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September 20, 1991

Michael Stewart  
Empire Farms  
P.O. Box 40  
Empire, NV 89405

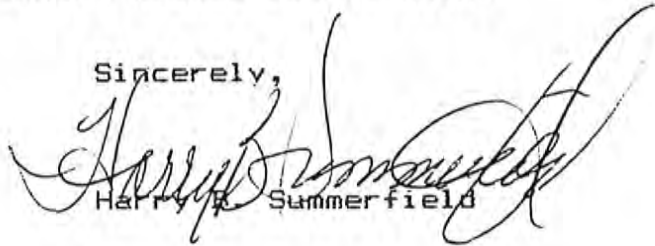
RE: Soil Survey Report for the property located on Empire  
Farms, San Emidio Desert, Nevada.

Dear Mr. Stewart,

Enclosed is the Soil Survey Report for the above mentioned  
property.

If you need further assistance, please let me know.

Sincerely,



Harry B. Summerfield

Enclosure

cc: Dennis T. Trexler, Director, Div. of Earth Sciences,  
University of Nevada.

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SOIL INVESTIGATION  
for the property located on  
Empire Farms,  
San Emidio Desert  
Nevada  
September 20, 1991

At the request of Michael Stewart, a detailed soil survey was conducted on the Empire Farms, San Emidio Desert, Nevada. The soils of the area were studied utilizing standard soil survey procedures. Slopes were measured utilizing a hand held level. The following are the reference pedons representing the six mapping units found in the area. No attempt was made to correlate these soils to the soil series level of classification as developed by the U.S.D.A. Soil Conservation Service.

MAP UNIT 1

Reference Pedon: Typic Torriorthents, loamy-skeletal,  
mixed, mesic.

Slope: 0 to 2 percent slopes.

Aspect: Northeasterly.

Vegetation: Russian thistle.

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Moderate.

Parent Material: Mixed alluvium.

Hydrological Group: B.

Shrink-swell Potential: Low.

Available Water Capacity: Moderate.

Salinity: Moderate.

Pedon: (Colors are for dry soil unless otherwise noted)

Ap 0 to 10 inches. Pale brown (10YR 6/3) silt loam, brown or dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; root crowns only; few very fine and fine interstitial pores; 5 to 10 percent gravel; strongly effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

C1k 10 to 20 inches. Light brownish gray (10YR 6/2) very gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; single grain, loose, loose, nonsticky, nonplastic; common very fine roots; many very fine and fine interstitial pores; 50 percent gravel; strongly effervescent; violently effervescent on gravel; very strongly alkaline (pH 9.6); abrupt smooth boundary.

C2k 20 to 27 inches. Pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; many very fine and fine interstitial pores; few very thin patchy clay films; strongly effervescent; very strongly alkaline (pH 9.6); abrupt smooth boundary.

C3k 27 to 35 inches. Light brownish gray (10YR 6/2) very gravelly loamy fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose, loose, nonsticky, nonplastic; common micro roots; many very fine and fine interstitial pores; 50 percent gravel; violently effervescent on gravel, slightly effervescent in spots; very strongly alkaline (pH 9.4); abrupt smooth boundary.

C4 35 to 40 inches. Light brownish gray (10YR 6/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, loose, nonsticky, nonplastic; few micro roots; many very fine interstitial pores; noneffervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.

C5 40 to 64 inches. Pale brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) moist; single grain, loose, loose, nonsticky, nonplastic; few micro roots; many very fine and fine interstitial pores; slightly effervescent in spots; very strongly alkaline (pH 9.2); . This horizon consists of several thin discontinuous horizons but is dominated by the loamy sand textures.

### DISCUSSION

None of this soil is presently under cultivation. For the most part, this soil should be considered as being saline-alkali affected. Minor inclusions consisting of soils found in Mapping Unit 2 have been recognized along the boundaries of this soil, but comprise less than 2 percent of the map unit.

MAP UNIT 2

Reference Pedon: Typic Torriorthents, coarse-loamy, mixed,  
mesic.

Slope: 0 to 2 percent.

Aspect: Northwesterly.

Vegetation: Russian thistle.

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Moderate.

Parent Material: Mixed alluvium.

Hydrological Group: B.

Shrink-swell Potential: Low.

Available Water Capacity: Moderate to high.

Salinity: Moderate.

Pedon: (Colors are for dry soil unless otherwise noted)

Ap1 0 to 7 inches. Light brownish gray (10YR 6/2)  
very fine sandy loam, very dark grayish brown  
(10YR 3/2) moist; massive; hard, friable,  
nonsticky, nonplastic; root crowns only; many  
very fine and fine interstitial, and few very  
fine tubular pores; noneffervescent; strongly  
alkaline (pH 9.0); abrupt smooth boundary.

Ap2 7 to 14 inches. Light brownish gray (10YR 6/2)  
silt loam, very dark grayish brown (10YR 3/2)  
moist; massive; hard, friable, nonsticky,  
nonplastic; common very fine roots; common very  
fine and fine interstitial pores;  
noneffervescent; very strongly alkaline (pH  
9.2); abrupt smooth boundary.

C1 14 to 29 inches. Light brownish gray (10YR 6/2)  
silt loam, dark brown (10YR 3/3) moist;  
massive; slightly hard, friable, nonsticky,  
nonplastic; common very fine roots; many very  
fine and fine interstitial pores;  
noneffervescent; very strongly alkaline (pH  
9.4); abrupt smooth boundary. Contains a thin  
discontinuous 1 to 3 inch gravelly sand lense.

- C2k 29 to 48 inches. Pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; massive, slightly hard, friable, nonsticky, nonplastic; few micro fine roots; common very fine and fine interstitial pores; many fine and medium, distinct lime filaments; strongly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.
- C3k 48 to 60 inches. Light brownish gray (10YR 6/2) very gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, loose, nonsticky, nonplastic; few micro roots; many very fine and fine interstitial pores; 50 percent gravel; slightly effervescent; violently effervescent on gravel; strongly alkaline (pH 8.8).

#### DISCUSSION

Only a small area of this soil is presently under cultivation. In general, it has all the characteristics as described in the reference pedon. In the area that is cultivated, the surface soil is slightly darker, which in turn would change the Taxonomic classification. This is not considered to be significant, therefore, this area is included within Map Unit 2.

MAP UNIT 3

Reference Pedon: Typic Natrargids, fine, montmorillonitic, mesic.

Slope: 0 to 2 percent.

Aspect: Northeasterly.

Vegetation: Lambsquarter.

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Slow.

Parent Material: Mixed alluvium.

Hydrological Group: D.

Shrink-swell Potential: High.

Available Water Capacity: Moderate.

Salinity: Strongly saline-alkali.

Pedon: (Colors are for dry soil unless otherwise noted)

Ap1 0 to 3 inches. Pale brown (10YR 6/3) silt loam, brown or dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky, nonplastic; root crowns only; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.6); abrupt smooth boundary.

Ap2 3 to 11 inches. Light brownish gray (10YR 6/2) silt loam, brown or dark brown (10YR 4/3) moist; massive; very hard, friable, nonsticky, nonplastic; common very fine roots; common very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.6); abrupt smooth boundary.

Bt1 11 to 22 inches. Pale brown (10YR 6/3) clay, brown or dark brown (10YR 4/3) moist; strong fine and medium prismatic structure; extremely hard, very firm, very sticky, very plastic; common very fine roots; many fine and medium interstitial pores; many moderately thick and thick clay films on ped faces; noneffervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

- C1 22 to 34 inches. Brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; very hard, friable, nonsticky, nonplastic; few micro roots; many very fine interstitial, and few very fine tubular pores; few thin clay films as bridges; noneffervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.
- C2 34 to 43 inches. Brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; soft, friable, nonsticky, nonplastic; few micro roots; many very fine interstitial pores; noneffervescent; strongly alkaline (pH 9.0); abrupt smooth boundary.
- C3k 43 to 53 inches. Pale brown (10YR 6/3) silty clay loam, brown or dark brown (10YR 4/3) moist; strong fine and medium prismatic structure; very hard, friable, sticky, plastic; no roots; common very fine and fine interstitial pores; many medium and coarse lime filaments; many thin and moderately thick clay films on ped faces; violently effervescent; strongly alkaline (pH 9.0); abrupt smooth boundary.
- IIBt2 53 to 64 inches. Light gray (2.5Y 7/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky, plastic; no roots; common very fine interstitial pores; common thin clay films as bridges; strongly effervescent; strongly alkaline (pH 9.0). Has a thin 1 to 2 inch thin discontinuous sand lense at the upper boundary.

#### DISCUSSION

These soils are strongly saline-alkali affected. There are small areas along the delineation boundary where the soils found in Map Unit 2 have been superimposed on top of this soil. Any soil sampling to be done in this area should be restricted to the central part of the mapping unit, and should not be near the boundary of the two soils.



MAP UNIT 4

Reference Pedon: IRRIGATED. Typic Pelloxererts, very fine, montmorillonitic, mesic.

Slope: 0 to 2 percent.

Aspect: Flat.

Vegetation: Plowed.

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Very slow.

Parent Material: Mixed alluvium.

Hydrological Group: D.

Shrink-swell Potential: High.

Available Water Capacity: Low.

Salinity: Strongly saline-alkali

Pedon: (Colors are for dry soil unless otherwise noted)

Ap1 0 to 2 inches. Brown (10YR 5/3) silty clay, brown or dark brown (10YR 4/3) moist; strong very fine granular structure; soft, friable, very sticky, very plastic; no roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

Ap2 2 to 7 inches. Brown (10YR 5/3) clay, brown or dark brown (10YR 4/3) moist; strong fine and medium angular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few medium roots; common fine and medium interstitial pores; many moderately thick and thick clay films on ped faces; strongly effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

- C1 7 to 34 inches. Brown (10YR 5/3) clay, brown or dark brown (10YR 4/3) moist; strong medium and coarse columnar structure; extremely hard, extremely firm, very sticky, very plastic; few medium roots; common fine and medium pores; continuous pressure cutans; slightly effervescent; strongly alkaline (pH 9.0); clear smooth boundary.
- C2 34 to 60 inches. Brown (10YR 5/3) clay, brown or dark brown (10YR 4/3) moist; strong medium and coarse prismatic structure; extremely hard, very sticky, very plastic; no roots; common medium and coarse interstitial pores; very few, very fine faint lime mottles; continuous pressure cutans; slightly effervescent; strongly alkaline (pH 9.0).

#### DISCUSSION

Before this soil was put under farming practices, it probably had a profile having a well developed surface horizon. Farming practices have destroyed this surface horizon causing this soil to change enough in physical and chemical characteristics to cause a change in Taxonomic classification.

This soil has extremely high shrink-swell potential. This means the soil expands when wet, and shrinks when dry. This process leaves cracks in the surface soil that may be as wide as 2 inches in width. Some areas within this mapping unit have stands of alfalfa that appear to be growing under stress and appear to be lower in production than alfalfa growing on other soils. However, the clayey nature of the subsoil and substrata of these soils is consistent with that as that described in the reference pedon.

Along the Map Unit boundary, I found soils in Map Unit 5 that have been superimposed over these clayey soils. I attempted to separate these areas but found no consistency in their occurrence. I recommend that all soil sampling be done within the interior of the Mapping Unit and not near the boundaries of the unit.

These soils are probably saline-alkali affected.

MAP UNIT 5

Reference Pedon: IRRIGATED. Typic Haplargids, fine-loamy,  
mixed, mesic.

Slope: 0 to 4 percent.

Aspect: Easterly.

Vegetation: Alfalfa

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Moderately slow.

Parent Material: Mixed alluvium.

Hydrological Group: C.

Shrink-swell Potential: Moderate.

Available Water Capacity: High.

Salinity: The majority is slight.

Pedon: (Colors are for dry soil unless otherwise noted)

Ap1            0 to 3 inches. Light brownish gray (10YR 6/2)  
silt loam, dark brown (10YR 3/3) moist; weak  
fine subangular blocky structure; soft,  
friable, slightly sticky, slightly plastic;  
root crowns only, many very fine and fine  
interstitial pores; strongly effervescent; very  
strongly alkaline (pH 9.2); abrupt smooth  
boundary.

Ap2            3 to 10 inches. Pale brown (10YR 6/3) silty clay  
loam, brown or dark brown (10YR 4/3) moist;  
moderate fine and medium subangular blocky  
structure; slightly hard, friable, sticky,  
plastic; common very fine roots; many very fine  
and fine interstitial pores; common thin clay  
films as bridges and on ped faces; strongly  
effervescent; strongly alkaline (pH 8.8);  
abrupt smooth boundary.

Bt1            10 to 18 inches. Pale brown (10YR 6/3) clay loam,  
brown or dark brown (10YR 4/3) moist; weak  
medium subangular blocky structure; slightly  
hard, friable, sticky, plastic; common very

fine roots; many very fine and fine interstitial pores; few thin patchy clay films as bridges; strongly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.

Bt2 18 to 23 inches. Pale brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, sticky, plastic; few fine roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.

B3k 23 to 32 inches. Pale brown (10YR 6/3) heavy silty clay loam, brown or dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky, plastic; few micro roots; many very fine and fine interstitial pores; few thin patchy clay films; many medium and coarse distinct lime mottles; violently effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

C1 32 to 60 inches. Pale brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) moist; massive; soft, friable, sticky, plastic; few micro roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.6).

#### DISCUSSION

In several areas, the silty clay loam and clay loam subsoil (argillic horizon) has been at least partially destroyed due to plowing. The textures remain, but the structure has been destroyed. The surface colors are variable in part due to the density of the alfalfa that is growing on them. This affects the organic carbon found in these surface horizons, which in turn would change the Taxonomic classification of each soil. An attempt was made to separate these differences in surface color into two soils, but it was impossible.

This is a relative large mapping unit, and soil sampling should be restricted to the interior boundaries of the unit.

MAP UNIT 6

Reference Pedon: IRRIGATED. Aridic Calcixerolls, fine-  
loamy, mixed, mesic.

Slope: 0 to 2 percent.

Aspect: Easterly.

Vegetation: Alfalfa.

Drainage: Well.

Runoff: Slow.

Erosion Hazard: Slight.

Permeability: Moderately slow.

Parent Material: Mixed alluvium.

Hydrological Group: C.

Shrink-swell potential: Moderate.

Salinity: None.

Pedon: (Colors are for dry soil unless otherwise noted)

Ap1 0 to 6 inches. Grayish brown (10YR 5/2) heavy  
silt loam, very dark grayish brown (10YR 3/2)  
moist; massive; very soft, very friable,  
nonsticky, nonplastic; root crowns only; many  
very fine and fine interstitial pores; slightly  
effervescent; strongly alkaline (pH 8.8);  
abrupt smooth boundary.

Ap2 6 to 12 inches. Brown (10YR 5/3) silty clay  
loam, dark brown (10YR 3/3) moist; massive;  
very soft, very friable, slightly sticky,  
slightly plastic; common very fine and few fine  
roots; many very fine and fine interstitial  
pores; strongly effervescent; strongly alkaline  
(pH 8.8); abrupt smooth boundary.

C1 12 to 22 inches. Pale brown (10YR 6/3) silty clay  
loam, dark brown (10YR 3/3) moist; massive;  
very soft, very friable, slightly sticky,  
slightly plastic; common fine roots; many very  
fine and fine interstitial pores; strongly  
effervescent; very strongly alkaline (pH 9.2);  
abrupt smooth boundary. Contains  
discontinuous lenses of fine sand.

- C2 22 to 36 inches. Pale brown (10YR 6/3) silt loam, very dark grayish brown (10YR 3/2) moist; massive; very soft, very friable, nonsticky, nonplastic; few fine roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.
- C3 36 to 53 inches. Pale brown (10YR 6/3) heavy silt loam, very dark grayish brown (10YR 3/2) moist; massive; very soft, very friable, nonsticky, nonplastic; few fine roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.
- C4 53 to 60 inches. Brown (10YR 5/3) gravelly sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, loose, nonsticky, nonplastic; few micro roots; many very fine and fine interstitial pores; 15 percent gravel; noneffervescent; very strongly alkaline (pH 9.2).

#### DISCUSSION

Minor inclusions of stream channel deposition were found within this Unit. These areas comprise less than 1 percent of the area. They consist of very gravelly sands stratified with sandy material. They occur near the south end of the Unit. Soil sampling should be restricted to the central part of the Mapping Unit.