sacaton-saltgrass state (1a): Increasing salinity due to changes in flooding regime (i.e. decreased frequency or volume) and/or to changes in the permeability of the soil due to soil-surface exposure and compaction, initiated by grazing or disturbance, may lead to the loss of giant sacaton. Without repeated flooding and drainage of salts into the ground water, sites with shallow water tables accumulate salts due to capillary rise (Hendrickx et al. 1999).

Key indicators of approach to transition: Increases in bare ground cover, salinity, reduced frequency and volume of flooding.

Transition to cottonwood state (2a): This transition used to occur independently of human influence and is considered a natural component of dynamics. Overbank flooding with sediment agradation may kill grasses and provide a substrate for germination and growth of cottonwood, as well as exotics.

Transition to mixed exotics state (3a): May be due to disturbance, via mechanical means or by overgrazing, where propagules of exotics are available.

Transition to saltcedar state (4a): Reduced flooding frequency with associated increases in salinity, or perhaps due to reduced water tables. This probably also requires disturbance to vegetation and the presence of propagules of exotics. The lowering of the water table and increasing salinity may reduce the resistance of the meadow communities to saltcedar invasion (Tesky 1992, Di Tomaso 1998). Disturbances (e.g. grazing) may facilitate saltcedar establishment by reducing competition (Di Tomaso 1998, Stromberg 1998). Periodic flooding disturbances, however, may inhibit the establishment of saltcedar.

Key indicators of approach to transition: Increases in bare ground cover, increased salinity, reduced frequency and volume of flooding, lowering of water table.

Alkali sacaton-saltgrass: This site differs from the meadow grassland largely by the absence of giant sacaton, a large grass that is an important structural element of the historic community. It is unknown which other elements may differ within this state. Soil salinity is presumably higher within the state. Saltgrass assumes greater importance.

Diagnosis: Giant sacaton is absent over extensive areas, and alkali sacaton is dominant. Saltgrass may dominate many patches.

Transition to saltgrass state (5): The transition is caused by increasing salinity with soil compaction, and may also require mechanical disturbance or heavy grazing. If sacaton species are eliminated and the relatively unpalatable saltgrass expands in area, the dense roots of saltgrass effectively preempt space and inhibit germination by other species. Saltgrass reproduction by seed is poor under highly saline conditions, so vegetative reproduction through rhizomes is usually responsible for expansion (Hansen et al. 1976, Cluff and Roundy 1988).

Key indicators of approach to transition: Increases in bare ground cover and loss of sacaton plants, increases in salinity, increasing soil compaction.

Transition to saltcedar state (7): See 3a above.

Transition to mixed exotics state (9): See 4a above.

Saltgrass grassland: This state is characterized by a dense mat of saltgrass that may be interspersed with patches of alkali muhly. The dense root mass of saltgrass precludes establishment by other species and diversity is generally low in this state. Saltgrass is believed to tolerate a higher level of salinity than the sacaton species and is able to expand in compacted, clay soils by virtue of its rhizome morphology (Hansen et al. 1976). Saltgrass is also very flood tolerant (Uchytil 1990). Patches in this state are often associated with saltcedar-dominated patches.

Diagnosis: Saltgrass is extremely dominant, almost completely covering the ground surface. Exposed soil often reveals encrusted salt.

Transition to mixed exotics or saltcedar state (10a): See 4a above. Disturbance to saltgrass may be especially important to allow invasion, considering the dominance exerted by saltgrass. Campbell and Dick Peddie (1964) note that saltcedar does not grow well in saltgrass-dominated communities when the water table is within 3 feet (1 m). Observations in the Rio Grande valley by Darrell Reasner (NRCS Socorro), however, dispute this claim. He feels that tamarisk establishment is not limited in saltgrass.

Transition to meadow grassland state (6): Unknown. May require the disruption of saltgrass root systems, but this would make the community susceptible to invasion by exotics (transition 10a or 11a). The return of flooding events and/or irrigation (see Hendrickx et al. 1999) to remove salt concentrations would probably be needed if salt limits sacaton establishment. Seeding may also be necessary.

Saltcedar: Saltcedar may come to dominate in systems where water tables are lowered and where disturbance has occurred. Dense stands of saltcedar occur in areas where the water table is from 5-20 feet (1.5-6 m; Tesky 1992). Saltgrass may persist in depressions and areas between saltcedar patches, but this grass tends to be absent within saltcedar patches. Saltcedar has been described as an opportunistic species that is not a strong competitor (Everitt 1998). Nonetheless, two feedback mechanisms may promote extreme dominance by this species. First, salts drawn from below the soil surface are excreted through glands in stems and leaves and concentrate on the soil surface, producing a saline crust that inhibits germination and survival of other species. Second, saltcedar is tolerant of fire. Litter accumulation in dense stands leads to fire frequencies of 16-20 years in some systems (Tesky 1992). In principle, this might help to exclude less fire tolerant species but the increased salinity and competitive interactions with established, dense saltcedar stands probably play a primary role in maintaining saltcedar dominance. Within the saltcedar state, natural (flooding) and management-induced disturbances (mowing) may promote a grassland aspect (Taylor and McDaniel 1998). Fire disturbances may also temporarily alter species composition of tamarisk communities.

Diagnosis: Saltcedar is dominant, sometimes forming impenetrable stands. Grass cover (particularly saltgrass and alkali muhly) may occur in areas where saltcedar densities are lower.

Transition to meadow grassland state (4b): Unknown. A combination of herbicide use, burning, and mechanical control can be used to clear saltcedar (Taylor and McDaniel 1998). The use of subsurface herbicide techniques may be useful (Hollingsworth et al. 1979). The reestablishment of flooding regimes and high water tables would probably be needed to restore and sustain a meadow grassland. Irrigation using water flow diversions may achieve this (Taylor and McDaniel 1998).

Transition to saltgrass state (10b): Unknown. In principle, this transition can be brought about by the removal of saltcedar but without restoring the conditions required for the establishment of meadow grasslands (e.g. changed hydrology).

Transition to cottonwood state (11b): Techniques applied by Taylor and McDaniel (1998) have been successful in establishing this state in the Bosque del Apache National Wildlife Refuge. This includes the removal of saltcedar via herbicides, fire, and mechanical control alongside irrigation and plantings of cottonwoods and black willow (*Salix nigra*).

Cottonwood: This state is characterized by the development of a cottonwood canopy alongside other woody species such as black willow, coyote willow (*Salix exigua*), and tornillo and an understory of herbs. Grasses are usually a minor component.

Transition to meadow grassland state (2b): Removal of cottonwood canopy, or perhaps aging and mortality of cottonwoods over longer periods.

Transition to saltcedar state (11a): Removal of cottonwoods and subsequent colonization by saltcedar.

Mixed exotics: This state may exhibit dominance by Russian olive and/or other invasives, such as Russian knapweed, in disturbed settings. Little is known about the conditions under which different species invade. Because exotic species may coexist with native meadow grassland species, we speculate that the changed hydrology and salinization that accompanies the transition to a saltcedar state does not necessarily occur in this state. Where soil drying is a factor, upland species such as saltbush (*Atriplex canescens*) may colonize.

Transition to meadow grassland state (3b): Variable recovery of grasses may be achieved by mowing and/or the use of herbicides to remove exotic shrubs if hydrology is not the limiting factor (Muldavin et al. 1999).

Transition to saltcedar state (12): Disturbance and subsequent colonization by saltcedar.

Data and information sources and theoretical background: Communities and states are derived largely from observations of Darrel Reasner, NRCS Socorro. Despite a proliferating literature on the ecology of cottonwoods and saltcedar, there is little work on the ecology of grasses in the riparian context. The mechanisms underlying the transitions rely largely on the idea that giant and alkali sacaton require conditions of relatively high soil moisture and low soil salinity relative to species defining the other states. The reduced frequency and volume of flooding may lead to accumulations of salt where the water table is high, leading to a turnover to more salt tolerant taxa. Grazing may also contribute to this turnover. Continued dominance of saltgrass, once it has established, may be enforced by its competitive preemption of space. For the invasion of opportunistic exotic taxa, disturbance is assumed to play an important role with or without changes in salinity by reducing competitive interactions with native species. On the other hand, a *reduction* in flooding disturbances has been invoked to explain the increase in saltcedar (Tesky 1992). It is possible that disturbance type is important. Alternatively, the role of flooding disturbance in inhibiting saltcedar establishment may apply to river banks and not to the more distant salt meadow sites. Similarly, the role of water table depth is unclear. Salinity seems to be promoted by shallow water tables but tamarisk is observed to dominate where water tables are relatively deep. Everitt (1998) notes that channel narrowing and subsequent sediment deposition over the last century due to depleted flow has led to a rise in dry-season water tables beneath the Rio Grande flood plain, and thus and increase in wetland conditions. The roles of salinity, water table depth, and flooding frequency on the vegetation dynamics of this ecological site have yet to be explored in detail.

Ecological Site Interpretations

Animal Community:

This site provides hatitat which support a resident animal community that is characterized by raccoon, desert shrew, desert pocket gopher, Apache pocket mouse, great horned owl, red shafted flicker, mourning dove, ladder backed woodpecker, vermillion flycatcher, phainopepla, redwinged blackbird, Bullock's oriole, boat-tailed grackle, Gambel's quail, bullfrog, Great Plains skink, New Mexico whiptail, kingsnake, and checkered garter snake.

Hydrology Functions:

The runoff curve numbers are determined by field investigations using hydraulic cover conditions and hydrologic soil groups.

Hydrologic Interpretations	
Soil Series	Hydrologic Group
Aqua	B
Belen	C
Balmorhea	C

Recreational Uses:

Associated cottonwood and other riparian trees provide welcome shade. The site has high suitability for bird watching, nature study and other non-consumptive forms of wildlife use. Picnicking and camping suitability if fair. Hunting for waterfowl, quail and dove is good. Suitability for hunting deer, small game and/or predators is poor to fair.

Wood Products:

The site has little, if any, significant value for wood products. '

Other Products:

The site is grazed by cattle and horses, generally without regard to class of livestock or season of use. Palatability of the dominant forage plants is greatest during the summer months when inland saltgrass and alkali sacaton are green. Sheep and goats may also graze the site, with a tendency to browse as much or more than they graze. Site retrogression is characterized by a decline in alkali sacaton and an increase in inland saltgrass. Signs of serious deterioration of the site is indicated by a heavy canopy of woody plants such as salt cedar.

Other Information:

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index	Ac/AUM
100 - 76	2.8 – 4.0
75 – 51	3.5 – 4.5
50 – 26	4.0 – 7.0
25 – 0	7.0 - +

Plant Preference by Animal Kind:

	Code	Species Preference	Code
Stems	S	None Selected	N/S
Leaves	L	Preferred	P
Flowers	F	Desirable	D
Fruit/Seeds	F/S	Undesirable	U
Entire Plant	EP	Not Consumed	NC
Underground Parts	UP	Emergency	E
		Toxic	T

Animal Kind: Livestock

Animal Type: Cattle

Common Name	Scientific Name	Plant Part	Forage Preferences											
			J	F	M	A	M	J	J	A	S	O	N	D
alkali sacaton	Sporobolus airoides	EP	U	U	U	D	D	D	P	P	D	U	U	U
giant sacaton	Sporobolus Wrightii	EP	U	U	U	D	D	D	P	P	D	U	U	U
cottonwood (seedlings)	Populus fremontii	L/S	U	U	U	P	P	P	P	P	D	U	U	U
inland saltgrass	Distichlis spicata	EP	U	U	U	U	D	D	P	P	D	D	U	U

Supporting Information

Associated Sites:

Site Name	Site ID	Site Narrative

Similiar Sites:

Site Name	Site ID	Site Narrative

State Correlation:
This site has been correlated with the following states:

Inventory Data References:

Data Source	Number of Records	Sample Period	State	County

Type Locality:

Relationship to Other Established Classifications:

Other References:
Data collection for this site was done in conjunction with the progressive soil surveys within the Southern Desertic Basins, Plains and Mountains, Major Land Resource Areas of New Mexico. This site has been mapped and correlated with soils in the following soil surveys. Sierra County Dona Ana County Grant County Hidalgo County Luna County Otero County

Characteristic Soils Are:	
Aqua Variant (wet) soils	
Belen Variant (wet) soils	
Other Soils included are:	
Balmorhea loam	

Site Description Approval:

Author	Date	Approval	Date
Don Sylvester	07/12/1979	Don Sylvester	07/12/1979

Site Description Revision:

Author	Date	Approval	Date
Dr. Brandon Bestelmeyer	02/27/03	George Chavez	03/04/03
George Chavez	02/27/03		