APPENDIX D

NRCS Custom Soil Resource Reports

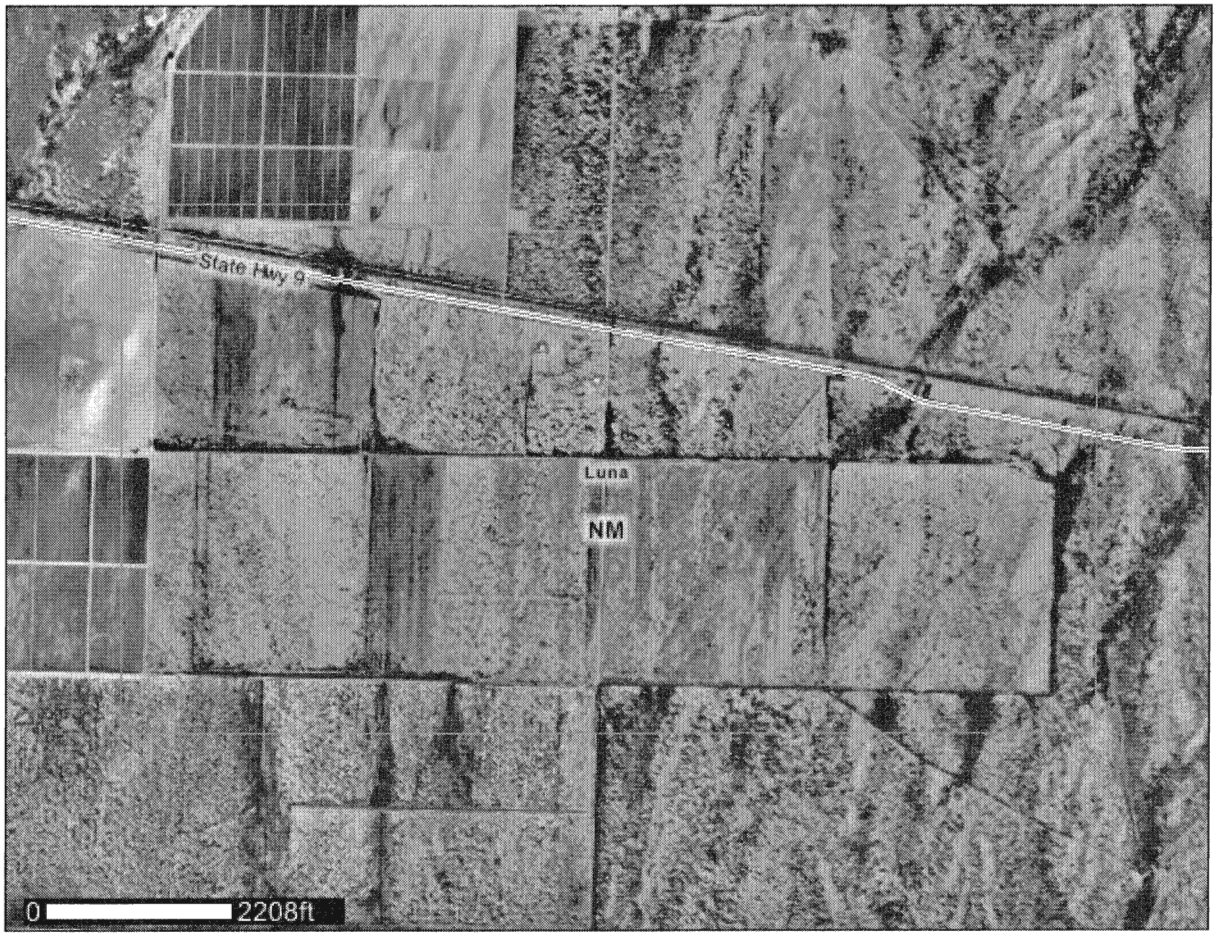
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Luna County, New Mexico



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

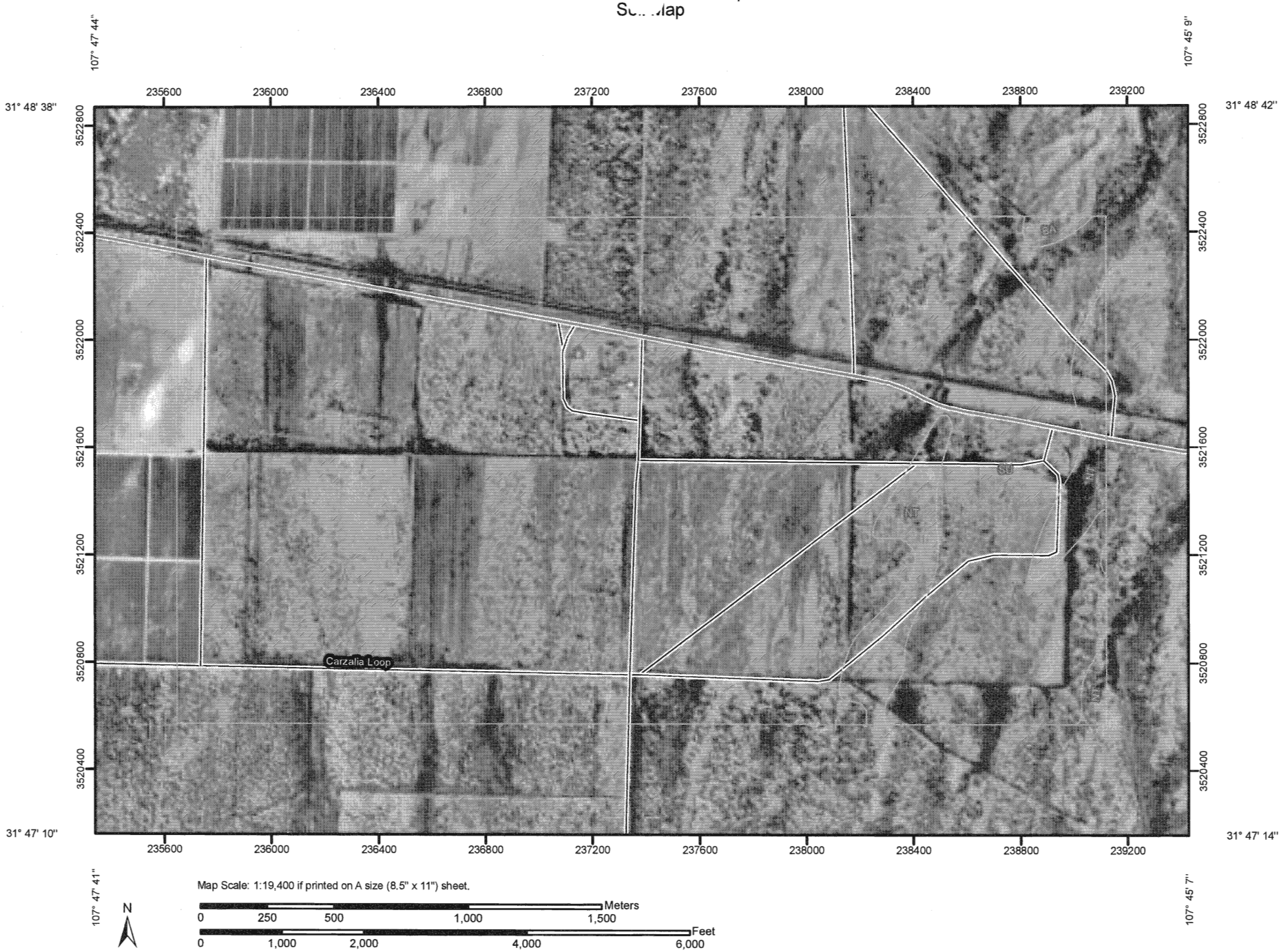
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


107° 47' 44"
107° 45' 9"
31° 48' 38"
31° 48' 42"
235600
236000
236400
236800
237200
237600
238000
238400
238800
239200
3522800
3522400
3522000
3521600
3521200
3520800
3520400
Carzalia Loop
31° 47' 10"
31° 47' 14"
107° 47' 41"
107° 45' 7"
Map Scale: 1:19,400 if printed on A size (8.5" x 11") sheet.
N
Meters
0
250
500
1,000
1,500
Feet
0
1,000
2,000
4,000
6,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Luna County, New Mexico (NM029)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BA	Berino and Mohave soils	5.0	0.3%
NT	Nickel-Tres Hermanos complex	78.2	4.8%
SU	Stellar silty clay loam	1,535.1	94.9%
Totals for Area of Interest		**1,618.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Luna County, New Mexico

BA—Berino and Mohave soils

Map Unit Setting

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Berino and similar soils: 65 percent
Mohave and similar soils: 30 percent

Description of Berino

Setting

Landform: Valley floors, fan piedmonts
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)

Typical profile

0 to 5 inches: Loamy sand
5 to 40 inches: Sandy clay loam
40 to 60 inches: Loamy sand

Description of Mohave

Setting

Landform: Fan piedmonts, valley floors
Landform position (two-dimensional): Backslope, shoulder, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 7c
Ecological site: Sandy (R042XB012NM)

Typical profile

0 to 8 inches: Sandy loam
8 to 60 inches: Clay loam

NT—Nickel-Tres Hermanos complex

Map Unit Setting

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 170 to 210 days

Map Unit Composition

Nickel and similar soils: 65 percent
Tres hermanos and similar soils: 20 percent

Description of Nickel

Setting

Landform: Fan piedmonts, fan remnants
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability (nonirrigated): 7s
Ecological site: Gravelly (R042XB010NM)

Typical profile

0 to 4 inches: Very gravelly sandy loam
4 to 18 inches: Very gravelly loam
18 to 60 inches: Very gravelly loam

Description of Tres Hermanos

Setting

Landform: Alluvial fans, hillslopes
Landform position (two-dimensional): Shoulder, footslope, backslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s
Ecological site: Gravelly (R042XB010NM)

Typical profile

0 to 3 inches: Gravelly sandy loam
3 to 36 inches: Gravelly clay loam
36 to 60 inches: Very gravelly sandy clay loam

SU—Stellar silty clay loam

Map Unit Setting

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Stellar and similar soils: 100 percent

Description of Stellar

Setting

Landform: Hillslopes, basin floors
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7s
Ecological site: Clayey (R042XB023NM)

Typical profile

0 to 3 inches: Silty clay loam
3 to 37 inches: Clay
37 to 60 inches: Clay loam

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes (Western Cooper Ranch)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

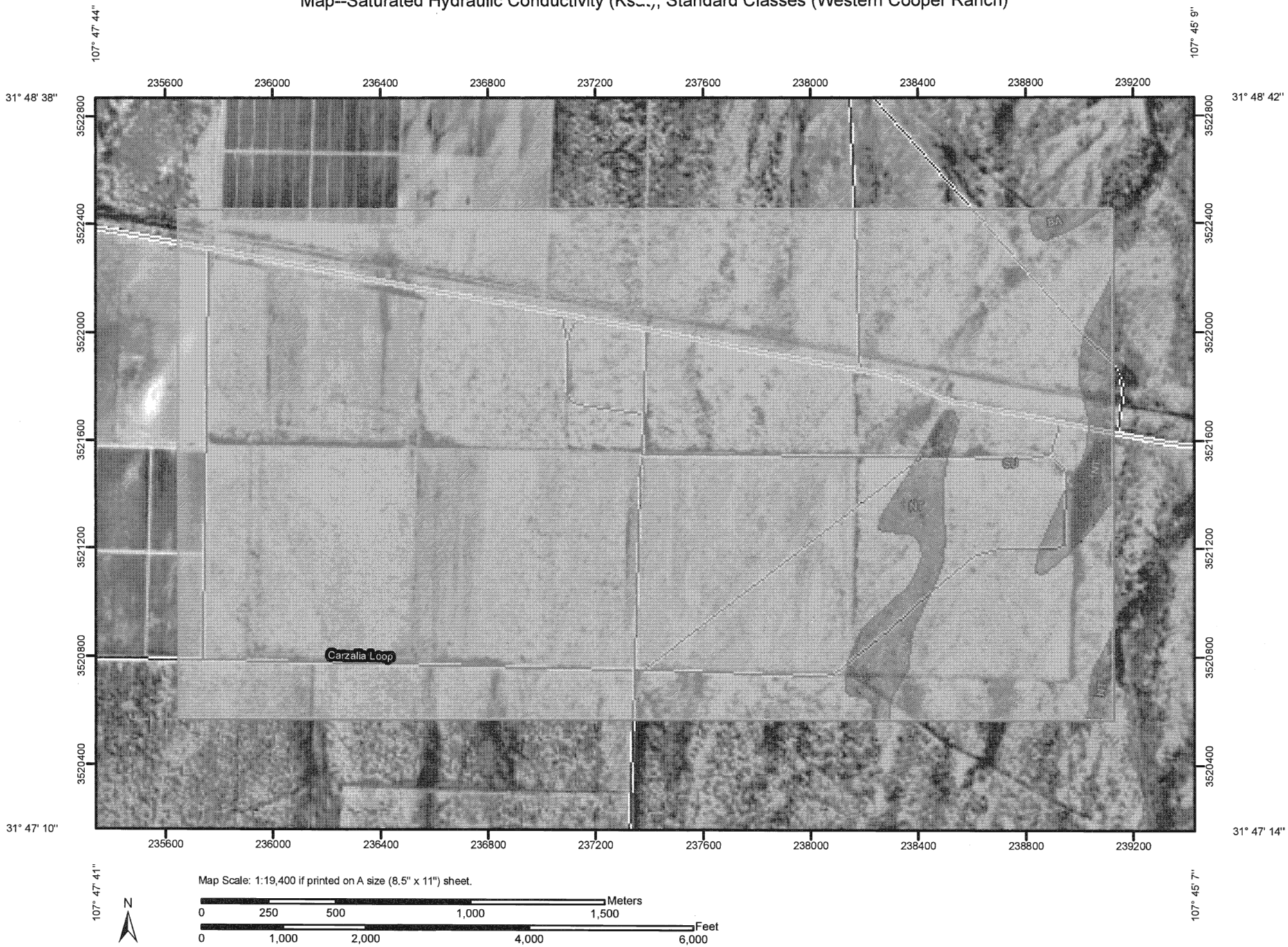
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Custom Soi[illegible]ource Report
Map--Saturated Hydraulic Conductivity (Ks[illegible], Standard Classes (Western Cooper Ranch)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Western Cooper Ranch)

Saturated Hydraulic Conductivity (Ksat), Standard Classes— Summary by Map Unit — Luna County, New Mexico				
Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
BA	Berino and Mohave soils	28.2300	5.0	0.3%
NT	Nickel-Tres Hermanos complex	28.2300	78.2	4.8%
SU	Stellar silty clay loam	2.8200	1,535.1	94.9%
Totals for Area of Interest			**1,618.4**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Western Cooper Ranch)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options: Surface Layer

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Unified Soil Classification (Surface) (Western Cooper Ranch)

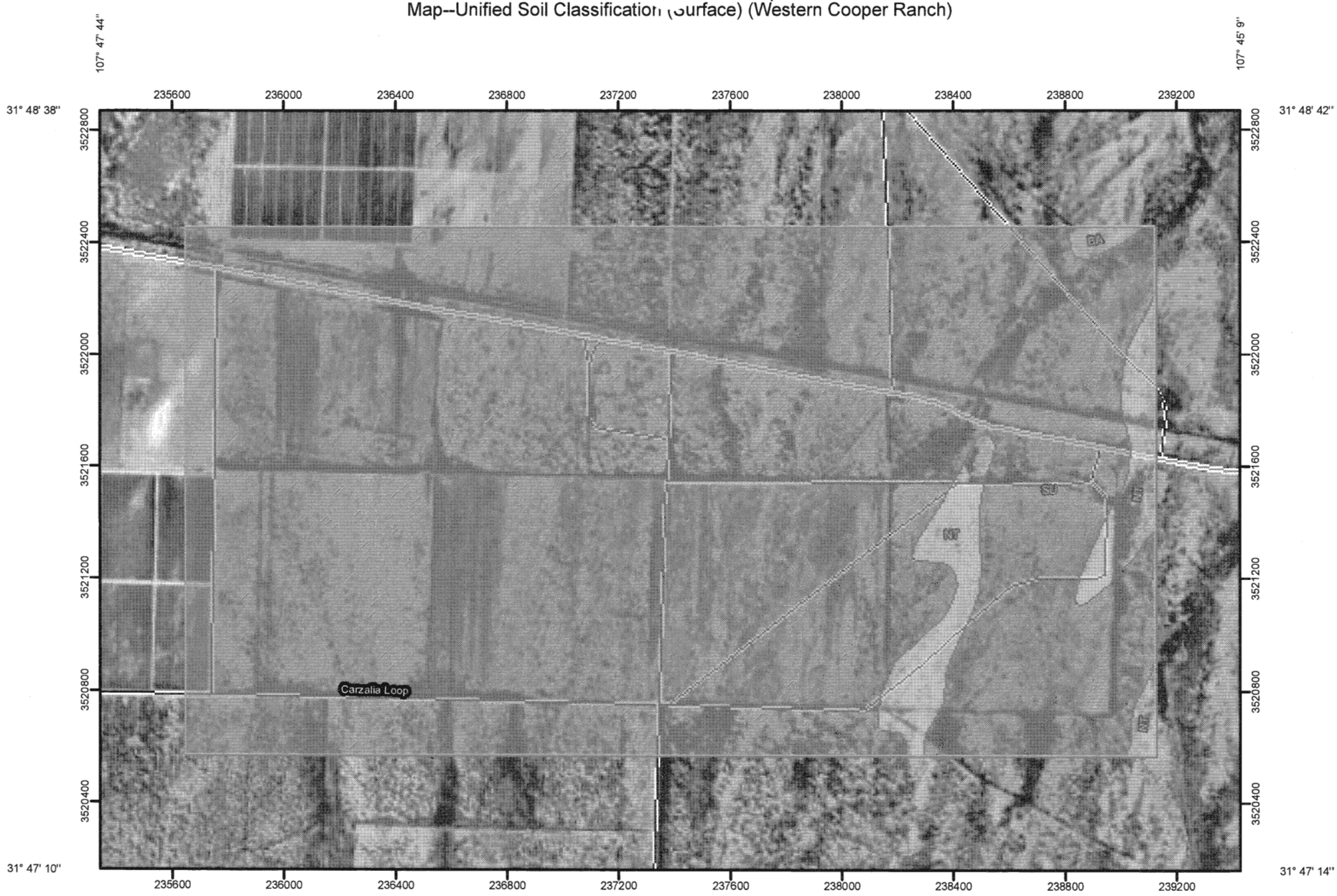
The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM

D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Custom So source Report
Map--Unified Soil Classification (Surface) (Western Cooper Ranch)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Unified Soil Classification (Surface) (Western Cooper Ranch)

Unified Soil Classification (Surface)— Summary by Map Unit — Luna County, New Mexico				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BA	Berino and Mohave soils	SM	5.0	0.3%
NT	Nickel-Tres Hermanos complex	GC-GM	78.2	4.8%
SU	Stellar silty clay loam	CL	1,535.1	94.9%
Totals for Area of Interest			**1,618.4**	**100.0%**

Rating Options—Unified Soil Classification (Surface) (Western Cooper Ranch)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options: Surface Layer

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Taxonomic Classification of the Soils (Western Cooper Ranch)

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. This table shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great

group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, active, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

References:
Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (The soils in a given survey area may have been classified according to earlier editions of this publication.)

Report—Taxonomic Classification of the Soils (Western Cooper Ranch)

[An asterisk by the soil name indicates a taxadjunct to the series]

Taxonomic Classification of the Soils-- Luna County, New Mexico	
Soil name	**Family or higher taxonomic classification**
Berino	Fine-loamy, mixed, thermic Typic Haplargids
Mohave	Fine-loamy, mixed, thermic Typic Haplargids
Nickel	Loamy-skeletal, mixed, thermic Typic Calciorthids
Stellar	Fine, mixed, thermic Ustollic Haplargids
Tres Hermanos	Fine-loamy, mixed, thermic Typic Haplargids

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Western Cooper Ranch)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
BA—Berino and Mohave soils												
Berino	0-5	Loamy sand	SM, SW-SM	A-2-4	0	0	95-100	95-100	50-95	10-35	0-0	NP
	5-40	Sandy clay loam, sandy loam, loam	SC, SC-SM, CL	A-4, A-6	0	0	95-100	95-100	65-80	35-60	20-35	5-15
	40-60	Loamy sand	SM, SC-SM	A-2-4	0	0	95-100	95-100	55-75	15-25	10-20	1-6
Mohave	0-8	Sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	75-100	70-100	55-75	25-45	20-30	NP-10
	8-60	Clay loam, loam	CL, CL-ML	A-4, A-6, A-7-6	0	0	100	95-100	85-95	70-80	25-45	5-25

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
NT—Nickel-Tres Hermanos complex												
Nickel	0-4	Very gravelly sandy loam	GC, GC-GM, GM	A-2-4, A-1-b	0	10-15	45-60	40-55	30-45	20-35	20-30	NP-10
	4-18	Gravelly loam, very gravelly loam, gravelly fine sandy loam	GC-GM, SC-SM, GC, SC	A-1-b, A-2-4, A-4	0	10-15	45-75	40-70	30-50	20-40	25-30	5-10
	18-60	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam	GC-GM, GW-GC, GC	A-1-a, A-2-4	0	10-15	20-60	15-55	10-40	5-30	25-30	5-10
Tres hermanos	0-3	Gravelly sandy loam	SM, SC-SM, SW-SM	A-1-b, A-2, A-4	0	0-5	60-80	55-75	35-60	10-40	20-25	NP-5
	3-36	Gravelly loam, gravelly clay loam	SC, CL, GC	A-6	0	0-10	60-80	55-75	45-70	35-55	25-35	10-15
	36-60	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam	GW-GC, GC-GM, GC	A-1-a, A-2-4	0	0-15	35-55	30-50	25-45	10-30	25-30	5-10
SU—Stellar silty clay loam												
Stellar	0-3	Silty clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-40	10-20
	3-37	Clay, sandy clay, clay loam	SC, CH, CL	A-7-6, A-6	0	0	100	100	80-95	45-90	40-60	15-30
	37-60	Clay loam, sandy clay loam, gravelly clay loam	GM, ML, SC, CL	A-4, A-6, A-7-6	0	0-5	65-100	60-100	55-100	45-70	30-50	5-25

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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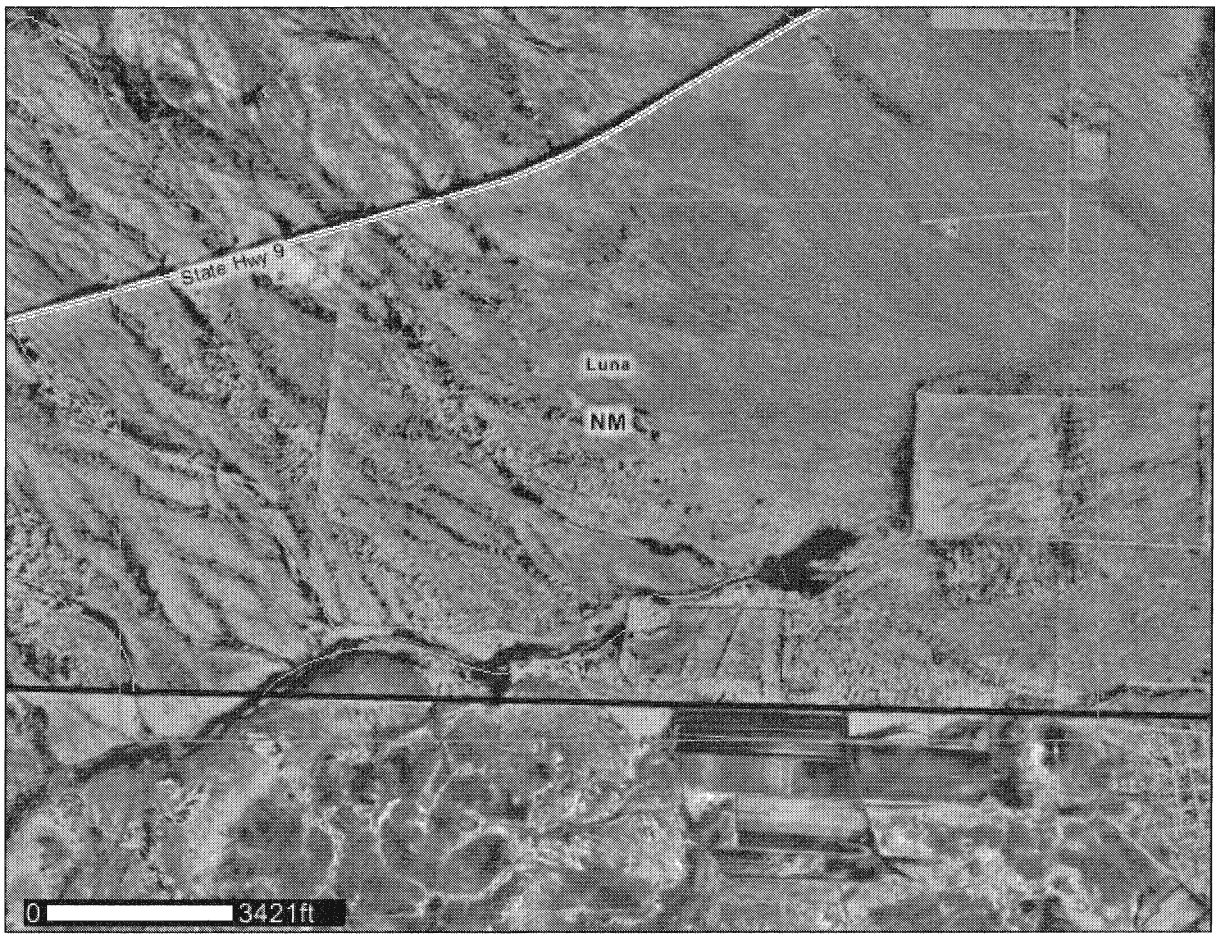
United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Luna County, New Mexico



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

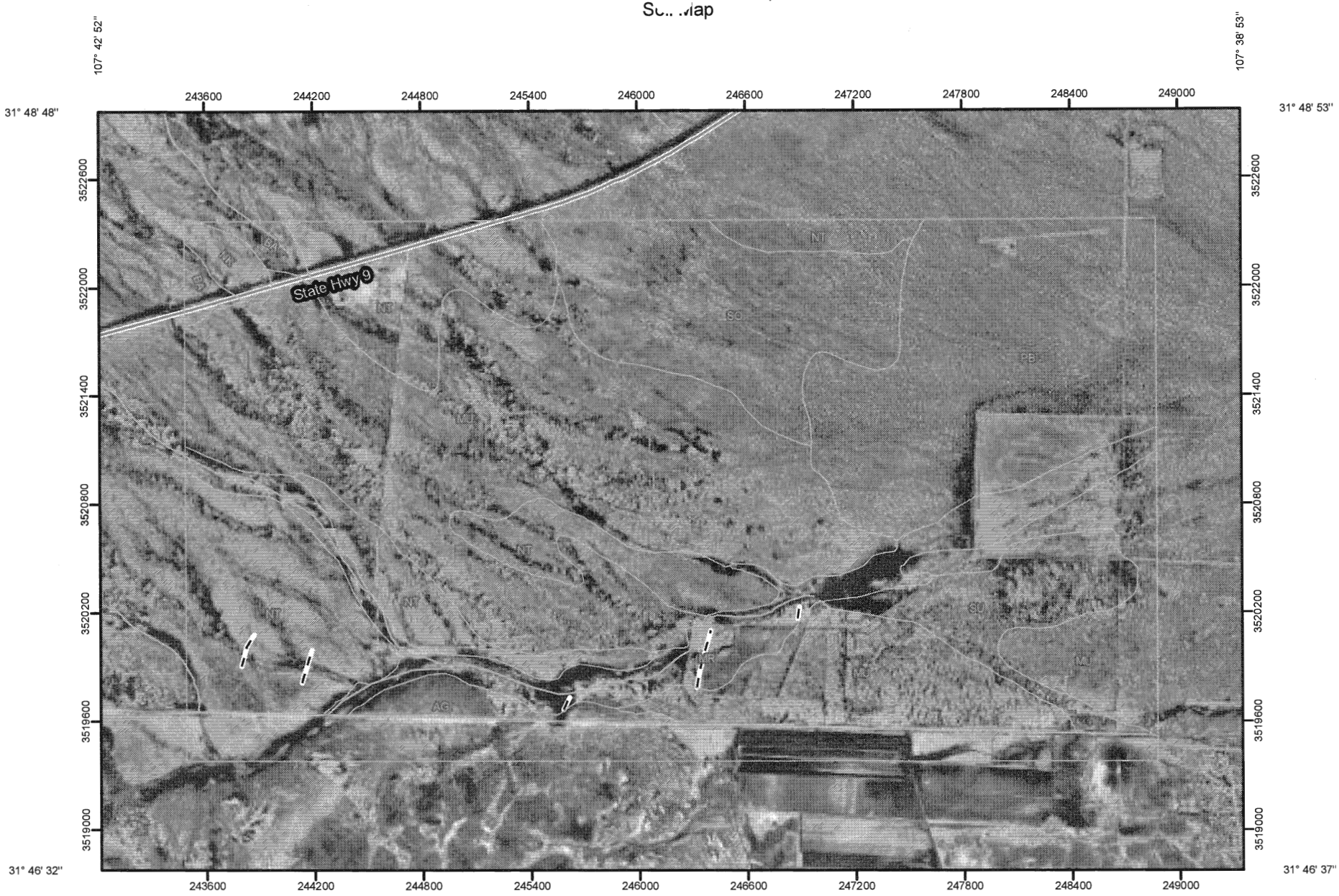
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


107° 42' 52"
107° 38' 53"
31° 48' 48"
31° 48' 53"
243600
244200
244800
245400
246000
246600
247200
247800
248400
249000
3522600
3522000
3521400
3520800
3520200
3519600
3519000
State Hwy 9
NT
SO
PB
AG
SU
31° 46' 32"
31° 46' 37"
107° 42' 48"
107° 38' 49"
Map Scale: 1:30,100 if printed on A size (8.5" x 11") sheet.
N
Meters
0
400
800
1,600
2,400
Feet
0
1,500
3,000
6,000
9,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:30,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Luna County, New Mexico (NM029)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AG	Akela very gravelly loam, 0 to 10 percent slopes	53.2	1.3%
BA	Berino and Mohave soils	38.4	1.0%
MR	Mimbres and Verhalen soils	278.7	7.0%
MU	Mohave sandy clay loam, 0 to 3 percent slopes	1,427.1	35.9%
NK	Nickel very gravelly sandy loam, 3 to 9 percent slopes	30.1	0.8%
NT	Nickel-Tres Hermanos complex	734.7	18.5%
PB	Pintura-Berino complex, eroded	606.5	15.3%
SO	Sonoita gravelly sandy loam	366.2	9.2%
SU	Stellar silty clay loam	163.4	4.1%
Subtotals for Soil Survey Area		**3,698.3**	**93.1%**
Totals for Area of Interest		**3,974.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the

contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Luna County, New Mexico

AG—Akela very gravelly loam, 0 to 10 percent slopes

Map Unit Setting

Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 8 to 10 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 170 to 210 days

Map Unit Composition

Akela and similar soils: 95 percent

Description of Akela

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: 4 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Very low (about 1.4 inches)

Interpretive groups

Land capability (nonirrigated): 7s
Ecological site: Malpais (R042XB037NM)

Typical profile

0 to 3 inches: Very gravelly loam
3 to 18 inches: Very gravelly loam
18 to 60 inches: Bedrock

BA—Berino and Mohave soils

Map Unit Setting

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 8 to 11 inches

Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition
Berino and similar soils: 65 percent
Mohave and similar soils: 30 percent

Description of Berino

Setting
Landform: Valley floors, fan piedmonts
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)

Typical profile
0 to 5 inches: Loamy sand
5 to 40 inches: Sandy clay loam
40 to 60 inches: Loamy sand

Description of Mohave

Setting
Landform: Fan piedmonts, valley floors
Landform position (two-dimensional): Backslope, shoulder, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 7c
Ecological site: Sandy (R042XB012NM)

Typical profile

0 to 8 inches: Sandy loam
8 to 60 inches: Clay loam

MR—Mimbres and Verhalen soils

Map Unit Setting

Elevation: 3,800 to 6,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 55 to 62 degrees F
Frost-free period: 170 to 210 days

Map Unit Composition

Mimbres and similar soils: 50 percent
Verhalen and similar soils: 45 percent

Description of Mimbres

Setting

Landform: Alluvial fans, stream terraces, valley floor remnants
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0

Available water capacity: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7c
Ecological site: Bottomland (R042XB018NM)

Typical profile

0 to 3 inches: Silty clay loam
3 to 42 inches: Silty clay loam
42 to 60 inches: Sandy clay loam

Description of Verhalen

Setting

Landform: Alluvial fans, stream terraces, valley floor remnants
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 6s
Ecological site: Bottomland (R042XB018NM)

Typical profile

0 to 5 inches: Silty clay loam
5 to 60 inches: Clay

MU—Mohave sandy clay loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 3,800 to 6,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 55 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition
Mohave and similar soils: 100 percent

Description of Mohave

Setting
Landform: Alluvial fans, hillslopes
Landform position (two-dimensional): Backslope, shoulder, footslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: High (about 12.0 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 7c
Ecological site: Loamy (R042XB014NM)

Typical profile
0 to 8 inches: Sandy clay loam
8 to 60 inches: Clay loam

NK—Nickel very gravelly sandy loam, 3 to 9 percent slopes

Map Unit Setting
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 55 to 57 degrees F
Frost-free period: 170 to 210 days

Map Unit Composition
Nickel and similar soils: 100 percent

Description of Nickel

Setting
Landform: Fan piedmonts, fan remnants
Landform position (two-dimensional): Shoulder, footslope, backslope

Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability (nonirrigated): 7s
Ecological site: Gravelly (R042XB010NM)

Typical profile

0 to 4 inches: Very gravelly sandy loam
4 to 18 inches: Very gravelly loam
18 to 60 inches: Very gravelly loam

NT—Nickel-Tres Hermanos complex

Map Unit Setting

Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 170 to 210 days

Map Unit Composition

Nickel and similar soils: 65 percent
Tres hermanos and similar soils: 20 percent

Description of Nickel

Setting

Landform: Fan piedmonts, fan remnants
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability (nonirrigated): 7s
Ecological site: Gravelly (R042XB010NM)

Typical profile

0 to 4 inches: Very gravelly sandy loam
4 to 18 inches: Very gravelly loam
18 to 60 inches: Very gravelly loam

Description of Tres Hermanos

Setting

Landform: Alluvial fans, hillslopes
Landform position (two-dimensional): Shoulder, footslope, backslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s
Ecological site: Gravelly (R042XB010NM)

Typical profile

0 to 3 inches: Gravelly sandy loam
3 to 36 inches: Gravelly clay loam
36 to 60 inches: Very gravelly sandy clay loam

PB—Pintura-Berino complex, eroded

Map Unit Setting

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 8 to 10 inches
Mean annual air temperature: 58 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Pintura and similar soils: 50 percent
Berino and similar soils: 40 percent

Description of Pintura

Setting

Landform: Fan piedmonts, valley floors
Landform position (two-dimensional): Backslope, footslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Hummocks of alluvium derived from calcareous sandstone

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)

Typical profile

0 to 2 inches: Fine sand
2 to 60 inches: Fine sand

Description of Berino

Setting

Landform: Fan piedmonts, valley floors
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)

Typical profile

0 to 5 inches: Loamy sand
5 to 40 inches: Sandy clay loam
40 to 60 inches: Loamy sand

SO—Sonoita gravelly sandy loam

Map Unit Setting

Elevation: 4,200 to 5,700 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Sonoita and similar soils: 100 percent

Description of Sonoita

Setting

Landform: Hillslopes, terraces
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 7s
Ecological site: Gravelly Loam (R042XB035NM)

Typical profile

0 to 3 inches: Gravelly sandy loam
3 to 60 inches: Sandy loam

SU—Stellar silty clay loam

Map Unit Setting

Elevation: 3,800 to 5,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 62 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Stellar and similar soils: 100 percent

Description of Stellar

Setting

Landform: Hillslopes, basin floors
Landform position (two-dimensional): Footslope, shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0

Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 7s
Ecological site: Clayey (R042XB023NM)

Typical profile

0 to 3 inches: Silty clay loam
3 to 37 inches: Clay
37 to 60 inches: Clay loam

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes (Eastern Cooper Ranch)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

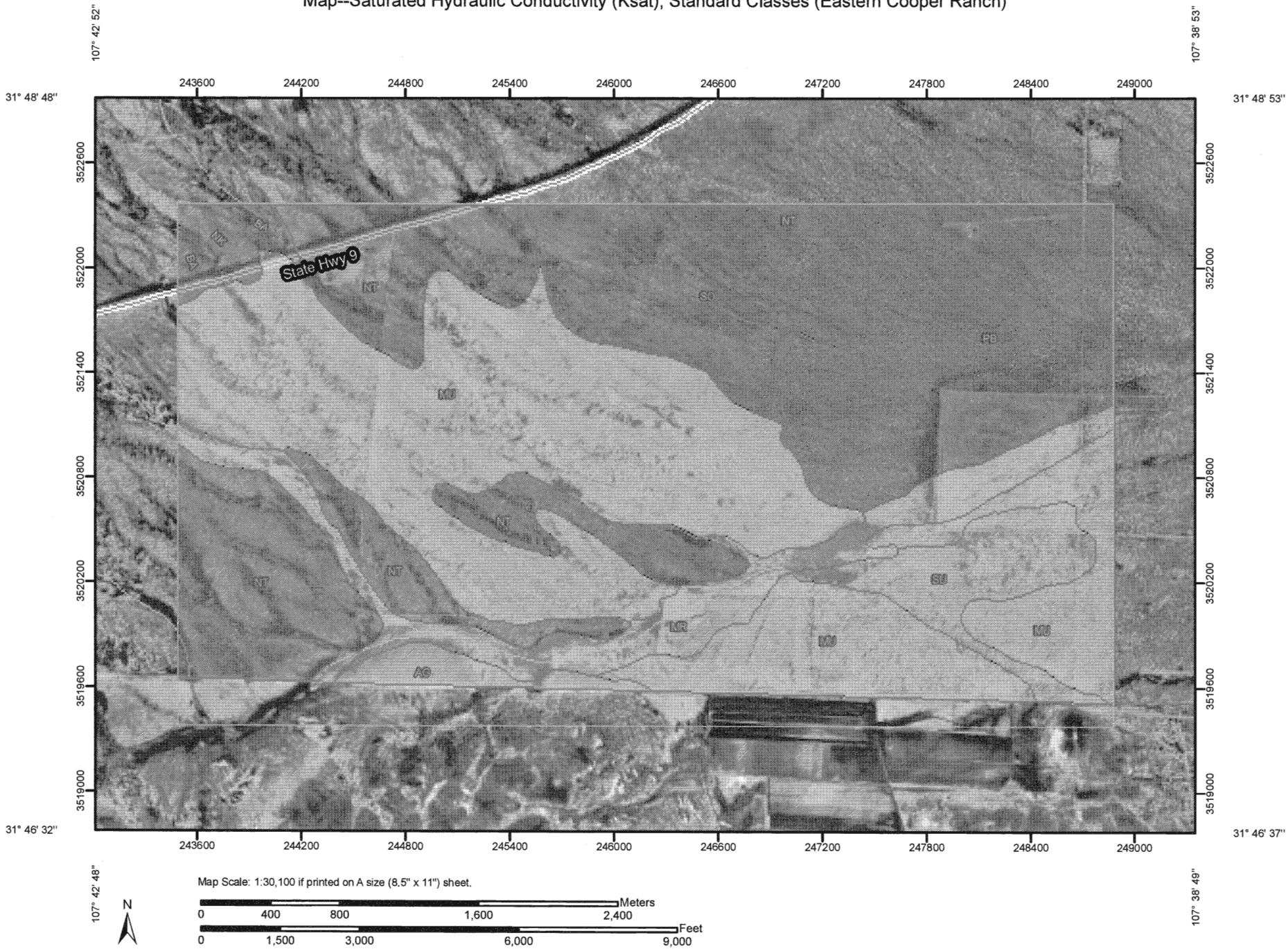
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Custom Soil ource Report
Map--Saturated Hydraulic Conductivity (Ksat), Standard Classes (Eastern Cooper Ranch)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:30,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Eastern Cooper Ranch)

Saturated Hydraulic Conductivity (Ksat), Standard Classes— Summary by Map Unit — Luna County, New Mexico				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
AG	Akela very gravelly loam, 0 to 10 percent slopes	9.1700	53.2	1.3%
BA	Berino and Mohave soils	28.2300	38.4	1.0%
MR	Mimbres and Verhalen soils	2.8200	278.7	7.0%
MU	Mohave sandy clay loam, 0 to 3 percent slopes	2.8200	1,427.1	35.9%
NK	Nickel very gravelly sandy loam, 3 to 9 percent slopes	28.2300	30.1	0.8%
NT	Nickel-Tres Hermanos complex	28.2300	734.7	18.5%
PB	Pintura-Berino complex, eroded	91.7400	606.5	15.3%
SO	Sonoita gravelly sandy loam	28.2300	366.2	9.2%
SU	Stellar silty clay loam	2.8200	163.4	4.1%
Subtotals for Soil Survey Area			**3,698.3**	**93.1%**
Totals for Area of Interest			**3,974.2**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Eastern Cooper Ranch)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options: Surface Layer

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Unified Soil Classification (Surface) (Eastern Cooper Ranch)

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Custom Soil ource Report
Map--Unified Soil Classificatio , urface) (Eastern Cooper Ranch)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:30,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luna County, New Mexico
Survey Area Data: Version 7, Dec 9, 2008

Date(s) aerial images were photographed: 1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Unified Soil Classification (Surface) (Eastern Cooper Ranch)

Unified Soil Classification (Surface)— Summary by Map Unit — Luna County, New Mexico				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AG	Akela very gravelly loam, 0 to 10 percent slopes	GM	53.2	1.3%
BA	Berino and Mohave soils	SM	38.4	1.0%
MR	Mimbres and Verhalen soils	CL	278.7	7.0%
MU	Mohave sandy clay loam, 0 to 3 percent slopes	CL	1,427.1	35.9%
NK	Nickel very gravelly sandy loam, 3 to 9 percent slopes	GC-GM	30.1	0.8%
NT	Nickel-Tres Hermanos complex	GC-GM	734.7	18.5%
PB	Pintura-Berino complex, eroded	SM	606.5	15.3%
SO	Sonoita gravelly sandy loam	SC-SM	366.2	9.2%
SU	Stellar silty clay loam	CL	163.4	4.1%
Subtotals for Soil Survey Area			**3,698.3**	**93.1%**
Totals for Area of Interest			**3,974.2**	**100.0%**

Rating Options—Unified Soil Classification (Surface) (Eastern Cooper Ranch)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options: Surface Layer

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Taxonomic Classification of the Soils (Eastern Cooper Ranch)

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. This table shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great

group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, active, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

References:
Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (The soils in a given survey area may have been classified according to earlier editions of this publication.)

Report—Taxonomic Classification of the Soils (Eastern Cooper Ranch)

[An asterisk by the soil name indicates a taxadjunct to the series]

Taxonomic Classification of the Soils– Luna County, New Mexico	
Soil name	**Family or higher taxonomic classification**
Akela	Loamy-skeletal, mixed (calcareous), thermic Lithic Torriorthents
Berino	Fine-loamy, mixed, thermic Typic Haplargids
Mimbres	Fine-silty, mixed, thermic Typic Camborthids
Mohave	Fine-loamy, mixed, thermic Typic Haplargids
Nickel	Loamy-skeletal, mixed, thermic Typic Calciorthids
Pintura	Mixed, thermic Typic Torripsamments
Sonoita	Coarse-loamy, mixed, thermic Typic Haplargids
Stellar	Fine, mixed, thermic Ustollic Haplargids
Tres Hermanos	Fine-loamy, mixed, thermic Typic Haplargids
Verhalen	Fine, montmorillonitic, thermic Mollic Torrerts

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Eastern Cooper Ranch)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
AG—Akela very gravelly loam, 0 to 10 percent slopes												
Akela	0-3	Very gravelly loam	GM, GC-GM	A-1-b, A-2-4	0	5-20	40-55	35-50	30-45	20-35	20-25	NP-5
	3-18	Very gravelly sandy loam, very gravelly loam, extremely gravelly loam	GM, GW-GM, GC-GM	A-1-b, A-1-a, A-2-4	0	10-15	15-60	10-55	10-40	5-30	20-25	NP-5
	18-60	Bedrock	—	—	—	—	—	—	—	—	—	—
BA—Berino and Mohave soils												
Berino	0-5	Loamy sand	SM, SW-SM	A-2-4	0	0	95-100	95-100	50-95	10-35	0-0	NP
	5-40	Sandy clay loam, sandy loam, loam	SC, SC-SM, CL	A-4, A-6	0	0	95-100	95-100	65-80	35-60	20-35	5-15
	40-60	Loamy sand	SM, SC-SM	A-2-4	0	0	95-100	95-100	55-75	15-25	10-20	1-6
Mohave	0-8	Sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	75-100	70-100	55-75	25-45	20-30	NP-10
	8-60	Clay loam, loam	CL, CL-ML	A-4, A-6, A-7-6	0	0	100	95-100	85-95	70-80	25-45	5-25

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
MR—Mimbres and Verhalen soils												
Mimbres	0-3	Silty clay loam	CL	A-6	0	0	100	100	95-100	75-95	35-40	15-20
	3-42	Silty clay loam, silt loam, clay loam	CL	A-6	0	0	100	100	95-100	75-95	25-40	10-20
	42-60	Sandy clay loam, silt loam, clay loam	CL, SC	A-6	0	0	90-100	90-100	90-100	40-95	25-40	10-20
Verhalen	0-5	Silty clay loam	CH, CL	A-7-6, A-6	0	0	95-100	95-100	90-100	70-85	40-55	20-33
	5-60	Clay, silty clay, clay loam	CH, CL	A-7-6	0	0	95-100	95-100	90-100	70-95	45-65	25-40
MU—Mohave sandy clay loam, 0 to 3 percent slopes												
Mohave	0-8	Sandy clay loam	CL	A-6, A-7-6	0	0	100	95-100	85-95	70-80	35-45	15-25
	8-60	Clay loam, loam	CL, CL-ML	A-7-6, A-4, A-6	0	0	100	95-100	85-95	70-80	25-45	5-25
NK—Nickel very gravelly sandy loam, 3 to 9 percent slopes												
Nickel	0-4	Very gravelly sandy loam	GC, GC-GM, GM	A-2-4, A-1-b	0	10-15	45-60	40-55	30-45	20-35	20-30	NP-10
	4-18	Gravelly loam, very gravelly loam, gravelly fine sandy loam	SC, GC-GM, SC-SM, GC	A-2-4, A-4, A-1-b	0	10-15	45-75	40-70	30-50	20-40	25-30	5-10
	18-60	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam	GC-GM, GW-GC, GC	A-1-a, A-2-4	0	10-15	20-60	15-55	10-40	5-30	25-30	5-10

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
NT—Nickel-Tres Hermanos complex												
Nickel	0-4	Very gravelly sandy loam	GC, GC-GM, GM	A-2-4, A-1-b	0	10-15	45-60	40-55	30-45	20-35	20-30	NP-10
	4-18	Gravelly loam, very gravelly loam, gravelly fine sandy loam	GC-GM, SC-SM, GC, SC	A-1-b, A-2-4, A-4	0	10-15	45-75	40-70	30-50	20-40	25-30	5-10
	18-60	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam	GC-GM, GW-GC, GC	A-1-a, A-2-4	0	10-15	20-60	15-55	10-40	5-30	25-30	5-10
Tres hermanos	0-3	Gravelly sandy loam	SM, SC-SM, SW-SM	A-1-b, A-2, A-4	0	0-5	60-80	55-75	35-60	10-40	20-25	NP-5
	3-36	Gravelly loam, gravelly clay loam	SC, CL, GC	A-6	0	0-10	60-80	55-75	45-70	35-55	25-35	10-15
	36-60	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam	GW-GC, GC-GM, GC	A-1-a, A-2-4	0	0-15	35-55	30-50	25-45	10-30	25-30	5-10

Engineering Properties– Luna County, New Mexico												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
PB—Pintura-Berino complex, eroded												
Pintura	0-2	Fine sand	SM	A-2-4, A-3	0	0	100	100	70-95	5-15	0-0	NP
	2-60	Loamy fine sand, fine sand	SC-SM, SM, SW-SM	A-2-4	0	0	100	100	70-95	5-25	12-20	2-6
Berino	0-5	Loamy sand	SW-SM, SM	A-2-4	0	0	95-100	95-100	50-95	10-35	0-0	NP
	5-40	Sandy clay loam, sandy loam, loam	SC-SM, CL, CL-ML, SC	A-4, A-6	0	0	95-100	95-100	65-80	35-60	20-35	5-15
	40-60	Loamy sand	SM, SC-SM	A-2-4	0	0	95-100	95-100	55-75	15-25	10-20	1-6
SO—Sonoita gravelly sandy loam												
Sonoita	0-3	Gravelly sandy loam	SM, SC-SM	A-1-b, A-2-4	0	0-5	70-75	65-75	40-60	20-30	15-21	3-6
	3-60	Gravelly sandy loam, sandy loam, fine sandy loam	SM, SC-SM	A-1-b, A-2-4	0	0-5	70-95	65-95	40-65	20-35	15-25	NP-5
SU—Stellar silty clay loam												
Stellar	0-3	Silty clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-40	10-20
	3-37	Clay, sandy clay, clay loam	SC, CH, CL	A-7-6, A-6	0	0	100	100	80-95	45-90	40-60	15-30
	37-60	Clay loam, sandy clay loam, gravelly clay loam	GM, ML, SC, CL	A-4, A-6, A-7-6	0	0-5	65-100	60-100	55-100	45-70	30-50	5-25

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

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Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

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United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

APPENDIX E

USDA Highly Erodible Land Determinations

U.S.D.A.
Soil Conservation Service

SCS CPA 026
(1-88)

HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION DETERMINATION

1. Name and Addr. of Person
SAM TERGUL
902 VENTURE OUT
MESA, AZ 85205

2. Date of Request
6-22-87

3. County
LUNA

4. Name of USDA Agency or Person Requesting Determination
ASCS

5. Farm No. and Tract No.
260 - TRACTS 140 & 243

SECTION I – HIGHLY ERODIBLE LAND

	Yes	No	Field No.(s)	Total Acres
6. Is soil survey now available for making a highly erodible land determination?	X			
7. Are there highly erodible soil map units on this farm?	X			
8. List highly erodible fields that, according to ASCS records, were used to produce an agricultural commodity in any crop year during 1981-1985.			TR. 140 - 2, 3 & 7 TR. 243 - 1, 2 & 3	455.1
9. List highly erodible fields that have been or will be converted for the production of agricultural commodities and, according to ASCS records, were not used for this purpose in any crop year during 1981-1985; and were not enrolled in a USDA set-aside or diversion program.			NA	

10. This Highly Erodible Land determination was completed in the: Office [X] Field [ ]

NOTE: If you have highly erodible cropland fields, you may need to have a conservation plan developed for these fields. For further information, contact the local office of the Soil Conservation Service.

SECTION II – WETLAND

	Yes	No	Field No.(s)	Total Wetland Acres
11. Are there hydric soils on this farm?		X		
List field numbers and acres, where appropriate, for the following EXEMPTED WETLANDS:				
12. Wetlands (W), including abandoned wetlands, or Farmed Wetlands (FW). Wetlands may be farmed under natural conditions. Farmed Wetlands may be farmed and maintained in the same manner as they were prior to December 23, 1985, as long as they are not abandoned.			N.A.	
13. Prior Converted Wetlands (PC) - The use, management, drainage, and alteration of prior converted wetlands (PC) are not subject to FSA unless the area reverts to wetland as a result of abandonment. You should inform SCS of any area to be used to produce an agricultural commodity that has not been cropped, managed, or maintained for 5 years or more.			N.A.	
14. Artificial Wetlands (AW) - Artificial Wetlands includes irrigation induced wetlands. These Wetlands are not subject to FSA.			N.A.	
15. Minimal Effect Wetlands (MW) - These wetlands are to be farmed according to the minimal effect agreement signed at the time the minimal effect determination was made.			N.A.	
NON-EXEMPTED WETLANDS:				
16. Converted Wetlands (CW) - In any year that an agricultural commodity is planted on these Converted Wetlands, you will be ineligible for USDA benefits. If you believe that the conversion was commenced before December 23, 1985, or that the conversion was caused by a third party, contact the ASCS office to request a commenced or third party determination.			N.A.	

17. The planned alteration measures on wetlands in fields N.A. are considered maintenance and are in compliance with FSA.

18. The planned alteration measures on wetlands in fields N.A. are not considered to be maintenance and if installed will cause the area to become a Converted Wetland (CW). See item 16 for information on CW.

19. This wetland determination was completed in the: Office [X] Field [ ]

20. This determination was: Delivered [X] Mailed [ ] To the Person on Date: 10/18/89

NOTE: If you do not agree with this determination, you may request a reconsideration from the person that signed this form in Block 22 below. The reconsideration is a prerequisite for any further appeal. The request for the reconsideration must be in writing and must state your reasons for the request. The request must be mailed or delivered within 15 days after this determination is mailed to or otherwise made available to you. Please see reverse side of the producer's copy of this form for more information on appeals procedure.

NOTE: If you intend to convert additional land to cropland, or alter any wetlands you must initiate another Form AD-1026 at the local office of ASCS. Abandonment is where land has not been cropped, managed, or maintained for 5 years or more. You should inform SCS if you plan to produce an agricultural commodity on abandoned wetlands.

21. Remarks THERE ARE OTHER NON-CROPLAND FIELDS ON THIS FARM THAT ARE HIGHLY ERODIBLE. IF ANY OF THESE FIELDS ARE CONVERTED TO CROPLAND AND PLANTED TO A COMMODITY CROP, THEY WILL NEED TO BE INCLUDED IN THIS CONSERVATION PLAN.

22. Signature of SCS District Conservationist
Bobby K. Hanna

23. Date
3-2-88

AD-1026
(07 86)

UNITED STATES DEPARTMENT OF AGRICULTURE

HIGHLY ER[illegible]E LAND AND WETLAND CONSERVAT[illegible]RTIFICATION

The following statements are made in accordance with the Privacy Act of 1974 (5 USC 552a). The authority for requesting the information to be supplied on this form is the Food Security Act of 1985, P.L. 99-198, and regulations promugulated under the Act (7CFR Part 12). The information will be used to determine eligibility for program benefits and other financial assistance administered by USDA agencies. The information may be furnished to other USDA agencies, IRS, Department of Justice, or other State and Federal law enforcement agencies, and in response to orders of a court magistrate or administrative tribunal. Furnishing the Social Security Number is voluntary. Furnishing the other requested information is voluntary; however, failure to furnish the correct, complete information will result in a determination of ineligibility for certain program benefits and other financial assistance administered by USDA agencies. The provisions of criminal and civil fraud statutes, including 18 USC 286, 287, 371, 641, 1001; 15 USC 714m; and 31 USC 3729, may be applicable to information provided by the producer on this form.

PART A - PRODUCER'S INTENTIONS FOR USE OF LAND

1. NAME AND ADDRESS OF PRODUCER	2. SOCIAL SECURITY NUMBER (or tax ID number)	3. CROP YEAR
SAM TEAGUE		1987

4. FARM NUMBER(S)	5. COUNTY(IES) WHERE LOCATED
260	LUNA, NEW MEXICO
	Deaf Smith, TEXAS Hartley
	Gaines County, Texas Seminole

	Yes	No
6. During either the crop year entered in item 3 above, or the term of a requested USDA loan, will an agricultural commodity be produced on fields of the farm(s) that were not used for the production of any agricultural commodity (see instructions) or not enrolled in an USDA set-aside or diversion program during any crop year 1981 through 1985? If "yes," list the farm and field numbers.		✓
7. Will an agricultural commodity be produced on any land on the farm(s) listed above that was a wet area but was improved, drained, or modified, or converted after December 23, 1985? If "yes," list the farm and field numbers.		✓
8. Do you plan to convert any land including wet areas for the production of an agricultural commodity this year or during the term of a requested USDA loan or other program benefit? If "yes," list the farm and field numbers.		✓

I certify that the above information is true and correct to the best of my knowledge and belief.

9. SIGNATURE OF PRODUCER: Sam Teague — DATE: June 22, 1987

PART B - REFERRAL TO SCS

10. Based on county office information, a SCS determination is:	CHECK
a. Needed prior to the producer's certification in Part C.	
b. Needed before January 1, 1990.	

NOTE: If the producer answers "No" to Part A, items 6, 7, and 8, and the agency so agrees, the producer may complete the certification in Part C without a SCS determination. However, beginning January 1, 1990, or 2 years after a soil survey is completed, the producer must be actively applying an approved conservation plan on all highly erodible fields. Therefore, a SCS determination regarding the existence of any highly erodible fields on the farm(s) listed above is necessary before January 1, 1990.

11. DATE REFERRED TO SCS FOR DETERMINATION	12. SIGNATURE OF AGENCY REPRESENTATIVE	DATE
	John Burris	6-22-87

PART C - USE CERTIFICATION (Completed by producer)

13. As a condition of eligibility for any USDA loans or other program benefits, I hereby certify that:

a. I will not produce an agricultural commodity on highly erodible fields (except fields that, in any crop year between 1981 and 1985, were used to produce any agricultural commodity or were enrolled in a USDA set-aside or diversion program); and I will not use the proceeds of any FmHA loan, insured or guaranteed, received after December 23, 1985, for a purpose that will contribute to production of an agricultural commodity on these highly erodible fields, as determined by SCS, unless an approved conservation system has been fully applied.

b. I will not produce an agricultural commodity on converted wetlands or use proceeds from any FmHA farm loan, insured or guaranteed, received after December 23, 1985, for a purpose that will contribute to the conversion of a wetland to produce an agricultural commodity, as determined by SCS.

c. I will not convert wetlands or bring new lands into production for the purpose of producing an agricultural commodity without first consulting all USDA agencies with which (1) I have a current contract or loan agreement, insured or guaranteed, or (2) I have a crop insurance contract issued by or reinsured by the Federal Crop Insurance Corporation.

d. USDA representatives may enter upon my land for the purpose of confirming any of the above statements.

ATURE OF PRODUCER: Sam Teague — DATE: June 22, 1987

14. REMARKS

SCS COPY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-CPA-027
(11-87)

CERTIFICATION OF HIGHLY ERODIBLE LAND CONSERVATION PLAN(S) AND SYSTEM(S)

1. NAME AND ADDRESS OF PERSON
SAM TEAGUE
902 VENTURE OUT
MESA, AZ 85205

2. FARM NO.
260

3. COUNTY
LUNA

CONSERVATION PLAN APPROVED

4. TRACT NUMBER(S)	5. FIELD NUMBER(S)	6. ACRES	7. PLAN APPROVED (Date)	8. CONSERVATION SYSTEM APPLIED (Date)	9. REMARKS
140	2,3,7	240.8			
243	1,2,3	214.3			

10. REMARKS

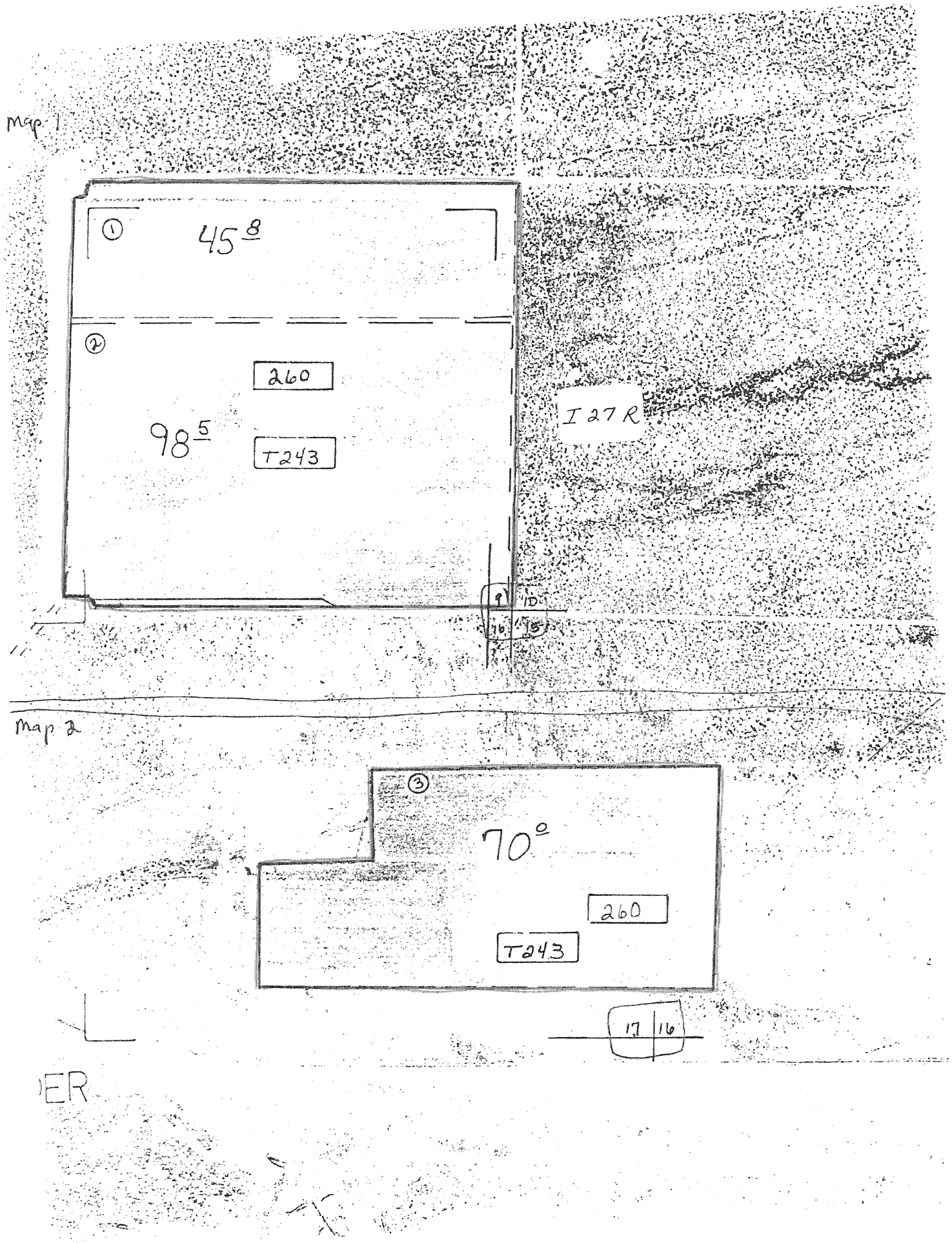
11. SIGNATURE OF SCS DISTRICT CONSERVATIONIST
Bobby K. Hanna

12. DATE
3-2-88

CROPPING SYSTEM HISTORY SAM TEAGUE

YEAR

FIELD NUMBER	ACRES	88	89	90	91	92
TR 140 2	65.7	IDLE	IDLE			
3	13.1	IDLE	IDLE			
7	162.0	IDLE	IDLE			
TR 243 1	45.8	IDLE	IDLE			
2	98.5	IDLE	IDLE			
3	70.0	IDLE	IDLE			


Map 1
①
45 8
②
260
98 5
T243
I 27 R
9
10
16
15
Map 2
③
70°
260
T243
17
16
IER

CONSERVATION PLAN MAP

Owner SAM TEAGUE Operator SAME

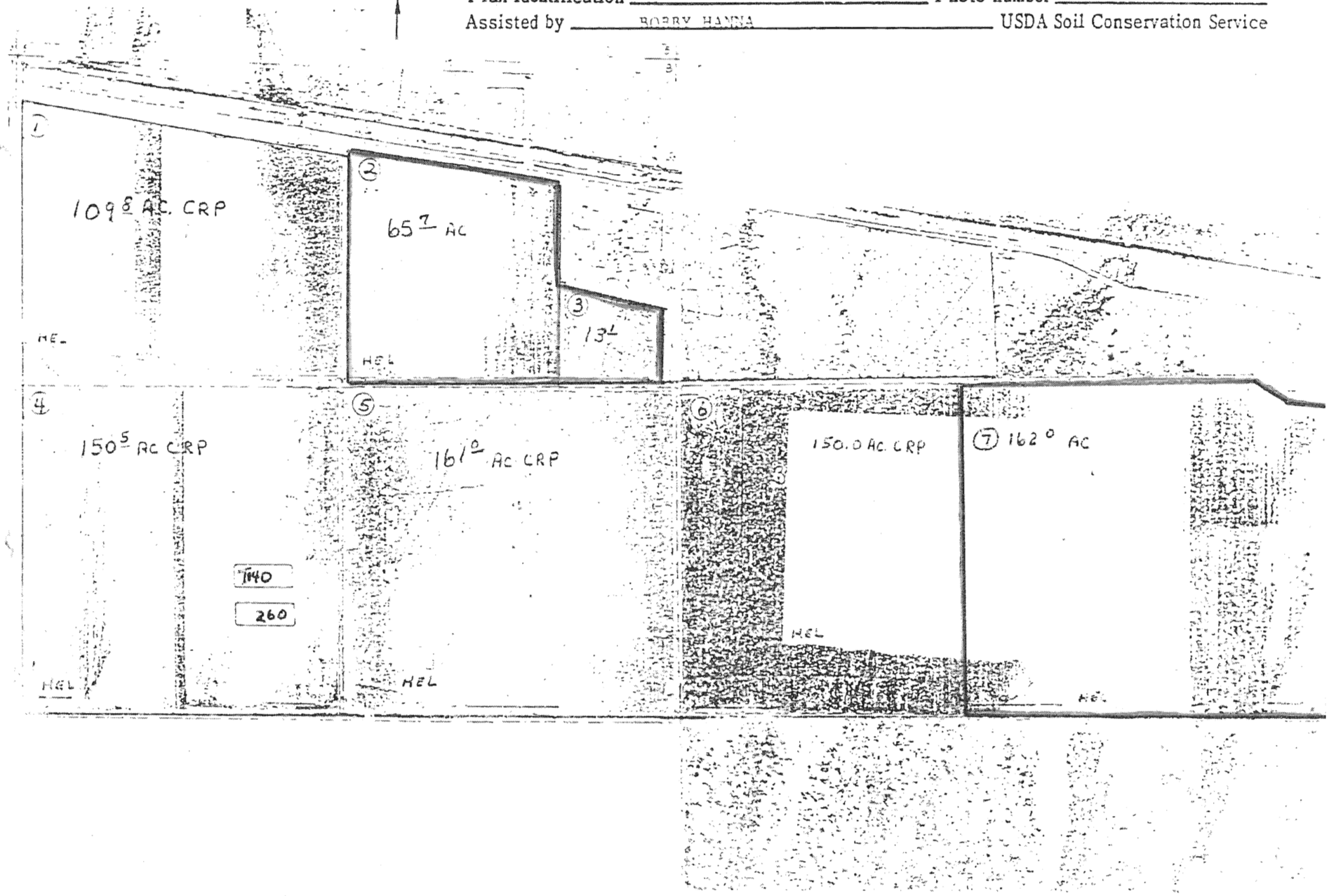
County LUNA State NEW MEXICO Date 2-17-88

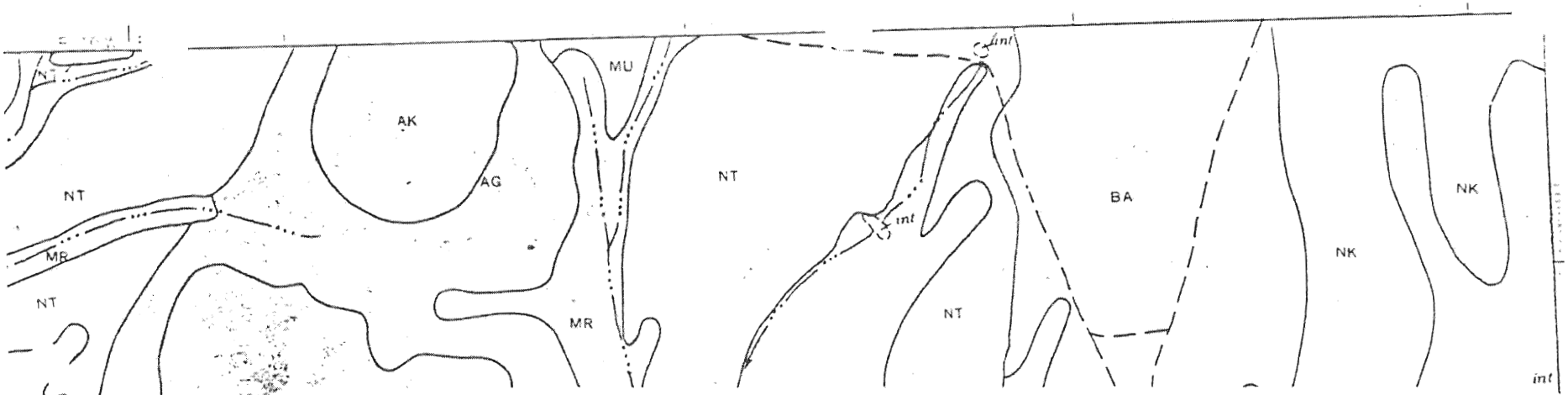
Approximate acres 708.7 Approximate scale

Cooperating with DEMING SOIL AND WATER Conservation District

Plan identification Photo number

Assisted by BOBBY HANNA USDA Soil Conservation Service





SCS-CONS-15
OCTOBER 1974

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

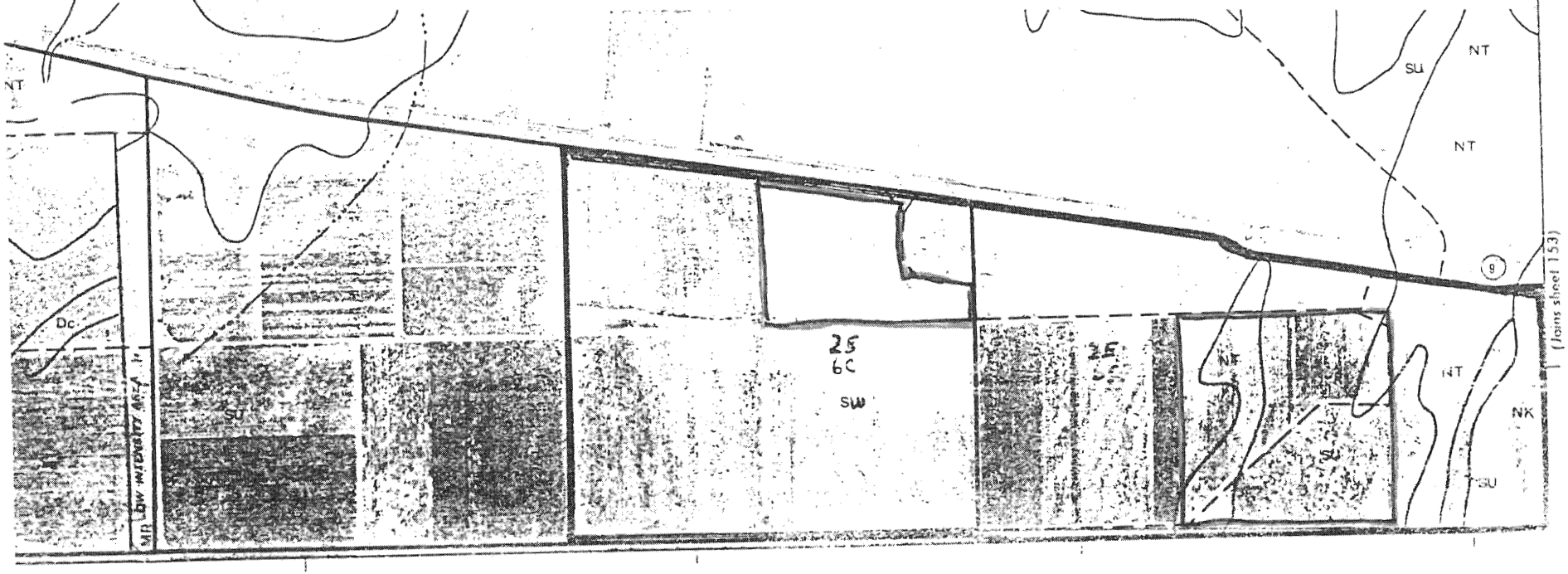
SOIL MAP

Owner Sam Teague Operator same

County Luna State New Mexico

Soil survey sheet(s) or code nos. 152 Approximate scale 1:24,000

Prepared by U.S. Department of Agriculture, Soil Conservation Service cooperating with Deming Soil and Water Conservation District



U.S.D.A.
Soil Conservation Service

SCS-CPA-026
(1 68)

HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION DETERMINATION

1. Name and Ac : of Person
SAM TEAGUE
902 VENTURE OUT
MESA, AZ 85205

2. Date of Request
6-22-87

3. County
LUNA

Name of USDA Agency or Person Requesting Determination
SAM TEAGUE

5. Farm No. and Tract No.
260 TRACT 140

SECTION I – HIGHLY ERODIBLE LAND

	Yes	No	Field No.(s)	Total Acres
6. Is soil survey now available for making a highly erodible land determination?	X			
7. Are there highly erodible soil map units on this farm?	X			
8. List highly erodible fields that, according to ASCS records, were used to produce an agricultural commodity in any crop year during 1981-1985.			1, 2, 4, 5 & W. 150 AC. 6	571.3
9. List highly erodible fields that have been or will be converted for the production of agricultural commodities and, according to ASCS records, were not used for this purpose in any crop year during 1981-1985; and were not enrolled in a USDA set-aside or diversion program.			NONE	

10. This Highly Erodible Land determination was completed in the: Office [X] Field [ ]

NOTE: If you have highly erodible cropland fields, you may need to have a conservation plan developed for these fields. For further information, contact the local office of the Soil Conservation Service.

SECTION II – WETLAND

	Yes	No	Field No.(s)	Total Wetland Acres
11. Are there hydric soils on this farm?		X		
List field numbers and acres, where appropriate, for the following EXEMPTED WETLANDS:				
12. Wetlands (W), including abandoned wetlands, or Farmed Wetlands (FW). Wetlands may be farmed under natural conditions. Farmed Wetlands may be farmed and maintained in the same manner as they were prior to December 23, 1985, as long as they are not abandoned.				
13. Prior Converted Wetlands (PC) - The use, management, drainage, and alteration of prior converted wetlands (PC) are not subject to FSA unless the area reverts to wetland as a result of abandonment. You should inform SCS of any area to be used to produce an agricultural commodity that has not been cropped, managed, or maintained for 5 years or more.				
14. Artificial Wetlands (AW) - Artificial Wetlands includes irrigation induced wetlands. These Wetlands are not subject to FSA.				
15. Minimal Effect Wetlands (MW) - These wetlands are to be farmed according to the minimal effect agreement signed at the time the minimal effect determination was made.				
NON-EXEMPTED WETLANDS:				
16. Converted Wetlands (CW) - In any year that an agricultural commodity is planted on these Converted Wetlands, you will be ineligible for USDA benefits. If you believe that the conversion was commenced before December 23, 1985, or that the conversion was caused by a third party, contact the ASCS office to request a reconsidered or third party determination.				

17. The planned alteration measures on wetlands in fields _____ are considered maintenance and are in compliance with FSA.

18. The planned alteration measures on wetlands in fields _____ are not considered to be maintenance and if installed will cause the area to become a Converted Wetland (CW). See item 16 for information on CW.

19. This wetland determination was completed in the: Office [X] Field [ ]

20. This determination was: Delivered [X] Mailed [ ] To the Person on Date: _____

NOTE: If you do not agree with this determination, you may request a reconsideration from the person that signed this form in Block 22 below. The reconsideration is a prerequisite for any further appeal. The request for the reconsideration must be in writing and must state your reasons for the request. The request must be mailed or delivered within 15 days after this determination is mailed to or otherwise made available to you. Please see reverse side of the producer's copy of this form for more information on appeals procedure.

NOTE: If you intend to convert additional land to cropland, or alter any wetlands you must initiate another Form AD-1026 at the local office of ASCS. Abandonment is where land has not been cropped, managed, or maintained for 5 years or more. You should inform SCS if you plan to produce an agricultural commodity on abandoned wetlands.

Remarks

22. Signature of SCS District Conservationist
Bobby K. Hanna

23. Date
2-22-88

AD-1026
(07-86)

UNITED STATES DEPARTMENT OF AGRICULTURE

HIGHLY ERODIBLE LAND AND WETLAND CONSERVATION CERTIFICATION

NOTE *The following statements are made in accordance with the Privacy Act of 1974 (5 USC 552a). The authority for requesting the information to be supplied on this form is the Food Security Act of 1985, P.L. 99-198, and regulations promulgated under the Act (7CFR Part 12). The information will be used to determine eligibility for program benefits and other financial assistance administered by USDA agencies. The information may be furnished to other USDA agencies, IRS, Department of Justice, or other State and Federal law enforcement agencies, and in response to orders of a court magistrate or administrative tribunal. Furnishing the Social Security Number is voluntary. Furnishing the other requested information is voluntary; however, failure to furnish the correct, complete information will result in a determination of ineligibility for certain program benefits and other financial assistance administered by USDA agencies. The provisions of criminal and civil fraud statutes, including 18 USC 286, 287, 371, 641, 1001; 15 USC 714m and 31 USC 3729, may be applicable to information provided by the producer on this form.*

PART A - PRODUCER'S INTENTIONS FOR USE OF LAND

1. NAME AND ADDRESS OF PRODUCER	2. SOCIAL SECURITY NUMBER (or tax ID number)	3. CROP YEAR
Sam Teague		1987

FARM NUMBER(S) 4	COUNTY(IES) WHERE LOCATED 5
260	Luna, New Mexico
	Deaf Smith, Texas Hereford
	Gaines County, Texas Seminole

	Yes	No
6. During either the crop year entered in item 3 above, or the term of a requested USDA loan, will an agricultural commodity be produced on fields of the farm(s) that were not used for the production of any agricultural commodity (see instructions) or not enrolled in an USDA set-aside or diversion program during any crop year 1981 through 1985? If "yes," list the farm and field numbers.		✓
7. Will an agricultural commodity be produced on any land on the farm(s) listed above that was a wet area but was improved, drained, or modified, or converted after December 23, 1985? If "yes," list the farm and field numbers.		✓
8. Do you plan to convert any land including wet areas for the production of an agricultural commodity this year or during the term of a requested USDA loan or other program benefit? If "yes," list the farm and field numbers.		✓

I hereby certify that the above information is true and correct to the best of my knowledge and belief.	9. SIGNATURE OF PRODUCER	DATE
	Sam Teague	June 22, 1987

PART B - REFERRAL TO SCS

10. Based on county office information, a SCS determination is:	CHECK
a. Needed prior to the producer's certification in Part C.	
b. Needed before January 1, 1990.	

NOTE: If the producer answers "No" to Part A, items 6, 7, and 8, and the agency so agrees, the producer may complete the certification in Part C without a SCS determination. However, beginning January 1, 1990, or 2 years after a soil survey is completed, the producer must be actively applying an approved conservation plan on all highly erodible fields. Therefore, a SCS determination regarding the existence of any highly erodible fields on the farm(s) listed above is necessary before January 1, 1990.

11. DATE REFERRED TO SCS FOR DETERMINATION	12. SIGNATURE OF AGENCY REPRESENTATIVE	DATE
	John Burns	6-22-87

PART C - USE CERTIFICATION (Completed by producer)

13. As a condition of eligibility for any USDA loans or other program benefits, I hereby certify that:

a. I will not produce an agricultural commodity on highly erodible fields (except fields that, in any crop year between 1981 and 1985, were used to produce any agricultural commodity or were enrolled in a USDA set-aside or diversion program); and I will not use the proceeds of any FmHA loan, insured or guaranteed, received after December 23, 1985, for a purpose that will contribute to production of an agricultural commodity on these highly erodible fields, as determined by SCS, unless an approved conservation system has been fully applied.

b. I will not produce an agricultural commodity on converted wetlands or use proceeds from any FmHA farm loan, insured or guaranteed, received after December 23, 1985, for a purpose that will contribute to the conversion of a wetland to produce an agricultural commodity, as determined by SCS.

c. I will not convert wetlands or bring new lands into production for the purpose of producing an agricultural commodity without first consulting all USDA agencies with which (1) I have a current contract or loan agreement, insured or guaranteed, or (2) I have a crop insurance contract issued by or reinsured by the Federal Crop Insurance Corporation.

d. USDA representatives may enter upon my land for the purpose of confirming any of the above statements.

SIGNATURE OF PRODUCER	DATE
Sam Teague	June 22, 1987

14. REMARKS

SCS COPY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-CPA-027
(11-87)

CERTIFICATION OF HIGHLY ERODIBLE LAND CONSERVATION PLAN(S) AND SYSTEM(S)

1. NAME AND ADDRESS OF PERSON
SAM TEAGUE
902 VENTURE OUT
MESA, AZ 85205

2. FARM NO.
260 TR. 140

3. COUNTY
LUNA

CONSERVATION PLAN APPROVED

4. TRACT NUMBER(S)	5. FIELD NUMBER(S)	6. ACRES	7. PLAN APPROVED (Date)	8. CONSERVATION SYSTEM APPLIED (Date)	9. REMARKS
140	1, 2, 4, 5 & W 150 AC. 6	571.3	2/18/88		

10. REMARKS

11. SIGNATURE OF SCS DISTRICT CONSERVATIONIST

12. DATE

CONSERVATION PLAN MAP

Owner: SAM TEAGUE Operator: SAME

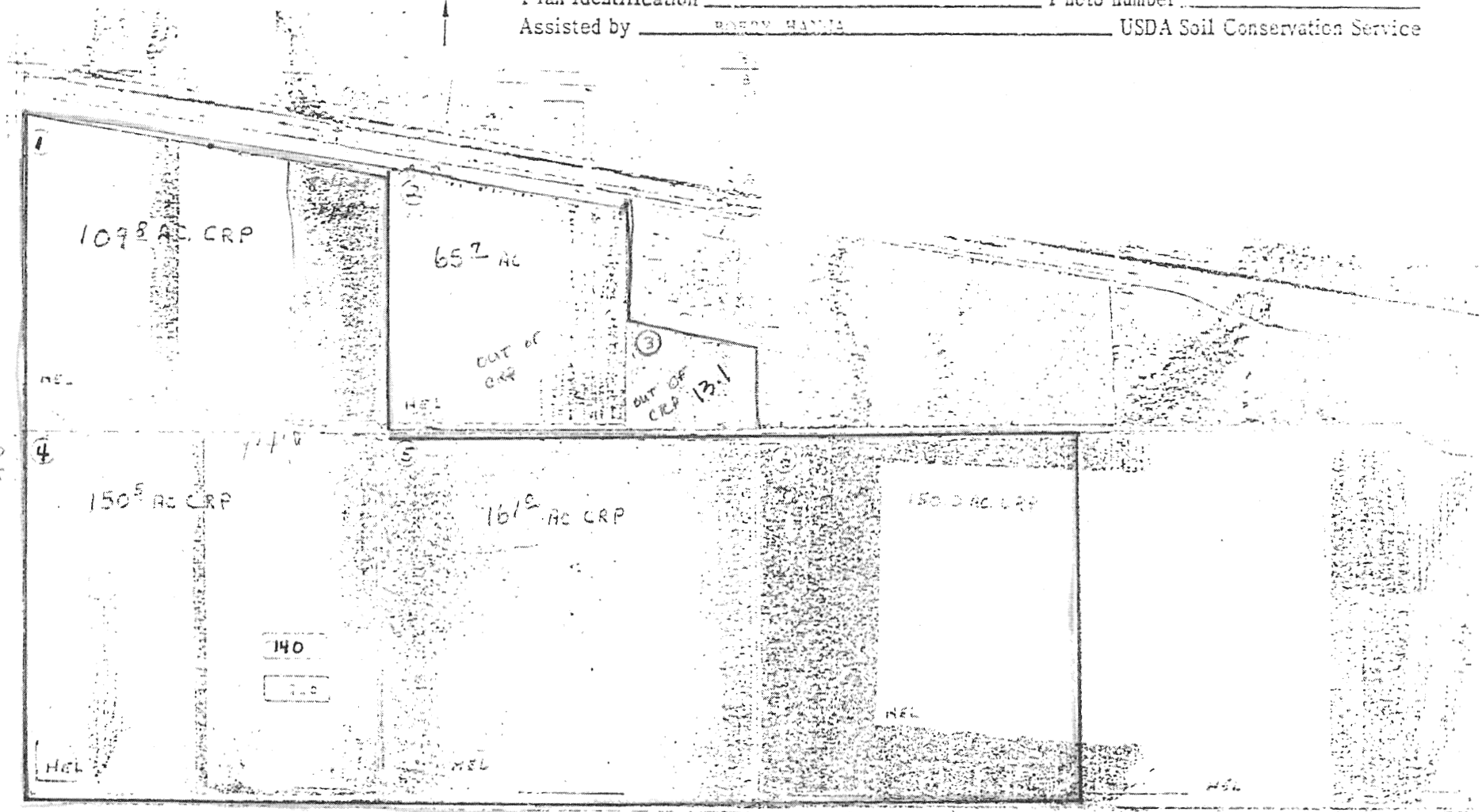
County: LUNA State: NEW MEXICO Date: 2-17-93

Approximate acres: 571.3 Approximate scale:

Cooperating with: DEMING SOIL AND WATER Conservation District

Plan identification: Photo number:

Assisted by: BOBBY HANNA USDA Soil Conservation Service



U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

ART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 8/14/09
Name Of Project SAPPHIRE ENERGY	Federal Agency Involved USDA
Proposed Land Use INTEGRATED ALGA BIO-REFINERY FACILITY	County And State LUNA NEW MEXICO
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes	No	Acres Irrigated	Average Farm Size
	[redacted]	N/A KB	0	

Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount Of Farmland As Defined In FPPA Acres: %
Name Of Land Evaluation System Used N/A	Name Of Local Site Assessment System N/A	Date Land Evaluation Returned By NRCS

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	400.0			
B. Total Acres To Be Converted Indirectly	442.4			
C. Total Acres In Site	842.4	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	0			
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value				
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	0	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	0			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	15			
6. Distance To Urban Support Services	15	10			
7. Size Of Present Farm Unit Compared To Average	10	10			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	0			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160	65	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	65	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	65	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

Contains no prime, unique, statewide or locally designated cropland. 8/31/09 KENNETH F. SCHOFFE, STATE Soil Scientist

(See Instructions on reverse side) Form AD-1006 (10-83)

This form was electronically produced by National Production Services Staff

Part VI Site Assessment Criteria

1. Area In Non-urban Use – 100% of the land is in non-urban use within 1.0 mile from where the project is intended. The nearest urban center is 2 miles away. Maximum Total Points 15, Points earned 15.

2. Perimeter In Non-urban Use – 100% of the land perimeter borders non-urban use. The nearest urban center is 2 miles away. Maximum Total Points 10, Points earned 10.

3. Percentage of Site Being Farmed – 0% of the land is being farmed. The last time the land was farmed was 1978. Maximum Total Points 20, Points earned 0.

4. Protection Provided By State And Local Governments – 0% of the site is subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland. Maximum Total Points 20, Points earned 0.

5. Distance to Urban Built-up Area – The site is 2 miles or more from an urban built-up area. Maximum Total Points 15, Points earned 15.

6. Distance to Urban Support Services – Some services such as electricity, fire and police protection and schools are more than 1 mile but less than 3 miles from the site. Maximum Total Points 15, points earned 10.

7. Size of Present Farm Unit Compared to Average – The farm unit is as large as the average size farm unit in the area. Maximum Total Points 10, Points earned 10.

8. Creation of Non-Farmable Farmland – The land currently is not farmed but upon closure of the facility the land will be returned to its pre-development conditions. Maximum Total Points 10, Points earned 0.

9. Availability of Farm Support Services – The site will not have an adverse affect on the available farm support services. Currently those services are not being used because no farming has been done since 1978. Maximum Total Points 5, Points earned 5.

10. On-Farm Investments – There are no structures on the site or irrigation systems that are operational. Maximum Total Points 20, Points Earned 0.

11. Effects Of Conversion On Farm Support Services – The site would actually require many support services and possibly create demand some new services. Maximum Total Points 10, points Earned 0.

12. Compatibility With Existing Agricultural Use – The site is currently not being farmed. The site use would be compatible with the surrounding area and would not have any long-term environmental effect. Maximum Total Points 10, Points earned 0.

APPENDIX F

Laboratory Test Summary

SAPPHIRE ENERGY
PROJECT NO. 14848.000.0
PERMEABILITY TESTING FOR COLUMBUS SITE

Sample	ESS-13 Compound	Application	$\gamma_{initial}$ (pcf)	$wc_{initial}$ (%)	$RC_{initial}$ (%)	γ_{final} (pcf)	wc_{final} (%)	$RC_{initial}$ (%)	k_{avg} (cm/s)	Improvement
B-1	None	N/A	114.5	11.0	95.0%	120.8	14.6	100.2%	7.25E-06	N/A
B-1	White/100	Treat and Compact with Spray On	114.5	11.0	95.0%	115.8	16.8	96.1%	4.70E-07	93.5%
B-1	Brown/100	Treat and Compact with Spray On	114.5	11.0	95.0%	115.9	16.8	96.2%	1.16E-06	84.0%
B-1	Yellow/1000	Treat and Compact with Spray On	114.5	11.0	95.0%	116.2	16.7	96.4%	1.71E-06	76.4%

3

ATTACHMENT F-3

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES
NEW MEXICO TECH
801 LEROY PLACE, SOCORRO, NM 87801
Phone: (575) 835-5160 FAX: (575) 835-6333

General Chemistry Analysis

Name	Greg Miller		
Address	AMEC	Date Received	3/16/2009
Address 2	P.O. Box 445	Date Completed	3/18/2009
City, State, Zip code	Socorro NM 87801		
Phone	(575) 835-2569	**CHARGES**	
FAX	(575) 835-2609		
Cell phone			
Email	greg.miller@amec.com		

Lab ID	09-0186	09-0187
Well Name	**M-3668**	**M1933a**
pH	7.7	7.9
Conductivity (uS/cm)	**1400**	**1120**
TDS calculated (mg/L)	794	699
Hardness (mg eq/L CaCO3)	**105**	**70**
Alkalinity as $CO3^{-2}$ (mg/L)		
Alkalinity as HCO3- (mg/L)	**290**	**365**
Bromide (mg/L)	0.75	<0.5
Chloride (mg/L)	**105**	**51**
Fluoride (F-) (mg/L)	4.6	6.0
Nitrite (NO2-) (mg/L)	**<0.5**	**<0.5**
Nitrate (NO3-) (mg/L)	11	5.5
Phosphate (mg/L)	**<2.5**	**<2.5**
Sulfate (SO42-) (mg/L)	210	170
Sodium (Na) (mg/L)	**230**	**205**
Potassium (K) (mg/L)	21	17
Magnesium (Mg) (mg/L)	**5.8**	**4.2**
Calcium (Ca) (mg/L)	33	21
Total cations (meq/L)	12.64	10.73
Total anions (meq/L)	12.51	11.37
Percent difference	0.50	-2.89

Approved By: _____

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES
NEW MEXICO TECH
801 LEROY PLACE, SOCORRO, NM 87801
PH: 505-835-5160 FAX: 505-835-6333

METALS AND MAJOR CATION ANALYSES

Customer name	Greg Miller	Date Received	3/16/2009
Address	AMEC	Date Completed	3/18/2009
Address 2	P.O. Box 445		
City, State, Zip code	Socorro NM 87801	**CHARGES**	
Phone	(575) 835-2569		
FAX	(575) 835-2609		
Cell phone			
Email	greg.miller@amec.com		

All concentrations in mg/L.

Lab ID	09-0186 filt	09-0186 un	09-0187 filt	09-0187 un
Well Name	**M-3668**	**M-3668**	**M-1933a**	**M-1933a**
Basis	**Filtered**	**Unfiltered**	**Filtered**	**Unfiltered**
ICP-MS				
Aluminum (Al)	0.001	0.004	0.006	1.2
Antimony (Sb)	**<0.005**	**<0.005**	**<0.005**	**<0.005**
Arsenic (As)	0.005	0.007	0.002	0.032
Barium (Ba)	**0.18**	**0.013**	**0.38**	**0.094**
Beryllium (Be)	<0.001	<0.001	<0.001	0.001
Boron (B)	**0.28**	**0.26**	**0.31**	**0.27**
Cadmium (Cd)	<0.001	<0.001	<0.001	0.002
Chromium (Cr)	**0.001**	**0.005**	**0.001**	**0.10**
Cobalt (Co)	<0.001	<0.001	<0.001	0.009
Copper (Cu)	**0.008**	**0.015**	**0.008**	**0.16**
Lead (Pb)	0.001	0.002	<0.001	0.029
Lithium (Li)	**0.21**	**0.21**	**0.18**	**0.19**
Manganese (Mn)	0.007	0.015	0.021	0.43
Molybdenum (Mo)	**0.030**	**0.030**	**0.051**	**0.024**
Nickel (Ni)	0.001	0.001	0.001	0.013
Selenium (Se)	**0.006**	**0.006**	**<0.005**	**<0.005**
Silicon (Si)	19	19	15	27
Silver (Ag)	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Strontium (Sr)	0.74	0.74	0.40	0.58
Thalium (Tl)	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Thorium (Th)	<0.001	<0.001	<0.001	0.003
Tin (Sn)	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Titanium (Ti)	0.002	0.002	0.002	0.012
Uranium (U)	**0.003**	**0.002**	**0.005**	**0.009**
Vanadium (V)	0.011	0.013	0.018	0.21
Zinc (Zn)	**0.10**	**0.074**	**0.11**	**0.24**
ICP-OES				
Iron (Fe)	**0.052**	**0.57**	**0.066**	**52**

Approved By: _____

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES
NEW MEXICO TECH
801 LEROY PLACE, SOCORRO, NM 87801
Phone: (575) 835-5160 FAX: (575) 835-6333

General Chemistry Analysis

Name	Greg Miller		
Address	AMEC	Date Received	3/20/2009
Address 2	P.O. Box 445	Date Completed	3/25/2009
City, State, Zip code	Socorro NM 87801		
Phone	(575) 835-2569	**CHARGES**	
FAX	(575) 835-2609		
Cell phone			
Email	greg.miller@amec.com		

Lab ID	09-0213	09-0214	09-0215	09-0216
Well Name	**M-4747**	**M-4748**	**M-1598**	**M-15985**
pH	8.5	8.1	7.8	7.6
Conductivity (uS/cm)	**910**	**855**	**2033**	**1514**
TDS calculated (mg/L)	587	526	1429	992
Hardness (mg eq/L CaCO3)	**50**	**56**	**244**	**148**
Alkalinity as $CO3^{-2}$ (mg/L)	4.5			
Alkalinity as HCO3- (mg/L)	**295**	**280**	**375**	**395**
Bromide (mg/L)	0.31	0.24	<1.0	<0.5
Chloride (mg/L)	**43**	**30**	**71**	**62**
Fluoride (F-) (mg/L)	3.5	3.7	3.0	4.6
Nitrite (NO2-) (mg/L)	**<0.1**	**<0.1**	**<1.0**	**<0.5**
Nitrate (NO3-) (mg/L)	7.9	3.7	4.7	8.7
Phosphate (mg/L)	**<0.5**	**<0.5**	**<5.0**	**<2.5**
Sulfate (SO42-) (mg/L)	145	125	650	340
Sodium (Na) (mg/L)	**185**	**165**	**375**	**270**
Potassium (K) (mg/L)	9.8	11	18	18
Magnesium (Mg) (mg/L)	**7.3**	**4.5**	**24**	**12**
Calcium (Ca) (mg/L)	8.1	15	59	40
Total cations (meq/L)	9.31	8.59	21.65	15.15
Total anions (meq/L)	9.53	8.30	21.91	15.69
Percent difference	-1.19	1.71	-0.60	-1.74

Approved By: _____

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES
NEW MEXICO TECH
801 LEROY PLACE, SOCORRO, NM 87801
PH: 505-835-5160 FAX: 505-835-6333

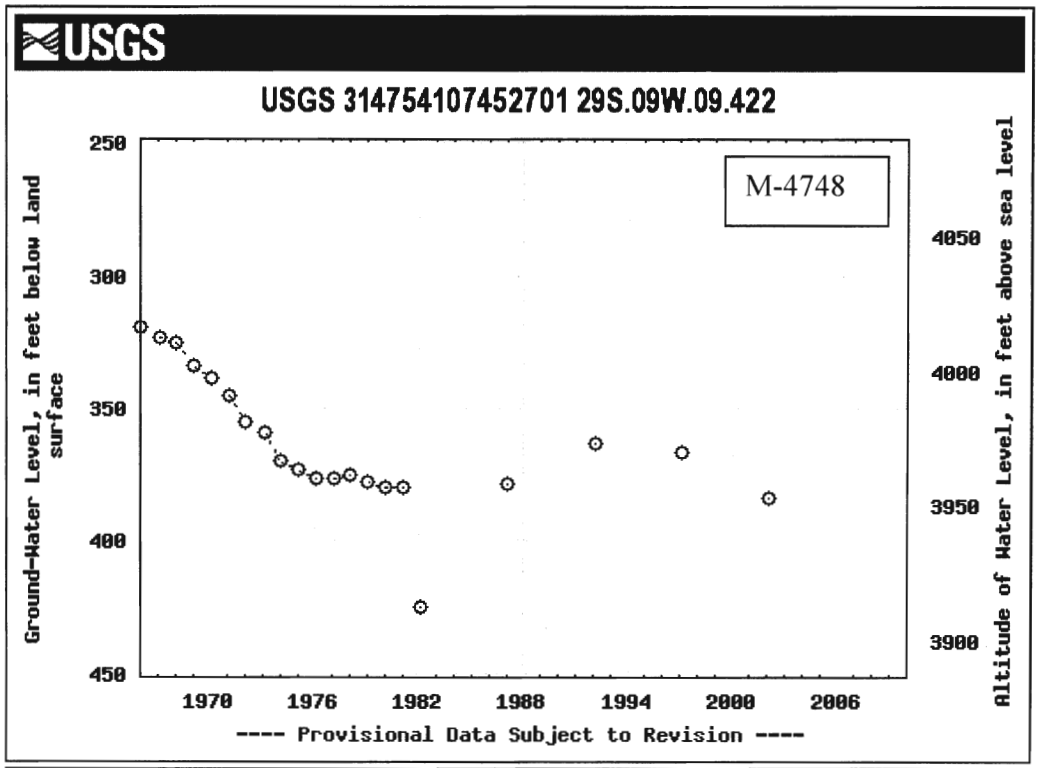
METALS AND MAJOR CATION ANALYSES

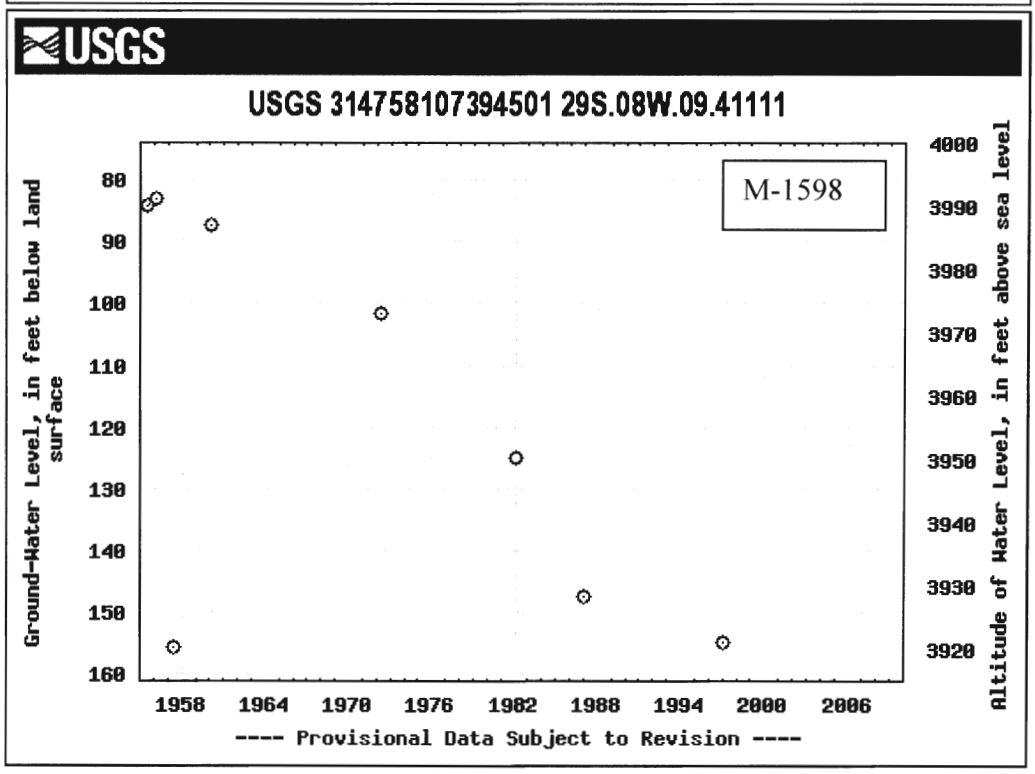
Customer name	Greg Miller
Address	AMEC
Address 2	P.O. Box 445
City, State, Zip code	Socorro NM 87801
Phone	(575) 835-2569
FAX	(575) 835-2609
Cell phone	
Email	greg.miller@amec.com

Date Received 2009-03-20
Date Completed
CHARGES

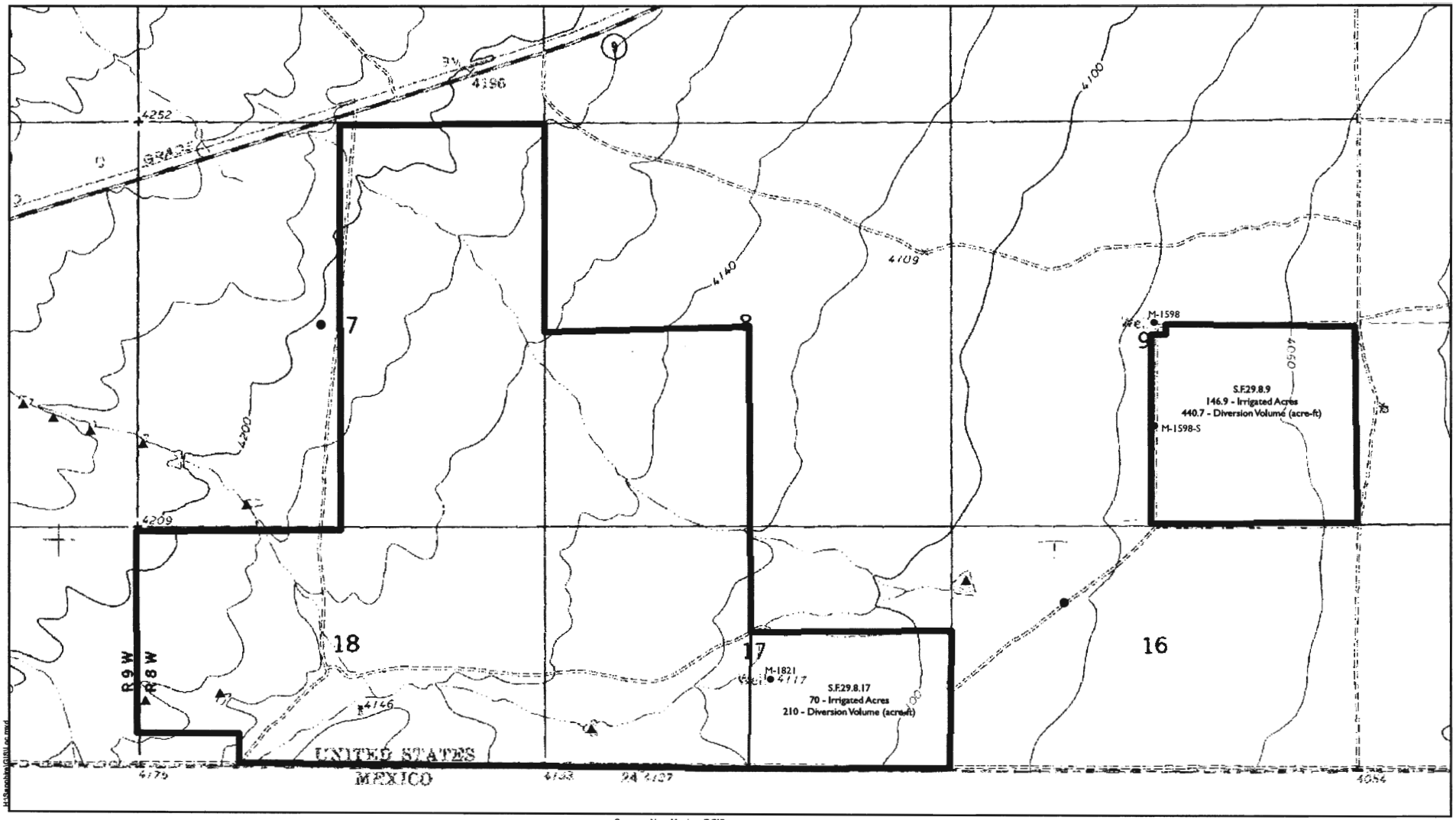
All concentrations in mg/L

Lab ID	09-0213 fil	09-0214 fil	09-0215 fil	09-0216 fil	09-0213 unf	09-0214 unf	09-0215 unf	09-0216 unf
Well Name	**M-4747**	**M-4748**	**M-1598**	**M-1598s**	**M-4747**	**M-4748**	**M-1598**	**M-1598s**
Basis	**Filtered**	**Filtered**	**Filtered**	**Filtered**	**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**
ICP-MS								
Aluminum (Al)	0.006	<0.005	<0.01	<0.01	0.031	0.16	0.078	<0.01
Antimony (Sb)	**<0.025**	**<0.025**	**<0.05**	**<0.05**	**<0.025**	**<0.025**	**<0.05**	**<0.05**
Arsenic (As)	0.006	0.020	<0.01	<0.01	0.006	0.025	<0.01	<0.01
Barium (Ba)	**0.18**	**0.096**	**0.14**	**0.13**	**<0.025**	**0.013**	**<0.05**	**0.127**
Beryllium (Be)	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.01	<0.01
Boron (B)	**0.36**	**0.31**	**0.57**	**0.56**	**0.34**	**0.29**	**0.55**	**0.56**
Cadmium (Cd)	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.01	<0.01
Chromium (Cr)	**<0.005**	**<0.005**	**<0.01**	**<0.01**	**0.005**	**<0.005**	**<0.01**	**<0.01**
Cobalt (Co)	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.01	<0.01
Copper (Cu)	**0.007**	**<0.005**	**<0.01**	**<0.01**	**0.16**	**0.044**	**0.013**	**<0.01**
Lead (Pb)	<0.005	<0.005	<0.01	<0.01				
Lithium (Li)	**0.12**	**0.11**	**0.25**	**0.22**	**0.12**	**0.11**	**0.25**	**0.22**
Manganese (Mn)	0.005	0.043	0.21	0.12	0.040	0.130	0.27	0.12
Molybdenum (Mo)	**0.021**	**0.015**	**0.015**	**0.022**	**0.020**	**0.011**	**<0.01**	**0.021**
Nickel (Ni)	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	0.013	0.002
Selenium (Se)	**<0.025**	**<0.025**	**<0.05**	**<0.05**	**<0.025**	**<0.025**	**<0.05**	**<0.05**
Silicon (Si)	16	18	16	14	16	19	17	14
Silver (Ag)	**<0.005**	**<0.005**	**<0.01**	**<0.01**				
Strontium (Sr)	0.34	0.39	2.1	1.2	0.35	0.40	2.1	1.16
Thalium (Tl)	**<0.005**	**<0.005**	**<0.01**	**<0.01**				
Thorium (Th)	<0.005	<0.005	<0.01	<0.01				
Tin (Sn)	**<0.005**	**<0.005**	**<0.01**	**<0.01**	**<0.005**	**<0.005**	**<0.01**	**0.000**
Titanium (Ti)	<0.005	<0.005	<0.01	<0.01	<0.005	0.005	<0.01	0.002
Uranium (U)	**0.005**	**0.005**	**0.012**	**0.006**				
Vanadium (V)	0.023	0.012	<0.01	<0.01	0.023	0.020	0.013	0.009
Zinc (Zn)	**0.021**	**0.043**	**0.073**	**0.064**	**0.072**	**0.099**	**0.045**	**0.078**
ICP-OES								
Iron (Fe)	**<0.25**	**<0.25**	**<0.5**	**<0.5**	**0.30**	**4.2**	**15**	**<0.5**
Silicon (Si)	15	18	15	13	15	18	17	13





Hydrographs for Site Wells



Source: New Mexico, RGIS

N

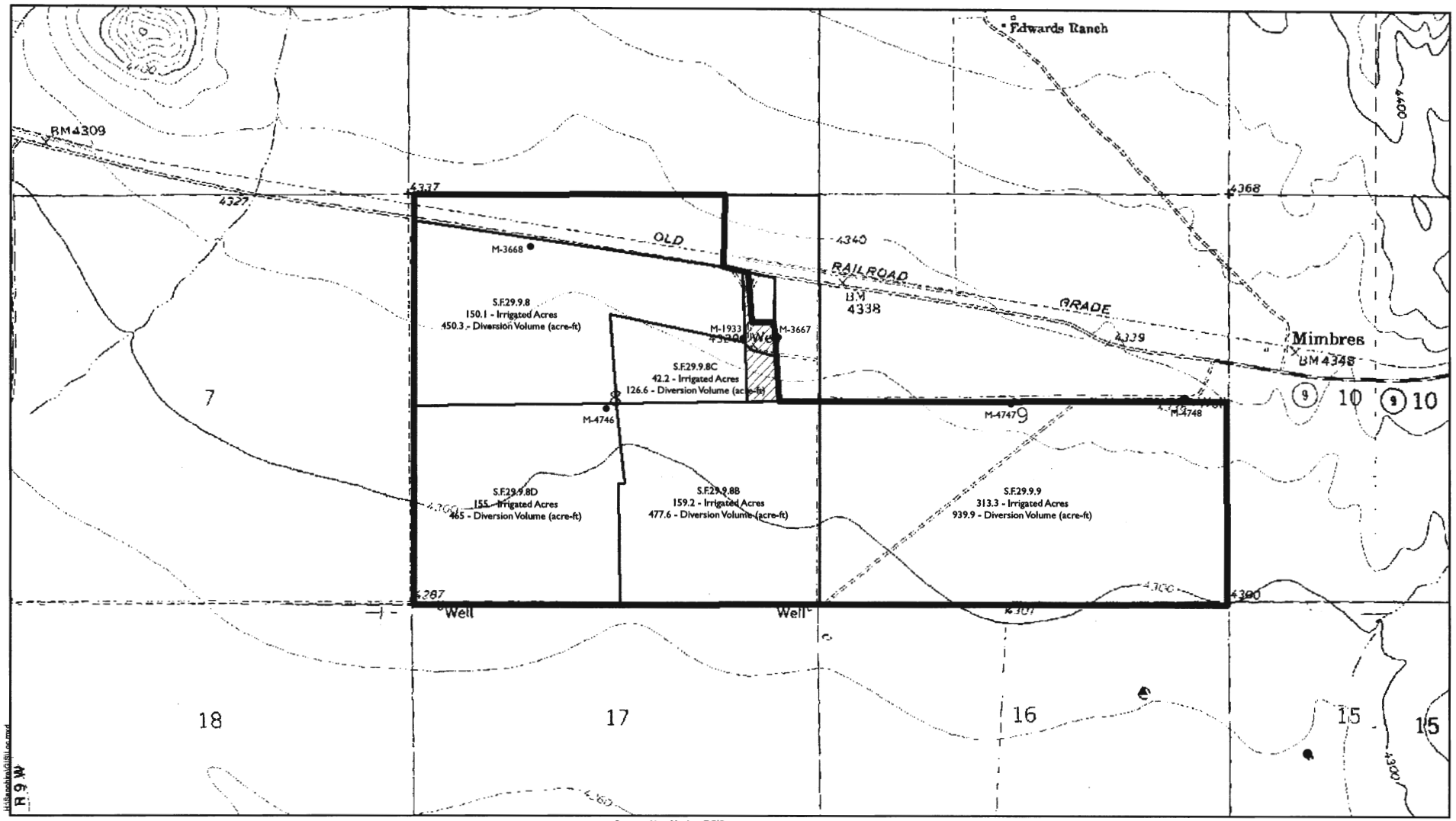
Feet
0 1,200

AMEC Geomatrix

- Irrigation Well
- Property Boundary
  Total Irrigated - 216.9 ac.
  Total Volume - 650.7 acft/year
- Irrigated Property

Wetlands (NWI)
- Palustrine Flat Wetland
- Palustrine Open Water Wetland

Site Features - East Parcels
Columbus, New Mexico
FIGURE 3



Source: New Mexico, RGIS

N

Feet

0 1,200

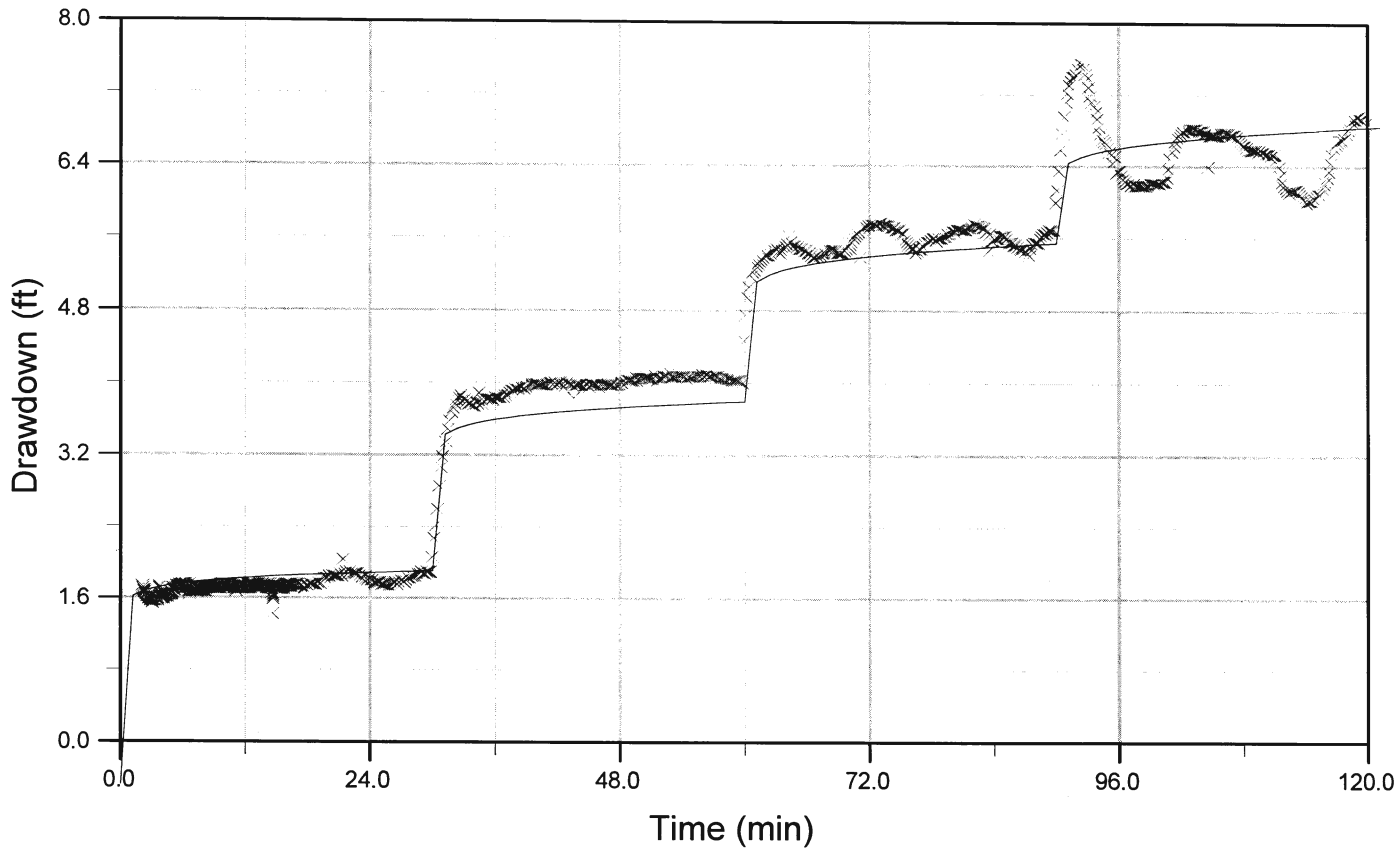
AMEC Geomatrix

- Irrigation Well
- Property Boundary
  Total Irrigated - 819.8 ac.
  Total Volume - 2,459.4 acft/year

Irrigated Property
- Cook Property
- May Property
- Irrigated Property
- Proposed for sale to May

Wetlands (NWI)
- Palustrine Flat Wetland
- Palustrine Open Water Wetland

Site Features - West Parcels
Columbus, New Mexico
FIGURE 4

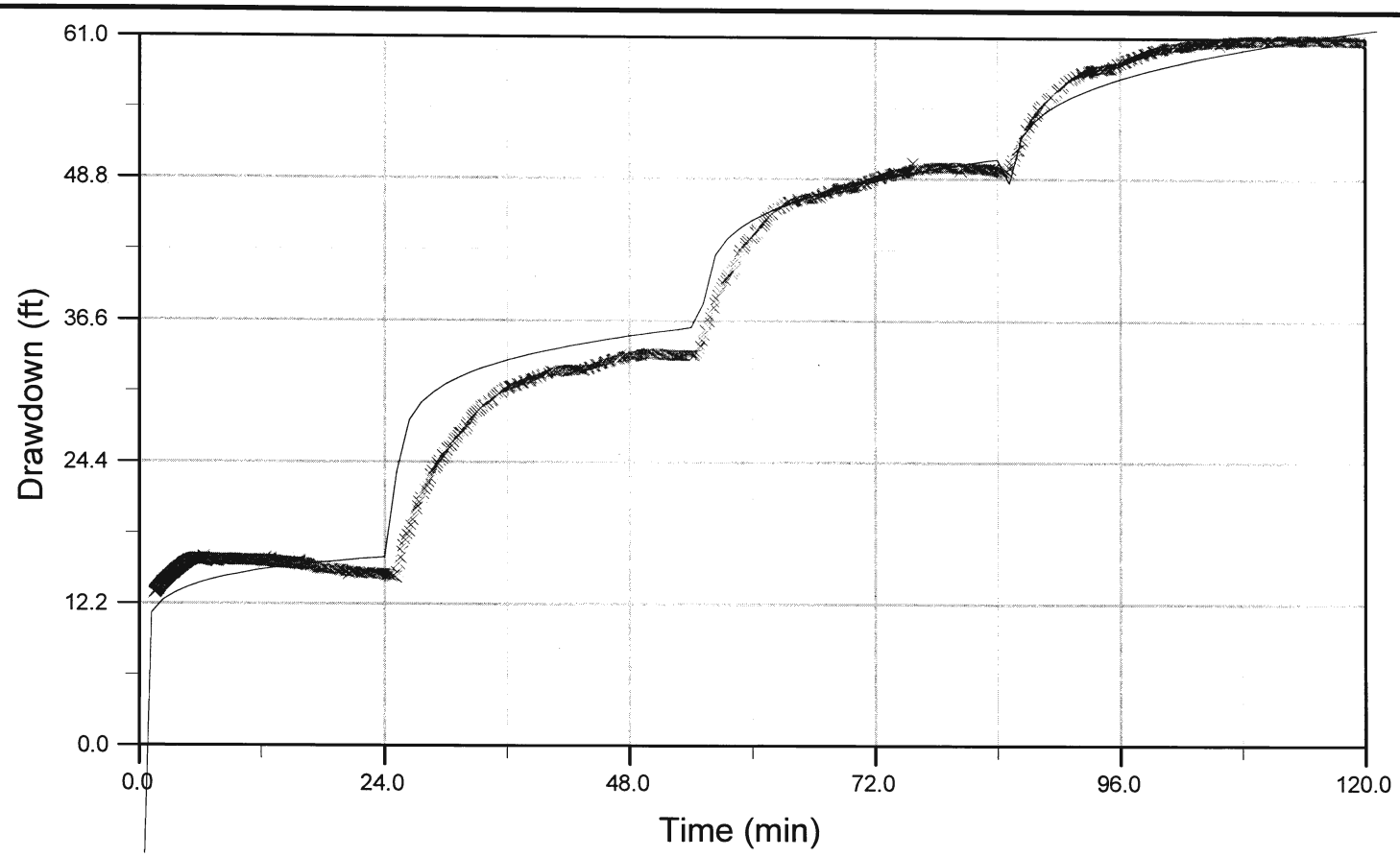


Step Test of Well: M-1598S

Pumping Rates:		Maximum Drawdown:	
Step 1:	47	Step 1:	4.31
Step 2:	98	Step 2:	5.17
Step 3:	151	Step 3:	6.14
Step 4:	188	Step 4:	7.56

Results:
Transmissivity:
7,958 sq ft/d
Eden and Hazel, 1973

amec

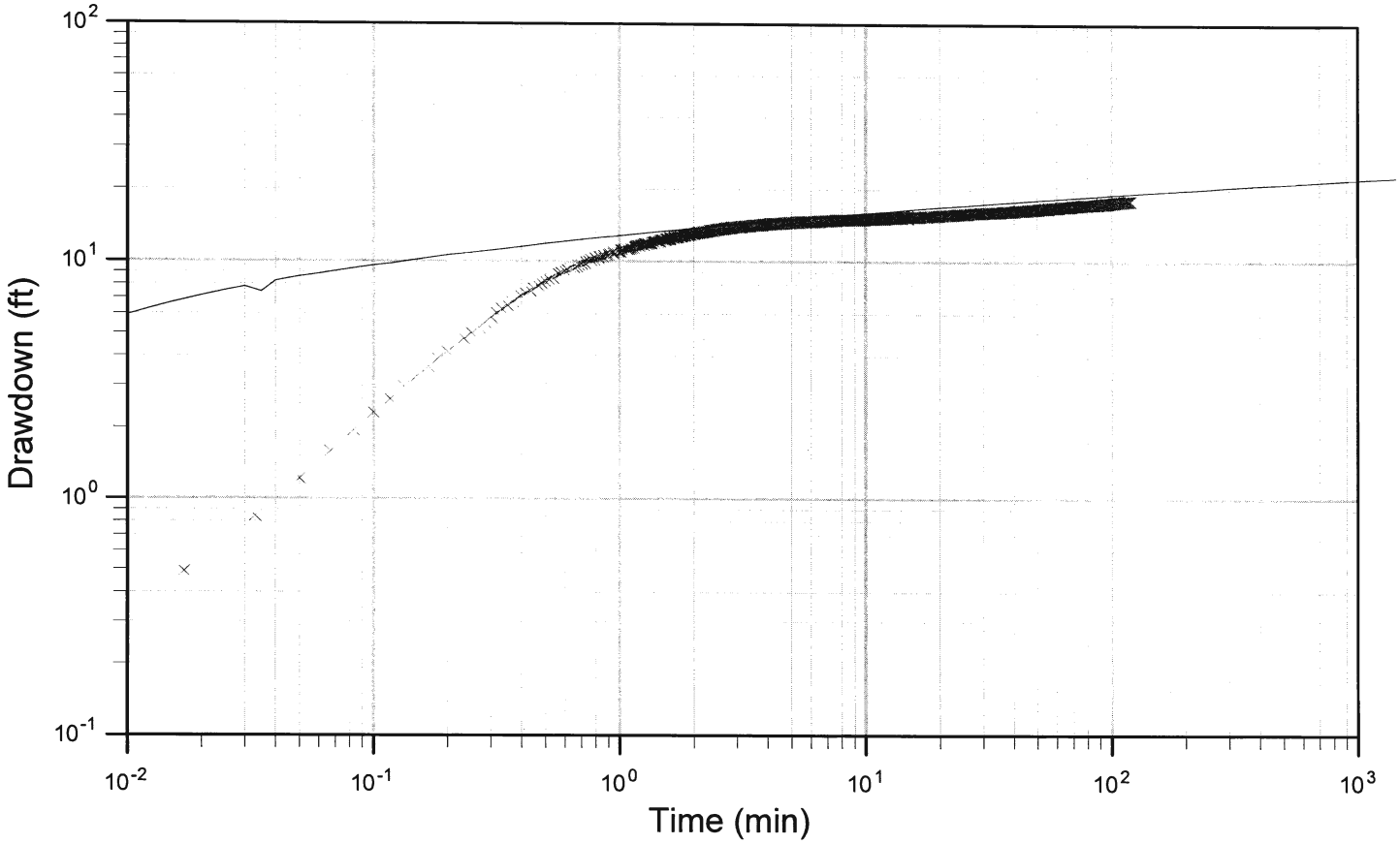


Step Test of Well: M-1933

Pumping Rates:		Maximum Drawdown:	
Step 1:	41	Step 1:	26.5
Step 2:	98	Step 2:	44.9
Step 3:	150	Step 3:	57.9
Step 4:	199	Step 4:	60.9

Results:
Transmissivity:
1,398 sq ft/d
Eden and Hazel, 1973

amec



Step Test of Well: M-3668

Pumping Rates:

Step 1: 243

Maximum Drawdown:

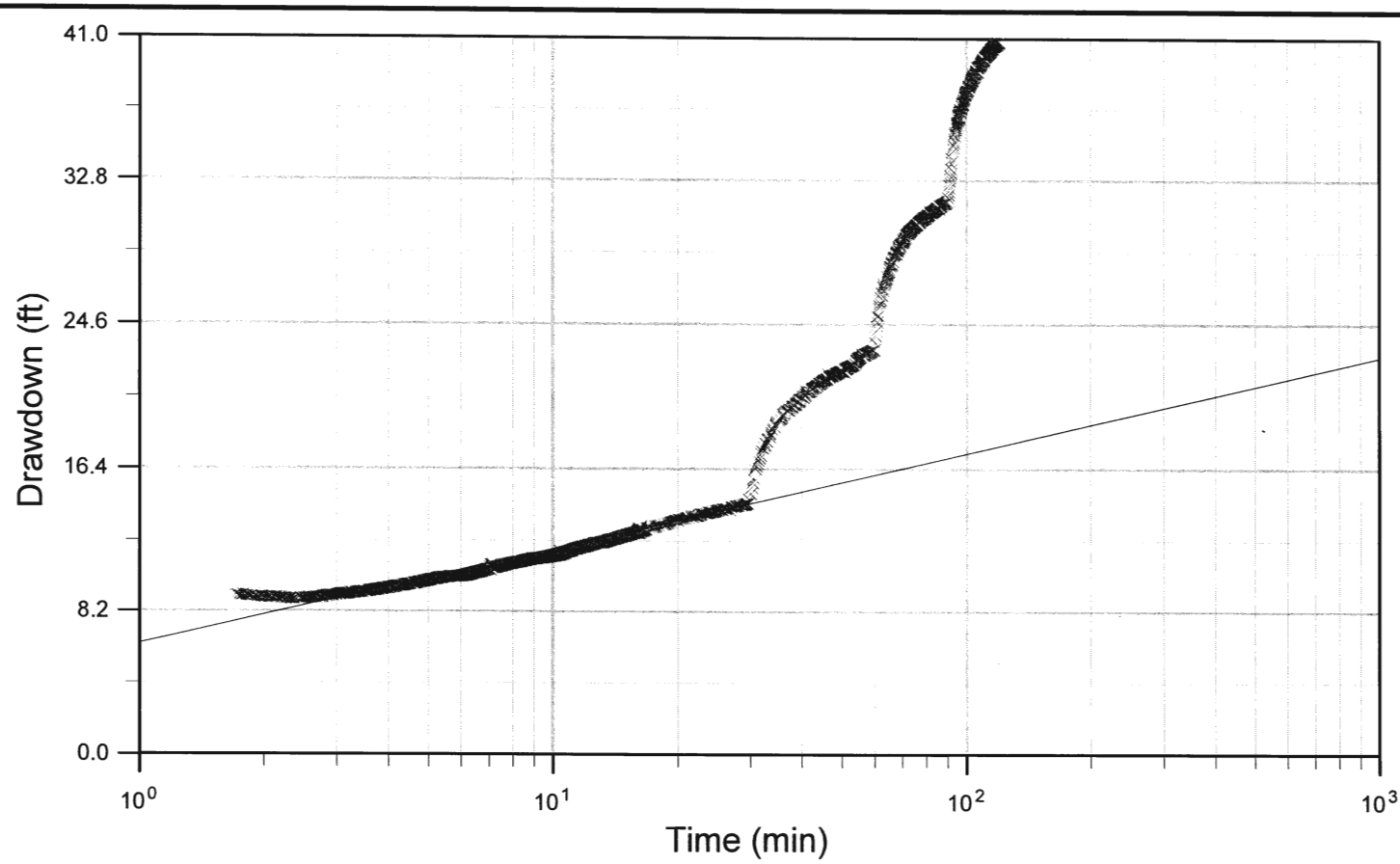
Step 1: 18.5

Results:

Transmissivity:

3,769 sq ft/d

Papadopolus and Cooper, 1967

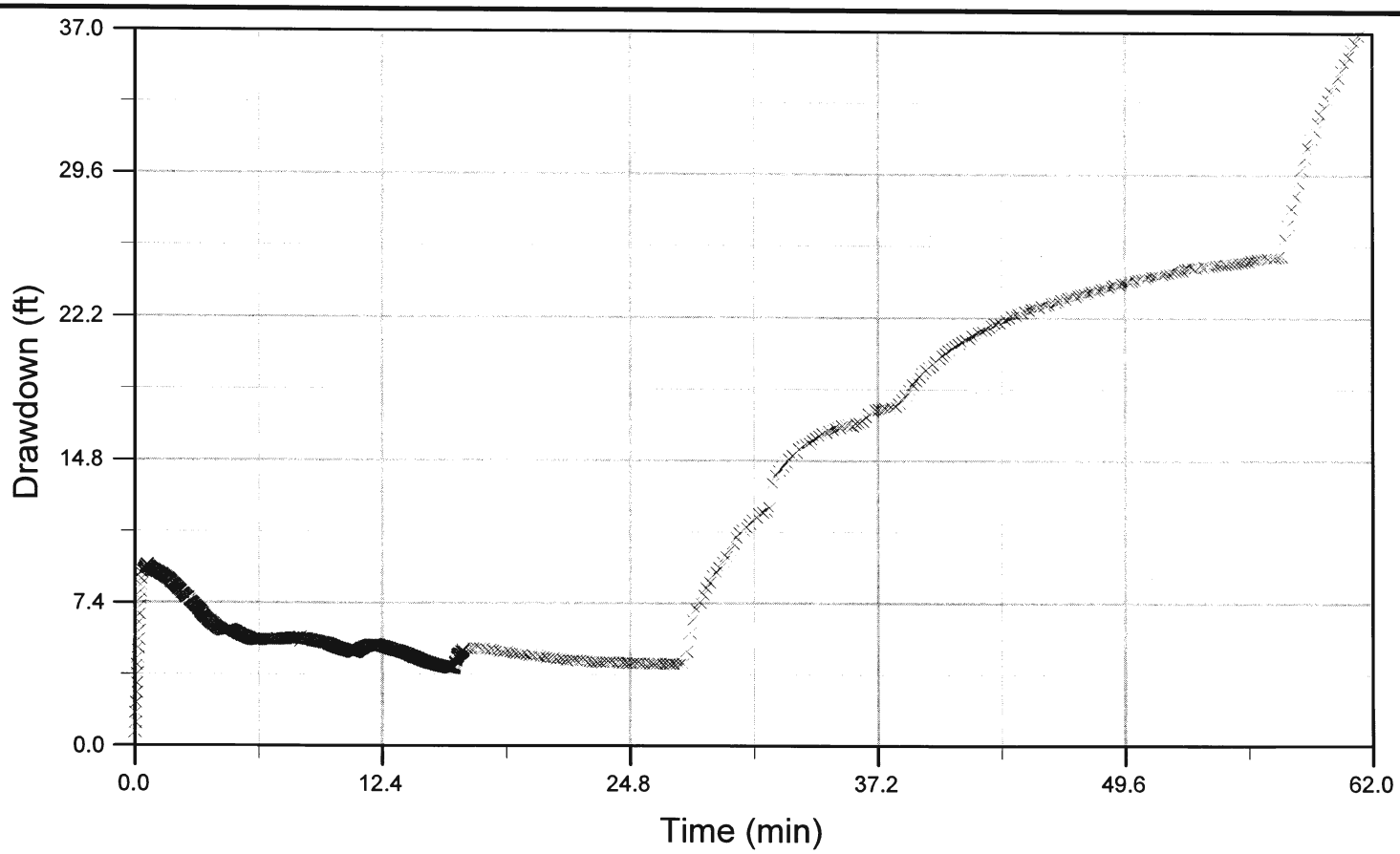


Step Test of Well: M-4748

Pumping Rates:		Maximum Drawdown:	
Step 1:	99	Step 1:	15.0
Step 2:	149	Step 2:	23.2
Step 3:	199	Step 3:	33.8
Step 4:	247	Step 4:	40.8

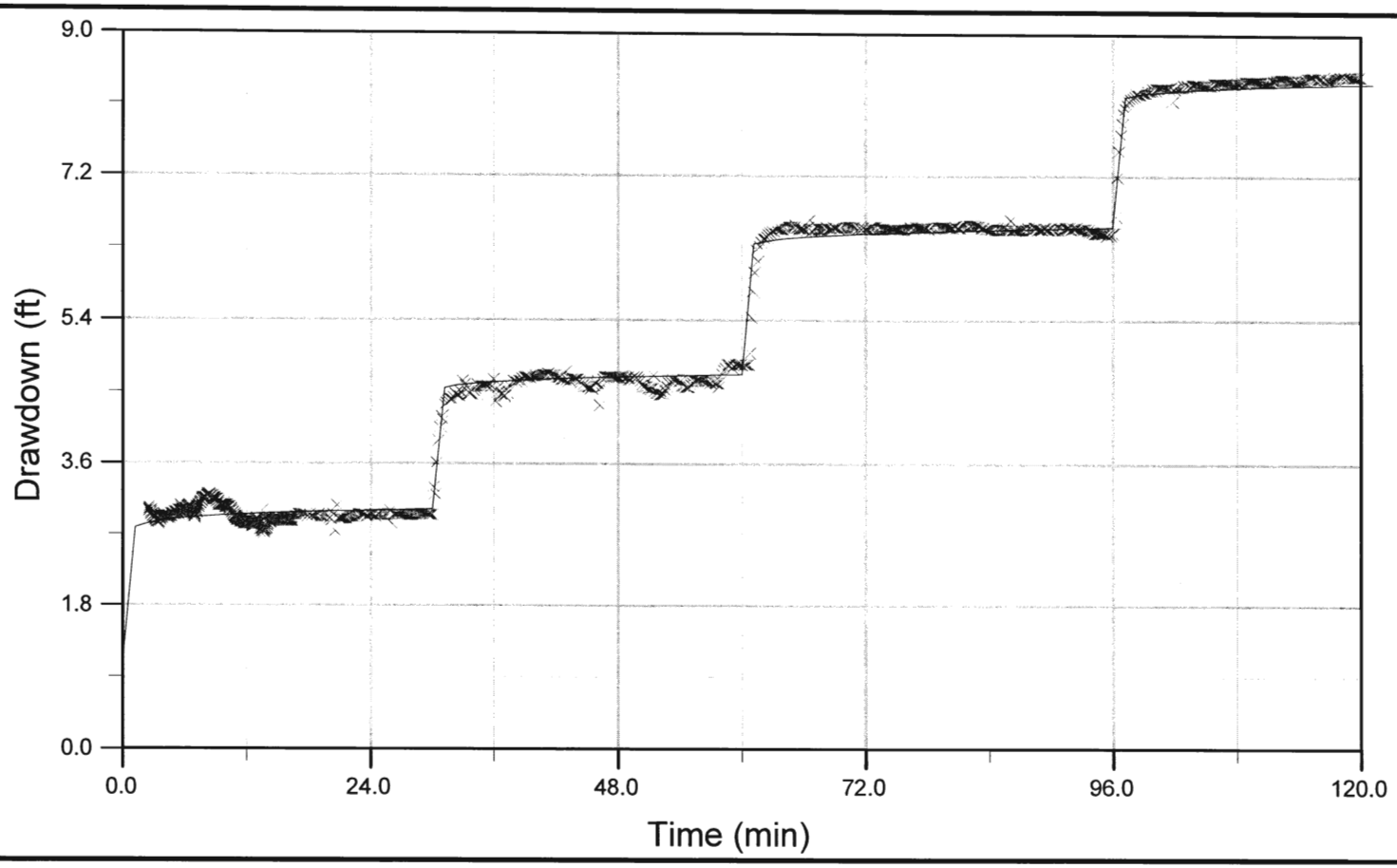
Results:
Transmissivity:
960 sq ft/d
Cooper and Jacob, 1946

amec



Step Test of Well: M-1598

Pumping Rates:		Maximum Drawdown:		Results:
Step 1:	44	Step 1:	10.8	Transmissivity:
Step 2:	104	Step 2:	34.3	Not calculated
Step 3:	162	Step 3:	37.3	



Step Test of Well:

Pumping Rates:		Maximum Drawdown:	
Step 1:	94	Step 1:	7.19
Step 2:	145	Step 2:	4.87
Step 3:	199	Step 3:	6.65
Step 4:	253	Step 4:	8.64

Results:
Transmissivity:
10,965 sq ft/d
Eden and Hazel, 1973

amec

4

ATTACHMENT F-4

SENT BY CERTIFIED MAIL

September 18, 2009

Ms. Lesley McWhirter
NM/TX Branch Chief, Regulatory Division
Albuquerque District, U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109

RE: Concurrence Request for Wetlands Jurisdictional Determination; Property in Luna County, New Mexico

Dear Ms. McWhirter:

By this letter, Sapphire Energy Company (Sapphire) requests appropriate persons in the Army Corps of Engineers review the enclosed biological survey report for a property our company is attempting to develop in Luna County, New Mexico and concur with the findings reported on the "Preliminary Jurisdictional Determination Form." This form, along with the "Wetland Determination Data Form," are included in Appendix B of the attached document.

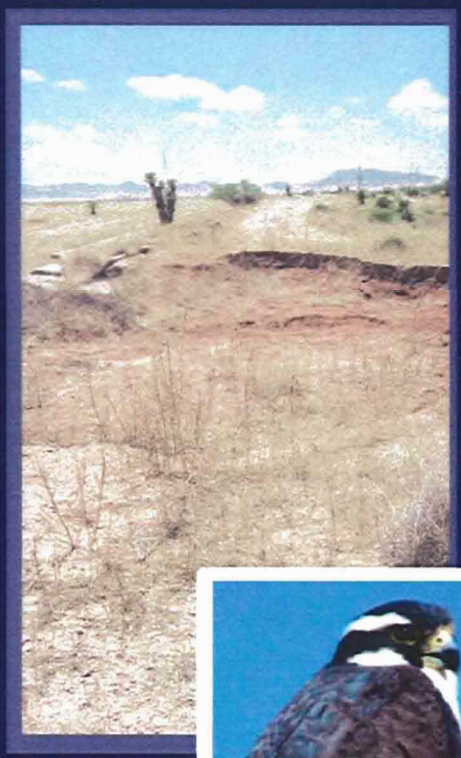
We would appreciate your timely response to this request.

Regards,

Name
Title
Sapphire Energy Company

Enc.

Biological and Wetland Field Survey Report Proposed IABR Project Cooper Ranch Property Luna County, New Mexico



Sapphire Energy

september 2009

AMEC Geomatrix

BIOLOGICAL AND WETLAND FIELD SURVEY REPORT
PROPOSED IABR PROJECT
COOPER RANCH PROPERTY
LUNA COUNTY, NEW MEXICO

Prepared for:

Sapphire Energy Company
3115 Merryfield Row
San Diego, California 92121

Prepared by:

AMEC Geomatrix, Inc.
1824 North Last Chance Gulch
Helena, Montana USA 59601
Contact: Myles Grotbo
+1 406 442 0860
myles.grotbo@amec.com

AMEC Geomatrix

September 2009

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APPENDICES

1.0 INTRODUCTION

Sapphire Energy Company (Sapphire) proposes to construct and operate an Integrated Algal Biorefinery Facility (IABR) to produce oil from algae, ultimately refining the oil into various types of transportation fuels. The proposed project is located in Luna County, New Mexico, southwest of the village of Columbus (Sections 8 and 9, Township 29 North, Range 9 West) (**Figure 1**). As part of environmental compliance, Sapphire contracted with AMEC Geomatrix Inc (AMEC Geomatrix) to conduct biological field surveys and wetland surveys of the project area. AMEC Geomatrix biologists conducted reconnaissance studies of the proposed project area (the Property) in March, 2009 and field surveys on June 2 through 5 and September 9 through 11, 2009 to:

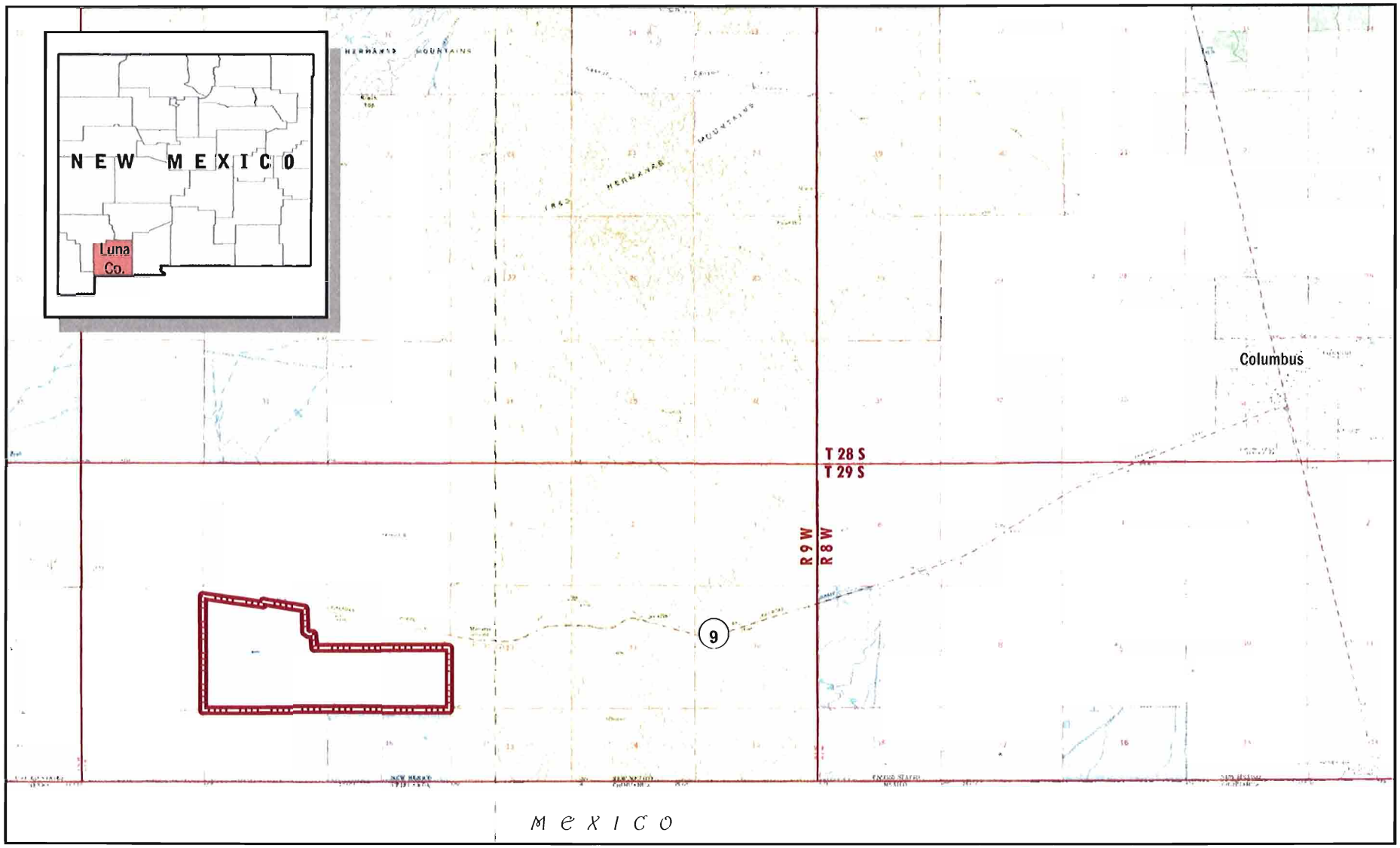
- Assess species of birds and other wildlife on and near the Property;
- Evaluate potential foraging and nesting habitat for the Aplomado falcon and other species protected under the Endangered Species Act of 1973;
- Assess habitat suitability for plant and animal species of conservation concern to the state of New Mexico;
- Conduct a survey for plant species of concern and identify dominant plant species; and,
- Identify and map wetlands and other waters of the United States that may be present on the Property.

This report presents findings from the June and September 2009 field surveys. The data presented herein and information reported in the scientific literature will be used as the basis for preparing portions of permit applications and environmental assessments related to the potential development of the Property as an IABR. Also included in this report are descriptions of agency consultations likely to be needed to fill data gaps to support the needs of various agency requirements for the possible development of the Property.

1.1 PROJECT AREA DESCRIPTION

The proposed project area lies within the Basin and Range physiographic province, which is characterized by low parallel mountain ranges separated by flat desert plains. The general terrain exhibits low relief with drainage flowing to the southeast. The site occurs within the Chihuahuan Desert Ecoregion and habitat is ecotonal between Chihuahuan semi-desert grassland and Chihuahuan desertscrub.

Ecological conditions of the part of the Property proposed for development have been altered by past land uses that have removed the original cover of native vegetation from the site. All of the property south of the east-west paved highway was used to produce irrigated crops until 1971, when farming was



N
W E
S

0 10,000
Feet

AMEC Geomatrix

Cooper Property
Bureau of Land Management
State of New Mexico
Private

Location Map
Sapphire Energy
Cooper Property
Luna County, New Mexico
FIGURE 1

discontinued and the site was allowed to colonize with invasive plants typical of soil that has been tilled. Much of the property contains dense stands of invasive species with low densities of native plants (**Photographs 1 and 2, Appendix A**). The species composition and canopy structure of vegetation on the property differs from native plant communities on adjacent state and federally managed public land (**Photograph 3 and 4, Appendix A**). Native vegetation on adjacent land is typical of the Semidesert Grassland and Chihuahuan Desertscrub (Brown 1982).

1.2 METHODS

1.2.1 Wildlife Observations

Observations of wildlife or their sign (e.g., tracks, scats, skeletal remains, and carcasses) including small mammals, and herps (amphibians and reptiles) were made while conducting avian surveys, vegetation surveys, walking transects, driving between sampling points, and during other phases of baseline data collection.

1.2.2 Avian Point Counts

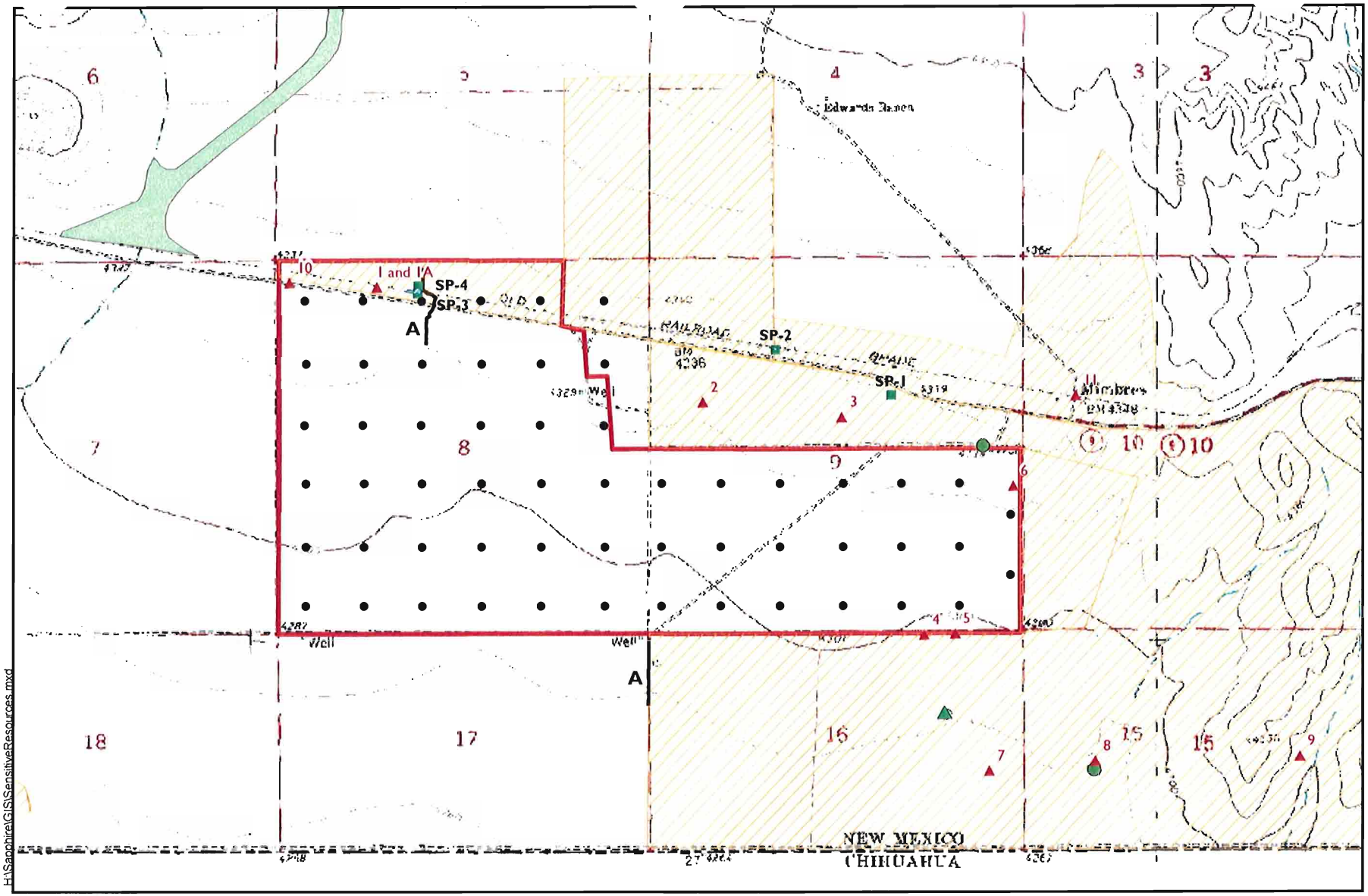
Avian surveys were conducted in June 2009 utilizing standard point-count methods. Sampling locations were spaced 250 meters apart, 125 meters from the Property fence line. All species observed visually or aurally within a 125-meter radius were recorded, along with the bird's distance from the observer and the bird's activity. Surveys were conducted for five minutes at each sampling station following a one minute listening period to allow birds to acclimate to the surveyor's presence. Surveys were conducted within the first three to four hours following sunrise; a total of 56 sampling points were used in completing the survey (**Figure 2**).

1.2.3 Vegetation Surveys

Surveys for New Mexico state-listed plant species potentially occurring on the Property were conducted using survey transects spaced at approximately 100 meters. Wetlands, other waters of the U.S., and wildlife habitat were also evaluated during these surveys. Dominant and subdominant vegetation was noted and infrequent plants were identified to determine if plant species of conservation concern are present on the Property. Taxonomic references included the Flora of Arizona (Kearney and Peebles 1960), A Flora of New Mexico (Martin and Hutchens 1980) the Flora of North America http://www.efloras.org/flora_page.aspx?flora_id=1). Taxonomic nomenclature follows USDA Plants (http://plants.usda.gov/checklist.html).

1.2.4 Wetland Surveys

Potential wetlands and other waters of the U.S. were surveyed along 100-meter transects within the Property boundaries. Special attention was directed towards drainages and low spots on topographic maps or indicated as a National Wetland Inventory (NWI) wetland. Potential wetlands were evaluated by following the methodology for the on-site determination outlined in the U.S. Army Corps of



N

Miles

0 0.5

AMEC Geomatrix

- Wetland Sample Point (SP-1)
- Avian Point-Count Survey Locations
- Potential Aplomado Falcon Nest Sites
- Erosional Feature

Wetlands (As mapped by National Wetland Inventory)

- Palustrine Flat Wetland
- Palustrine Open Water Wetland

- Cooper Property
- Wetlands
- 100 Year Floodplain
- Aplomado Suitable Falcon Habitat

Sensitive Resources Map
Sapphire Energy
Cooper Property
Luna County, New Mexico
FIGURE 2

Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2) (Environmental Laboratory 2008). These methods require an area to have positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology to satisfy the criteria for jurisdictional wetlands regulated under the Section 404 of the Clean Water Act.

1.2.5 Wetland Vegetation

The U.S. Fish and Wildlife Service classified vegetation according to its frequency of occurrence in wetlands (Reed 1988). Plant species have been given wetland indicator status of either obligate wetland (OBL), facultative wetlands (FACW), facultative (FAC), facultative upland (FACU), or upland (UPL) based on probabilities of occurring in wetlands. Definitions of wetland indicator status of plants are shown in **Table 1**. The Natural Resources Conservation Service (NRCS) has also compiled a list of plants and their wetland indicator status for Region 7. The NRCS list for Region 7 was used to determine wetland indicator status for plants at sites evaluated on the Property for jurisdictional wetlands.

Table 1: Plant Indicator Definitions

Indicator Symbol	Indicator Status	Definition
OBL	Obligate	Species that occur almost always (probability >99 %) in wetlands under natural conditions.
FACW	Facultative wetland	Species that usually occur in wetlands (probability 67 to 99 %), but occasionally found in non-wetlands
FAC	Facultative	Species that are equally likely to occur in wetlands and non-wetlands (probability 33 to 66 %).
FACU	Facultative upland	Species that usually occur in non-wetlands (probability 67 to 99 %), but occasionally found in wetlands
UPL	Upland	Species that occur almost always in non-wetlands under normal conditions (probability >99 %).
NI	No indicator	Species for which insufficient information was available to determine indicator status

1.2.6 Soils

Soils in the project area were evaluated for hydric conditions by digging holes 20-inches deep and recording soil colors based on Munsell Color Chart comparisons and observing soil textural and hydrological features (saturation depth).

1.2.7 Hydrology

Criteria for wetland hydrology require that jurisdictional wetlands have permanent or periodic inundation or soil saturation for a significant period of the growing season. Wetland hydrology may be supplied by surface water, groundwater, and direct precipitation

1.2.8 Significant Nexus Determinations

Significant nexus determinations were made for drainage features to determine if they have a surface connection to traditionally navigable waters of the United States. Significant nexus determinations were made by examining the topography and spatial extent of erosional features (ephemeral drainages) and plant communities adjacent to the wetlands. Information in the U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Handbook was reviewed to assist in nexus determinations.

2.0 WILDLIFE AND VEGETATION

2.1 SPECIES OBSERVED IN PROJECT AREA

Species diversity of wildlife within the Property is low, reflecting habitat conditions with limited breeding and foraging capacity for many species. Wildlife or their sign encountered during the site visit includes the striped skunk (*Mephitis mephitis*), deer (unknown species, tracks only), the banner-tailed kangaroo rat (*Dipodomys spectabilis*), roundtail horned lizard (*Phrynosoma modestum*), Texas horned lizard (*Phrynosoma cornutum*), coyote (*Canis latrans*), green cicada (*Sphecius grandis*), tarantula wasp (*Pepsis* sp.), grasshoppers, harvester ants, prairie rattlesnake (*Crotalus viridis*), black-tailed jackrabbit (*Lepus californicus*), northern earless lizard (*Holbrookia maculata maculata*), and tarantulas (*Aphonopelma* sp).

2.2 FEDERAL AND STATE SPECIES OF CONSERVATION CONCERN

No plant species protected under the Endangered Species Act are likely to inhabit the Project Area and federally designated critical habitat does not occur on the Property. **Table 2** lists federal and state species of conservation concern known or with the potential to be present in the Mimbres Basin.

According to the New Mexico Rare Plant Technical Council (NMRPTC), five special status species are known to occur within the project vicinity. Three of these species are considered Species of Concern by the USFWS and the State of New Mexico. Species that have been confirmed to be present in the northeast portion of the Mimbres Basin by NMRPTC are the grayish-white giant hyssop (*Agastache cana*), Orcutt pincushion cactus (*Escobaria orcuttii*), Chihuahua scurf pea (*Pediomelum pentaphyllum*), and Griffith's saltbush (*Atriplex griffithsii*). The dune prickly pear (*Opuntia arenaria*) and night-blooming cereus (*Peniocereus greggii* var. *greggii*), have documented occurrences near the Project Area and are considered Species of Concern by the USFWS and Endangered by the State of New Mexico.

Table 2: Federal and State Species of Concern
Known or with the Potential to be Present in the Mimbres Basin

Species	Status*	Habitat	Possible Occurrence in the Project Area	Reason for yes/no occurrence in Project Area
Amphibians				
Chiricahua leopard frog	FT	Permanent aquatic habitats between 2,800 and 7,300 ft. amsl	No	No habitat
Great Plains narrowmouth toad	SE	Grassland and desert grassland, tobosa grass, requires wet habitat in summer	Yes	Small amounts of suitable upland habitat may be present
New Mexico ridge-nose rattlesnake	FW	Montane woodlands and Madrean evergreen woodlands	No	No habitat
Fish				
Loach minnow	FT	Streams with riffle habitat	No	No habitat
Spikedace	FT	Streams with riffle habitat	No	No habitat
Beautiful shiner	FT	Rivers and streams	No	No habitat
Birds				
Bald eagle	BGEPA	Large trees or cliffs within one mile of foraging habitat.	No	No habitat

Species	Status*	Habitat	Possible Occurrence in the Project Area	Reason for yes/no occurrence in Project Area
Golden eagle	BGEPA	Grassland habitats	Yes	Foraging habitat present, no nesting habitat
Northern aplomado falcon	NEXP, SE	Grassy plains interspersed with mesquite, cactus, and yucca	Yes	Foraging habitat present limited nesting habitat
Common black-hawk	ST	Riparian woodlands	No	No habitat
Peregrine falcon	ST	Forages in desert, shrubland, chaparral, and woodlands; nests in rocky cliffs.	Yes, resident and summer migrants	Foraging habitat present, no nesting habitat
Southwestern willow flycatcher	FE, SE	Riparian woodlands, tamarisk stands	No	No habitat
Broad-billed hummingbird	ST	Varied habitat, including riparian woodlands and Chihuahuan desert scrub	No	Suitable nesting habitat not present
Costa's hummingbird	ST	Desertscrub, chaparral, deciduous forests	No	Suitable nesting habitat not present
Lucifer hummingbird	ST	Arid deserts with preferred nectaring plants	No	Suitable nesting habitat not present

Species	Status*	Habitat	Possible Occurrence in the Project Area	Reason for yes/no occurrence in Project Area
Violet-crowned hummingbird	ST	Riparian woodlands, forests, scrub-oak adjacent to xeric habitats	No	No habitat; there are no riparian woodlands
White-eared hummingbird	ST	Montane habitats, woodlands, forests	No	No habitat
Yellow-eyed junco	ST	High-elevation mixed coniferous and Ponderosa pine forests	No	No habitat
Thick-billed kingbird	SE	Riparian canyons, deciduous forests, thornscrub, woodlands.	No	Known to forage in desert scrub adjacent to habitat; however, no nesting habitat
Buff-collared nightjar	SE	In New Mexico, generally in canyons and washes with mesquite and other small trees	No	Preferred habitat absent, will likely occur only as a transient
Whiskered screech-owl	ST	Dense oak and pine-oak woodlands in canyon bottoms	No	No habitat
Mexican spotted owl	FE	Montane forests	No	No habitat
Arizona grasshopper sparrow	SE	Typically well-developed grasslands lacking woody vegetation	Unlikely	Marginal habitat, project area is invaded by shrubs or contains weeds.

Species	Status*	Habitat	Possible Occurrence in the Project Area	Reason for yes/no occurrence in Project Area
Mammals				
Spotted bat	ST	Roost in cliffs, found in higher elevation habitats during summer, lower elevations in winter	No	No habitat
Mexican long-nosed bat	FE	Desert scrub vegetation with century plants, creosotebush, and cacti. Roosts in mines, caves, and old buildings	No	No habitat
Lesser long-nosed bat	FE	Requires mines and caves for roost sites and saguaro cactus and paniculate agave for foraging	No	No habitat
Western yellow bat	ST	Wooded riparian habitats	No	No habitat
Southern pocket gopher	ST	Typically occur in 5,800 to 8,000 feet in rabbitbrush riparian, oak savanna, oak woodland, pinon-juniper, chapparal, and coniferous forest habitats	No	Site below elevational range; no habitat

Species	Status*	Habitat	Possible Occurrence in the Project Area	Reason for yes/no occurrence in Project Area
Jaguar	FE	Chihuahuan desert scrub and semi-desert grassland within 10 square miles of water	No	No hiding or escape cover
Gray wolf	NEXP	Variety of habitats with abundand prey populations	No	No hiding cover and prey base very limited
Arizona shrew	SE	Mesic wooded habitats	No	Site is not mesic, no trees
Molluscs				
Hacheta Grande Woodlandsnail	ST	Rock outcrops and talus slopes, typically montane	No	No habitat

*FE = federally endangered; FT = federally threatened; NEXP = federally endangered/non-essential experimental; SE = state endangered; ST = state threatened; BGEPA – Bald and Golden Eagle Protection Act
Source: USFWS Website http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm

2.3 FEDERALLY LISTED SPECIES

There are 56 federally listed species of animals in New Mexico with 12 of these being present in the Mimbres Basin (Dona Ana, Hidalgo, and Luna counties). Of these 12 species, five are endangered, five are threatened, and two are experimental, non-essential populations. Based on an analysis of habitat features in project area, AMEC Geomatrix determined that there is the potential for one of these species, the aplomado falcon, to utilize habitat in the project area.

2.3.1 Northern Aplomado Falcon

The northern aplomado falcon, a federally endangered species (experimental non-essential population), has been re-introduced into New Mexico and may utilize habitat on or near the Property; however field studies in June and September did not detect its presence. One active aplomado falcon nest is known in New Mexico.

AMEC Geomatrix biologists searched the "action area" for suitable northern aplomado falcon habitat. The "action area," as related to impacts associated with the Endangered Species Act, comprises the Property and adjacent land within visual and aural range of proposed project activities. The action area was estimated to include a one-mile radius from the Property. Suitable habitat includes semi-desert grassland habitat interspersed with large yuccas and/or trees containing raptor and/or corvid nests (aplomado falcons do not build their own nests). Typically, yuccas and trees suitable as nesting substrates are over six-feet tall and have a platform formed by branches or flowering stalks. Potential nesting habitat was assessed by driving roads and conducting pedestrian surveys on the Property with binoculars and a spotting scope.

Potentially suitable nests for the northern aplomado falcon were identified within the Property (**Photograph 5, Appendix A**), north of the paved highway, on Bureau of Land Management (BLM), and state-administered land immediately adjacent to the Property (**Figure 2**). These nests were constructed by raptors and ravens. A small patch of suitable habitat, consisting of large yuccas, also occurs approximately 0.8 miles southwest of the Property boundary on private land.

Removal of yuccas and associated nests may be avoidable due to their location on the periphery of the Property (although noise and visual disturbance would not be avoidable). Three nests (two are on one yucca) occur immediately north of the highway in the northwestern-most portion of the Property between the old railroad grade and Highway 9 (**Figure 1**). The other nest is located in the northeastern-most portion of the east half of the Property, adjacent to the eastern Property fence line.

2.3.2 Migratory Birds

Avian diversity was low within the Property boundaries, presumably due to lack of canopy structure. This finding is supported by the relatively greater number of species observed on BLM and state lands which were discovered to contain more heterogeneous habitat than that present at the Property. Most species encountered during point-count surveys were passerines, either nesting on the ground or in the sparsely scattered yucca, or were raptors engaged in soaring/foraging activities. **Table 3** summarizes the results from the June point-count surveys.

The majority of the birds detected were the ground-nesting western meadowlark and the mourning dove, which usually nests in shrubs and trees. Nests were not observed for these species, although several mourning dove pairs were seen and were occasionally flushed during sampling point transitions. Western kingbirds were abundant, and two active nests were identified on the Property; one located in a yucca and one on a power pole.

Burrowing owls were also observed on the Property and on state land immediately south of the Property during the June surveys but were not observed during the September surveys. Potential burrowing owl habitat is present throughout the Property as evidenced by the abundance of burrow systems.

The horned lark was observed on and adjacent to the Property. The long-billed curlews noted on the Property are likely transients in the area, as they were observed flying overhead; suitable habitat for this species does not appear to be present in the vicinity. Swainson's hawks were regulary observed during the surveys and while activities were conducted at the property. One active nest was observed in a yucca adjacent to the Property.

Ground-disturbing construction activities and clearing of yuccas potentially associated with development of the proposed IABR and conducted from March through August would likely result in a "take" of birds nesting on the Property, as defined by the Migratory Bird Treaty Act (MBTA), as a result of egg destruction and bird deaths. Avoidance measures required typically include conducting ground-clearing activities prior to the breeding season. In addition, avian monitoring is often required by the regulatory agencies during construction activities.

Table 3: Avian Point Count Survey Results

Common Name	Auditory	Visual	Total
Western meadowlark (*Sturnella neglecta*)	34	9	43
Mourning dove (*Zenaida macroura*)	4	17	21
Western kingbird (*Tyrannus verticalis*)	4	12	16
Gambel's quail* (*Callipepla gambelii*)	5		5
Swainson's hawk (*Buteo swainsoni*)		3	3
Long-billed curlew (*Numenius americanus*)		2	2
White-winged dove (*Zenaida asiatica*)		2	2
Loggerhead shrike (*Lanius ludovicianus*)		2	2
Unknown		2	2
Horned lark (*Eremophila alpestris*)		1	1
Cactus wren* (*Campylorhynchus brunneicapillus*)	1		1
Ash-throated flycatcher (*Myiarchus cinerascens*)	1		1
Burrowing owl (*Athene cunicularia*)		1	1

The presence of burrowing owls may require additional mitigation measures be employed by Sapphire if the site is to be developed as an IABR, as these owls are also protected under the MBTA. Burrowing owls could occur throughout the property during the breeding and non-breeding seasons and could be

killed during construction activities. The New Mexico Department of Game and Fish (NMDGF), in coordination with the New Mexico Burrowing Owl Working Group, California Burrowing Owl Consortium, and the California Department of Fish and Game, developed "Guidelines and Recommendations for Burrowing Owl Surveys and Mitigation" (July 2007). These guidelines were established to provide direction for conducting burrowing owl surveys and designing mitigation during the preparation of environmental assessment reports and environmental impact statements. When burrowing owls are confirmed on a project site, these guidelines outline three general approaches to mitigation:

- Design and implement project activities to spatially avoid negative impacts and disturbance to burrowing owls and their habitat;
- Design and implement project activities to seasonally avoid negative impacts and disturbances to burrowing owls (although confirmation of unoccupied burrows will still be required); and/or,
- Relocate burrowing owls that will be negatively impacted to protected areas.

To allow greater flexibility with the project schedule, implementing the third option may be in Sapphire's best interest. This would involve either trapping and relocating, or utilizing one-way doors in burrow entrances to exclude burrowing owls. One-way doors must be inserted 48-hours prior to construction so that burrows remain unoccupied. This method (trapping or utilizing one-way doors) must be initiated prior to March 1 in the year of construction to avoid an MBTA take (nesting activities begin after March 1). Construction must be phased so that ground-clearing would occur immediately after trapping or excluding to ensure burrow destruction and disallow re-occupation by owls. A video probe should be used to determine if burrow is providing burrowing owl nesting habitat. If there is a lag between initial ground clearing/burrow destruction and other construction activities, surveys may need to be conducted to ensure that further burrows have not been constructed and subsequently occupied by owls.

Two natural or artificial burrows should be constructed to compensate for each active burrow rendered unsuitable, and a minimum of 6.5 acres of foraging habitat should be maintained in an undisturbed habitat condition for each pair or unpaired resident bird. Permits must be obtained by USFWS and NMDGF to handle burrowing owls.

2.3.3 Bald and Golden Eagle Protection Act

Golden eagles are protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Under these statutes, it is illegal to implement activities that would result in "take" of bald eagles or golden eagles. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill capture, trap, collect, molest or disturb". Disturb means to agitate or bother eagles to a

degree that causes or is likely to cause, based on the best scientific data available, injury to an eagle; decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or, nest abandonment by substantially interfering with normal breeding, feeding or sheltering behavior.

Golden eagles occur throughout western North America and hunt by soaring over open prairie, sagebrush-grassland and woodland habitats. Golden eagles eat primarily jackrabbits, ground squirrels, and carrion and occasionally prey on deer and antelope fawns, other small mammals, and waterfowl. Golden eagles generally nest on cliffs, in large trees, or occasionally on artificial structures such as power poles. Golden eagles have not been observed on the Property, but have been regularly observed along Highway 9 east of the Property. They may periodically utilize the Property for foraging.

2.4 NEW MEXICO STATE-LISTED WILDLIFE

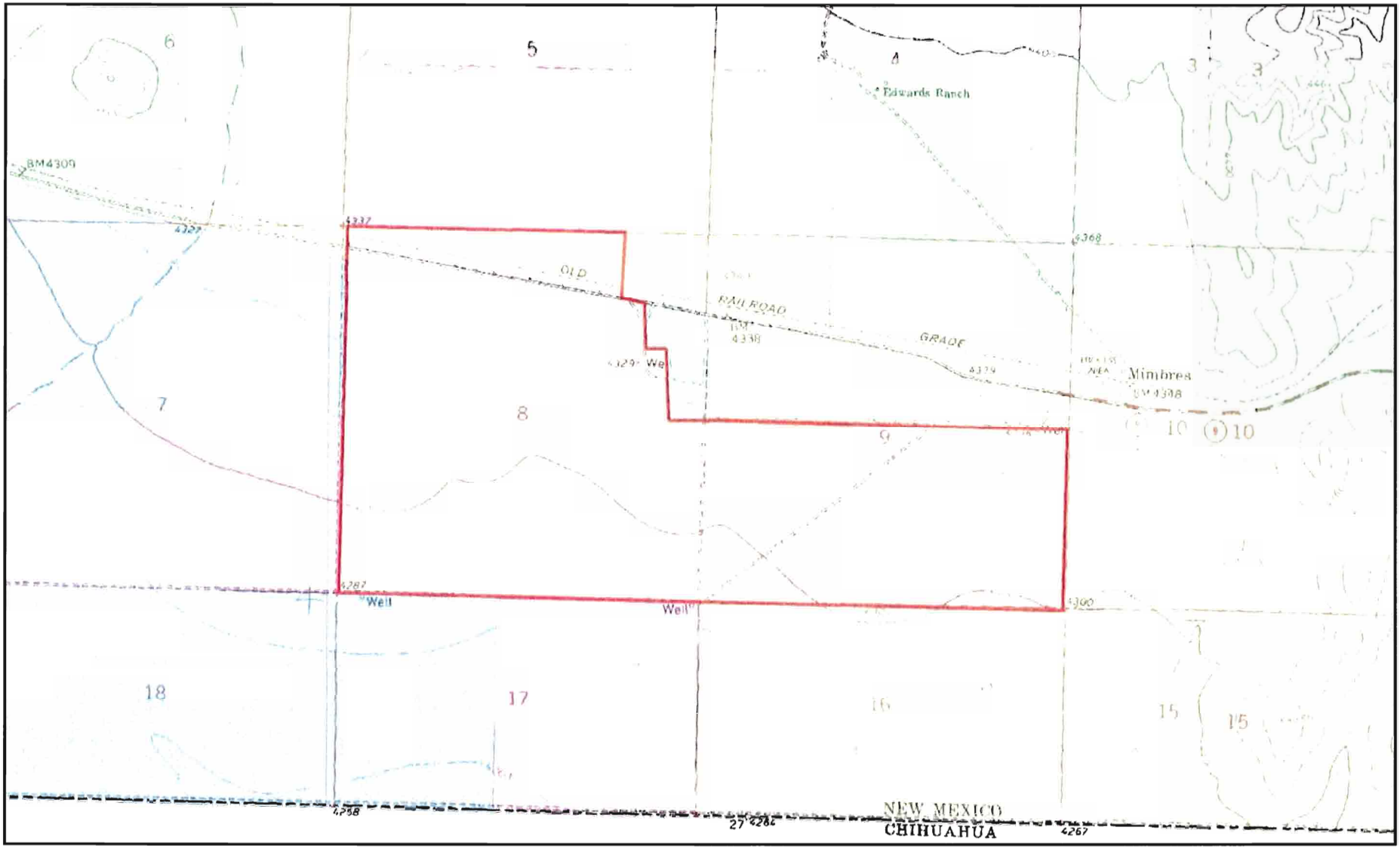
The primary species of potential concern relative to New Mexico State-Listed wildlife in and near the Property is the Great Plains narrowmouth toad (*Gastrophryne olivacea*). Habitat for this species was assessed along 100-meter survey transects during with the wetland and plant surveys. General habitat was characterized and mapped, as shown on **Figure 3**.

Habitat for the Great Plains narrowmouth toad is limited within the Property. Suitable habitat includes grassland and desert grassland habitats, principally those containing tobosa grass and aquatic habitat in summer for reproduction. Aquatic habitat for reproduction may consist of swales and/or roadside ditches. Tobosa grass was sparse on the Property, although other grasses that occur on site may provide the same type of refuge, such as blue panic grass. Tobosa grass and other suitable grasses occur north of Highway 9 within the Property boundaries. Rodent burrows which may also be used as refuges by this toad are extensive throughout the Property. Aquatic habitat was not observed during the site suveys, but several swales and roadside ditches may be suitable for breeding. It is unlikely that this species would occur in the project area due to the limited amount of suitable habitat.

2.5 VEGETATION SURVEY RESULTS

Ecological conditions within the Property have been altered by past land uses that have removed the original cover of native vegetation from the site. Nearly all of the Property was used to produce irrigated crops until 1971, when farming was discontinued and the site was allowed to colonize with invasive plants typical of disturbed soils. Much of the Property has dense stands dominated by invasive species with low densities of native plants.

The species composition and canopy structure of vegetation on the Property differs substantially from native plant communities on adjacent state and federally managed land. Native vegetation on adjacent land is typical of the Semidesert Grassland and Chihuahuan Desertscrub. Dominant native species



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0 Miles 0.5

AMEC Geomatrix

Cooper Property

Habitat Types

- Agricultural
- Creosote Flats
- Disturbed Grassland
- Disturbed Grassland, sparse yuccas
- Residential
- Semidesert Grassland

Habitat Map
Sapphire Energy
Cooper Property
Luna County, New Mexico
FIGURE 3

include soaptree yucca, creosote bush (*Larrea tridentata*), honey mesquite (*Prosopis glandulosa*), tarbush (*Flourencia cernua*), Mormon tea (*Ephedra trifurca*), tobosa (*Hilaria mutica*), vine mesquite (*Panicum obtusum*), and a diversity of other forbs grasses, and cacti. The canopy structure of the native plant communities, with an upper tier of shrubs and a lower tier of herbaceous species supports much higher levels of biodiversity than the Property, which is dominated by herbaceous invasive species interspersed with patches of bare ground.

2.6 NEW MEXICO STATE-LISTED PLANTS

The majority of the vegetation on the Property consists of grasses with occasional yucca and cacti. **Table 4** summarizes the dominant grass species encountered during the June and September 2009 site visit. At the time of the site surveys in June, there had been limited rainfall and much of the vegetation was dry. During the surveys in September, the monsoon rains had begun and vegetation, especially warm-season grasses, were initiating new growth.

Table 4: Dominant Grasses in Project Area

Scientific Name	Common Name	Growth Form/ Habitat
Aristida adscenionis	Six weeks three awn	Annual, occurs on sites where native grasses have been depleted.
Aristida divaricata	Poverty three-awn	Perennial bunch grass.
Chloris virgata	Feather finger grass	Annual, invasive species which occurs on disturbed soils.
Eragrostis lehmanniii	Lehman's lovegrass	Introduced, perennial bunch grass.
Hilaria mutica	Tobosa	Perennial bunch grass, fine-textured soils, often occurs in swales.
Panicum antidotale	Blue panic grass	Introduced, perennial bunch grass, often associated with irrigation.
Panicum obtusum	Vine mesquite	Perennial, often found in swales with fine-textured soils.
Tridens pulchellus	Fluff grass	Perennial bunch grass, indicator of low potential productivity of soils.

Dominant forbs present at the site included cocklebur (*Xanthium strumarium*), unicorn plant (*Proboscidea louisianica*), Russian thistle (*Salsola iberica*), silver-leaf nightshade (*Solanum eleagnifolium*), and Powell amaranth (*Amaranthus powellii*). Sub-dominant forbs included scarlet gaura (*Gaura coccinea*), velvety gaura (*Gaura parviflora*), milkweed (*Asclepias brachstephana and engelmannii*), bladderpod (*Lesquerella gordonii*), bindweed (*Convolvulus incanus*), desert marigold (*Baileya multiradiata*), *Verbena goodingii*, hogpotato (*Hoffmanseggia densiflora*), lobed ground-cherry (*Physalis lobata*), cholla (*Opuntia imbricata*), scarlet globemallow (*Sphaeralcea coccinea*), narrowleaf globemallow (*Sphaeralcea angustifolia*), soaptree yucca (*Yucca elata*), broom snakeweed (*Gutierrhezia sarothrae*), yellow star thistle (*Centuarea solstitialis*), kochia

(*Kochia scoparia*), thistle (*Cirsium* sp.), puncture vine (*Tribulus terrestris*) and prickly-pear (*Opuntia polycantha*). No rare or special status species were identified on the Property during the June and September surveys.

2.7 WETLAND AND OTHER WATERS OF THE U.S.

2.7.1 Overview of Wetland Regulations

The COE is responsible for regulation of wetlands as specified under the Clean Water Act and has defined wetlands in the 1987 Wetland Delineation Manual based on features of soils, vegetation, and hydrology. The 1987 Wetland Delineation Manual describes the process that is used to determine whether a site meets the requirements to be defined as a wetland in accordance with federal regulation as follows:

> "Wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes bogs and similar areas."

Wetlands generally have the following characteristics:

- Water on or near the surface, all or part of the year.
- Distinctive poorly drained soils that develop certain physical characteristics due to the presence of water (referred to as hydric soils).
- A predominance of vegetation composed of species (referred to as hydrophytes) adapted to life in wet soils.

Wetlands can be present in riparian areas, flood plains, and upland forested areas. Some wetlands hold fresh water, some are saline, and others are created by underground water that discharges at or is very close to the surface. They are wet long enough and often enough to provide natural ecological functions, though they can be dry part of the year. Wetlands form part of a continuous gradient between uplands and open water. They may be bordered by both wetter areas (deepwater habitats) and by drier uplands (non-wetlands).

Wetlands and riparian areas are also protected by Executive Order 11990 (wetland protection) and 11988 (floodplain management), which regulate federal activities in wetlands or riparian areas.

Legal decisions (Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers) indicate that jurisdictional wetlands must have a direct connection (nexus) to interstate commerce. Generally, wetlands associated with streams and intermittent drainages are considered by the COE to have a connection to interstate commerce, but isolated depressional wetlands (e.g., ponds, lakes, and potholes) often do not and, therefore, are not regulated under Section 404 of the Clean Water Act.

Recent Supreme Court rulings (Rapanos v. United States and Carabell v. United States.) direct the COE to make case-by-case analyses to determine if wetlands have a "significant nexus" to navigable waters. A significant nexus exists when it is demonstrated that a tributary or wetland has "more than a speculative or insubstantial effect on the chemical, physical, and biological integrity of a traditional navigable water". Determinations for the presence of a significant nexus must be made for the following waters:

- Non-navigable tributaries that do not typically flow year-round or have continuous flow for at least three months of the year.
- Wetlands that are adjacent to such tributaries
- Wetlands that are adjacent to but that do not directly abut a relatively permanent non-navigable tributary.

2.7.2 Wetlands and Non-wetland Waters of the United States

Natural drainage patterns within the Property have been extensively modified by construction of concrete irrigation ditches, a paved highway, access roads, irrigated crop fields, and a railroad right-of-way (abandoned). Topographically, the land slopes gently to the south and overland flow paths are largely determined by openings in the railroad embankment or under the concrete irrigation ditches and in roadside ditches. Incised, eroded drainages are present where overland flows are concentrated by the railroad embankment, highway, and concrete irrigation ditches. These eroded, incised drainages are most prominent at the northern part of the Property, becoming barely un-discernable at the southern edge of the Project Area.

One palustrine open water (POW) wetland was indicated on NWI maps depicted for the area (**Figure 2**). This wetland was assessed for Clean Water Act applicability. The POW was determined to be a man-made pond associated with a historical windmill and stock tank, and is located immediately north and outside of the Property boundaries. Neither the windmill or stock tank is currently functional, nor did the POW contain water. A Routine Wetland Determination form was not completed because the POW was determined to be outside of the Property. Observations indicate that this is not a wetland applicable to the Clean Water Act due to the lack of hydrophytic vegetation and appropriate hydrologic conditions.

Two potential wetlands were identified on the Property, north of Highway 9, abutting the north side of the Property (**Figure 2**). These vegetated swales (SP- 2 and SP-3, **Figure 2**) are present where surface water seasonally collects as a result of the old railroad grade intercepting surface runoff from rangeland and irrigated crop fields (**Photographs 6 and 7, Appendix A)**. Wetland Determination Data Forms for these sites are included as **Appendix B.** These sites have hydrophytic vegetation but the soils do not exhibit hydric features. Plant species present on these sites include the species listed in **Table 5**.

Table 5: Plant Species Present at Wetland Evaluation Sites

Scientific Name	Common Name	Wetland Indicator Status
Amaranthus powellii	Powell's amaranth	UPL
Aristida adscenionis	Six-weeks three awn	UPL
Asclepias engelmannii	Milkweed	UPL
Chloris virgata	Feather finger-grass	UPL
Chrysothamnus nauseosus	Rubber rabbitbrush	UPL
Echinochloa colona	Jungle-rice	FACW
Eriochloa acuminate	Taper-tip cup grass	FACW
Hilaria mutica	Tobosa	UPL
Opuntia imbricate	Cholla	UPL
Opuntia polycantha	Prickly pear cactus	UPL
Panicum obtusum	Vine mesquite	FAC
Setaria macrostachya	Plains bristlegrass	UPL
Solanum eleagnifolium	Silver-leaf nightshade	UPL
Sorghum halapense	Johnson grass	FACU
Xanthium strumarium	Cocklebur	FACU
Yucca elata	Soaptree yucca	UPL

Wetland hydrology is present at sites SP-2 and SP-3 during the monsoon season when runoff collects on the upslope side of the railroad embankment. It is likely that the soils at these sites have been altered by construction of the railroad and by erosional deposition from irrigated cropland that is immediately adjacent and upslope from the railroad grade. The soils at the SP- 3 have no horizon development to 20 inches, exhibit no redox features, and do not have a chroma that is typically associated with hydric soils. The soils at SP-3 have the same color and chroma (7.5 YR 3/3) as soils at SP-4, an adjacent upland site (**Figure 2**).

Site SP-2 has hydrophytic vegetation and wetland hydrology during the monsoon season but like site SP-3; the soils do not exhibit hydric features. The upper 2 inches of the soil horizon has a color and chroma of 7.5 YR 3/3 and from 2-18 inches the soil color and chroma are 5YR 4/4. The soil exhibits no redox features associated with anaerobic conditions. Evaluation of site SP-1 (Figure 2), in a broad swale down slope from a gap in the railroad embankment, indicated that the vegetation was not hydrophytic

and the soils had a brighter chroma (7.5 YR 3/4). It appears that in depressons formed by railroad embankment soils have slightly lower chromas than soils that do not support hydrophytic vegetation (7.5 YR 3/3 versus 7.5 YR 3/4). According to the Arid West Region Supplement, the soils of the Property may be "problem soils" based on Indicator TF2: Red Parent material described in the Arid West Regional Supplement to the Wetland Delineation Manual.

Because sites SP-2 and SP-3 have hydrophytic vegetation and wetland hydrology and the soils have been extensively altered and are derived from red parent material ("problem soils"), these sites were determined to be wetlands and were evaluated for a nexus with traditionally navigable waters of the United States. SP-2 is 0.042 acres and SP-3 is 0.245 acres.

Wetland SP-3 has a hydrologic connection to areas down-slope through a wash (Erosional Feature A, **Figure 2**). This erosional feature begins at an irrigated crop field and collects water in a constructed ditch (**Photograph 8, Appendix A**) that extends through a gap in the railroad grade (**Photograph 9, Appendix A**) and continues south (**Photograph 10, Appendix A**), for approximately 817 feet before becoming undetectable because the bank and bed become undefined. Flow from this wash seeps into the soil without connecting to other drainage features.

Erosional Feature B begins at the south boundary of the Project Area and extends south in a roadside ditch for 966 feet before being intercepted by a berm associated with an irrigation pipe (**Photograph 11, Appendix A**). This ditch exhibits features of regular flows and supports several hydrophytic plant species. This erosional feature originates at an outflow pipe from an irrigation pumping station (**Photograph 12, Appendix A)** that discharges water to the road-side ditch as part of flushing associated with maintenance. Water discharged to this ditch does not flow to a series of road-side ditches that extend along the road on the Mexican border; rather, water is confined by berms and slightly higher topographic relief before the ditch reaches the road-side border ditch. Road maintenance, agricultural management, and activities by the Border Patrol to create unvegetated strips along roads continually alter the configuration and microtopography of road-side ditches in and around the Project Area.

There are other erosional features on the Property where overland flows have been channeled through breaks in the abandoned concrete irrigation ditch, resulting in head cutting above the ditch (**Photograph 13, Appendix A**) and a drainage channel extending several hundred feet downslope from the ditch. None of these erosional features has a nexus with other drainages, ditches, or water ways. These drainages all become undefined by a bank and bed and water seeps into the broad, relatively flat upland. The vegetation associated with these erosional features is dominated by upland plant species (e.g., Powell's amaranth, feather finger-grass, and six-weeks three awn).

None of the drainages (erosional features) has a nexus with traditionally navigable waters of the United States. The Property and surrounding land slopes toward the Mexican border, which is one-half mile from the boundary of the Property; consequently, ephemeral, non-wetland drainages that exit the

United States in the vicinity of the Project Area would have the potential to flow into the waters of Mexico.

3.0 LITERATURE CITED

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PHOTOGRAPHS OF PROJECT AREA

APPENDIX A

Photograph 1 – Abandoned irrigation ditch on Property and typical sparse vegetation (June)

Photograph 2 – Typical view of Property (June)

Photograph 3 – Raptor or raven nests in yucca on Property north of railroad grade

Photograph 4 – Creosote bush community on land adjacent to Property (June)

Photograph 5 – Yucca/grassland community on land adjacent to Property (June)

Photograph 6 – Wetland at SP-3, north of railroad grade (September)

Photograph 7 – Wetland at SP-2 north of railroad grade (September)

Photograph 8 – Beginning of Erosional Feature A, upslope from railroad grade (September)

Photograph 9 – Erosional Feature A, downslope from Highway 9 and railroad (September)

Photograph 10 – Point at which flow is not detectable in Erosion Feature A (September)

Photograph 11 – Beginning of Erosional Feature B and irrigation pump station (September)

Photograph 12 – Erosional Feature B at berm with irrigation pipe (September)

Photograph 13 – Eroded drainage feature at break in irrigation ditch (September)
Note eroded head cut from overland flow, upslope from break in ditch.

WETLAND DETERMINATION DATA FORMS

APPENDIX B

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

District Office | File/ORM # | PJD Date:

State | City/County

Nearest Waterbody:

Location: TRS, LatLong or UTM:

Name/ Address of Person Requesting PJD: Jaime Moreno, Sapphire Energy Company, 3115 Merryfield Row, San Diego, CA 92121

Identify (Estimate) Amount of Waters in the Review Area:

Non-Wetland Waters: linear ft | width | acres | Stream Flow: N/A

Wetlands: acre(s) | Cowardin Class: Palustrine, emergent

Name of Any Water Bodies on the Site Identified as Section 10 Waters: Tidal: | Non-Tidal:

Office (Desk) Determination

✓ Field Determination: Date of Field Trip: June, Sept 2009

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- ✓ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- ✓ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - Office concurs with data sheets/delineation report.
  - Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps
- Corps navigable waters' study:
- U.S. Geological Survey Hydrologic Atlas:
  - USGS NHD data.
  - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite quad name:
- USDA Natural Resources Conservation Service Soil Survey. Citation:
- ✓ National wetlands inventory map(s). Cite name:
- State/Local wetland inventory map(s):
- FEMA/FIRM maps:
- 100-year Floodplain Elevation is:
- ✓ Photographs: Aerial (Name & Date):
  - ✓ Other (Name & Date): See attached biological resources and wetlands re
- Previous determination(s). File no. and date of response letter:
- ✓ Other information (please specify): See attached report

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and Date of Regulatory Project Manager (REQUIRED)

Signature and Date of Person Requesting Preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

EXPLANATION OF PRELIMINARY AND APPROVED JURISDICTIONAL DETERMINATIONS:

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "preconstruction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters, (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions, (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization, (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary, (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable, (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court, and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Appendix A - Sites

District Office: Albuquerque District | File/ORM #: | PJD Date:

State: ID | City/County: Luna County | Person Requesting PJD: Jaime Moreno, Sapphire Energy

Site Number	Latitude	Longitude	Cowardin Class	Est. Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
			n/a		Non-Section 10 non-wetland
SP- 2			Palustrine, emergent		Non-Section 10 non-wetland
SP-3			Palustrine, emergent		Non-Section 10 non-wetland

Notes:

see attached Biological Resources and Wetlands Report

WETLAND DETERMINATION DATA FORM – Arid West Region

9/9/09

Project/Site: LABR - COOPER RANCH City/County: LUNA Sampling Date: SP-1

Applicant/Owner: State: NM Sampling Point: SP-1

Investigator(s): J ELLIOTT Section, Township, Range: SEC 9 T29N R9W

Landform (hillslope, terrace, etc.): SWALE Local relief (concave, convex, none): CONCAVE Slope (%): 2

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation NO, Soil NO, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: SITE IS IN BROAD SWALE DOWNSLOPE FROM A DRAINAGE GAP IN THE ABANDONED RAILROAD EMBANKMENT DURING PERIODS OF HIGH FLOW, WATER SPREADS OUT ACROSS THIS BROAD SWALE THERE ARE NO DEFINED CHANNELS

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. NONE			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 0-1 ACRE)			
1. YUCCA ELATA	1	NO	UPL
2. GRANJENOCHRYSOTHAMNUS NAU	1	NO	UPL
3. OPUNTIA IMBRICATA	1	NO	UPL
4. OPUNTIA POLYCANTHA	1	NO	UPL
5.			
	4 = Total Cover		
Herb Stratum (Plot size: ____)			
1. HILARIA MUTICA	80	YES	UPL
2. ASCLEPIAS ENGELMANNII	1	NO	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1. NONE			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: THIS IS NATIVE, UNDISTURBED VEGETATION

SOIL

Sampling Point: SP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20+	7.5YR 3/4						CLAY LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: IABR - COOPER RANCH City/County: LUNA Sampling Date: 9/9/09

Applicant/Owner: _____ State: NM Sampling Point: SP-2

Investigator(s): J. ELLIOTT Section, Township, Range: SEC 9 T29N R9W

Landform (hillslope, terrace, etc.): DEPRESSION Local relief (concave, convex, none): CONCAVE Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation YES, Soil YES, or Hydrology YES significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes ✓ No _____
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks: SITE IS IN DEPRESSION WITH NO OUTLET UPSLOPE FROM RAILROAD EMBANKMENT. SOILS ARE "PROBLEM SOILS" because of PAST DISTURBANCE AND RED PARENT MATERIAL AND LOW CHROMA (3/3) 7.5YR 3.3

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. NONE			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. NONE			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 0.1 ACRE)			
1. PANICUM OBTUSUM	30	YES	FAC
2. ARISTIDA ADSCENIONIS	15	YES	UPL
3. SOLANUM ELEAGNIFOLIUM	10	NO	UPL
4. AMARANTHS POWELLII	5	NO	UPL
5. ASCLEPIAS ENGELMANNII	2	NO	UPL
6. ERIOCHLOA ACUMINATA	15	YES	FACW
7.			
8.			
	~~77~~ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1. NONE			
2.			
	77 = Total Cover		

% Bare Ground in Herb Stratum 23 % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: SP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	7.5YR 3/3						GRAVELLY CLAY LOAM	
2-20	5YR 4/4						"	"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks: NO REDOX FEATURES AND BRIGHT CHROMA INDICATIVE OF "PROBLEM SOIL".

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No _____ Depth (inches): 2"

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: IABR-COOPER RANCH City/County: LUNA Sampling Date: 9/9/09

Applicant/Owner: State: NM Sampling Point: SP-3

Investigator(s): J. ELLIOTT Section, Township, Range: Sec. 8 T29N R9W

Landform (hillslope, terrace, etc.): ALLUVIAL Local relief (concave, convex, none): CONCAVE Slope (%): 0

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No (If no, explain in Remarks.)

Are Vegetation YES, Soil YES, or Hydrology YES significantly disturbed? Are "Normal Circumstances" present? Yes No ✓

Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No	Is the Sampled Area within a Wetland? Yes ✓ No
Hydric Soil Present?	Yes	No ✓	
Wetland Hydrology Present?	Yes ✓	No	

Remarks: SITE IS IN SWALE DOWNSLOPE FROM IRRIGATED FIELD AND UPSLOPE FROM ABANDONED RAILROAD EMBANKMENT. RR GRADE BLOCKS SURFACE RUNOFF. SOILS ARE "PROBLEM SOILS" AND DISTURBED BY RR CONSTRUCTION AND DEPOSITION OF SEDIMENT FROM UPSLOPE SOURCES (CROP FIELD AND RANGELAND)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1. NONE			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1. NONE			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 01 ACRE)			
1. PANICUM OBTUSUM	30	YES	FAC
2. SOLANUM ELEAGNIFOLIUM	10	NO	UPL
3. SORGHUM HALEPENSE	20	YES	FACU
4. ECHINOCHLOA COLONA	20	YES	FACW
5. XANTHIUM STRUMARIUM	2	NO	FAC
6. AMARANTHUS POWELLII	5	NO	UPL
7. HILARIA MUTICA	2	NO	UPL
8. ASCLEPIAS ENGELMANII	10	NO	UPL
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1. NONE			
2.			
	101 = Total Cover		

% Bare Ground in Herb Stratum % Cover of Biotic Crust

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

✓ Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks:

SOIL

Sampling Point: SP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20"	7.5YR 3/3	100					CLAY LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks: NO HORIZON DEVELOPMENT OR REDOX FEATURES. SOIL COLOR AND CHROMA THE SAME AS ADJACENT UPLANDS. THIS IS A "PROBLEM SOIL".

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ✓ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No _____ Depth (inches): 2"

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: THIS SITE EVALUATED IN ~~SPRING~~ JUNE AND FOLLOWING RAINSTORM IN SEPTEMBER. APPEARS TO ONLY RETAIN WATER AFTER SIGNIFICANT STORM EVENTS

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LABR - COOPER RANCH City/County: LUNA Sampling Date: 9/9/04

Applicant/Owner: _____ State: NM Sampling Point: SP-1

Investigator(s): J ELLIOTT Section, Township, Range: SEC 8 T29N R9W

Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): NONE Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No ✓ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	Is the Sampled Area within a Wetland? Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: SITE IS DOWNSLOPE FROM ADJACENT IRRIGATED CROPLAND AND UPSLOPE FROM ABANDONED RAILROAD GRADE THAT BLOCKS OVERLAND WATER FLOW

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. NONE			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. NONE			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 0.1 ACRE)			
1. AMARANTHUS POWELLII	85	YES	UPL
2. SCHEUM HALEPENSE	5	NO	UPL
3. HILARIA MUTICA	2	NO	UPL
4.			
5.			
6.			
7.			
8.			
	92 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1. NONE			
2.			
	92 = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species _____	x 1 =	_____
FACW species _____	x 2 =	_____
FAC species _____	x 3 =	_____
FACU species _____	x 4 =	_____
UPL species _____	x 5 =	_____
Column Totals: _____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: SP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-26+	7.5YR 3/3						CLAY LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks: NO HORIZON DEVELOPMENT NO REDOX FEATURES
COLOR AND CHROMA THE SAME AS SP-3

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Photo Log
For Sapphire Energy
Field Visit

March 5, 2009

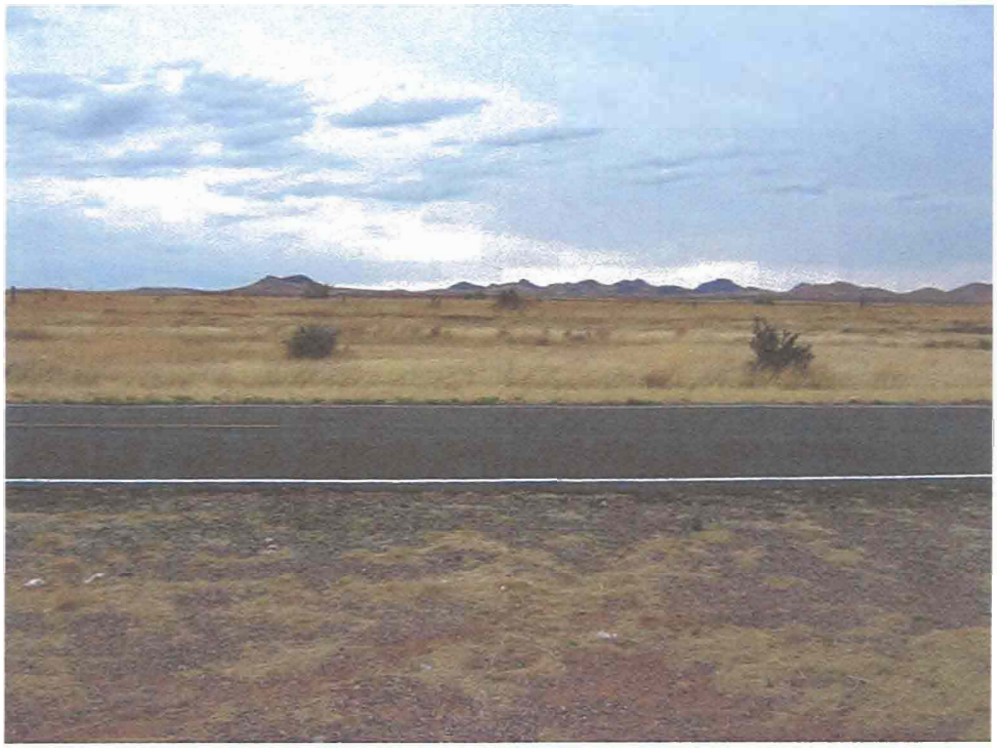
View NE from SW corner Section 8

View E along canal from mid-west edge of Section 8

View SE from NW corner Section 8

View S from north central point of Section 8

View S from NW portion of Section 8



View N from NW portion of Section 8 (the small piece of property across highway)

View N from S-mid point of Section 8

View NW from SE corner Section 8

View NE from SE corner Section 8

View SW from E-mid point of Section 9

View NW from SE corner Section 9

View N from S-mid point of Section 9

View S from middle of Section 8

Photo 1: Plowmarks in abandoned field of the proposed project (photograph taken facing north in southwestern portion of project area).

Photo 2: Concrete canal (photograph taken facing north in center of proposed project area).

Photo 3: Well head east of proposed project (photograph taken facing west toward project area). Wells on the property have been inventoried for potential future use in the project.

Photo 4: Powerline and abandoned field in northern portion of proposed project area (photograph taken facing north to northern edge of project area).

Photo 5: Southern boundary of proposed project (photograph taken facing north across project area).

Photo 6: Abandoned field in project area (facing north in southwestern portion of project area).

Photo 7: Small eroded area in eastern portion of proposed project (photograph taken facing north).

Photo 8: Powerline and abandoned field in southeastern portion of proposed project area (photograph taken facing northwest toward center of project area).

Photo 9: Eastern edge of proposed project (photograph taken facing east past the project boundary).

Photo 10: Powerline and abandoned field in southwestern portion of proposed project area (photograph taken facing northeast toward center of project area).

Mimbres Basin, NM

Common Name	Scientific Name	County	Status
Fish			
Chub, Roundtail	Gila robusta	Hidalgo	State: Endangered
Minnow, Loach	Tiaroga cobitis	Hidalgo	Federal: Threatened State: Threatened
Spikedace	Meda fulgida	Hidalgo	Federal: Threatened State: Endangered
Amphibians			
Frog, Leopard, Chiricahua	Rana chiricahuensis	Hidalgo Luna	Federal: Threatened
Frog, Leopard, Lowland	Rana yavapaiensis	Hidalgo	State: Endangered
Toad, Desert, Sonoran	Bufo alvarius	Hidalgo	State: Threatened
Toad, Narrowmouth, Great Plains	Gastrophryne olivacea	Luna	State: Endangered
Reptiles			
Lizard, Bunchgrass, Slevin's	Sceloporus slevini	Hidalgo	State: Threatened
Monster, Gila, Reticulate	Heloderma suspectum suspectum (NM,AZ)	Hidalgo Luna	State: Endangered
Rattlesnake, Ridgenose, NM	Crotalus willardi obscurus (NM)	Hidalgo	Federal: Threatened State: Endangered
Rattlesnake, Rock, Mottled	Crotalus lepidus lepidus (NM)	Hidalgo	State: Threatened
Skink, Mountain	Eumeces callicephalus	Hidalgo	State NM: Threatened
Snake, Garter, Mexican	Thamnophis eques megalops (NM)	Hidalgo	State: Endangered
Snake, Garter, Narrowhead	Thamnophis rufipunctatus rufipunctatus (NM)	Hidalgo	State: Threatened
Snake, Rat, Green	Senticolis triaspis intermedia (NM,AZ)	Hidalgo	State: Threatened
Whiptail, Gray-checkered	Aspidoscelis dixoni	Hidalgo	State: Endangered
Whiptail, Spotted, Canyon	Aspidoscelis burti stictogrammus (NM,AZ);xanthonotus (AZ)	Hidalgo	State: Threatened
Birds			
Tyrannulet, Beardless, N.	Camptostoma imberbe ridgwayi (NM)	Hidalgo	State: Endangered
Black-Hawk, Common	Buteogallus anthracinus anthracinus (NM)	Dona Ana Hidalgo Luna	State: Threatened
Bunting, Varied	Passerina versicolor versicolor (NM);dickeyae (NM)	Dona Ana Hidalgo Luna	State: Threatened
Cormorant, Neotropic	Phalacrocorax brasilianus	Dona Ana Hidalgo Luna	State: Threatened
Eagle, Bald	Haliaeetus leucocephalus alascanus (NM)	Dona Ana Hidalgo Luna	State: Threatened
Falcon, Aplomado	Falco femoralis septentrionalis (NM)	Dona Ana Hidalgo Luna	Federal: Endangered State: Endangered
Falcon, Peregrine	Falco peregrinus anatum	Dona Ana Hidalgo Luna	State: Threatened
Falcon, Peregrine, Arctic	Falco peregrinus tundrius	Dona Ana Hidalgo Luna	State: Threatened
Flycatcher, Willow, SW.	Empidonax traillii extimus	Dona Ana Hidalgo Luna	Federal: Endangered State: Endangered
Ground-dove, Common	Columbina passerina pallescens (NM)	Dona Ana Hidalgo Luna	State: Endangered

Hummingbird, Broad-billed	Cynanthus latirostris magicus (NM)	Dona Ana Hidalgo	State: Threatened
Hummingbird, Costa's	Calypte costae	Dona Ana Hidalgo	State: Threatened
Hummingbird, Lucifer	Calothorax lucifer	Hidalgo Luna	State NM: Threatened
Hummingbird, Violet-crowned	Amazilia violiceps ellioti (NM)	Dona Ana Hidalgo Luna	State NM: Threatened
Hummingbird, White-eared	Hylocharis leucotis borealis (NM)	Hidalgo	State NM: Threatened
Junco, Yellow-eyed	Junco phaeonotus palliatus (NM)	Hidalgo	State NM: Threatened
Kingbird, Thick-billed	Tyrannus crassirostris	Hidalgo	State NM: Endangered
Nightjar, Buff-collared	Caprimulgus ridgwayi ridgwayi (NM)	Dona Ana Hidalgo	State NM: Endangered
Screech-Owl, Whiskered	Megascops trichopsis asperus (NM)	Hidalgo	State NM: Threatened
Owl, Spotted, Mexican	Strix occidentalis lucida (NM,AZ)	Dona Ana Hidalgo Luna	Federal: Threatened
Pelican, Brown	Pelecanus occidentalis carolinensis (NM)	Dona Ana Luna	State NM: Endangered
Sparrow, Baird's	Ammodramus bairdii	Dona Ana Hidalgo Luna	State NM: Threatened
Sparrow, Grasshopper, AZ	Ammodramus savannarum ammolegus (NM,AZ)	Hidalgo	State NM: Endangered
Tern, Least	Sterna antillarum athalassos (NM)	Dona Ana	Federal: Endangered State NM: Endangered
Towhee, Abert's	Pipilo aberti aberti (NM)	Hidalgo	State NM: Threatened
Trogon, Elegant	Trogon elegans canescens (NM)	Hidalgo	State NM: Endangered
Turkey, Wild, Gould's	Meleagris gallopavo mexicana (NM,AZ)	Hidalgo	State NM: Threatened
Vireo, Bell's	Vireo bellii arizonae (NM,AZ);medius (NM)	Dona Ana Hidalgo Luna	State NM: Threatened
Vireo, Gray	Vireo vicinior	Dona Ana Hidalgo Luna	State NM: Threatened
Woodpecker, Gila	Melanerpes uropygialis uropygialis (NM)	Hidalgo	State NM: Threatened
Mammals			
Bat, Long-nosed, Mexican	Leptonycteris nivalis	Hidalgo	Federal: Endangered State NM: Endangered
Bat, Long-nosed, Southern	Leptonycteris curasoae yerbabuenae (NM,AZ)	Hidalgo	Federal: Endangered State NM: Threatened
Bat, Spotted	Euderma maculatum	Dona Ana	State NM: Threatened
Bat, Yellow, Western	Lasiurus xanthinus	Hidalgo	State NM: Threatened
Chipmunk, Colorado, Organ Mtns.	Neotamias quadrivittatus australis (NM)	Dona Ana	State NM: Threatened
Gopher, Pocket, Southern	Thomomys umbrinus emotus (NM)	Hidalgo	State NM: Threatened
Jaguar	Panthera onca arizonensis (NM,AZ)	Hidalgo	Federal: Endangered
Rabbit, Jack, White-sided	Lepus callotis gaillardi (NM)	Hidalgo	State NM: Threatened
Sheep, Bighorn, Desert	Ovis canadensis mexicana (endangered pops)	Dona Ana Hidalgo	State NM: Endangered
Shrew, Arizona	Sorex arizonae	Hidalgo	State NM: Endangered
Wolf, Gray, Mexican	Canis lupus baileyi (NM,AZ)	Hidalgo	Federal: Endangered State NM: Endangered
Molluscs			
Woodlandsnail, Hacheta Grande	Ashmunella hebardi	Hidalgo	State NM: Threatened
Woodlandsnail, Cooke's Peak	Ashmunella macromphala	Luna	State NM: Threatened
Snail, Snaggletooth, Shortneck	Gastrocopta dalliana dalliana (NM)	Hidalgo	State NM: Threatened
Talussnail, Dona Ana	Sonorella todseni	Dona Ana	State NM: Threatened

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Talussnail, Dona Ana	Sonorella todseni	Dona Ana	State NM: Threatened

Home
About NMRPTC
Contacts

Rare Plant List
County List
Agency Status
Photo List

About the List
History of Changes
Species Considered, but dropped

Photographers and Authors
Sponsors
Discussion Group
Useful Literature
Links

Results of County Search

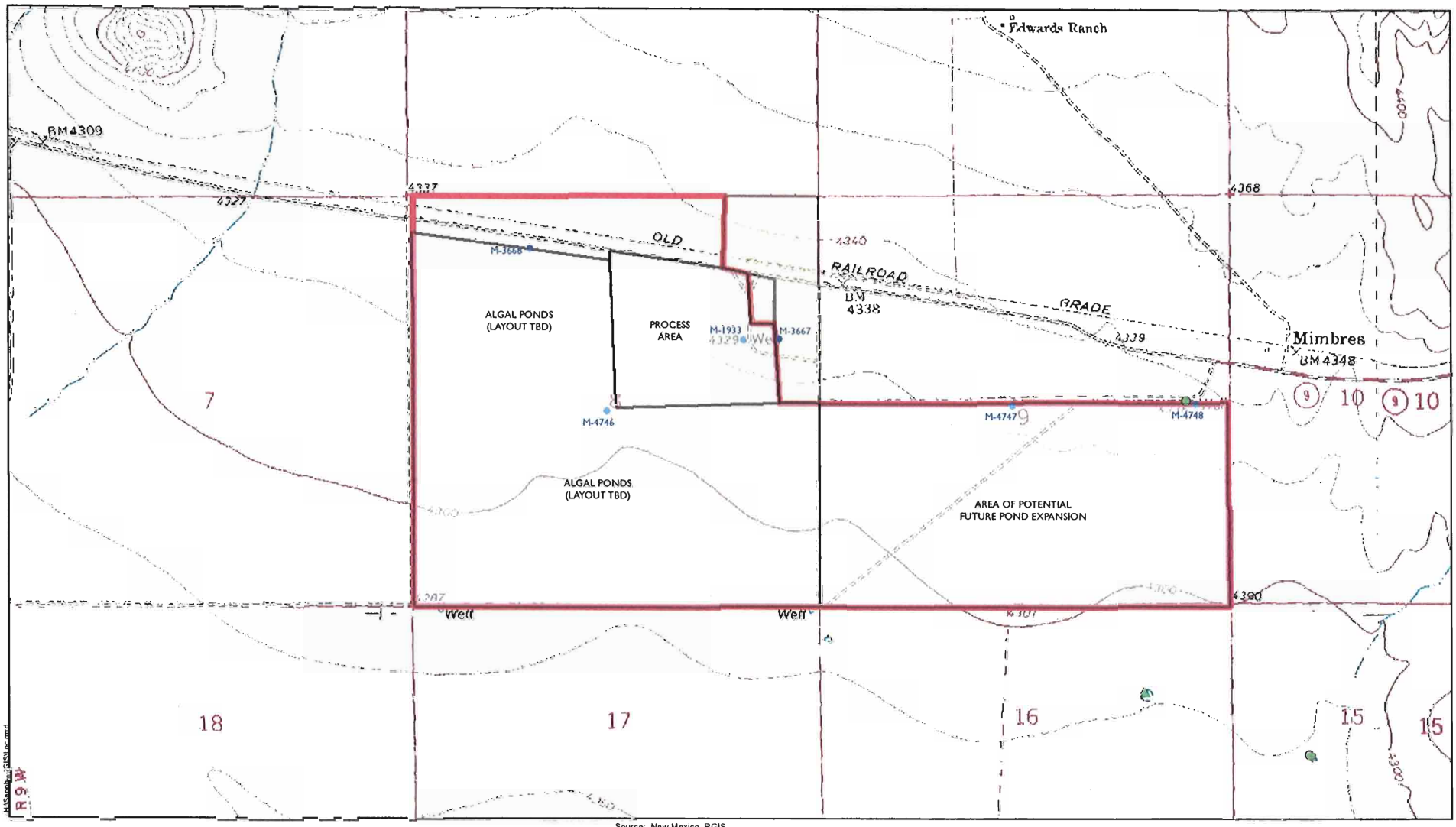
DONA ANA	
Scientific name	County-NM
Agastache cana	Dona Ana, Grant, Luna, Sierra
Agastache pringlei var. verticillata	Dona Ana
Astragalus castetteri	Dona Ana, Sierra
Castilleja organorum	Dona Ana
Draba standleyi	Dona Ana, Otero, Sierra, Socorro
Escobaria organensis	Dona Ana
Escobaria sandbergii	Dona Ana, Sierra
Escobaria sneedii var. sneedii	Dona Ana
Escobaria villardii	Dona Ana, Otero
Hexalectris spicata var. arizonica	Dona Ana, Hidalgo, Otero, Sierra
Hymenoxys vaseyi	Dona Ana, Sierra
Oenothera organensis	Dona Ana
Opuntia arenaria	Dona Ana, Luna, Socorro
Peniocereus greggii var. greggii	Dona Ana, Grant, Hidalgo, Luna
Penstemon alamosensis	Dona Ana, Lincoln, Otero
Perityle cernua	Dona Ana
Perityle staurophylla var. staurophylla	Dona Ana, Otero, Sierra
Polygala rimulicola var. mescalerorum	Dona Ana
Salvia summa	Chaves, Dona Ana, Eddy
Scrophularia laevis	Dona Ana
Silene plankii	Bernalillo, Dona Ana, Sandoval, Sierra, Socorro, Torrance

GRANT	
Scientific name	County-NM
Agastache cana	Dona Ana, Grant, Luna, Sierra
Brickellia chenopodina	Grant

Cleome multicaulis	Grant
Crataegus wootoniana	Catron, Grant, Lincoln
Cymopterus davidsonii	Catron, Grant
Desmodium metcalfei	Grant, Sierra
Draba mogollonica	Catron, Grant, Sierra, Socorro
Grindelia arizonica var. neomexicana	Grant, Sierra
Peniocereus greggii var. greggii	Dona Ana, Grant, Hidalgo, Luna
Penstemon linarioides ssp. maguirei	Grant
Phemeranthus humilis	Grant, Hidalgo
Puccinellia parishii	Catron, Cibola, Grant, Hidalgo, Mckinley, San Juan, Sandoval
Scrophularia macrantha	Grant, Luna
Silene thurberi	Grant, Hidalgo, Sierra
Silene wrightii	Catron, Grant, Luna, Sierra, Socorro
Stellaria porsildii	Grant
LUNA	
Scientific name	County-NM
Agastache cana	Dona Ana, Grant, Luna, Sierra
Atriplex griffithsii	Hidalgo, Luna
Escobaria orcuttii	Hidalgo, Luna
Opuntia arenaria	Dona Ana, Luna, Socorro
Peniocereus greggii var. greggii	Dona Ana, Grant, Hidalgo, Luna
Scrophularia macrantha	Grant, Luna
Silene wrightii	Catron, Grant, Luna, Sierra, Socorro
Sphaeralcea procera	Luna
Sphaeralcea wrightii	Luna
SIERRA	
Scientific name	County-NM
Agastache cana	Dona Ana, Grant, Luna, Sierra
Astragalus castetteri	Dona Ana, Sierra
Cirsium wrightii	Chaves, Guadalupe, Otero, Sierra, Socorro
Cuscuta warneri	Roosevelt, Sierra
Desmodium metcalfei	Grant, Sierra
Draba mogollonica	Catron, Grant, Sierra, Socorro
Draba standleyi	Dona Ana, Otero, Sierra, Socorro
Erigeron scopulinus	Catron, Sierra, Socorro
Escobaria duncanii	Sierra

Escobaria sandbergii	Dona Ana, Sierra
Grindelia arizonica var. neomexicana	Grant, Sierra
Hedeoma todsenii	Otero, Sierra
Hexalectris spicata var. arizonica	Dona Ana, Hidalgo, Otero, Sierra
Hymenoxys vaseyi	Dona Ana, Sierra
Penstemon metcalfei	Sierra
Perityle staurophylla var. homoflora	Sierra, Socorro
Perityle staurophylla var. staurophylla	Dona Ana, Otero, Sierra
Physaria gooddingii	Catron, Sierra
Silene plankii	Bernalillo, Dona Ana, Sandoval, Sierra, Socorro, Torrance
Silene thurberi	Grant, Hidalgo, Sierra
Silene wrightii	Catron, Grant, Luna, Sierra, Socorro

Photo credits in header *Peniocereus greggii var. greggii* © T. Todsen, *Lepidospartum burgessii* © M. Howard, *Argemone pleiacantha ssp. pinnatisecta* © R. Sivinski



Source: New Mexico, RGIS

N

Feet
0 1,200

Irrigation Well
Property Boundary
Total Acres - 819.8 ac.

Irrigated Property
Cook Property
May Property

Wetlands (As mapped by National Wetland Inventory)
Palustrine Flat Wetland
Palustrine Open Water Wetland

Site Plan
Proposed IABR Facility
Columbus, New Mexico
FIGURE 1

ATTACHMENT F-5

CULTURAL RESOURCE SURVEY FOR THE MIMBRES DUE DILIGENCE PROJECT, LUNA COUNTY, NEW MEXICO

Prepared for
Amec Geomatrix
7007 Wyoming Blvd. NE
Suite F-1
Albuquerque, NM 87109

LONE MOUNTAIN ARCHAEOLOGICAL SERVICES, INC.

NMCRIS No. 113215
Lone Mountain Report 1210
March 27, 2009

NMCRIS INVESTIGATION ABSTRACT FORM (NIAF)

1. NMCRIS Activity No.:	2a. Lead (Sponsoring) Agency:	2b. Other Permitting Agency(ies):	3. Lead Agency Report No.:
113215	Unknown at this time		

4. Title of Report: *Cultural Resource Survey for the Mimbres Due Diligence Project near Columbus, Luna County, New Mexico*

Author(s) Beth McCormack and Peggy Allison

5. Type of Report ☐ **Negative** ☒ **Positive**

6. Investigation Type

☐ Research Design ☒ Survey/Inventory ☐ Test Excavation ☐ Excavation ☐ Collections/Non-Field Study
☐ Overview/Lit Review ☐ Monitoring ☐ Ethnographic study ☐ Site specific visit ☐ Other

7. Description of Undertaking (what does the project entail?): The proposed facility would be constructed completely within the boundary of the western parcel of land indicated in Figure 1. Surface disturbance planned at the site would include approximately 400 acres of land. About 350 acres of disturbance would be for the construction of shallow ponds and the remaining 50 acres of disturbance would result from construction of buildings to house processing equipment, administration facilities, parking areas, powerline corridors, and access roads. The ponds would be shallow (less than two feet deep) and would be filled with brackish water to be used for algae growth. On-site processing activities would include algae harvesting, drying, and algae oil production.

8. Dates of Investigation: (from: March 3, 2009 to March 17, 2009)

9. Report Date: March 27, 2009

10. Performing Agency/Consultant:
Lone Mountain Archaeological Services, Inc.
Principal Investigator: Douglas H.M. Boggess
Field Supervisor: Thoras R. Dye and Peggy Allison
Field Personnel Names: Francisco Britton, Richard Francisco, Noel Pacheco, Timothy Ruiz Brown

11. Performing Agency/Consultant Report No.: 1210

12. Applicable Cultural Resource Permit No(s): NM 09-073

13. Client/Customer (project proponent): Amec Geomatrix
Contact: Tom Tangen
Address: 7007 Wyoming Blvd. NE Suite F-1, Albuquerque, NM 87109
Phone: (505) 821-0221

14. Client/Customer Project No.:

15. Land Ownership Status ***(Must be indicated on project map):***

Land Owner	Acres Surveyed	Acres in APE
Private	2,149	2,149
TOTALS	2,149	2,149

16 Records Search(es):

Date(s) of ARMS File Review	3-4-2009	**Name of Reviewer(s)** Saundra D. Daras	
Date(s) of NR/SR File Review	3-4-2009	**Name of Reviewer(s)** Saundra D. Daras	
Date(s) of Other Agency File Review N/A		**Name of Reviewer(s)** N/A	**Agency** N/A

17. Survey Data:

a. Source Graphics ☒ **NAD 27** ☐ **NAD 83**

☒ **USGS 7.5' (1:24,000) topo map** ☐ **Other topo map, Scale:**

☒ **GPS Unit** **Accuracy** ☐ **<1.0m** ☒ **1-10m** ☐ **10-100m** ☐ **>100m**

b. USGS 7.5' Topographic Map Name | **USGS Quad Code**

Malpais Hill, NM (1965)	31107-G7
Colombus, NM (1965)	31107-G6

c. County(ies): Luna

17. Survey Data (continued):

d. Nearest City or Town: Colombus, NM

e. Legal Description:

Township (N/S)	Range (E/W)	Section	¼ ¼ ¼
29S	09W	8	S ½ and S ½, NE ¼ and NW ¼, NW ¼ and S ½, NE ¼, NW ¼ and NW ¼, NE ¼, NW ¼ and S ½, NW ¼, NE ¼ and SW ¼, NE ¼, NE ¼ and W ½, SE ¼, NE ¼ and SW ¼, NE ¼
29S	09W	9	S ½.
29S	08W	7	E ½.
29S	08W	8	SW ¼.
29S	08W	9	SE ¼.
29S	08W	17	NW ¼ and S ½, NE ¼ and N ½, NE ¼, SE ¼ and N ½, NW ¼, SE ¼ and N ½, NE ¼, SW ¼ and N ½, NW ¼, SW ¼ (irregular section – anchored NW corner)
29S	08W	18	N ½ and N ½, NE ¼, SE ¼ and N ½, NW ¼, SE ¼ and N ½, NE ¼, SW ¼ and N ½, NW ¼, SW ¼ (irregular section – anchored NW corner)

Projected legal description? Yes [ ], No [x] **Unplatted [ ]**

f. Other Description (e.g. well pad footages, mile markers, plats, land grant name, etc.):

18. Survey Field Methods:

Intensity: ☒ 100% coverage ☐ <100% coverage

Configuration: ☒ block survey units ☐ linear survey units (l x w): ☐ other survey units (specify):

Scope: ☒ non-selective (all sites recorded) ☐ selective/thematic (selected sites recorded)

Coverage Method: ☒ systematic pedestrian coverage ☐ other method (describe)

Survey Interval (m): 15 **Crew Size:** 5 **Fieldwork Dates:** 3-5-2009 to 3-17-2009

Survey Person Hours: 340 **Recording Person Hours:** 140 **Total Hours:** 480

Additional Narrative:

19. Environmental Setting (NRCS soil designation; vegetative community; elevation; etc.): The project is located in an area described as Chihuahuan Desertscrub (Brown 1994). Soils in the area are part of the Nickel-Tres Hermanos complex, which includes Stellar silty clay loam on the hill slopes and basin floors and, within the eastern project area, the Pintura-Berino complex, which includes Akela very gravelly loam on hill slopes, Mimbres and Verhalen soils on alluvial fans, stream terraces, and valley floor remnants, and Mohave sandy clay loam on alluvial fans and hill slopes. Elevation varies from 4,050 ft (1,234 m) amsl on the eastern edge of the project to 4,335 ft (1,321 m) amsl on the far western edge of the project.

20. a. Percent Ground Visibility: 30-80 **b. Condition of Survey Area (grazed, bladed, undisturbed, etc.):** Project Area 1 (PA1) exists only on once cultivated fields that have been plowed extensively for many years. Numerous vehicle tracks and two-track roads are located within the APE. The United States Border Patrol utilizes the area heavily. Project area 2 (PA2) is similar to the area in the west in terms of vegetation and visibility; however, it has not been plowed or used as extensively for farming, except in the far eastern regions. It has, however, been used for cattle grazing for a long period of time, as evidenced by heavy bioturbation and the presence of multiple ranching features, such as corrals and stock tanks. Several of these features are still in use.

21. CULTURAL RESOURCE FINDINGS ☒ **Yes, See Page 3** ☐ **No, Discuss Why:**

22. Required Attachments (check all appropriate boxes):
- ☒ **USGS 7.5 Topographic Map with sites, isolates, and survey area clearly drawn**
- ☒ **Copy of NMCRIS Mapserver Map Check**
- ☒ **LA Site Forms - new sites (*with sketch map & topographic map*)**
- ☒ **LA Site Forms (update) - previously recorded & un-relocated sites (*first 2 pages minimum*)**
- ☐ **Historic Cultural Property Inventory Forms**
- ☒ **List and Description of isolates, if applicable**
- ☐ **List and Description of Collections, if applicable**

23. Other Attachments:
- ☒ **Photographs and Log**
- ☐ **Other Attachments**

***(Describe)*:**

24. I certify the information provided above is correct and accurate and meets all applicable agency standards.

Principal Investigator/Responsible Archaeologist: Douglas H.M. Boggess

Signature _____ **Date** _____ **Title (if not PI):**

25. Reviewing Agency:
Reviewer's Name/Date

Accepted ( ) Rejected ( )

Tribal Consultation (if applicable): ☐ **Yes** ☐ **No**

26. SHPO
Reviewer's Name/Date:

HPD Log #:
SHPO File Location:
Date sent to ARMS:

CULTURAL RESOURCE FINDINGS

[fill in appropriate section(s)]

1. NMCRIS Activity No.:	2. Lead (Sponsoring) Agency:	3. Lead Agency Report No.:
113215	Unknown at this time	

SURVEY RESULTS:

Sites discovered and registered: 6
Sites discovered and NOT registered: 0
Previously recorded sites revisited (*site update form required*): **1**
Previously recorded sites not relocated ***(site update form required):*** **0**
TOTAL SITES VISITED: 7
Total isolates recorded: 43 **Non-selective isolate recording?** ☒
Total structures recorded (*new and previously recorded, including acequias*): **0**

MANAGEMENT SUMMARY: The 43 recorded isolated occurrences have been adequately recorded consistent with currently accepted standards and are not likely to yield information beyond what has already been documented, and no additional investigations are recommended for them.

Two of the newly recorded sites have been recommended eligible for nomination to the NRHP for their possible contribution toward understanding of ranching and homesteading practices in early twentieth century New Mexico. The previously-recorded site has been determined eligible by SHPO for inclusion on the NRHP. Of the remaining sites, three are ineligible and one is undetermined (see Table below). All of the sites fall, at least partially, within the areas that have been identified as impact areas. There is a high potential that the sites will be destroyed by the proposed action. Protection and preservation may not be an option in most cases. If the sites cannot be avoided, testing and data recovery plans should be developed and implemented in consultation with the New Mexico State Historic Preservation Division. Furthermore, if buried cultural deposits are encountered during ground disturbing activities, work should cease immediately and the New Mexico State Historic Preservation Division should be notified, and an assessment should be made by a qualified archaeologist.

IF REPORT IS NEGATIVE YOU ARE DONE AT THIS POINT.

SURVEY LA NUMBER LOG

Sites Discovered:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
162362	1210-001	N
162363	1210-002	Undetermined
162364	1210-005	Y, D
162365	1210-006	Y, D
162366	1210-007	N
162367	1210-008	N

Previously recorded revisited sites:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
50343	N/A	Y, D

CULTURAL RESOURCE SURVEY FOR THE MIMBRES DUE DILIGENCE PROJECT, LUNA COUNTY, NEW MEXICO

Prepared by
Beth McCormack and Peggy Allison,
Lone Mountain Archaeological Services, Inc.

Submitted by
Douglas Boggess, Principal Investigator
Lone Mountain Archaeological Services, Inc.
2625 Pennsylvania Street NE
Albuquerque, New Mexico 87110

Prepared for
Tom Tangen
Amec Geomatrix
7007 Wyoming Blvd. NE, Suite F-1
Albuquerque, NM 87109

LONE MOUNTAIN ARCHAEOLOGICAL SERVICES, INC.

NMCRIS No. 113215
New Mexico State Permit: NM 09-073
Lone Mountain Report No.1210
March 27, 2009

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Field Supervisor Thoras Dye and Peggy Allison and Field Technicians Francisco Britton, Richard Francisco, Noel Pacheco, and Timothy Ruiz Brown completed the field inventory between March 5 and March 17, 2009. The Principal Investigator for the project is Douglas Boggess. The survey was undertaken at the request of Tom Tangen of Amec Geomatrix.

The project area is located in Luna County, New Mexico, near the town of Columbus. The project area has been separated into two distinct areas of survey, Project Area 1 (PA1) and Project Area 2 (PA2). These appear on the Columbus and Malpais Hill, NM 7.5' Quadrangles (1965). Project Area 1 occupies Township 29 South, Range 09 West, portions of Sections 8 and 9, while Project Area 2 occupies Township 29 South, Range 08 West, portions of Sections 7, 8, 9, 17, and 18. Highway 9 runs directly north of the two survey areas. The overall project area measures 2,149 acres (869.7 hectares). PA1 is located west of PA2. PA1 is 842.4 acres (341 hectares) and PA2 is 1,306.6 acres (528.7 hectares). The project consisted of 100-percent pedestrian survey in 15-m intervals. The survey was conducted entirely on privately owned land, under NMCRIS No. 113215, State Permit No. NM 09-073.

Four previously recorded sites (LA 50343, LA 50344, LA 50346, and LA 131904) are located within a 500-m radius surrounding the project area. All four sites are located outside the project boundary and were not encountered during the current investigation. The first three were assigned a NM Statehood through WWII Hispanic (A.D. 1912 to 1945) and the fourth a NM Statehood through WWII Anglo (A.D. 1920 to 1939) temporal/cultural affiliation. LA 50343 was determined eligible for nomination for the NRHP while eligibility recommendations have not been entered for the remaining sites.

Seven sites and 43 isolated occurrences were encountered during this survey. Six sites are newly recorded and one (LA 50343) previously recorded. None of the sites contain prehistoric elements. All of the sites have been assigned a Historic through Recent temporal affiliation. Five of the sites are related to early 20th century homesteading. LA 162363 is located on a 1919 homestead patent issued to Charles E. Bourgeois, while LA 162364, LA 162365, LA 162366, and LA 162367 are located on a parcel issued to Clifford Moody in 1916 (BLM-GLO records).

Two of the newly recorded sites have been recommended eligible for nomination to the NRHP for their possible contribution toward understanding of ranching and homesteading practices in early 20th century New Mexico. The previously-recorded site has been determined eligible by SHPO for inclusion on the NRHP. Of the remaining sites, three are ineligible and one is undetermined

All work was completed in compliance with applicable federal and state legislation and procedures designed to protect nonrenewable cultural resources, including Section 106 of the National Historic Preservation Act of 1966 as amended (PL 89-665), the National Environmental Policy Act of 1969 (PL 91-852), the Archaeological Resource Protection Act of 1979 (PL 96-95), and Executive Order 11593.

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LIST OF FIGURES

Field Supervisor Thoras Dye and Peggy Allison and Field Technicians Francisco Britton, Richard Francisco, Noel Pacheco, and Timothy Ruiz Brown completed the field inventory between March 5 and March 17, 2009. The Principal Investigator for the project is Douglas Boggess. The survey was undertaken at the request of Tom Tangen of Amec Geomatrix.

INTRODUCTION

PURPOSE OF THE SURVEY AND PROJECT BACKGROUND

This project was undertaken in anticipation of the construction of a proposed facility. The facility would be constructed completely within the boundary of the western parcel of land indicated in Figure 1. Surface disturbance planned at the site would include approximately 400 acres of land. About 350 acres of disturbance would be for the construction of shallow ponds and the remaining 50 acres of disturbance would result from construction of buildings to house processing equipment, administration facilities, parking areas, powerline corridors, and access roads. The ponds would be shallow (less than two feet deep) and would be filled with brackish water to be used for algae growth. On-site processing activities would include algae harvesting, drying, and algae oil production.

PROJECT DESCRIPTION AND LOCATION

The project area is located in Luna County, New Mexico, near the town of Columbus (Figure 1.1). The project area has been separated into two distinct areas of survey, which will hereafter be referred to as Project Area 1 (PA1) and Project Area 2 (PA2). These appear on the Columbus and Malpais Hill, NM 7.5' Quadrangles (1965). Highway 9 runs directly north of the two survey areas. The project area includes areas that will be subject to mechanical modification and heavy vehicle traffic. The project consisted of 100-percent pedestrian survey in 15-m intervals. The survey was conducted entirely on privately owned land, under NMCRIS No. 113215, State Permit No. NM 09-073.

SIZE OF THE PROJECT AREA AND SURVEY AREA

The overall project area measures 2,149 acres (869.7 hectares). PA1 is located west of PA2. PA1 is 842.4 acres (341 hectares) and PA2 is 1,306.6 acres (528.7 hectares).

LAND OWNERSHIP

All of the land within the project area is privately owned.

LEGAL DESCRIPTION

Project Area 1 occupies Township 29 South, Range 09 West, portions of Sections 8 and 9, while Project Area 2 occupies Township 29 South, Range 08 West, portions of Sections 7, 8, 9, 17, and 18.

DESCRIPTION OF PROJECT AREA AND SURVEY AREA

The entirety of the western project area (PA1) exists only as formerly-cultivated fields and has been plowed extensively for many years. An informal conversation with a local rancher suggests that in the early 1950s a Mr. Teague installed pumps and cement for a ditch system in the area, although farming was already taking place at the time. The land was apparently sold once or twice, with farming coming to an end in the late 1970s or early 1980s. The last owner removed some of the pipe in order to sell it, although some is still visible in portions of the project area.

The eastern project area (PA2) is similar to the western in terms of vegetation and visibility; however it has not been plowed or used as extensively for farming except in the far eastern regions. It has been used for cattle grazing for a long period of time, as evidenced by heavy bioturbation and the presence of multiple ranching features such as corrals and stock tanks. Several of these features are still in use.

PROJECT PERSONNEL AND SURVEY DATES

Field Supervisor Thoras Dye and Peggy Allison and Field Technicians Francisco Britton, Richard Francisco, Noel Pacheco, and Timothy Ruiz Brown completed the field inventory between March 5 and March 17, 2009. The Principal Investigator for the project is Douglas Boggess. The survey was undertaken at the request of Tom Tangen of Amec Geomatrix.

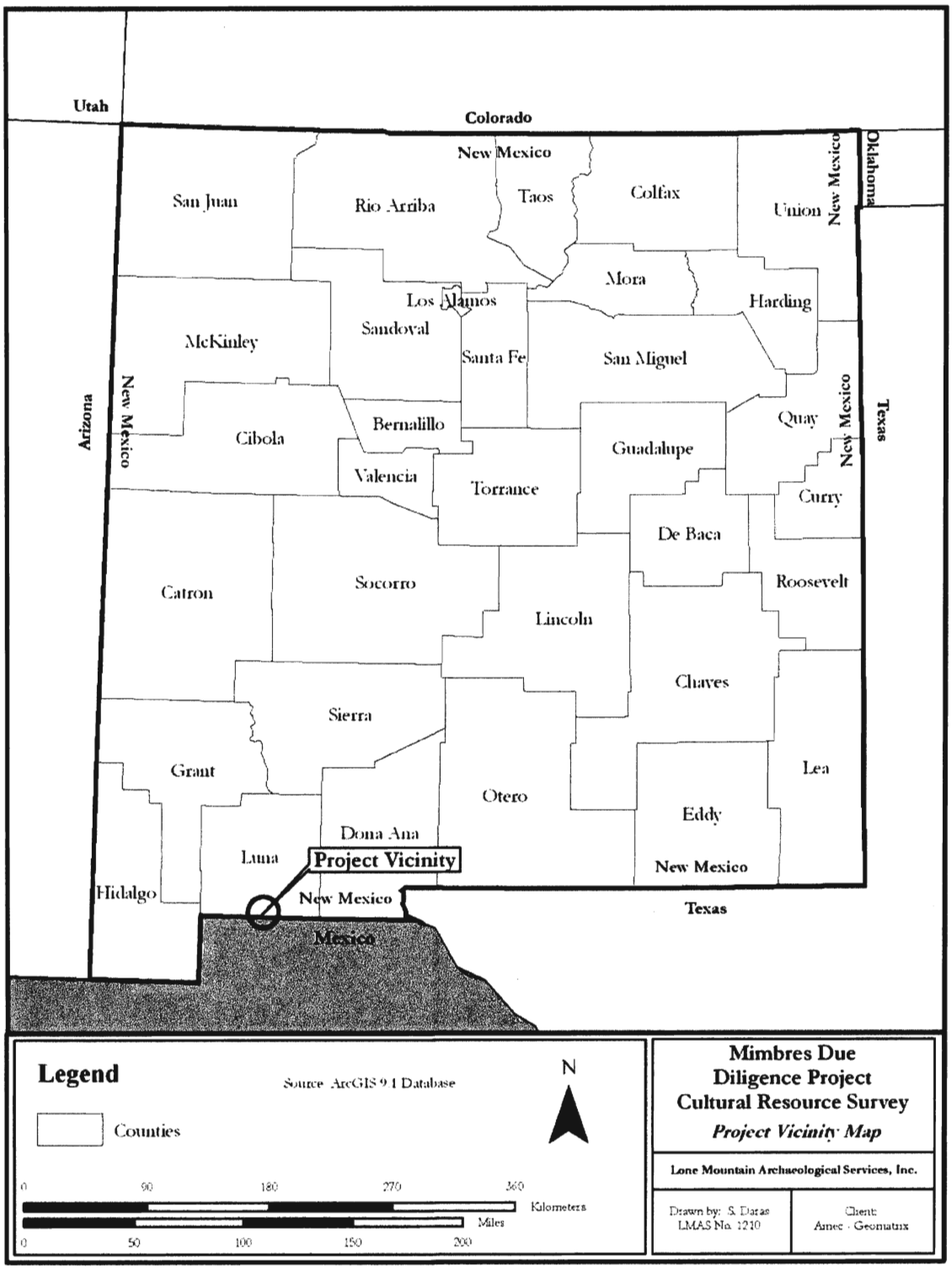

Figure 1.1: Project Vicinity.

ENVIRONMENTAL SETTING

NATURAL ENVIRONMENT

The project is located in an area described as Chihuahuan Desertscrub (Brown 1994). Located to the north are the Tres Hermanas and the Florida Mountains, to the west the Cedar and Hatchet Mountains, and to the south is the closest water source, the Rio Casas Grandes.

Soils in the area are part of the Nickel-Tres Hermanos complex, which includes Stellar silty clay loam on the hill slopes and basin floors and, within the eastern project area, the Pintura-Berino complex, which includes Akela very gravelly loam on hill slopes; Mimbres and Verhalen soils on alluvial fans, stream terraces, and valley floor remnants; and Mohave sandy clay loam on alluvial fans and hill slopes. It appears that much of the topsoil has eroded away, but recent flooding has deposited new alluvium sediments in some areas.

Elevation varies from 4,050 ft (1,234 m) amsl on the eastern edge of the project to 4,335 ft (1,321 m) amsl on the far western edge of the project.

CULTURAL ENVIRONMENT

The survey area is located in a region long used for farming activities and has several features associated with this practice. The area was once traversed by now-abandoned El Paso and Southwestern Railroad line running along the Mexican border between El Paso, Texas and Douglas, Arizona. The abandoned railroad grade through this area has been designated LA 69111. Today the track is absent, the grade is highly disturbed, and much of it functions as a two-track road. A railroad berm and slag are visible on the landscape. Roads in the westernmost part of the project area have been graveled with slag scavenged from the abandoned railroad beds. These roads are located near a series of ditches within the project area designated Lone Mountain Site 1206-001. The siding town of Mimbres, also now abandoned, is located close to the project area, although no trace remains. Of particular note is the series of cement ditches and pumps together with large amounts of historic and recent refuse. Numerous vehicle tracks and two-track roads are located within the APE. The area is heavily utilized by the United States Border Patrol.

PREVIOUS INVESTIGATIONS

On March 4, 2009, prior to entering the field, a files search was conducted by Saundra Daras of Lone Mountain, via the Internet, of the archaeological records maintained at the Archeological Records Management Section (ARMS) of the New Mexico Historic Preservation Division. Four previously recorded sites (LA 50343, LA 50344, LA 50346, and LA 131904) are located within a 500-m radius surrounding the project area. All four sites are located outside the project boundary and were not encountered during the current investigation. A summary of the sites is presented in Table 1.1. Five previous surveys were performed in the area. These surveys are summarized in Table 1.2.

The State Register of Cultural Properties and the National Register of Historic Properties were also consulted, but no properties on either register are located near the project area.

Informal conversations with the local ranchers provided information regarding the recent and historic use of the project area, particularly in regard to the ditch system and farming..

Table 1.1: Previously Recorded Sites within 500 m (0.31 mi) of the Project Area.

LA No.	Description	Cultural/Temporal Affiliation	Eligibility
50343	Historic trash dump	NM Statehood - WWII Hispanic (A.D. 1912 to 1945)	Eligible, Criterion D
50344	Historic trash dump	NM Statehood - WWII Hispanic (A.D. 1912 to 1945)	Not Entered
50346	Historic trash dump	NM Statehood - WWII Hispanic (A.D. 1912 to 1945)	Not Entered
131904	Historic artifact scatter	NM Statehood - WWII Anglo (A.D. 1920 to 1939)	Not Entered

Table 1.2: Previous NMCRIS-registered Activities within 500 m (0.31 mi) of the Project Area.

NMCRIS	Acres	Author	Citation	No. of Sites
115	0	Hilley, John	1981 407 Miles of Archaeological Transect Sampling in the Basins of Southern New Mexico	175
18868	27.5	Main, Rhonda, and Charles M. Haecker	1987 Cultural Resource Survey of Proposed Pit 87-5-S Near Columbus Project No. F-01301(21)	2
27852	28	Haecker, Charles M.	1989 Cultural Resources Survey Along State Road 9 Near Columbus, Luna County NMSHTD District One	0
50486	2644.3	Sechrist, Mark	1994 The Joint Task Force-Six Border Survey Archaeological Survey Along the U.S./Mexico Border Road from Anapra to Antelope Wells, New Mexico. 2 vols.	99
67167	1567.98	Lone Mountain's Staff	2002 Cultural Resource Survey for a Proposed Fiber Optic Corridor Spanning Hidalgo, Grant, Luna, and Dona Ana Counties, New Mexico	37

CULTURAL OVERVIEW

By Lone Mountain's Staff

Knowledge of local historic and prehistoric cultural history is of use to researchers who are conducting archaeological investigations in an area. An understanding of the material use and spatial patterning of various culture groups through time is necessary for the identification and interpretation of cultural objects and features discovered during such projects. The following synthesis of the archaeological and historical resources of southwestern New Mexico is mainly based on the overviews provided by Cordell (1984) and by Stuart and Gauthier (1984).

The cultural history of the project area generally is divided into the following broad developmental and chronological periods, with some variation occurring between defined cultural areas. Those divisions are the Paleoindian period (ca. 10,000 B.C. to 6000 B.C.), the Archaic period (ca. 6000 B.C. to A.D. 200), the Formative period (ca. A.D. 200 to 1450), and the Protohistoric and Historic periods (ca. A.D. 1450 to Present).

Paleoindian Period (ca. 10,000 B.C. to 6000 B.C.)

The initial settlement of North America by humans occurred during the Paleoindian period. Evidence indicates that during this period, which marks the ending of the Pleistocene (the last ice age) geological epoch, people lived in small nomadic bands. They were hunter-gatherers who hunted game that included now-extinct Pleistocene megafauna such as mammoths (*Mammutus primigenius*), and collected wild vegetation and seeds. Their flaked-stone tools commonly were comprised of fine-grain, non-local materials.

The Clovis complex (ca. 10,000 to 9000 B.C.) denotes the earliest identified groups of Paleoindians, and is mainly defined by a distinctive type of fluted projectile point, known as Clovis. The Clovis complex and point are named after the town of Clovis, New Mexico, which is near where the archaeological site used to first identify and define this complex is located (Cordell 1984:122).

Following the Clovis complex is the Folsom complex (ca. 9000 to 8500 B.C.), which also is named for a town in New Mexico that is located near the archaeological site that produced archaeological materials used to define this complex. Many Folsom complex sites are located near major water sources, which has been interpreted as indicating that this time period is marked by a decrease in moisture compared to the Clovis period. During this period, mammoths and other Pleistocene fauna either decreased in numbers or became extinct. One large game animal hunted by the Folsom hunter-gatherers is an extinct type of bison known as *Bison antiquus*. Stone tools associ-

ated with the Folsom complex include projectile points, knives, end scrapers, and side scrapers (Cordell 1984:126-127, 133).

The third, and final division of the Paleoindian period is known as the Plano complex (ca. 8000 to 6000 B.C.). Evidence indicates that during this period, which marks the end of the Pleistocene Epoch, the climate was marked by increased seasonal variation; it became warmer and drier. These environmental changes are thought to have contributed to the extinction of certain animal species and to changes in the types and locations of wild plants. These changes in animal and plant resources resulted in changes in the adaptive strategies and material cultural of the Plano complex peoples, although they appear to have continued living in small bands as hunter-gatherers. Unlike the Clovis and Folsom complexes, the Plano complex is characterized by several projectile point types that include Agate Basin, Alberta, Cody, and Hell Gap (Cordell 1984:134-135).

ARCHAIC PERIOD (CA. 6000 B.C. TO A.D. 200)

The beginning of the Archaic period generally occurred during the early part of the current Holocene geologic epoch. The Archaic period is characterized by a change in subsistence strategy in comparison to the preceding Paleoindian period. Archaic groups were hunter-gatherers who relied more on the gathering of a wider range of wild plant foods and hunting of small game than did the Paleoindian groups. This reliance on a wider range of food sources is considered an adaptive response of the Archaic period peoples to large-scale environmental changes that resulted in changes in food resources that included the extinction of Pleistocene megafauna. The shift in subsistence strategy is accompanied by greater diversity in their stone-tool assemblage, including reduction in projectile point size, an increase in the number of projectile point types, and an increase in groundstone tools. The location of Archaic period sites becomes increasingly variable in regard to their topographic and environmental settings (Cordell 1984:157-172).

In southwestern New Mexico, archaeological evidence of cultivated plants (cultigens) has been recovered from sites that date as early as 2000 B.C. In addition, evidence of pithouses dating from the Archaic period has been found in several areas. Sites assigned to the Archaic period are aceramic, although ceramics sometimes are absent from sites dating to the subsequent Mogollon tradition. Archaic flaked-stone assemblages generally contain a greater proportion of non-local and fine-grain types of materials, and more often exhibit evidence of tool retouch than later Mogollon flaked-stone tool assemblages (Whalen 1986:77-78). In the Jornada region, shallow circular huts and pithouses date to the Archaic period (Mauldin 1996:45-47, Table 6).

MOGOLLON TRADITION (CA. A.D. 200 TO 1450)

The currently proposed project area occurs within the Mogollon cultural area, which includes portions of southeastern Arizona, southwestern New Mexico, southwestern Texas, and northern Chihuahua (Stuart and Gauthier 1984:5,175, Map I.2). In general, the change from the Archaic period to the Formative period in the Mogollon cultural area is marked by the appearance of ceramics. Compared to the flaked-stone assemblage of the earlier Archaic period, Mogollon flaked-stone assemblages more often exhibit the utilization of locally available materials, and the production and use of more expedient types of tools (Whalen 1986:77-78). The Mogollon tradition, which was first defined as a distinct culture area by archaeologist Emil Haury (1936), is commonly divided into the Pithouse (ca. A.D. 200 to 1000) and Pueblo (ca. A.D. 1000 to 1450) periods. The project area falls on or near a frontier between the Mimbres Mogollon and the Jornada Mogollon culture areas (Stuart and Gauthier 1984:5, Map I.2).

PITHOUSE PERIOD (CA. A.D. 200 TO 1000)

The Pithouse period is marked by a cultural tradition that is broadly similar throughout the Mogollon culture area. This tradition includes the construction of subsurface habitation structures known as pithouses.

The Pithouse period is subdivided into four phases for the Mimbres Mogollon area: Cumbre (ca. A.D. 200 to 550), Georgetown (ca. A.D. 550 to 650), San Francisco (ca. A.D. 650 to 900), and Three Circle (ca. A.D. 900 to 1000).

Cumbre Phase (ca. A.D. 200 to 550)

The Cumbre phase of the Mimbres Mogollon Pithouse period is defined by the appearance of Alma plainware ceramics (Martin 1979:69). Subsistence and settlement patterns are viewed through increased sedentism and dependence on horiculture, which included the growing of corn, beans, squash, and cotton. Evidence indicates a continued reliance on the hunting of deer and rabbits, and gathering of wild plants and nuts such as acorns and piñon. Structures of the Cumbre phase consist of round or oval

pithouses that generally contain hearths. An average of 15 to 20 pithouses are present at habitation sites of this phase; they are located on high ridges and knolls. Use of the valley floors is indicated by the presence of debitage and plainware ceramics (Stuart and Gauthier 1984:178-185).

Georgetown Phase (ca. A.D. 550 to 650)

The major defining material type for the Georgetown phase, or Pine Lawn phase, is a highly polished ceramic known as San Francisco Red. Subsistence activities included the cultivation of crops such as corn, although the gathering of wild plants and hunting of game continued. Structures consisted of somewhat smaller, and occasionally D-shape, pithouses. Georgetown phase habitation sites generally contain fewer structures than do the preceding Cumbre phase sites, and are found in a greater variety of locations that include the first terraces above major drainages (Stuart and Gauthier 1984:186-188).

San Francisco Phase (ca. A.D. 650 to 900)

The San Francisco phase is predominantly defined by the production of red-on-white painted ceramics, and the construction of rectangular pithouses and associated kivas and communal structures. Evidence suggests that during this phase reliance on cultigens increased, as did the number of structures comprising habitation sites, suggesting a population increase as well. San Francisco phase habitation sites containing from 15 to 20 pithouses and one or two kivas are common. These San Francisco phase sites often were built at the same locations as Georgetown phase habitation sites, with the structures of one phase built over the structural ruins of the preceding phase. Mortuary practices of this phase began to include the ceremonial "killing" of ceramics that were placed in the grave of the deceased (LeBlanc and Whalen 1980:201; Stuart and Gauthier 1984:188-193).

Three Circle Phase (ca. A.D. 900 to 1000)

The Three Circle phase is distinguished by the presence of Three Circle Red-on-white ceramics, and during the latter parts of this phase, Early (Boldface) and Transitional Mimbres Black-on-white ceramics. Pithouses were rectangular and often had cobble masonry half-walls built inside the excavated pit walls. A substantial increase in population is indicated by the increased number of large villages being occupied versus those occupied during previous periods, and the appearance of villages along secondary drainages. The average size of habitation sites for this phase is 50 pithouses (Cordell 1984:115-117). Individual pithouse size declined compared to those of the preceding San Francisco phase, although the size of communal structures increased. The greater size of communal structures has been speculated to indicate increased emphasis on formal ceremonial activities (LeBlanc and Whalen 1980:181).

The most common burial treatment was to place the deceased in a flexed position in a subfloor pit, and to arrange ceramic bowls over the deceased's knees or side and later, the face or head (Stuart and Gauthier 1984:195-197). The occasional presence of turquoise, marine shell, and macaw feathers with inhumations indicates extensive exchange networks were occurring during the Three Circle phase (LeBlanc and Whalen 1980:187-190, 192-195).

PUEBLO PERIOD (CA. A.D. 1000 TO 1450)

The Pueblo period is marked by the construction of surface pueblos and greater interregional variation in material cultural, particularly ceramics and architecture. For the Mogollon culture region, a number of distinctive ceramic styles and forms of architecture first appear after A.D. 1000.

Material culture changes, and their indications for socio-economic changes, led archaeologists to define the following sequential phases for the Mimbres Mogollon culture area: Classic Mimbres (ca. A.D. 1000 to 1100 or 1150), Animas or Black Mountain (ca. A.D. 1100 or 1150 to 1300), and Cliff (ca. A.D. 1300 to 1450).

Classic Mimbres Phase (ca. A.D. 1000 to 1100 or 1150)

The Classic Mimbres phase developed in the Mimbres Valley and adjacent areas. It is defined by the appearance of above ground architecture and Classic Mimbres Black-on-white ceramics. The following trends are more typical of the Mimbres Valley occupation sites, with the sites in the outlying areas exhibiting less change from the preceding phase. The most common habitation sites are small, ranging from two to 20 rooms each. However, large village sites, pueblos that contained as many as 200 rooms each, appear during this phase. The populations of these large sites substantially decreased by A.D. 1150, for reasons that are yet unclear. This sharp drop in population appears to have occurred at the same time that a similar sharp population decrease occurred in the Chacoan Anasazi area to the north.

Subsistence was predominantly based on flood plain agriculture, although the subsistence base appears to have broadened to include food resources such as small game and fowl (as indicated by faunal remains), perhaps in response to inconsistent farming yields. Although irrigation was used, Mimbres irrigation systems are much less extensive and common than those for other southwestern cultures of this time.

The practice of interring the deceased beneath room floors continues during the Classic Mimbres phase. Burials recovered from excavated habitation sites averages five burials per room. The marked difference in the kinds and amounts of funerary objects associated with individuals at large sites in comparison to small sites has been speculated to reflect an increase in economic and social stratification. Exotic trade items such as marine shell and macaw feathers recovered archaeologically indicate the continued presence of trade networks to the south and west, and trade to the east is evidenced by exported Classic Mimbres ceramics (Stuart and Gauthier 1984:198-204).

Animas or Black Mountain Phase (ca. A.D. 1100 or 1150 to 1300)

The Animas or Black Mountain phase has been interpreted as representing an abrupt break from the Mogollon culture, with people from another cultural region moving into the area. However, evidence recovered more recently points toward an economic restructuring of the remnant Mimbres populations (Stuart and Gauthier 1984:206-208). Commonly, research for the Animas or Black Mountain phase emphasizes ties with Casas Grandes, Mexico, to the south, which reached its developmental height during the mid- to late-1200s.

The numerous ceramic types common for this phase are Playas Red, Ramos Polychrome, Chupadero Black-on-white, White Mountain Redware, and several corrugated, plain, and textured brownwares. The architecture changes from cobble masonry to puddled adobe. Pueblos are U-shape and typically contain 125 rooms. Residential rooms are relatively large compared to those of the Classic Mimbres phase, and surround the central plaza. Kivas usually are not present at village sites of this phase. Habitation sites most commonly occur in lower elevation areas in the desert with good agricultural soils and alluvial catchments, or playas (Stuart and Gauthier 1984:206-208).

Cliff Phase (ca. A.D. 1300 to 1450)

The Cliff phase includes the poorly understood Salado culture of the Mimbres Valley. Substantial population aggregation occurs during the Cliff phase, with the population heavily dependent on agriculture. The architecture of this phase is similar to that for the preceding Animas or Black Mountain phase. Village sites commonly consist of large, coarsed and puddled adobe pueblos with plazas.

The ceramic types of this phase, which may have originated in central Arizona, include Tonto, Pinto, and Gila Polychromes. The argument has been made that the Cliff phase people migrated from Casas Grandes after its collapse. Another view is that they came from the Tonto Basin of Arizona; therefore, it is not clear whether these ceramics represent trade activity or indicate that the Salado migrated from central Arizona. Archaeological evidence suggests that many of the Cliff phase sites were suddenly abandoned around A.D. 1450 (Lekson 1992:133-135). It is possible that these people joined other groups, such as the Jano- or Jocome-speaking people who may have been the predecessors of the Protohistoric period southern Apachean groups known in this region (Griffin 1983:330; Tainter 1985:144). It is equally possible that they were related to western Pueblo groups (Pilles 1996).

JORNADA MOGOLLON TRADITION (CA. A.D. 200 TO 1450)

Unlike the Mimbres Mogollon culture, the Jornada Mogollon sequence is characterized by cultural continuity, with little evidence of outside influence, throughout much of its developmental sequence. Divisions of the Pueblo period of the Jornada Mogollon culture are the Early Formative period (A.D. 200 to 1100) and the Late Formative period (A.D. 1100 to 1450) (LeBlanc and Whalen 1980:14).

EARLY FORMATIVE PERIOD (CA. A.D. 200 TO 1100 OR 1150)

The Early Formative period of the Jornada Mogollon includes the Mesilla phase (Carmichael 1986), and marks the advent of ceramic production and agriculture in this region. The shift to a more sedentary lifeway and dependence on agriculture to provide a food base appears to have occurred less completely for the Jornada in comparison to the Mimbres Mogollon. Reliance on hunting and gathering continued throughout the Pueblo period in the Jornada area (Upham 1984), although agricultural products did become increasingly important to the subsistence base. During the Mesilla phase, the population

aggregated into villages composed of round and rectangular pithouses with extramural hearths and storage pits. The initial use of pithouses actually occurred during the latter part of the Archaic period, and continued into the Mesilla phase. Other domiciles constructed during this time were shallow, basin-shape huts similar to those of the Archaic period (Hard 1983a; O'Laughlin 1980).

Mesilla phase ceramics are El Paso brownware (Whalen 1978, 1980), and Jornada Brown. After A.D. 750, small amounts of Mimbres Black-on-white ceramics occurred. Known sites of this period include long-term habitation sites and short-term special activity camps. Village sites commonly were situated near permanent water resources, although during the latter part of the Mesilla phase some habitation sites were placed at the base of foothills along alluvial fans (Carmichael 1985). Short-term camps were located in the central Basin and mountainous settings.

LATE FORMATIVE PERIOD (CA. A.D. 1100 OR 1150 TO 1450)

The Late Formative period of the Jornada Mogollon is subdivided into two phases: Doña Ana (ca. A.D. 1100 to 1200) (Lehmer 1948), and El Paso (ca. A.D. 1200 to 1450) (Upham 1991). Late Formative ceramics are El Paso brownware and El Paso Polychrome (Whalen 1978, 1980). Imported ceramics occur more frequently and include Chupadero Black-on-white, Playas Red, Three Rivers Red-on-terracotta, and Mimbres Black-on-white (Hard 1983b). The Doña Ana phase is characterized by the presence of above ground adobe pueblos and the continued use of pithouses similar to those of the preceding Mesilla phase.

During the El Paso phase, surface pueblo architecture completely replaced pithouse architecture. Pueblos were variable in size, and were composed of room blocks oriented in long east/west tiers or around a plaza. Special activity sites of the El Paso phase occur throughout the central Basin, and their larger size may indicate the formation of larger work groups (O'Laughlin 1980). The major type of ceramic produced during this time is El Paso Polychrome, with tradewares including Chupadero Black-on-white, Playas Red, Ramos Polychrome, Gila Polychrome, and Three Rivers Black-on-terracotta. Evidence provided by ceramic data suggests that the El Paso phase people were in contact with groups in central and northern New Mexico, the White Mountain region of southeast Arizona, the Gila River area of southwestern New Mexico and southeastern Arizona, and northwestern Chihuahua, Mexico. Exotic objects recovered from El Paso phase sites include copper bells from Mexico (Lehmer 1948), and marine shell from the Pacific Coast (Whalen 1978).

The Jornada Mogollon agricultural subsistence system began its decline around A.D. 1300, and abandonment of the area by much of its pueblo population followed. A more nomadic hunting-gathering lifeway was then adopted by the remaining population (Kelley 1984). Beckett and Corbett (1992) propose that a number of culture groups may have occupied the Jornada area during the last of the Prehistoric period. Those groups are generally identified as the Chinarra, Concho, Jano, Jocome, Manso, Suma, Piro, and Tarahumara.

PROTOHISTORIC AND HISTORIC PERIODS (CA. A.D. 1450 TO PRESENT)

Although evidence is slight and the date has been debated, the entrance of Athapaskan groups into southwestern New Mexico occurred at least by the mid-1400s with the appearance of the Navajo (Gunnerson 1979:162). Apachean groups are first definitely noted in written accounts from the 1620s, but Western Apaches may have occupied this region as much as a century before. These people were seminomadic hunter-gatherers who formed several bands, including those known as the Mogollon, Copper Mine, Mimbres, Warm Spring, and Chiricahua Apaches; these groups have been collectively referred to as the Gila Apache (Williams and McAllister 1979:28-29). These bands occupied the foothills and mountain ranges of southwestern New Mexico and southeastern Arizona. Their presence in this region ended with their removal into reservations in the 1860s by the United States government. Early Apachean archaeological sites documented for southwestern New Mexico are difficult to detect and define, and generally are represented by undated rock art and debitage scatters (Cordell 1984:356-360; Schaafsma 1980:333-341).

The entrance of Euro-Americans into southwestern New Mexico begins with the appearance of Alvar Nuñez Cabeza de Baca, Fray Marcos de Niza, and Francisco Vásquez de Coronado (Jenkins and Schroeder 1974; John 1975). This marked the beginning of the Historic period in the region. These early expeditions had little direct impact on the aboriginal occupants of the region, but succeeding Spanish involvement in the area eventually resulted in drastic changes in the lifeways of the Apaches. The introduction of European diseases, particularly smallpox,

severely reduced the size of the Apache population. Attempts at religious conversion, demands for slave labor, and the introduction of domestic animals (the horse in particular) by the Spanish, all resulted in changes in Apache culture. The Apache raided Spanish settlements to obtain livestock and other material goods. This resulted in retaliatory campaigns by the Spanish, a cycle that continued throughout much of the Spanish Colonial and Mexican periods (John 1975:3-97; Perry 1991:164-173; Williams and McAllister 1979:32-35).

Around 1799, the Spanish opened the Santa Rita Copper Mine and established the first permanent Spanish settlement in the area (Williams and McAllister 1979:34-35). During the first few years of operation, the Santa Rita Copper Mine was closed several times, mainly due to Apache raids. Spanish and Gila Apache leaders agreed to a treaty prior to Mexican independence in 1821, which confined the Apaches to "peace establishments" in return for supplies promised by the Spanish government. However, in 1821, when Mexico gained independence from Spain, the maintenance of these establishments ceased and led to severe food shortages for the Apaches. In response, the Apaches resumed their raiding tactics, and the Mexican government conducted military campaigns to try to stop the raids on their settlements.

Anglo-American fur trappers entered southwestern New Mexico once the Mexican border was opened for trade with the United States. For a time, the trappers' efforts to form treaties with the Apaches were fairly successful, and they could explore and trap the area between the Santa Rita Mine and the Rio Grande without interference from the Apaches. In 1837, however, conditions changed radically. That year, Anglo miner John Johnson led a scalp-hunting expedition to the town of Santa Rita, planning to collect the substantial bounty placed on all Apaches by the Mexican government. The Apaches, led by chiefs that included Cochise, Mangas Coloradas, Victorio, and Geronimo, then waged war against the miners and trappers. Despite military campaigns led by the Mexican military with the purpose of killing all Apaches, Apache raids against the Euro-Americans continued. Although peace was achieved between the two groups in 1842-1843, the occurrence of a smallpox epidemic and providing of meager rations at the Mexican "peace establishments" again led to unrest. Hostilities continued after the United States' victory in the Mexican War of 1848, with the Apaches attempting to retain possession of their lands against the continuing influx of miners, settlers, and military troops.

The presence of the United States military in southwestern New Mexico continued to increase until after the Civil War. Fort Dawson, Fort Webster, Fort McLane, and Fort Bayard are some of the military installations established during this period (Williams and McAllister 1979:40-41). The Apaches eventually were forced to resettle at reservations located at Ojo Caliente and San Carlos. Encroachment by Euro-American settlers on to lands promised to the Apaches, and shortages of rations, occasionally led to violent attacks and raids on soldiers and civilians by the Apaches. In 1886, the final band of renegade Apaches, led by Geronimo, was captured. Approximately 400 other Apaches from the San Carlos Reservation, in addition to several Apache prisoners from the last military campaign were taken by train to Florida and Pennsylvania, and then later to Alabama, and eventually to Oklahoma. Not until 1914 were the Chiricahua Apache released from Fort Sill Oklahoma and given the choice of remaining in Oklahoma and receiving land allotments, or moving to the Mescalero Apache Reservation in southeastern New Mexico (Perry 1991:176-179).

With the end of the Apache threat, Hispanic and Anglo-American settlement of southwestern New Mexico began to increase. Numerous villages and mining camps were established in quick response to finds of mineral wealth. Although most were abandoned, a few of these mining towns and camps managed to thrive despite fluctuations in mineral yields and prices. One of the more successful mines was the Santa Rita Copper Mine, which is currently owned by the Chino Mining Company. This is still a successful mine, largely due to the use of open-pit mining to obtain large amounts of copper from previously inaccessible areas.

The construction of the Southern Pacific Railroad across southern New Mexico, through the towns of Lordsburg and Deming, located north of the project area, occurred during 1880-1881. Although the railroad shipped ore and cattle for the southern New Mexican mining and livestock trade and quickly became an important factor in the economy of the region, the Southern Pacific's major source of income was from interstate shipping (Myrick 1970:59-66; Williams and McAllister 1979:42-43).

The El Paso and Southwestern Railroad began as an extension of the Arizona and Southeastern Railroad, which began building a line eastward from the town of Douglas, Arizona, in 1901. The railroad's name was changed to the El Paso and Southwestern Railroad in 1902. Trains began operating between Bisbee, Arizona, and Deming, New Mexico, by way of

Hermanas in February 1902. Completion of the entire route, which extended from Douglas, Arizona, through Rodeo, Hachita, Hermanas, Columbus, and Anapra, New Mexico, to El Paso, Texas, occurred in November 1902. Operation of trains along this route began in December of that same year (Myrick 1970:92-95; Williams and McAllister 1979:42-43).

In 1924, the El Paso and Southwestern Railroad merged with the Southern Pacific Railroad in response to investment losses suffered due to a sharp drop in the post-World War I price of copper. With this merger, the Southern Pacific gained possession of a number of coal-fired locomotives that had been used by the El Paso and Southwestern. To cut shipping costs, operation of the southern route established by the El Paso and Southwestern ceased on December 20, 1961. The tracks and facilities were left in place until 1963 when the railroad launched a clean-up effort (Myrick 1970:68-70, 92, 103).

Communities were established, increased in size, or relocated as a result of the establishment of a railroad through the area. The town of Rodeo was established after the El Paso and Southwestern Railroad extended its line from Douglas, Arizona, in 1901. This location became a major shipping point for area livestock (Julyan 1996:302; Myrick 1970:96). After Arizona voted to go dry around 1915, Rodeo boomed with as many as 17 saloons opening their doors to thirsty Arizonans. With the eventual lessening of alcohol restrictions in Arizona, though, business in Rodeo dwindled. The now abandoned locality of Pratt was a former siding along the railroad. The origin of the name is not known (Julyan 1996:275). Hermanas, named after the nearby Tres Hermanas Mountains, was founded in 1879 and served to furnish supplies to local miners (Carson 1991:30). Hermanas was the connection for the spur line to Deming that was built shortly after 1903 along the El Paso and Southwestern Railroad (Myrick 1970:93; Carson 1991:31). Hermanas relied on the railroad for financial support, although farming, ranching, and mining also contributed to the economy. It reached its peak population of 150 in 1902, and for a short time had a railroad station, a post office, a school, and various businesses (Carson 1991:30-31). Much of the town's population had left by 1910, however, and it is now abandoned (Julyan 1996:164; Carson 1991:31). Malpais was a small settlement named after the lava flows in the area. The community of Malpais is now abandoned (Julyan 1996:218). The community of Mount Riley, named after the nearby summit of Mount Riley, and Potrillo, named for the Potrillo Mountains, are abandoned (Julyan 1996:235, 274).

Very close to the project area, Columbus and the now-abandoned town of Mimbres are located about halfway along the El Paso and Southwestern Railroad line. (Sumner 1999). No trace of Mimbres remains. The townsite is located 7.2 miles west of Columbus. A 1915 USGS map refers to the town as Mimbres, but a 1950 SP timetable refers to the town as Onyx (mile marker 1242.9).

The town of Columbus today has a population of approximately 1000. The town was originally established as a border station across from Palomas, Chihuahua, Mexico around 1890. The origin of the town's name is uncertain. When the El Paso & Southwestern railroad was constructed in 1902 a new town, also named Columbus, was built alongside the railway about 2 miles to the north and the original townsite was gradually abandoned (Myrick 1970:98). An attempt in 1928 to bring back the southern community under the name of Border City failed. Some maps of the period show the original town as South Columbus. The railroad station house still stands today and is used as a museum for the Columbus Historical Society.

Columbus has the distinction of being the only place in the United States to be invaded by armed foreign troops since the War of 1812. A detachment of the U.S. 13th Calvary Regiment was stationed at Camp Furlong in 1914 The garrison was constructed south of the El Paso and Southwestern Railroad tracks near the center of Columbus to protect the U.S./Mexican border from bandits and marauders. On March 9, 1916, Mexican revolutionary leader Francisco "Pancho" Villa, led 485 men in an attack against Columbus. It is unclear why Villa loosed his men on the camp and the town of Columbus, although frustration with US arms dealers and US policy with Mexico were likely causes. Ten civilians and eight U.S. soldiers were killed. Approximately eighty of Villa's men were killed by the garrison's newly-acquired machine guns and at least six were captured in the attack and later hanged. Villa and the surviving men escaped with supplies, weapons and ammunition seized from the garrison. President Woodrow Wilson responded to the raid by sending 10,000 troops under the leadership of General "Black Jack" Pershing to Mexico to pursue Villa. The punitive expedition was called off after 11 months because it failed to locate Villa. With their return in February 1917, the camp at Columbus was dismantled, although 5,000 men were still stationed there in 1919. By 1923, the number of men had dwindled to 60 (Carson 1991:34-35). This event is commemorated in Columbus by two museums and Pancho Villa State Park (Julyan 1996:91; Carson 1991:34-36).

Field Supervisor Thoras Dye and Peggy Allison and Field Technicians Francisco Britton, Richard Francisco, Noel Pacheco, and Timothy Ruiz Brown completed the field inventory between March 5 and March 17, 2009. The Principal Investigator for the project is Douglas Boggess. The survey was undertaken at the request of Tom Tangen of Amec Geomatrix.

METHODS

Lone Mountain archaeologists surveyed the APE by walking 15-m (50-ft) wide transects. Field conditions at the time of the survey were very good, with excellent visibility, little ground cover, and sunny weather conditions.

The southern portion, eastern portion, and approximately half of the northern portion of PA1 is bounded by a barbed-wire fence. The western area is bounded by a bladed gravel road. The western half of the northern boundary is bounded by State Road 9. Although fencelines are prevalent throughout PA2, the easternmost area, the project area was defined using GPS, a USGS 7.5' quadrangle, with the southern boundary being defined, primarily, by the United States/Mexico border. Site locations were established with the aid of a USGS topographic map, a Garmin GPS unit, and a detailed contour map provided by Amec Geomatrix.

For this survey, sites were defined in accordance with the guidelines established by the State of New Mexico. Sites are defined as "a location where there exists material evidence of the past life and culture of human beings in the state. A significant archaeological site typically is 50 or more years old. Examples of archaeological sites include, without limitation, campsites, pueblos, homesteads, artifact scatters, resource procurement or processing areas, agricultural fields, locales with one or more features in association with other cultural materials, and locales that have the potential for subsurface features or cultural deposits" (New Mexico Historic Preservation Division 2005).

When cultural remains are encountered, a determination is made as to whether they are an isolated occurrence or a site. Isolated occurrences are isolated cultural remains that do not qualify as sites and generally consist of single artifacts or artifact scatters that are of extremely low density, are widely dispersed, or represent a single or unintentional activity. Isolated occurrences are recorded on a Lone Mountain form and their locations are plotted on the appropriate USGS quadrangle.

Sites are recorded using a Laboratory of Anthropology Site Record form. A map is drawn and color film photographs are taken showing the setting of the site and any unique features or artifacts. Artifact forms are used to record samples of flaked stone, ceramics, groundstone, and historic artifacts. Any artifacts with diagnostic properties are illustrated. An aluminum datum tag and spike are placed within the site boundary and noted on the site sketch map. The location of the cultural property is then plotted on the appropriate USGS quadrangle and GPS readings are taken to verify the accuracy of the field plot. When single artifacts or low-density artifact scatters are encountered, they are recorded in the field as an isolated occurrence and their locations are plotted on the USGS quadrangle.

DESCRIPTION AND ANALYSIS OF FINDINGS

One previously recorded site, six new archaeological sites, and 43 isolated occurrences were recorded during the survey and are described below in detail.

PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES

SITE NO.: LA 50343

Site No.: LA 50343
Field No.
Components: Hispanic NM Statehood-WWII (A.D. 1920 to 1945)
Eligibility: Previously determined eligible under Criterion D

Description

LA 50343, a historic trash dump, is located at the junction of NM Highway 9 and County Road 005. The site was first recorded by the New Mexico State University in 1981 (Naylor 1981), the University of Texas at Austin in 1984 (Mallouf 1984), NMDOT in 1987 (Main and Haecker 1987), and Lone Mountain in 2000 (Snell 2000). The site was tested by Human Systems Research in 2002 (Kirkpatrick 2002), and Zia Engineering and Environmental Consultants performed a survey in 2006 (NMCRIS 102597). Vegeta-

tion consists of creosote, broom snakeweed, and various forbs and grasses. Ground visibility is between 76 percent and 99 percent (Figure 2.1).

Assemblage Information

Previous researchers found hundreds of historic artifacts at the site including a cold cream jar, a small trunk handle, meat tins and other rusted cans, condensed milk cans, rubber soled shoes, a tractor tire, and various colored glass shards. Screwtop bottle fragments enabled Mallouf (1984) to assign a 1920s date to the site. The assemblage was found to be in much the same condition as previously recorded, with the addition of one multidirectional purple rhyolite core.

Site Structure and Features

No features were observed at the site. A trowel test performed by Lone Mountain in 2000 revealed cultural materials to a depth of 20 cm.

Disturbances and Potential Impacts

The site is at the intersection of an active roadway (NM Highway 9) and Luna County Road C007 near fences and a border security camera. A buried fiber optic line has been placed between the concentration and NM Highway 9. The site remains between 76 percent and 99 percent intact.

Conclusions and Recommendations

A NM Statehood-WWII temporal affiliation (A.D. 1920 through 1945) has been assigned to this site based on documented artifacts. Previous recorders assigned a Hispanic cultural affiliation to the site. Previous researchers also determined that the site is a roadside dump with some buried artifacts. The site was therefore recommended eligible for nomination to the NRHP under Criterion D. NMHPD concurred. Some form of limited testing took place in connection with the installation of a fiber optic line but it is uncertain from available documents whether additional work will be necessary.

NEW ARCHAEOLOGICAL SITES

SITE NO.: LA 162362

Site No.: LA 162362
Field No. 1210-001
Components: NM Statehood-WWII to recent (A.D. 1935 to 1980s)
Eligibility: Ineligible

Description

LA 162362 is a series of agricultural ditches and associated features and materials. The recorded ditches are located on a flat plain half a mile to a mile north of the United States and Mexico border. It should be noted that the ditches extend outside the survey area onto private land that could not be accessed at the time of recording. Vegetation consists of various grasses, narrow leaf yucca, and prickly pear cactus. Ground visibility is between 76 percent and 99 percent (Figure 2.2).

Assemblage Information

Hundreds of artifacts were observed at this site, all associated with the ditch system. Materials observed include cement, metal pipe, and railroad tailing. Hundreds of segments of these materials have been used in the construction of the ditch system and related features.

Site Structure and Features

Eight features, including a cement block with piping (F1) and seven ditch segments (F2 through F8), were observed at this site. The features all appear to be part of an irrigation system.

Feature 1, located almost immediately south of State Road 9 and the property fence, is a cement block with a metal pipe, possibly the remains of a drill hole and the foundation for a pump. The structure measures 28 ¼ in from north to south by 30 in from east to west by 11 in tall. The block is composed of cement mixed with local gravels including basalt and rhyolite. The metal pipe, which is flush with the surface of the cement, is 10 ½ in wide. Inscribed in the cement is "MAR 30-35," written in letters approximately 3 in to 3 ½ in tall.

Features 2 through 8 are all irrigation ditches located south of State Highway 9. With the exception of Feature 8, which is made entirely of dirt, the ditches are all lined with cement segments. The pre-poured cement ditches are in segments that are 8 ft, 8 in long and 4 ft, 2 in wide. The outer flanges are 4½ in wide and the cement is 2½ in thick, only measurable

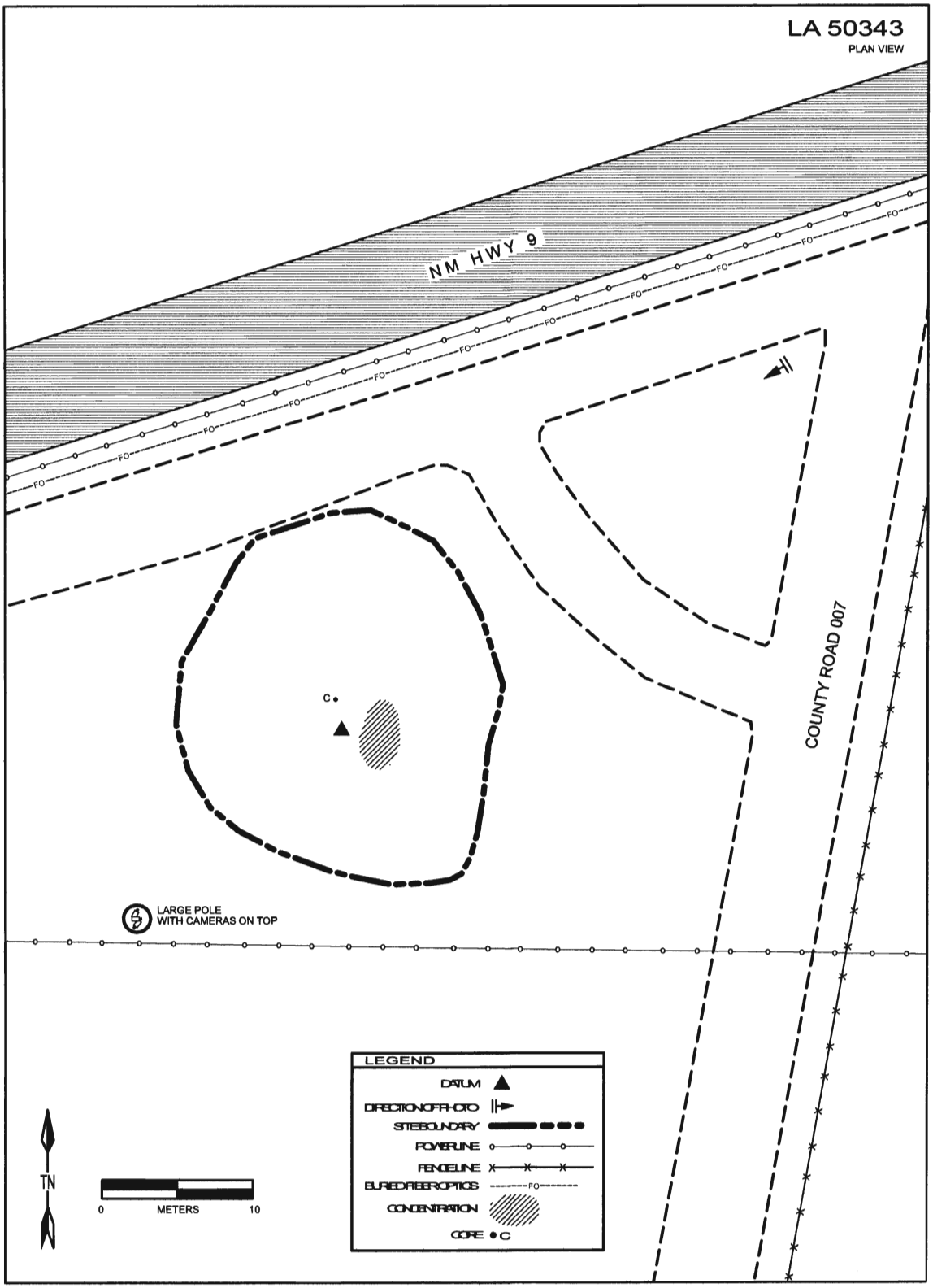

Figure 2.1: LA 50343 Plan View.

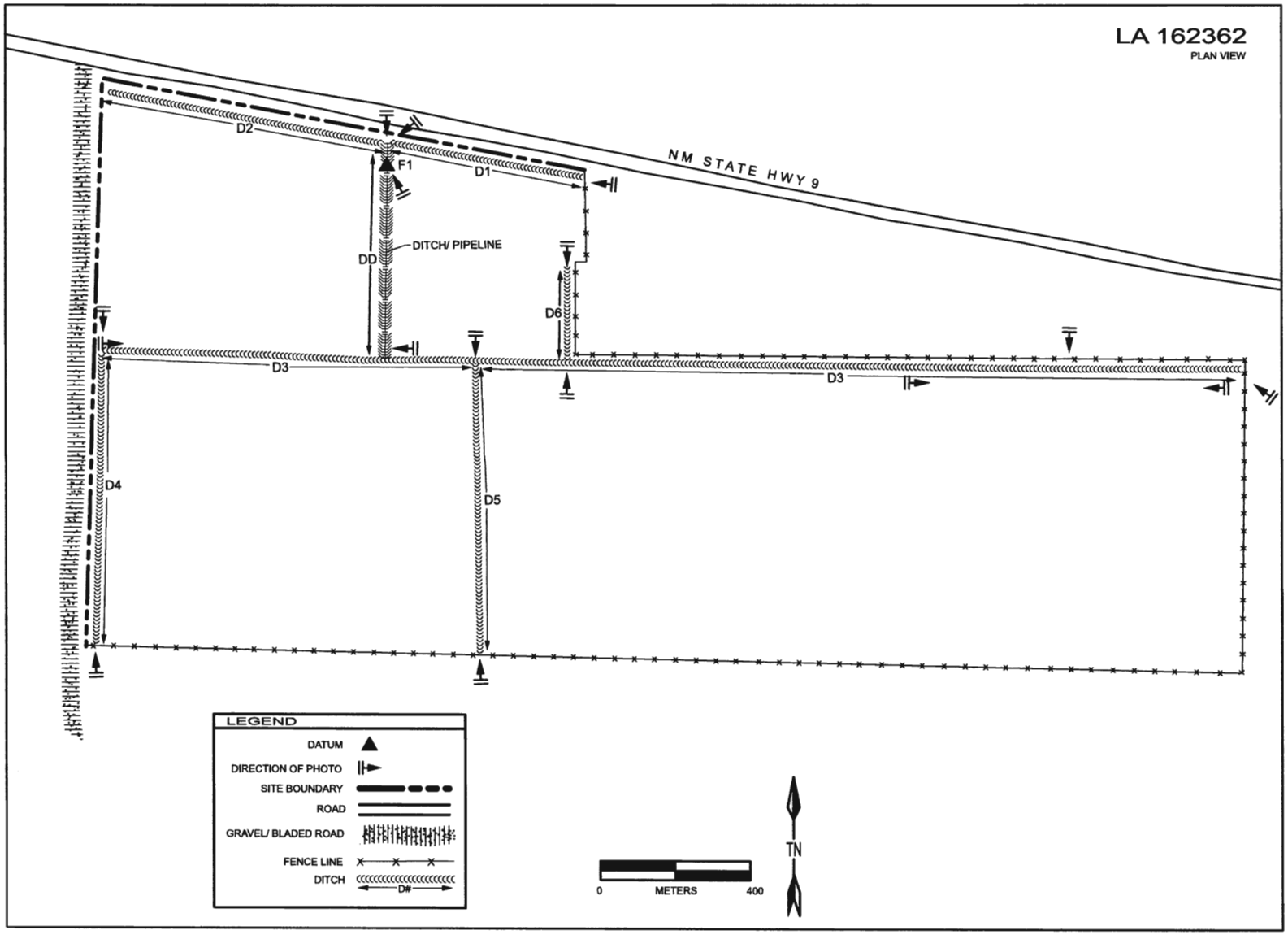

Figure 2.2: LA 162362 Plan View.

at the flanges. The sides and the base may be thicker. Although filled with sediment, the ditches are estimated to be between 2 ft to 2½ ft deep. There are two-track roads or bladed gravel roads or both on each side of all the ditches. Locals have been scavenging materials from the old railroad berm located north of State Highway 9, outside of the project area, for use on the gravel road. This slag and volcanic basalt is observed in many areas along the ditches. Local informants stated that the railroad was abandoned in the early 1950's, either 1951 or 1952, at the same time the cement ditches were installed. The ditches were installed by a Mr. Teague and in use until the late 1970s to early 1980s, through a succession of up to two landowners.

Feature 2 (Ditch 1) is approximately 1,804 ft (550 m) long and runs west-northwest to east-southeast. The ditch extends on to private property at its easternmost end.

Feature 3 (Ditch 2) is approximately 2,625 ft (800 m) long and runs west-northwest to east-southeast. The ditch extends on to private property at its westernmost end for approximately 30 ft (7 m) and has subsequently been demolished for the construction of a north to south trending bladed gravel road.

Feature 4 (Ditch 3) is approximately 10, 538 ft or 2 mi (3,212 m) long and runs east to west. No extensions were observed on either end. The ditch has been breeched in a few places by recent flooding. This ditch connects with Ditches 4, 5, 6, and 7. A few recent pumps and pump remains were observed along this ditch.

Feature 5 (Ditch 4) is approximately 2,543 ft (775 m) long and runs north to south. The north end connects to Ditch 3 and no extension to the south was observed.

Feature 6 (Ditch 5) is approximately 2,543 ft (775 m) long and runs north to south. The north end connects to Ditch 3 and no extension to the south was observed.

Feature 7 (Ditch 6) is approximately 820 ft (250 m) long and runs north to south. The north edge ends at what appears to be a pump location and an area in which the landowner has stacked pipe pulled from several pump locations. The south end connects to Ditch 3.

Feature 8 (Ditch 7) is approximately 1,804 ft (550 m) long and runs north to south. The south end connects to Ditch 3 and the north end connects to an area close to the eastern end of Ditch 2. Feature 1 is located near the northern end of this ditch. This is the only ditch not lined with concrete and is only observable as a shallow linear depression approximately 2.46 ft (0.75 m) wide with dense vegetation. An informal conversation with a local rancher suggests that a buried pipe was once located here and that is was removed by the last landowner so that it could be sold. The trench was then backfilled. This may explain why the western end of Ditch 1 and the eastern end of Ditch 2 do not connect, although it should be noted that they are somewhat offset; Ditch 2 ends approximately 65 ft (20 m) south of Ditch 1.

Although much of the topsoil has eroded away, the site surface is composed of alluvial sediments from recent flooding to a depth of roughly 1 m. Because the ditches were placed in machine-excavated trenches, sediments are not likely to contain further cultural deposits.

Disturbances and Potential Impacts

Multiple vehicle tracks, fences, and two-track roads are located in and around the site. The United States Border Patrol utilizes the area frequently. The entire area has been plowed extensively for many years and a previous landowner has dismantled portions of the features. Water action and wind action were also noted. The ditches remain 76 percent to 99 percent intact.

Conclusions and Recommendations

The site appears to be a mid twentieth century irrigation system. Although local informants date the concrete lined ditches to the early 1950s, an inscription on Feature 1 may indicate a 1935 construction date for at least that portion of the site. The site therefore has a NM Statehood-WWII to Recent (A.D. 1935 to 1985) affiliation. The site does not appear to be associated with significant historical events or people, does not retain any characteristic workmanship, and is not likely to yield any additional significant information concerning the mid twentieth century development of the area and is therefore recommended ineligible for nomination to the NRHP under any of the four criteria.

SITE NO.: LA 162363

Site No.: LA 162363
Field No. 1210-002
Components: NM Statehood-WWII to Recent (A.D. 1914 to 2009)
Eligibility: Undetermined

Description

LA 162363 is a historic artifact scatter with a single rock feature of unknown function. The site is located on a flat plain, with a slope of less than 2 degrees to the south-southeast. Vegetation consists of creosote, mesquite, narrow leaf yucca, and various forbs and grasses. Ground visibility is between 76 percent and 99 percent (Figure 2.3).

Assemblage Information

Hundreds of artifacts were observed at this site, all historic or recent, located mostly in a single concentration (Concentration 1). One hundred percent of the observed artifacts were recorded. Materials observed include glass, metal, and ceramic. Glass fragments within Concentration 1 are clear (n=30), aqua (n=8), manganese decolorized (amethyst [n=18]), and amber (n=13). Bottles and jars include one clear medicine bottle neck, the base of a manganese decolorized medicine bottle, two clear beverage bottle necks, the base of a clear beverage bottle, and the neck of a brown medicine bottle. Metal cans include 37 sanitary type cans, all smashed and rusted, with stamped ends and crimped side seams, all knife and key-striped opened; five tobacco tins, all smashed and rusted; 24 knife-opened condensed milk solder dot beverage cans, some crushed and some 2½ inches in diameter and 2½ inches in height, with stamped end seams and crimped side seams; and two hole-in-top cylindrical cans, smashed and heavily rusted. Historic ceramics in the concentration include 22 white-glazed semi-porcelain sherds from a dish or dinner plate; one white-glazed semi-porcelain dinner plate with a crackled glaze, and the base of a white-glazed semi-porcelain dinner plate. Makers' marks on the ceramics include one from the West End Pottery Company of East Liverpool, Ohio, dating from A.D. 1893 to 1910 (Kovel and Kovel 1986:223) and one from the Crescent Pottery Company of Alliance, Ohio, dating between A.D. 1920 and 1926. Two round-headed metal nails and a metal spring-loaded latch, 2¼ in long, ½ in wide, and ¼ in thick, are also present.

The general scatter of artifacts includes 20 fragments of aqua glass and 10 fragments of manganese decolorized glass. Metal cans include 20 three-part cylindrical sanitary types, all smashed and rusted, with crimped ends and side seams, and openings from a knife and a can opener; one cylindrical internal friction lid, smashed and rusted, with crimped end and side seams; one smashed paint can with crimped end seams and a rolled side seam; 20 hole-in-cap three-part cylindrical cans, smashed and rusted, with crimped end and side seams, mostly 3 in by 4 3/8 in and opened with a can opener; one wide and short can with a crimped seam that has a ½ in tab protruding from it, crimped end seams, and opened with a can opener; and one square tin storage container, 2½ in long, 2 in wide, and 2 ft tall. Historic (or recent) ceramics include 11 white-glazed semi-porcelain sherds that appear to be from a pitcher or a mug, but have no distinguishing marks; and 30 white-glazed semi-porcelain sherds that appear to be from a bowl, also with no distinguishing marks.

Site Structure and Features

A single feature was identified in the field as a small rhyolite and basalt cobble scatter that appear to be oriented in a line. Thirteen of the rhyolite cobbles are less than or equal to 5 in long, while 23 of the rhyolite cobbles are 5 in to 11 in long. Only one basalt cobble was noted. Approximately 30 small glass fragments, including manganese decolorized (amethyst), aqua, and clear are lying in a concentration approximately 2 m south of an eye bolt, which is driven into the ground approximately 2.5 m south of the feature. One tobacco tin and roughly five cans lie approximately 10 m southwest of the feature. The feature is highly disturbed and its function is unclear. Overall, the feature is 4 m in length and 2 m in width.

The site is heavily eroded and may in fact be the remains of a drill hole, based on the presence of the eye hole in Feature 1. Concentration 1 is the only area of the site that may have subsurface potential, but the nature of the site, a historic trash dump, would suggest that buried deposits are unlikely.

Disturbances and Potential Impacts

Wind action has scattered the metal artifacts. Sheetwash and powerline construction may have disturbed the site slightly. Bioturbation from cattle and rodent activity is present as well. The site remains 26 percent to 50 percent intact.

Conclusions and Recommendations

The site is located on a 1919 homestead patent issued to Charles E. Bourgeois (BLM-GLO records), suggesting a documented use of the property as

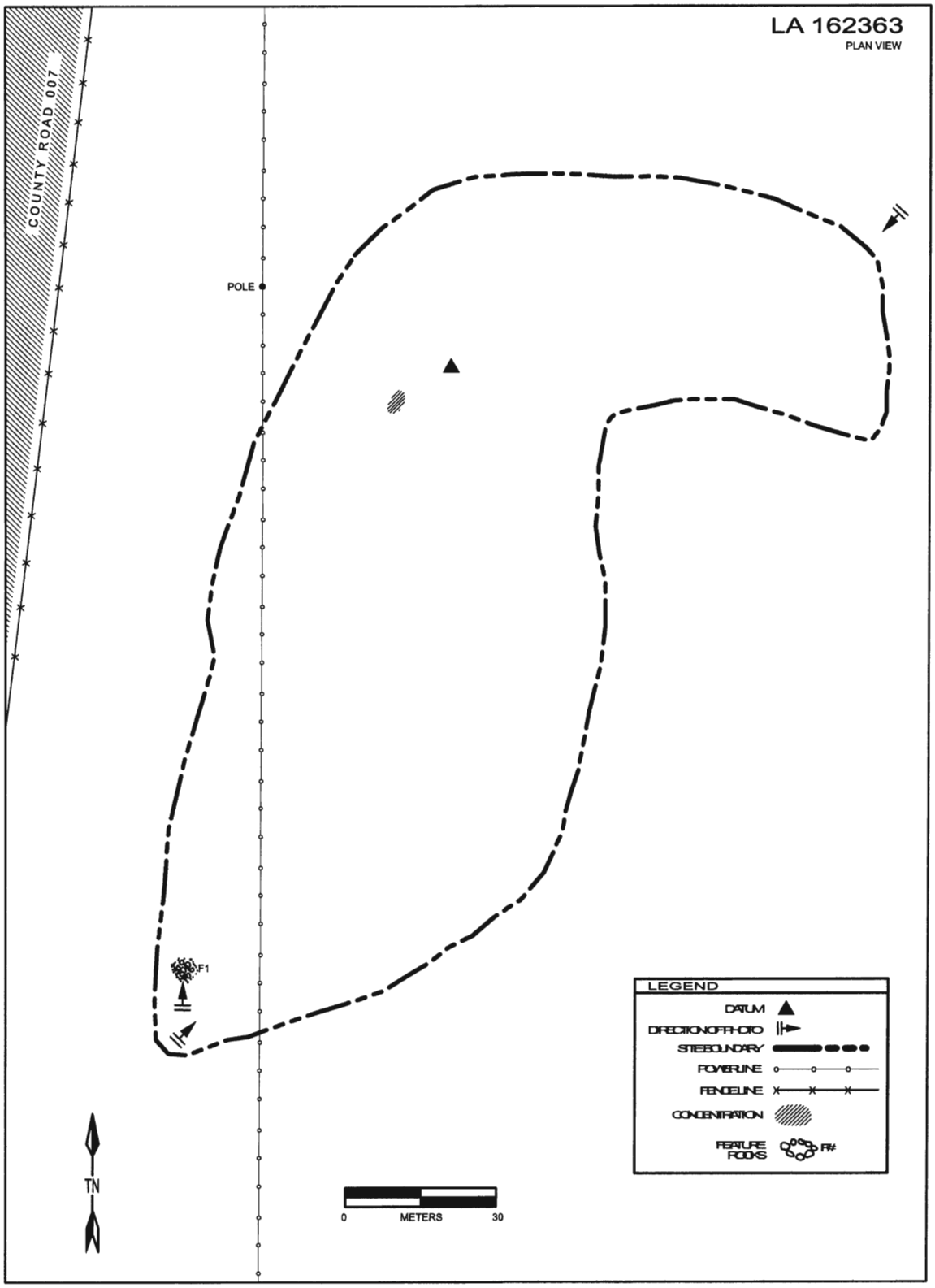

Figure 2.3: LA 162363 Plan View.

early as 1914. The area appears to have since accumulated recent refuse and so has been assigned a Euroamerican NM Statehood-WWII to Recent (A.D. 1914 to 2009) affiliation. It is unclear whether this site is a refuse dump or the remains of the Bourgeois homestead. More testing and archival research would serve to answer this question and establish the eligibility of this site. For this reason eligibility for nomination to the NRHP is undetermined.

SITE NO.: LA 162364

Site No.: LA 162364
Field No. 1210-005
Components: Euroamerican US Territorial to Recent (A.D. 1911 to 2009)
Eligibility: Eligible, D; Ineligible, C; Unevaluated A and B.

Description

LA 162634 is a historic artifact scatter with five features. The site is located on a flat area with a very gentle slope to the east, less than half a mile from the Mexican border. Vegetation consists of creosote, mesquite, and various forbs and grasses. Ground visibility is between 26 percent and 50 percent (Figure 2.4).

Assemblage Information

Hundreds of historic artifacts were observed on this site. A 90 percent judgmental sample was recorded by Lone Mountain archaeologists. The analyzed assemblage consists of two cans (an exterior friction and a tobacco); a homemade slide case consisting of the base of one can and the top of another conjoined with duct tape; 136 glass shards (22 manganese decolorized [amethyst], one aqua, 12 brown, 21 clear, 75 light green, one blue, one white, one red translucent, one yellow translucent); 35 sherds (one handpainted porcelain, 12 stoneware, 16 white-glazed stoneware, and six white-glazed semi-porcelain), seven nails, one iron washer, one iron fragment, one brass shotgun cartridge (pre 1958), three tin fragments, one iron hoe fragment, one brick tile, one brick fragment, one railroad spike, three 40-caliber R.P. S&W cartridges (post 1960), and one iron collar.

Site Structure and Features

Five features are present at this site including a house (F1), a depression (F2), a coop (F3), a windmill (F4), and a corral (F5). All appear to be inter-related and associated with ranching. Two small concentrations of rock were noted near Features 1 and 3. These may be discards associated with F1. Several pieces of broken glass are intermingled with the rocks.

Feature 1 is a 48-ft N/S by 42-ft E/W rectangular structure composed of unshaped basalt rocks. The structure may be a house though there are no visible room dividers. This feature consists of four partial walls. The basalt rocks are set in earthen berms, which appear to have been placed over the boulders during construction. These berms slant away from the walls to a distance of 6 ft to 8 ft. There is no visible mortar or bonding agent associated with the boulders. There are no access points to the interior or any of the walls. Fragments of red fire-brick are visible on the NW wall. Peculiarly, the northern, western, and eastern corners of the structure each have a large tree stump with massive root systems on the surface of the earthen berm. These trees appear to have been planted at the structure's corners during construction. Only a foundation remains with no evidence of wall materials, roofing, doors, wooden beams, or other construction materials, although two fragments of window glass are present in the northeastern wall. Erosion and weathering have caused the collapse of a portion of the northwestern wall. The feature remains approximately 75 percent intact.

Feature 2 is an 11-ft NE/SW by 9-ft NW/SE by up to 6-in deep roughly oval-shaped depression located approximately 21 ft southwest of F1. The feature appears to have been hand-dug as back dirt rings the surface of the feature. A corrugated metal fragment is protruding to 6 in from the ground at the north/northwest corner. Two milled pine beams measuring 8 in by 5 in by 6 ft, 4 in tall are set upright in the ground immediately west of the feature. One fragment of amethyst glass was observed at the base of one of these beams, approximately 5 ft apart. No other construction material is present near the feature. The feature may represent the remains of an outhouse. Erosion and weathering have seriously damaged this structure, leaving it less than 10 percent intact.

Feature 3 is an 18-in N/S by 12-in E/W by a maximum of 3-ft deep structure composed of cement over chicken wire walls and a concrete floor. This feature is approximately 50 ft northwest of F1. The walls have collapsed inward. Several fragments of milled lumber, possibly roofing supports, are scattered in the interior. Carbon stains on the cement walls and wood suggest the structure was destroyed by fire. Several 3-in wire nails protrude from the northern section of wall. No additional artifacts are present in

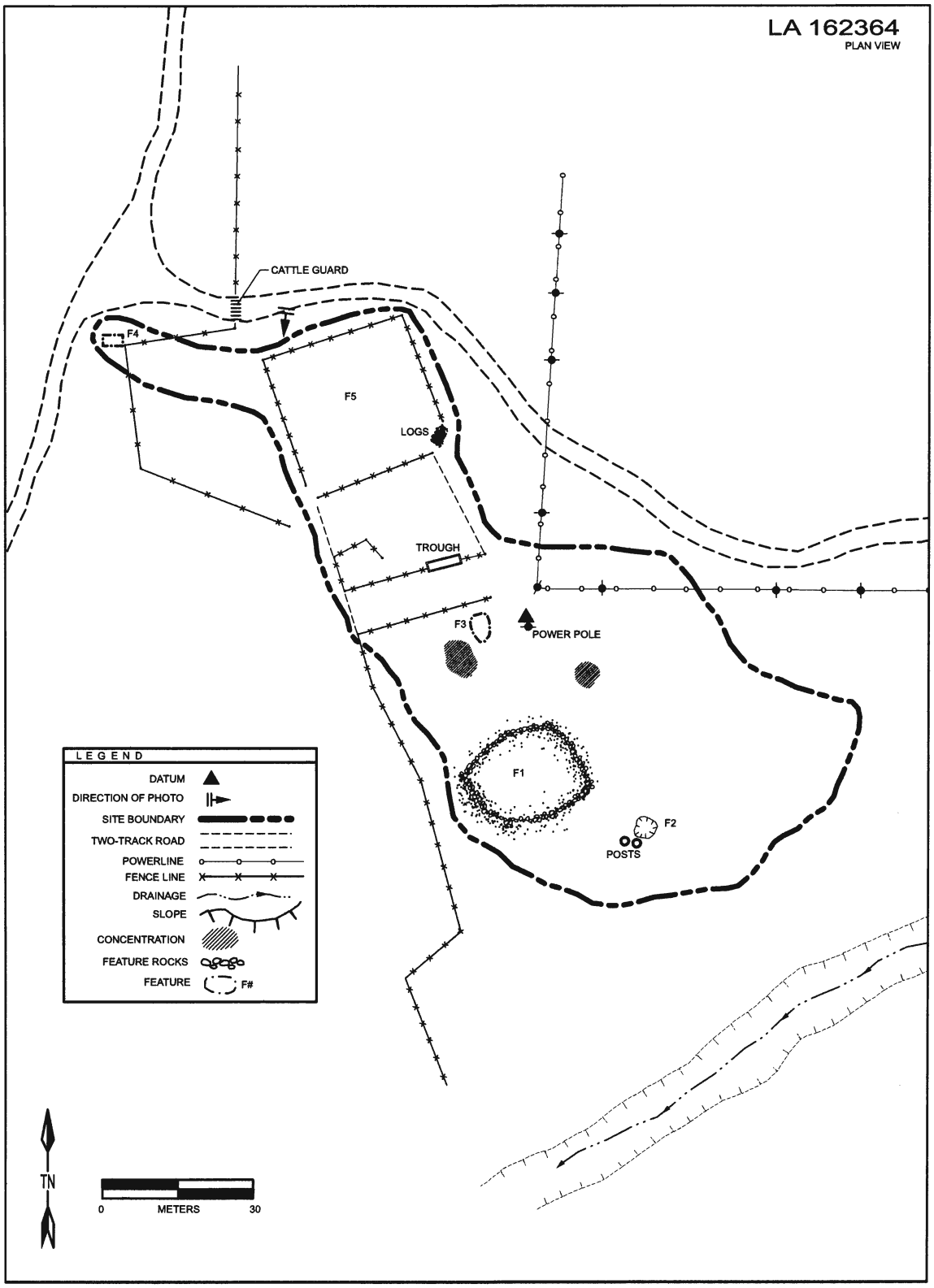

Figure 2.4: LA 162364 Plan View.

the interior. Glass and metal fragments are scattered outside of the structure. The feature is approximately 25 percent intact.

Feature 4 is a 7.5-ft square by 50-ft tall non-functioning galvanized steel and wood plank windmill located approximately 200 ft northwest of F3. A built-in vertical access ladder, located on the north face of the structure, terminates approximately 2 ft below a wooden plank platform. A faded rectangular steel sign reading "50 MILL" is affixed to the access ladder approximately 6 ft from the ground surface. Barbed wire encircles the steel-framed base of the windmill to a height of 5.5 ft. Only a 12-ft section of the original metal piping remains on the wellhead. The uppermost portion of this windmill is still intact. The wind pallet extending from the blade assembly bears a legend reading "Aeromotor Chicago." The feature is slightly weathered, but remains 80 percent intact.

Feature 5 is a corral. Although is appears to be recent, Lone Mountain archaeologists analyzed this feature as it is most likely related to Features 1 through 4. Construction materials include wood posts, milled lumber, round-head nails, barbed wire, sheep fencing, and chicken wire. Several gates and a smaller pen are located nearby.

Several bladed roads and a powerline are located around the site. A deep-cut drainage separates this site from LA 162365. Alluvial soils are present to a depth of at least 100 cm, as observed in road and arroyo cuts and rodent burrows. Buried deposits are unlikely aside from the depression feature, which may be an outhouse.

Disturbances and Potential Impacts

This site has been damaged by wind and water erosion, grazing, rodent activity, and construction. The site remains between 51 percent and 75 percent intact.

Conclusions and Recommendations

LA 162364 is located on lands patented in 1916 by Clifford L. Moody (BLM-GLO records). Given that the patent was issued as a homestead entry, it is probable that the site was in use as early as 1911. The site therefore has a Euroamerican US Territorial to Recent (A.D. 1911 to 2009) cultural and temporal affiliation. The site appears to be a homestead site and may yet yield significant data concerning the development of the area. For this reason the site is recommended eligible for nomination to the NRHP under Criterion D, does not have sufficient integrity to be eligible under Criterion C and is unevaluated under Criteria A and B.

SITE NO.: LA 162365

Site No.: LA 162365
Field No. 1210-006
Components: Euroamerican US Territorial to Recent (A.D. 1911 to 2009)
Eligibility: Eligible, D; Ineligible, C; Unevaluated A and B.

Description

LA 162365, located southeast of a large drainage and on the top and slope of a low, northwest-trending slope, is a historic artifact scatter with a stock-tank depression and remnants of a windmill. This site is likely associated with LA 162364, but is separated by the drainage. Vegetation consists of creosote, mesquite, and various forbs and grasses. Ground visibility is between 51 percent and 75 percent (Figure 2.5).

Assemblage Information

Hundreds of artifacts are present at the site. A 50 percent to 60 percent judgmental sample was recorded by Lone Mountain archaeologists. The assemblage consists of three sherds (one stoneware, one hard paste porcelain); two sheetmetal fragments; 47 cans (34 hole-in-cap, six sanitary, two score-strip, two exterior friction, one lard pail, two unidentifiable cans); and 168 glass shards, some with makers' marks (15 manganese decolorized [amethyst], nine aqua, and 144 green). The identifiable maker's mark present is an Adolphus Busch mark dating between 1904 and 1907 (Toulouse 1971).

Pieces of a windmill are scattered within the stock-tank depression, but there is no base or pipe to suggest that this was original windmill's location. A pile of vesicular basalt is also located within the tank, but this appears to have been recently stacked and is not associated with the site.

Site Structure and Features

No features were observed, though a slight depression from a stock tank that has since been removed is present at the northeast corner of the site.

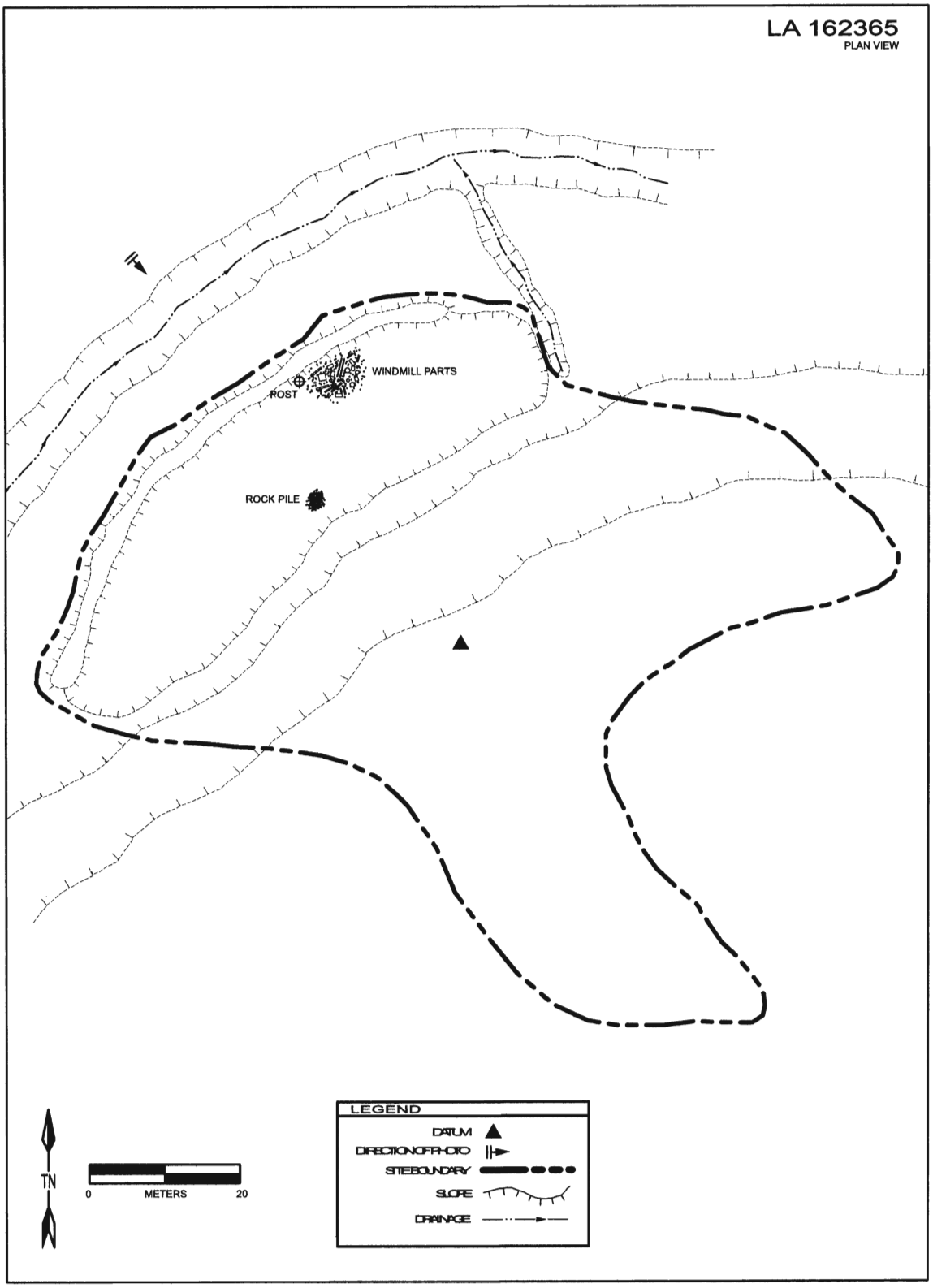

Figure 2.5: LA 162365 Plan View.

Based on examinations of arroyo cuts, Lone Mountain researchers have ascertained that alluvial and colluvial sediments are present to a depth of at least 110 cm. Buried deposits are unlikely, given the nature of the site.

Disturbances and Potential Impacts

This site has been damaged by wind and water erosion, grazing, rodent activity, and construction. The site remains between 51 percent and 75 percent intact.

Conclusions and Recommendations

LA 162365 also falls on the 1916 Clifford L. Moody homestead patent (BLM-GLO records). The Adolphus-Busch bottle may be a recycled item that survived its manufacture by several years or may indicate an even earlier habitation of the Moody patent than patent law suggests. At the least the site shares the Euroamerican US Territorial to Recent (A.D. 1911 to 2009) cultural and temporal affiliation evident at LA 162364. The site may contribute to our understanding of the Moody ranching operation, and is therefore recommended eligible for nomination to the NRHP under Criterion D, does not have sufficient integrity to be eligible under Criterion C and is unevaluated under Criteria A and B.

SITE NO.: LA 162366

Site No.: LA 162366
Field No. 1210-007
Components: NM Statehood-WWII to Recent (A.D. 1939 to 1951)
Eligibility: Ineligible

Description

LA 162366 is located on a flat area approximately one quarter mile north of the United States/Mexico border. The site consists of a historic artifact scatter and two historic artifact concentrations. Vegetation consists of creosote and various forbs and grasses. Ground visibility is between 76 percent and 99 percent (Figure 2.6).

Assemblage Information

Hundreds of historic artifacts are present at this site, some scattered across the surface and others clustered into two concentrations (C1 and C2). All observed artifacts were recorded by Lone Mountain.

The general scatter consists of 37 cans (15 sanitary, 16 hole-in-top, three score-strip, one three-hinge tobacco, two unidentified); three bottles, some with makers' marks, (one brown 1-quart with screw-cap, one clear, one gray/black opaque); three fragments of sheet metal, and one horse-shoe. One clear bottle base had a 1929, 1939, or 1949 Owens-Illinois mark (Toulouse 1971).

Concentration 1 is located at the northwestern edge of the site and consists of seven bottle fragments, some with makers' marks, (one amber Absorbine medicine bottle, three amethyst fragments, one clear 4/5 quart liquor bottle with a cork top, one clear one-quart liquor bottle with a cork top, one 2-oz Duraglass medicine jar dated to A.D. 1940 and later); 23 cans (11 hole-in-top, seven vent-hole, two sanitary, two score key, one wire-hinge folded tobacco); one enamel coffee pot; one enamel pan; one small steel cauldron; and two broken horse-shoes. Identifiable maker's marks on the bottles in Concentration 1 are Owens-Illinois dating to 1937 or 1947, 1933, 1943 or 1953, and 1941, or 1951, and an Armstrong Cork Company bottle dating from 1938 to 1969.

Concentration 2 is also located at the northwestern edge of the site, south of C1, and consists of three bottle fragments, some with makers' marks (one clear possible perfume bottle, one clear jar, one green coke bottle); 35 cans (six hole-in-top, 16 vent-hole, seven sanitary, three score-strip, two shaker, one folded Prince Albert tobacco); and one crushed caulking gun. The jar has a Duraglass mark and an Owens-Illinois maker's mark indicating manufacture in 1949.

Site Structure and Features

No features were observed at the site. There may be an old roadbed just east of Concentration 1, but it is only visible in patches and may be simply a result of erosion or bioturbation.

Based on examinations of arroyo cuts and rodent burrows, Lone Mountain researchers have ascertained that alluvial sediments are present on the site surface to a depth of 30 cm. Given the character of the site, there is a low potential for subsurface cultural deposits.

Disturbances and Potential Impacts

Sheetwash has been the primary agent of damage to the site. Bioturbation from cattle and rodents, wind action, and some gullying have also contributed to surface damage. The site remains between 76 percent and 99 percent intact.

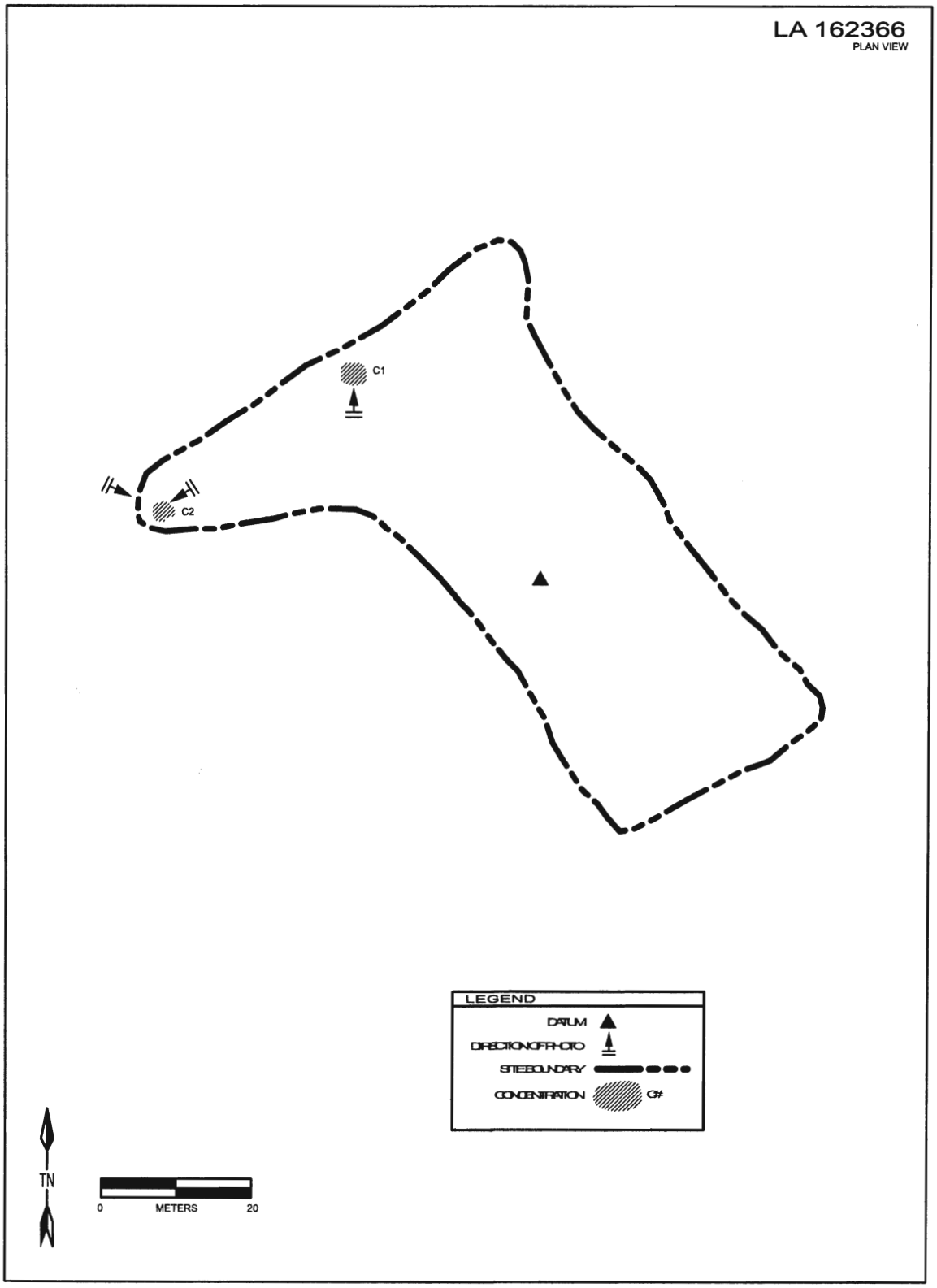

Figure 2.6: LA 162366 Plan View.

Conclusions and Recommendations

LA 162366 falls on the 1916 Clifford Moody patent (BLM-GLO records), but appears to consist of several dumping episodes that took place between 1939 and 1951. The site therefore has a NM Statehood-WWII to Recent (A.D. 1939 to 1951) component. It is uncertain whether this material is associated with LA 162364 and LA 162365, the two sites that appear to date from the early use of the patent. This material of composed of the remains of several dumping episodes, most of which appear to consist of ranching debris. The site is recommended ineligible under any of the four criteria.

SITE NO.: LA 162367

Site No.: LA 162367
Field No. 1210-008
Components: NM Statehood-WWII (A.D. 1920 to 1945)
Eligibility: Ineligible

Description

LA 162367, a historic artifact scatter and concentration, is located on a flat area immediately north of the United States/Mexico border. Vegetation consists of creosote and various forbs and grasses. Ground visibility is between 76 percent and 99 percent (Figure 2.7).

Assemblage Information

Artifacts in the general scatter consist of 13 cans (11 sanitary, two venthole); one clear jar base; and 24 glass shards, some with makers' marks (21 clear bottle fragments, three brown bottle fragments). The identifiable maker's mark belongs to the Hazel Atlas Company and dates from A.D. 1920 to 1964 (Toulouse 1971).

Artifacts in Concentration 1 include 21 white-glazed semi-porcelain sherds from a broken dinner plate; and 75 cans (three hole-in-top, 64 sanitary, six score-strip, two tobacco). The cans are crushed and heavily rusted with both knife and score-key openings.

Site Structure and Features

The United States/Mexico border fenceline and a two-track road are located immediately south of the site. Based on examinations of road cuts, Lone Mountain researchers have ascertained that alluvial sediments are present on the site surface to a depth of 25 cm. There is a low potential for subsurface cultural deposits.

Disturbances and Potential Impacts

Sheetwash has been the primary agent of damage to the site. Bioturbation from cattle and rodents have caused minor damage to the site. Wind erosion has been slight. The site remains between 76 percent and 99 percent intact.

Conclusions and Recommendations

The site is located on the 1916 Clifford Moody homestead patent (BLM-GLO records). It is uncertain if these materials are associated with the homestead. The site is likely a single episode dump that has become scattered and dates to the NM Statehood-WWII period between A.D. 1920 and 1945. The site is unlikely to yield any additional significant data and is recommended ineligible for nomination to the NRHP under any of the four criteria.

ISOLATED OCCURRENCES

Forty-three isolated occurrences were recorded within the boundary of the APE. The locations of these cultural manifestations are plotted and listed in Appendix A, and details of each are listed in Table 2.1.

SUMMARY

Seven sites and 43 isolated occurrences were encountered during this survey. Six sites are newly recorded and one (LA 50343) previously recorded (Table 2.2). None of the sites contain prehistoric elements. All of the sites have been assigned Historic through Recent temporal affiliations. Five of the sites are related to early 20th century homesteading. LA 162363 is located on a 1919 homestead patent issued to Charles E. Bourgeois, while LA 162364, LA 162365, LA 162366, and LA 162367 are located on a parcel issued to Clifford Moody in 1916 (BLM-GLO records).

EFFECT DETERMINATION AND RECOMMENDATIONS

The 43 recorded isolated occurrences have been adequately recorded consistent with currently accepted standards and are not likely to yield information beyond what has already been documented, and no additional investigations are recommended for them.

Two of the newly recorded sites have been recommended eligible for nomination to the NRHP for their possible contribution toward understanding of ranching and homesteading practices in early twentieth century New Mexico. The previously-recorded

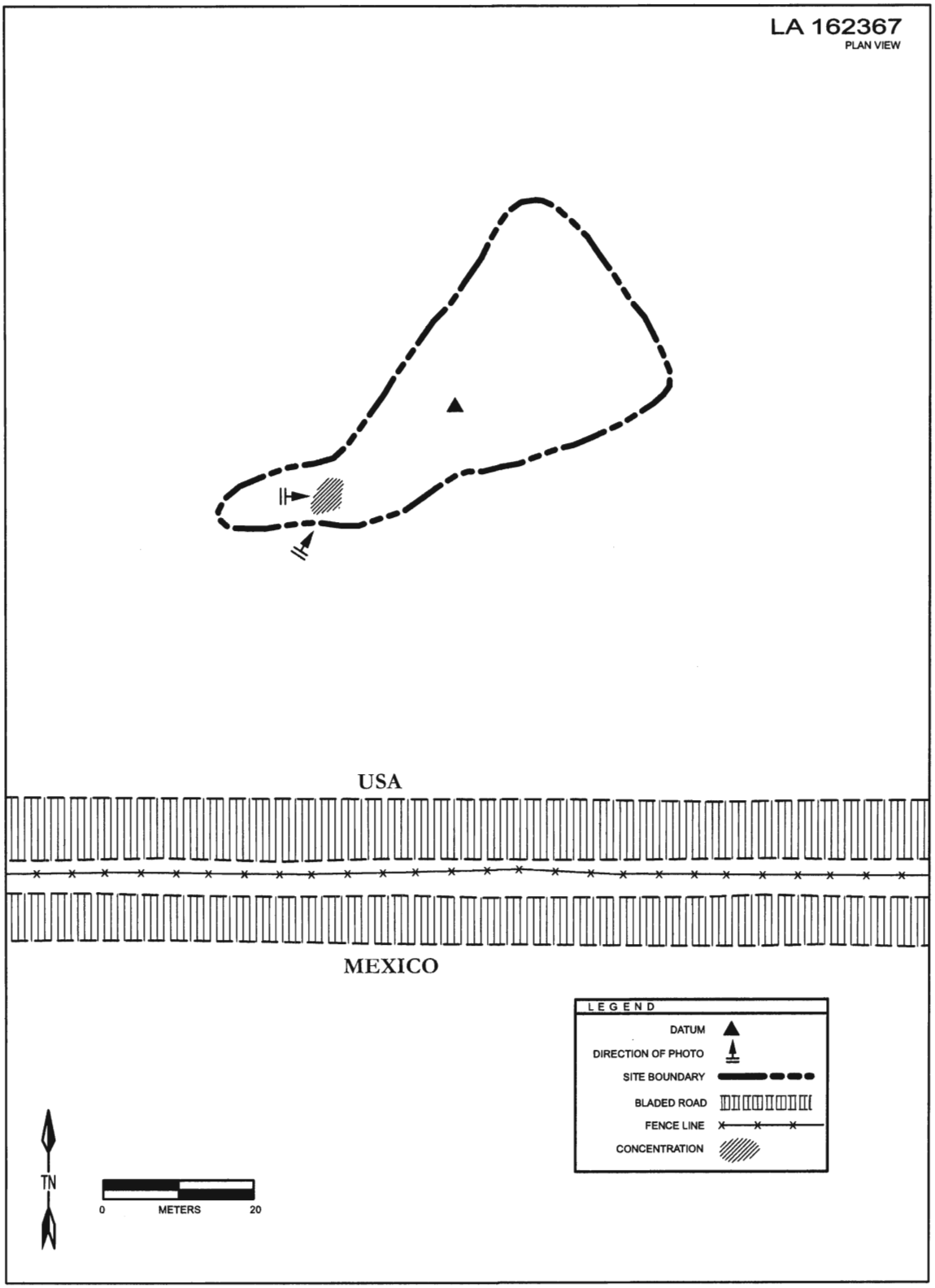

Figure 2.7: LA 162367 Plan View.

site has been determined eligible by SHPO for inclusion on the NRHP. Of the remaining sites, three are ineligible and one is undetermined (see Table 2.2). All of the sites fall, at least partially, within the areas that have been identified as impact areas. There is a high potential that the sites will be destroyed by the proposed action. Protection and preservation may not be an option in most cases. If the sites cannot be avoided, testing and data recovery plans should be developed and implemented in consultation with the New Mexico State Historic Preservation Division. Furthermore, if buried cultural deposits are encountered during ground disturbing activities, work should cease immediately and the New Mexico State Historic Preservation Division should be notified, and an assessment should be made by a qualified archaeologist.

Table 2.1: Isolated Occurrences.

IO No.	Description
1	One pink rhyolite basin metate fragment, moderately ground on two surfaces, no reuse, 16 cm.
2	One complete gray chert secondary flake, 10 percent cortex, 40 mm x 31 mm x 9 mm.
3	One complete red chert secondary flake, 30 percent cortex, 36 mm x 40 mm x 8 mm.
4	Four black basalt basin metate fragments, moderately ground on two surfaces, all from a single vessel, with some damage from plow, 5 cm, 12 cm, 10 cm, and 15 cm.
5	One pink rhyolite basin metate fragment, with heavy use on two surfaces, no reuse, 15 cm.
6	One complete black obsidian biface (possible preform), no retouch, all edges worked, 31 mm x 9 mm x 5 mm.
7	Eight fragments of whiteware ceramic with a floral glaze, all from a single tea or coffee cup, 1/8" to 1/4" thick. The Maker's mark on base is could not be identified, but reads "HECHO EN MEX..., MCA., A...ORA, R...RDO AMANO."
8	Three fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick.
9	One broken red, white, and gray mottled chert secondary flake, 10 percent cortex, 25 mm x 20 mm x 7 mm.
10	One complete black vesicular basalt basin metate, moderately ground on one surface, no reuse, with some recent plow damage, 25 cm x 28 cm x 9 cm.
11	One U.S. General Land Office Survey section marker, dated "1915"; two two-part oval tobacco canisters, double-hinged, with an external friction lid.
12	One x-shaped knife-cut hole-in-top cylindrical can, top only.
13	One barrel ring, riveted and extremely weathered, 1 1/2" wide.
14	One cylindrical canister external friction lid, embossed "Woodburys Cold Cream," 2 1/2" in diameter and 1/4" wide.
15	One piece of manganese decolorized (amethyst) bottle glass, 3/16" thick; one smashed and rusted sanitary-type can. Artifacts located 3 m apart.
16	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
17	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
18	One knife-punched solder dot cylindrical can, with stamped external ends and a crimped side seam, 2 3/8" in diameter and 4 5/8" tall.
19	One x-shaped knife-cut three-part cylindrical sanitary-type can, smashed and rusted, with crimped ends and side seam.

Table 2.1: Isolated Occurrences. (Continued)

IO No.	Description
20	Ten fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick; one two-part rectangular canister, with a stamped external end, overlapped side seam, machine soldered end and side seam, and an external friction lid for closure (missing), 20" tall and 12" wide. All artifacts are in a 25 m x 10 m area.
21	One knife-cut three-part cylindrical sanitary-type can, with crimped ends and side seam, 3 7/16" in diameter and 4 1/2" tall.
22	One three-part rectangular kerosine-type canister, smashed and rusted, with crimped ends and an overlap side seam with machine soldering. Solder on handle and a screw-on cap spout.
23	Two knife-punched solder dot three-part cylindrical canisters, smashed and rusted, with a crimped side seam; three knife-cut three part cylindrical canisters, smashed and rusted, with crimped ends and side seam; one two-part rectangular basin/tub, smashed and rusted, with a stamped external end, overlapped side seam, and hand soldered end and side seam. No handles. All artifacts are located in a 30 m x 20 m area.
24	One knife-punched three-part cylindrical vent hole can, smashed and rusted, with stamped external ends, a crimped side seam, and machine soldered ends and side seam; one knife-cut hole-in-top cylindrical canister, smashed and rusted. Artifacts located 1 m apart.
25	One three-part cylindrical solder dot evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
26	One knife-punched three-part cylindrical can, smashed and rusted, with crimped ends and side seam. Embossed "sanitary."
27	One two-part cylindrical canister, with crimped end and side seam and an external friction lid for closure, 11" tall and 4 1/4" in diameter; one two-part cylindrical lard-type bucket, smashed and rusted, with a stamped external end, crimped side seam, solder on lugs, no bail, and a machine soldered end and side seam. Artifacts located approximately 6 m apart.
28	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam. Embossed "EST 22, 28"
29	One two-part cylindrical bucket, smashed and rusted, with a stamped external end, crimped side seam, lugs with bail, and an external friction lid for closure (missing); three fragments of a metal canister, smashed and rusted, with no observable traits.
30	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam.
31	Two knife-punched solder dot cylindrical evaporated milk cans, smashed and rusted, with stamped external ends and crimped side seam.
32	One knife-opened hole-in-top can, hand soldered, 3 1/4" tall, 3" in diameter.
33	One two-part cylindrical canister (lard bucket), smashed and rusted. Has lugs with a wire handle and a stamped external end. The external friction lid is missing. Embossed with "Estab 2F".
34	One complete utilized brown chert secondary flake, 30 percent cortex, 38 mm x 20 mm x 15 mm.
35	One knife-punched hole-in-top can, smashed and rusted.
36	One complete red chert tertiary flake, 18 mm x 7 mm x 3 mm; one broken brown chert secondary flake, 60 percent cortex, 29 mm x 20 mm x 6 mm; located 15 m apart.
37	One complete white chert tertiary flake, 33 mm x 21 mm x 3 mm.

Table 2.1: Isolated Occurrences. (Continued)

IO No.	Description
38	One three-part cylindrical can, smashed and rusted. Key-strip opening, top missing, crimped ends and side seam, with a side seam that is machine soldered.
39	One complete pink rhyolite secondary flake, 60 percent cortex, 43 mm x 40 mm x 16 mm; one broken light gray chert tertiary flake, 19 mm x 14 mm x 2 mm; ten fragments of historic whiteware ceramic, all from a single tea cup vessel, with a clear glaze, 1/8" thick to 1/4" thick; one speed loader for ammunition, 1/2" wide and 4" long; two metal buttons with a concave front, 3/4" in diameter and 3/16" thick. All artifacts located in a 10 m diameter area.
40	One broken red and brown mottled rhyolite tertiary flake, 21 mm x 18 mm x 2 mm.
41	One three-part cylindrical can, smashed and rusted. Embossed "sanitary," with crimped ends and side seam and X-cut opened.
42	Five pieces of manganese decolorized (amethyst) bottle glass, 3/16" thick to 1/4" thick, all from a single vessel, located in a 1m x 1 m area.
43	One white chert drill tool, well-used and retouched on all edges, broken tip, 47 mm x 23 mm x 4 mm.

Table 2.2: Site Summary.

LA No.	Field No.	Description	Component	Eligibility
162362	1210-001	mid 20th century irrigation system represented by a series of agricultural ditches and associated features and materials.	NM Statehood-WWII to recent (A.D. 1935 to 1980s)	ineligible
162363	1210-002	possible homestead or refuse site, represented by a historic artifact scatter with a single rock feature of unknown function	NM Statehood-WWII to Recent (A.D. 1914 to 2009)	Undetermined
162364	1210-005	homestead site with a historic artifact scatter with five features	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B
162365	1210-006	homestead site with a historic artifact scatter with a stock-tank depression and remnants of a windmill.	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B.
162366	1210-007	probable refuse dump associated with a homestead site consisting of a historic artifact scatter and two historic artifact concentrations.	NM Statehood-WWII to Recent (A.D. 1939 to 1951)	Ineligible
162367	1210-008	single-episode dump associated with a homestead site consisting of a historic artifact scatter and concentration	NM Statehood-WWII (A.D. 1920 to 1945)	Ineligible
50343	LA 50343	historic trash dump with some buried artfacts	Hispanic NM Statehood-WWII (A.D. 1920 to 1945)	Previously determined eligible under Criterion D

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This appendix contains site data and locational maps.

THIS INFORMATION IS CONFIDENTIAL AND RESTRICTED FROM PUBLIC DISCLOSURE UNDER 36 CFR 296.18

Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13).

IO No.	Northing	Easting	Description
1	3521172	235860	One pink rhyolite basin metate fragment, moderately ground on two surfaces, no reuse, 16 cm.
2	3520754	236234	One complete gray chert secondary flake, 10 percent cortex, 40 mm x 31 mm x 9 mm.
3	3520765	236336	One complete red chert secondary flake, 30 percent cortex, 36 mm x 40 mm x 8 mm.
4	3521105	236364	Four black basalt basin metate fragments, moderately ground on two surfaces, all from a single vessel, with some damage from plow, 5 cm, 12 cm, 10 cm, and 15 cm.
5	3520851	236760	One pink rhyolite basin metate fragment, with heavy use on two surfaces, no reuse, 15 cm.
6	3520690	237158	One complete black obsidian biface (possible preform), no retouch, all edges worked, 31 mm x 9 mm x 5 mm.
7	3520835	237307	Eight fragments of whiteware ceramic with a floral glaze, all from a single tea or coffee cup, 1/8" to 1/4" thick. The Maker's mark on base is could not be identified, but reads "HECHO EN MEX..., MCA., A...ORA, R...RDO AMANO."
8	3521268	238140	Three fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick.
9	3520528	238373	One broken red, white, and gray mottled chert secondary flake, 10 percent cortex, 25 mm x 20 mm x 7 mm.
10	3521110	238540	One complete black vesicular basalt basin metate, moderately ground on one surface, no reuse, with some recent plow damage, 25 cm x 28 cm x 9 cm.
11	3520388	243870	One U.S. General Land Office Survey section marker, dated "1915"; two two-part oval tobacco canisters, double-hinged, with an external friction lid.
12	3519896	244724	One x-shaped knife-cut hole-in-top cylindrical can, top only.
13	3520775	244730	One barrel ring, riveted and extremely weathered, 1 1/2" wide.
14	3521353	244758	One cylindrical canister external friction lid, embossed "Woodburys Cold Cream," 2 1/2" in diameter and 1/4" wide.
15	3519755	244777	One piece of manganese decolorized (amethyst) bottle glass, 3/16" thick; one smashed and rusted sanitary-type can. Artifacts located 3 m apart.
16	3521967	244818	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
17	3521994	244836	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
18	3519643	244887	One knife-punched solder dot cylindrical can, with stamped external ends and a crimped side seam, 2 3/8" in diameter and 4 5/8" tall.
19	3521139	244897	One x-shaped knife-cut three-part cylindrical sanitary-type can, smashed and rusted, with crimped ends and side seam.

Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13). (Continued)

IO No.	Northing	Easting	Description
20	3521418	244912	Ten fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick; one two-part rectangular canister, with a stamped external end, overlapped side seam, machine soldered end and side seam, and an external friction lid for closure (missing), 20" tall and 12" wide. All artifacts are in a 25 m x 10 m area.
21	3521107	244915	One knife-cut three-part cylindrical sanitary-type can, with crimped ends and side seam, 3 7/16" in diameter and 4 1/2" tall.
22	3521121	244930	One three-part rectangular kerosine-type canister, smashed and rusted, with crimped ends and an overlap side seam with machine soldering. Solder on handle and a screw-on cap spout.
23	3521666	244931	Two knife-punched solder dot three-part cylindrical canisters, smashed and rusted, with a crimped side seam; three knife-cut three part cylindrical canisters, smashed and rusted, with crimped ends and side seam; one two-part rectangular basin/tub, smashed and rusted, with a stamped external end, overlapped side seam, and hand soldered end and side seam. No handles. All artifacts are located in a 30 m x 20 m area.
24	3521214	244952	One knife-punched three-part cylindrical vent hole can, smashed and rusted, with stamped external ends, a crimped side seam, and machine soldered ends and side seam; one knife-cut hole-in-top cylindrical canister, smashed and rusted. Artifacts located 1 m apart.
25	3519953	244974	One three-part cylindrical solder dot evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
26	3521157	245007	One knife-punched three-part cylindrical can, smashed and rusted, with crimped ends and side seam. Embossed "sanitary."
27	3521337	245041	One two-part cylindrical canister, with crimped end and side seam and an external friction lid for closure, 11" tall and 4 1/4" in diameter; one two-part cylindrical lard-type bucket, smashed and rusted, with a stamped external end, crimped side seam, solder on lugs, no bail, and a machine soldered end and side seam. Artifacts located approximately 6 m apart.
28	3520548	245067	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam. Embossed "EST 22, 28"
29	3521265	245081	One two-part cylindrical bucket, smashed and rusted, with a stamped external end, crimped side seam, lugs with bail, and an external friction lid for closure (missing); three fragments of a metal canister, smashed and rusted, with no observable traits.
30	3521202	245085	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam.
31	3519982	245098	Two knife-punched solder dot cylindrical evaporated milk cans, smashed and rusted, with stamped external ends and crimped side seam.
32	3521682	245105	One knife-opened hole-in-top can, hand soldered, 3 1/4" tall, 3" in diameter.

Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13). (Continued)

IO No.	Northing	Easting	Description
33	3521308	245232	One two-part cylindrical canister (lard bucket), smashed and rusted. Has lugs with a wire handle and a stamped external end. The external friction lid is missing. Embossed with "Estab 2F".
34	3519532	245247	One complete utilized brown chert secondary flake, 30 percent cortex, 38 mm x 20 mm x 15 mm.
35	3521202	245333	One knife-punched hole-in-top can, smashed and rusted.
36	3519528	245359	One complete red chert tertiary flake, 18 mm x 7 mm x 3 mm; one broken brown chert secondary flake, 60 percent cortex, 29 mm x 20 mm x 6 mm; located 15 m apart.
37	3520757	245773	One complete white chert tertiary flake, 33 mm x 21 mm x 3 mm.
38	3519608	245908	One three-part cylindrical can, smashed and rusted. Key-strip opening, top missing, crimped ends and side seam, with a side seam that is machine soldered.
39	3519715	245924	One complete pink rhyolite secondary flake, 60 percent cortex, 43 mm x 40 mm x 16 mm; one broken light gray chert tertiary flake, 19 mm x 14 mm x 2 mm; ten fragments of historic whiteware ceramic, all from a single tea cup vessel, with a clear glaze, 1/8" thick to 1/4" thick; one speed loader for ammunition, 1/2" wide and 4" long; two metal buttons with a concave front, 3/4" in diameter and 3/16" thick. All artifacts located in a 10 m diameter area.
40	3520667	246019	One broken red and brown mottled rhyolite tertiary flake, 21 mm x 18 mm x 2 mm.
41	3519458	246299	One three-part cylindrical can, smashed and rusted. Embossed "sanitary," with crimped ends and side seam. X-cut opened.
42	3519496	246417	Five pieces of manganese decolorized (amethyst) bottle glass, 3/16" thick to 1/4" thick, all from a single vessel, located in a 1m x 1 m area.
43	3520545	248348	One white chert drill tool, well-used and retouched on all edges, broken tip, 47 mm x 23 mm x 4 mm.

Table 2: Site UTM Coordinates (NAD27, Zone 13).

LA No.	Northing	Easting	Description	Component	Eligibility
162362	3521853	236613	mid 20th century irrigation system represented by a series of agricultural ditches and associated features and materials.	NM Statehood-WWII to recent (A.D. 1935 to 1980s)	ineligible
162363	3521251	244794	possible homestead or refuse site, represented by a historic artifact scatter with a single rock feature of unknown function	NM Statehood-WWII to Recent (A.D. 1914 to 2009)	Undetermined
162364	3519760	244674	homestead site with a historic artifact scatter with five features	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B
162365	3519633	244759	homestead site with a historic artifact scatter with a stock-tank depression and remnants of a windmill.	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B.
162366	3519894	244948	probable refuse dump associated with a homestead site consisting of a historic artifact scatter and two historic artifact concentrations.	NM Statehood-WWII to Recent (A.D. 1939 to 1951)	Ineligible
162367	3519454	246123	single-episode dump associated with a homestead site consisting of a historic artifact scatter and concentration	NM Statehood-WWII (A.D. 1920 to 1945)	Ineligible
50343	3521980	244739	historic trash dump with some buried artfacts	Hispanic NM Statehood-WWII (A.D. 1920 to 1945)	Previously determined eligible under Criterion D

This appendix contains site data and locational maps.

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Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13).

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3	3520765	236336	One complete red chert secondary flake, 30 percent cortex, 36 mm x 40 mm x 8 mm.
4	3521105	236364	Four black basalt basin metate fragments, moderately ground on two surfaces, all from a single vessel, with some damage from plow, 5 cm, 12 cm, 10 cm, and 15 cm.
5	3520851	236760	One pink rhyolite basin metate fragment, with heavy use on two surfaces, no reuse, 15 cm.
6	3520690	237158	One complete black obsidian biface (possible preform), no retouch, all edges worked, 31 mm x 9 mm x 5 mm.
7	3520835	237307	Eight fragments of whiteware ceramic with a floral glaze, all from a single tea or coffee cup, 1/8" to 1/4" thick. The Maker's mark on base is could not be identified, but reads "HECHO EN MEX..., MCA., A...ORA, R...RDO AMANO."
8	3521268	238140	Three fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick.
9	3520528	238373	One broken red, white, and gray mottled chert secondary flake, 10 percent cortex, 25 mm x 20 mm x 7 mm.
10	3521110	238540	One complete black vesicular basalt basin metate, moderately ground on one surface, no reuse, with some recent plow damage, 25 cm x 28 cm x 9 cm.
11	3520388	243870	One U.S. General Land Office Survey section marker, dated "1915"; two two-part oval tobacco canisters, double-hinged, with an external friction lid.
12	3519896	244724	One x-shaped knife-cut hole-in-top cylindrical can, top only.
13	3520775	244730	One barrel ring, riveted and extremely weathered, 1 1/2" wide.
14	3521353	244758	One cylindrical canister external friction lid, embossed "Woodburys Cold Cream," 2 1/2" in diameter and 1/4" wide.
15	3519755	244777	One piece of manganese decolorized (amethyst) bottle glass, 3/16" thick; one smashed and rusted sanitary-type can. Artifacts located 3 m apart.
16	3521967	244818	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
17	3521994	244836	One knife-punched solder dot cylindrical evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
18	3519643	244887	One knife-punched solder dot cylindrical can, with stamped external ends and a crimped side seam, 2 3/8" in diameter and 4 5/8" tall.
19	3521139	244897	One x-shaped knife-cut three-part cylindrical sanitary-type can, smashed and rusted, with crimped ends and side seam.

Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13). (Continued)

IO No.	Northing	Easting	Description
20	3521418	244912	Ten fragments of manganese decolorized (amethyst) bottle glass, all from a single vessel, 1/8" to 1/4" thick; one two-part rectangular canister, with a stamped external end, overlapped side seam, machine soldered end and side seam, and an external friction lid for closure (missing), 20" tall and 12" wide. All artifacts are in a 25 m x 10 m area.
21	3521107	244915	One knife-cut three-part cylindrical sanitary-type can, with crimped ends and side seam, 3 7/16" in diameter and 4 1/2" tall.
22	3521121	244930	One three-part rectangular kerosine-type canister, smashed and rusted, with crimped ends and an overlap side seam with machine soldering. Solder on handle and a screw-on cap spout.
23	3521666	244931	Two knife-punched solder dot three-part cylindrical canisters, smashed and rusted, with a crimped side seam; three knife-cut three part cylindrical canisters, smashed and rusted, with crimped ends and side seam; one two-part rectangular basin/tub, smashed and rusted, with a stamped external end, overlapped side seam, and hand soldered end and side seam. No handles. All artifacts are located in a 30 m x 20 m area.
24	3521214	244952	One knife-punched three-part cylindrical vent hole can, smashed and rusted, with stamped external ends, a crimped side seam, and machine soldered ends and side seam; one knife-cut hole-in-top cylindrical canister, smashed and rusted. Artifacts located 1 m apart.
25	3519953	244974	One three-part cylindrical solder dot evaporated milk can, smashed and rusted, with stamped external ends and a crimped side seam.
26	3521157	245007	One knife-punched three-part cylindrical can, smashed and rusted, with crimped ends and side seam. Embossed "sanitary."
27	3521337	245041	One two-part cylindrical canister, with crimped end and side seam and an external friction lid for closure, 11" tall and 4 1/4" in diameter; one two-part cylindrical lard-type bucket, smashed and rusted, with a stamped external end, crimped side seam, solder on lugs, no bail, and a machine soldered end and side seam. Artifacts located approximately 6 m apart.
28	3520548	245067	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam. Embossed "EST 22, 28"
29	3521265	245081	One two-part cylindrical bucket, smashed and rusted, with a stamped external end, crimped side seam, lugs with bail, and an external friction lid for closure (missing); three fragments of a metal canister, smashed and rusted, with no observable traits.
30	3521202	245085	One knife-punched solder dot can, smashed and rusted, with stamped external ends, and a crimped side seam.
31	3519982	245098	Two knife-punched solder dot cylindrical evaporated milk cans, smashed and rusted, with stamped external ends and crimped side seam.
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Table 1: Isolated Occurrences UTM Coordinates (NAD27, Zone 13). (Continued)

IO No.	Northing	Easting	Description
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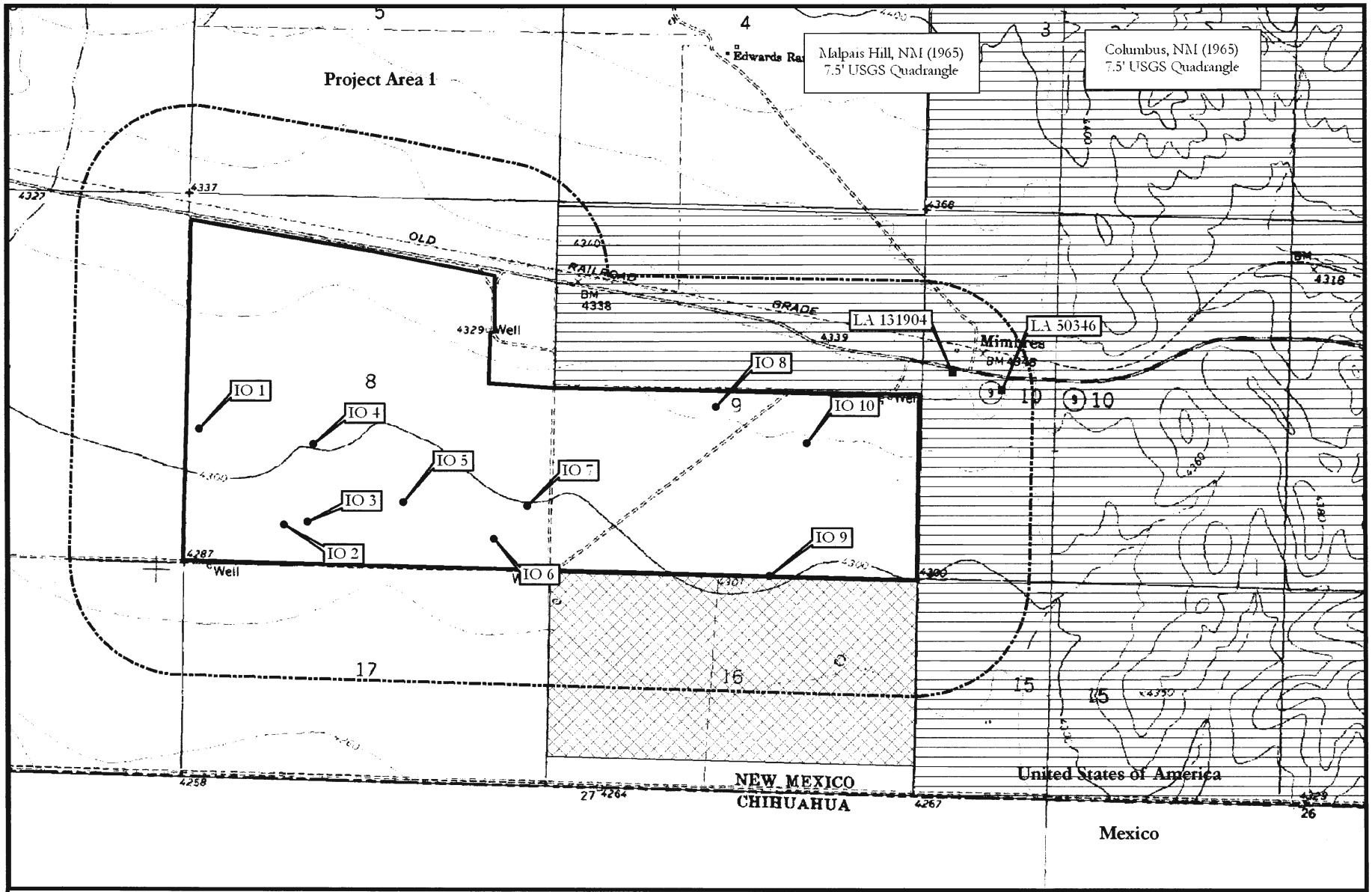
38	3519608	245908	One three-part cylindrical can, smashed and rusted. Key-strip opening, top missing, crimped ends and side seam, with a side seam that is machine soldered.
39	3519715	245924	One complete pink rhyolite secondary flake, 60 percent cortex, 43 mm x 40 mm x 16 mm; one broken light gray chert tertiary flake, 19 mm x 14 mm x 2 mm; ten fragments of historic whiteware ceramic, all from a single tea cup vessel, with a clear glaze, 1/8" thick to 1/4" thick; one speed loader for ammunition, 1/2" wide and 4" long; two metal buttons with a concave front, 3/4" in diameter and 3/16" thick. All artifacts located in a 10 m diameter area.
40	3520667	246019	One broken red and brown mottled rhyolite tertiary flake, 21 mm x 18 mm x 2 mm.
41	3519458	246299	One three-part cylindrical can, smashed and rusted. Embossed "sanitary," with crimped ends and side seam. X-cut opened.
42	3519496	246417	Five pieces of manganese decolorized (amethyst) bottle glass, 3/16" thick to 1/4" thick, all from a single vessel, located in a 1m x 1 m area.
43	3520545	248348	One white chert drill tool, well-used and retouched on all edges, broken tip, 47 mm x 23 mm x 4 mm.

Table 2: Site UTM Coordinates (NAD27, Zone 13).

LA No.	Northing	Easting	Description	Component	Eligibility
162362	3521853	236613	mid 20th century irrigation system represented by a series of agricultural ditches and associated features and materials.	NM Statehood-WWII to recent (A.D. 1935 to 1980s)	ineligible
162363	3521251	244794	possible homestead or refuse site, represented by a historic artifact scatter with a single rock feature of unknown function	NM Statehood-WWII to Recent (A.D. 1914 to 2009)	Undetermined
162364	3519760	244674	homestead site with a historic artifact scatter with five features	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B
162365	3519633	244759	homestead site with a historic artifact scatter with a stock-tank depression and remnants of a windmill.	Euroamerican US Territorial to Recent (A.D. 1911 to 2009)	Eligible, D; Ineligible, C; Unevaluated A and B.
162366	3519894	244948	probable refuse dump associated with a homestead site consisting of a historic artifact scatter and two historic artifact concentrations.	NM Statehood-WWII to Recent (A.D. 1939 to 1951)	Ineligible
162367	3519454	246123	single-episode dump associated with a homestead site consisting of a historic artifact scatter and concentration	NM Statehood-WWII (A.D. 1920 to 1945)	Ineligible
50343	3521980	244739	historic trash dump with some buried artfacts	Hispanic NM Statehood-WWII (A.D. 1920 to 1945)	Previously determined eligible under Criterion D



Legend

- Isolated Occurrence
- Previously Recorded Site
- Project Area
- ARMS Buffer (500 m)

Kilometers: 0, 0.5, 1, 1.5

Miles: 0, 0.5, 1

Land Ownership

- BLM
- Private
- State

N

T29S, R09W,
Sections 8 & 9
Luna County, NM

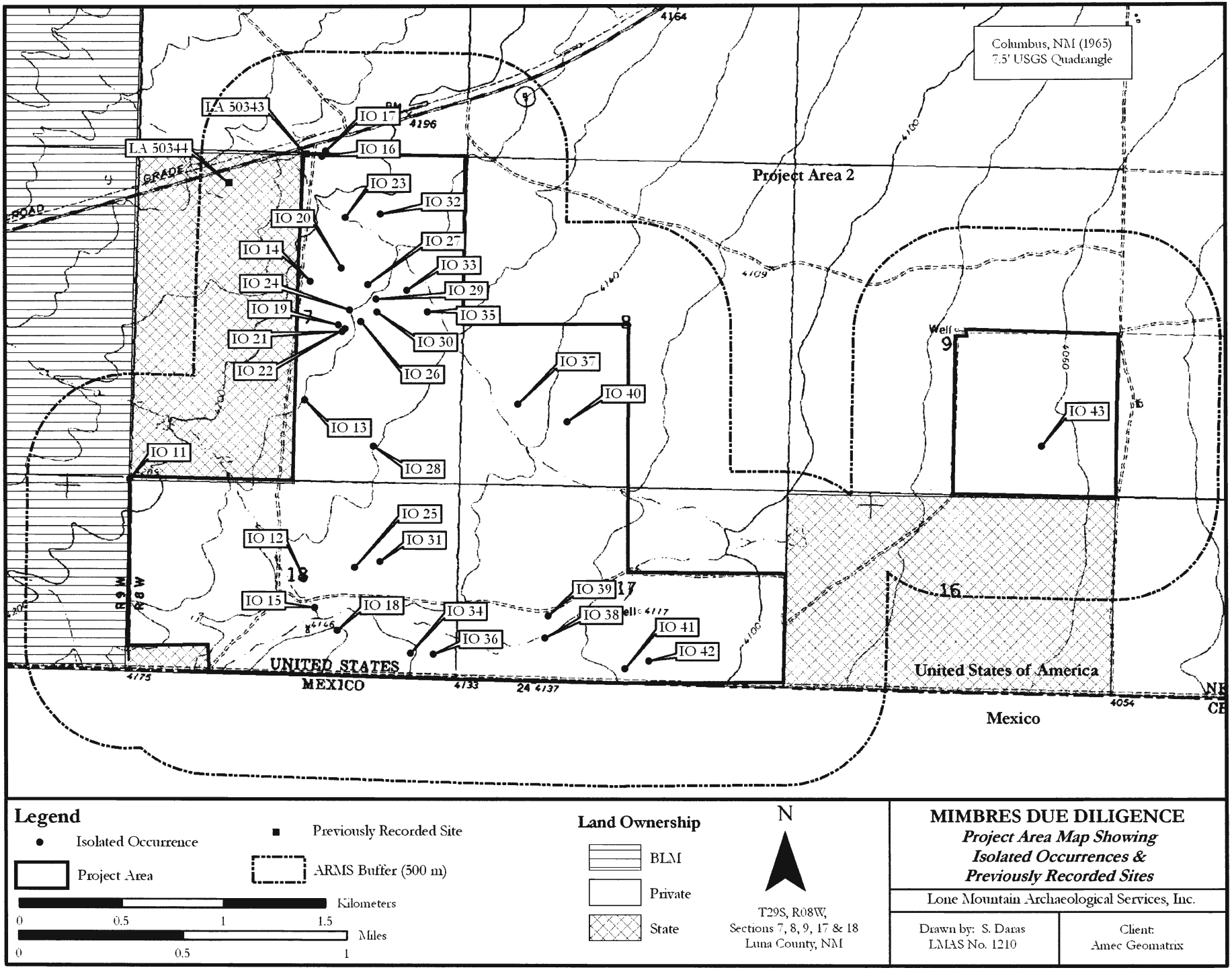
MIMBRES DUE DILIGENCE

Project Area Map Showing Isolated Occurrences & Previously Recorded Sites

Lone Mountain Archaeological Services, Inc.

Drawn by: S. Daras
LMAS No. 1210

Client:
Amec Geomatrix



Legend

- Isolated Occurrence
- Previously Recorded Site
- Project Area
- ARMS Buffer (500 m)

Kilometers: 0 — 0.5 — 1 — 1.5

Miles: 0 — 0.5 — 1

Land Ownership

- BLM
- Private
- State

N

T29S, R08W,
Sections 7, 8, 9, 17 & 18
Luna County, NM

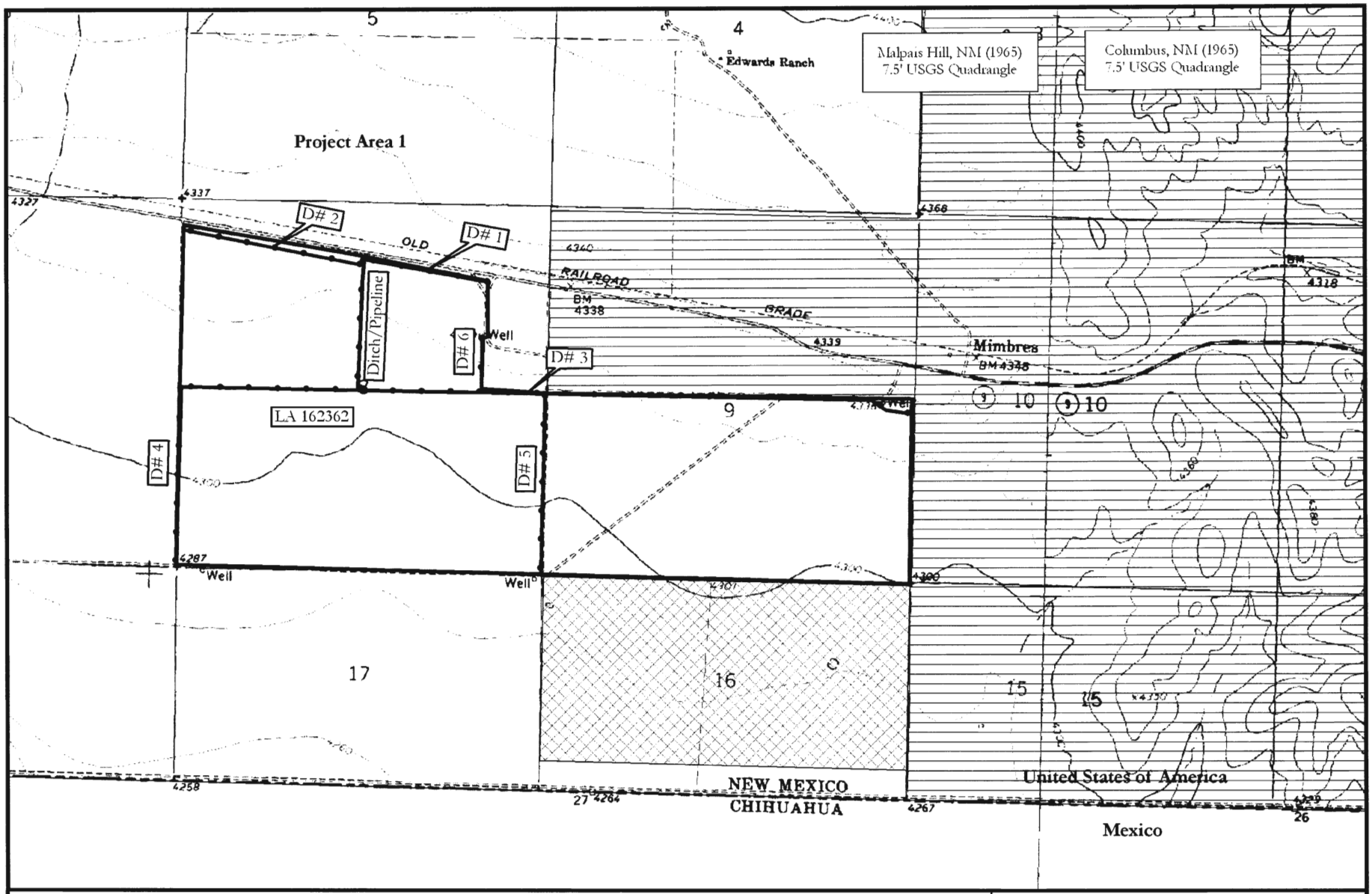
MIMBRES DUE DILIGENCE

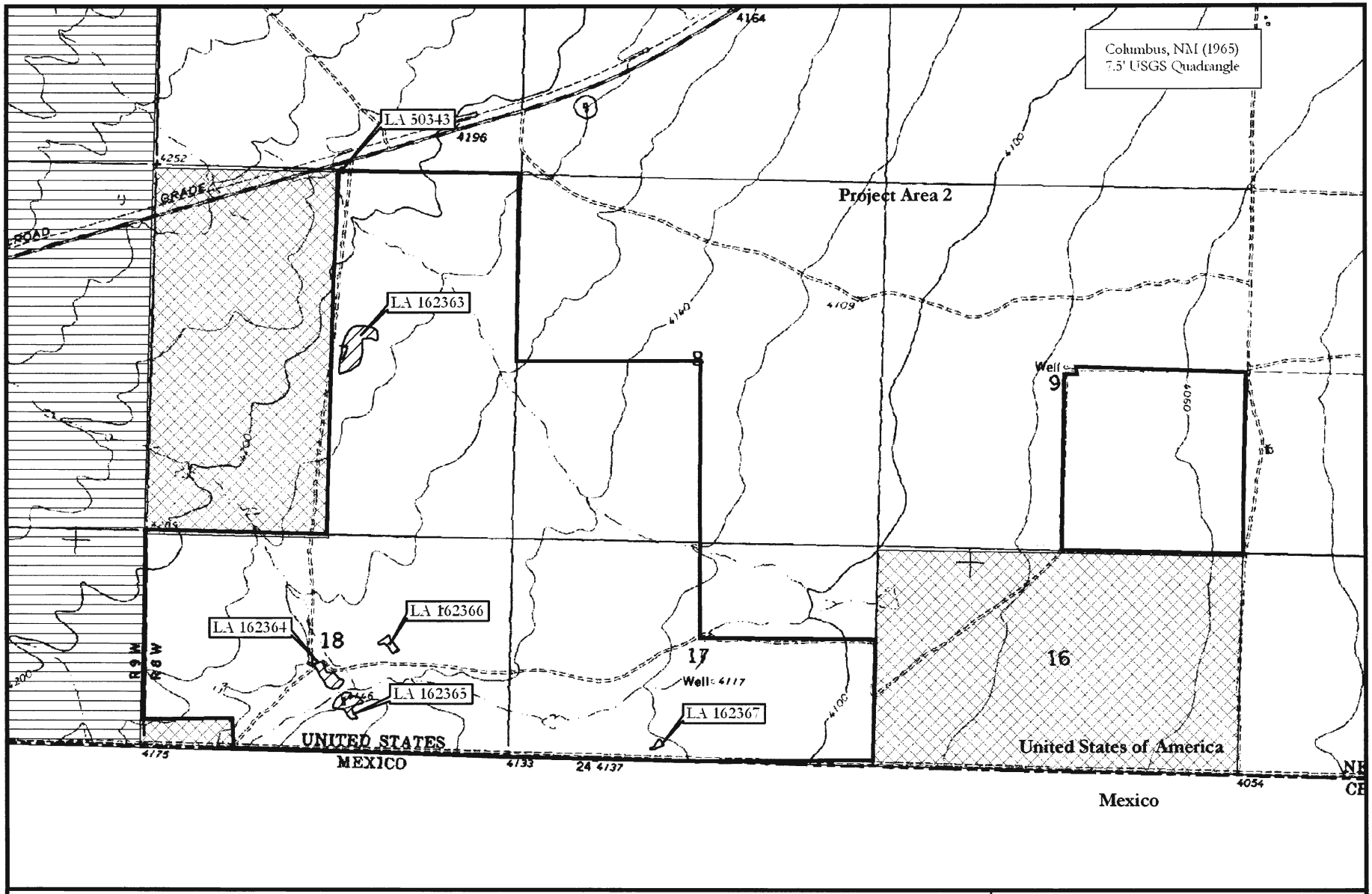
Project Area Map Showing Isolated Occurrences & Previously Recorded Sites

Lone Mountain Archaeological Services, Inc.

Drawn by: S. Daras
LMAS No. 1210

Client:
Amec Geomatrix


Malpais Hill, NM (1965)
7.5' USGS Quadrangle
Columbus, NM (1965)
7.5' USGS Quadrangle
Edwards Ranch
Project Area 1
D# 1
D# 2
D# 3
D# 4
D# 5
D# 6
OLD
RAILROAD
GRADE
Ditch/Pipeline
Well
BM 4338
BM 4318
Mimbres
BM 4338
LA 162362
NEW MEXICO
CHIHUAHUA
United States of America
Mexico
Legend
Ditch/Site Boundary
Project Area
Kilometers
0 0.5 1 1.5
Miles
0 0.5 1
Land Ownership
BLM
Private
State
N
T29S, R09W,
Sections 8 & 9
Luna County, NM
MIMBRES DUE DILIGENCE
Project Area Map Showing
LMAS Recorded Archaeological Sites
Lone Mountain Archaeological Services, Inc.
Drawn by: S. Daras
LMAS No. 1210
Client:
Amec Geomatrix



Legend

- Site Boundary
- Project Area

Kilometers: 0 — 0.5 — 1 — 1.5

Miles: 0 — 0.5 — 1

Land Ownership

- BLM
- Private
- State

N

T29S, R08W,
Sections 7, 8, 9, 17 & 18
Luna County, NM

MIMBRES DUE DILIGENCE

Project Area Map Showing LMAS Recorded Archaeological Sites

Lone Mountain Archaeological Services, Inc.

Drawn by: S. Daras
LMAS No. 1210

Client:
Amec Geomatrix

Field Supervisor Thoras Dye and Peggy Allison and Field Technicians Francisco Britton, Richard Francisco, Noel Pacheco, and Timothy Ruiz Brown completed the field inventory between March 5 and March 17, 2009. The Principal Investigator for the project is Douglas Boggess. The survey was undertaken at the request of Tom Tangen of Amec Geomatrix. (Lone Mountain Project Number 1213). This inventory was conducted under NMCRIS Number 113215. New Mexico State Permit, NM 09-073 (exp. 12/31/2009).

6

ATTACHMENT F-6

Preliminary Notice of Possible Impact on Important Resources

Sapphire Energy, Inc.
Luna County, New Mexico

The USDA, Rural Development is considering an application for loan guarantee pursuant to Section 9003 of the Food, Conservation, and Energy Act of 2008 received from **Sapphire Energy, Inc** 27101 Puerta Real, Suite 280, Mission Viejo, CA 92691 for constructing and operating an Integrated Algal Biorefinery (IABR) Project in Luna County, New Mexico. The facility would include the construction of a number of shallow ponds with a liner to be located southwest of Columbus, New Mexico in Sections 8 and 9, T29S, R8 and 9 West.

If implemented, the proposal may directly or indirectly affect approximately 400 acres important farmland, small areas of wetland and floodplains or cultural resources within the site. The purpose of this notice is to inform interested parties and the public, of possible impacts to important farmland, wetland, floodplains or cultural resources and to request comments concerning the proposal; any site or design alternatives; and, any methods that would avoid or minimize the impact to such important resources.

Information on the proposal is available for review at USDA, Rural Development, 1400 Independence Ave SW, Room 6858-S, Mail STOP 3225, Washington, DC, 20250. Contact Mr. Anthony Ashby, Loan Specialist at (202) 720-0661. Information is also available at the applicant's office at 9035 Advancement Avenue, Las Cruces, New Mexico 88007 Contact Mr. Jaime E. Moreno, Sapphire Energy, Inc at (575) 523-4777

Any person interested in commenting on the proposal should submit comments within 30 days following the date of this notice to Mr. Anthony Ashby, Loan Specialist, USDA, Rural Development, 1400 Independence Ave SW, Room 6858-S, Mail STOP 3225, Washington, DC, 20250.

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www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Saphire Energy** in the **8/19/2009** of the **Las Cruces Sun-News** in Las Cruces, New Mexico on page **2A**.

Bill Pitchkolan

Advertising Director

8/27/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 27th day of August AD 2009.

Notary Public Signature

My commission expires March 31, 2011

Notary Seal

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC, STATE OF NEW MEXICO
My commission expires: 3/31/2011

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Saphire Energy** in the **8/20/2009** of the **Las Cruces Sun-News** in Las Cruces, New Mexico on page **3A**.

Bill Pitchkolan

Advertising Director

8/27/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 27th day of August AD 2009.

Judy M. Luna

Notary Public Signature

My commission expires March 24, 2011

Notary Seal

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC / STATE OF NEW MEXICO
My commission expires: 3/24/2011

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Saphire Energy** in the **8/21/2009** of the **Las Cruces Sun-News** in Las Cruces, New Mexico on page **2C**.

Bill Pitchkolan

Advertising Director

8/27/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 27th day of August AD 2009.

Notary Public Signature

My commission expires March 27, 2011

Notary Seal

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 3/27/2011

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Saphire Energy** in the **8/19/2009, 8/21/2009** of the **Deming Headlight** in Deming, New Mexico on page **2A**.

Bill Pitchkolan

Advertising Director

8/27/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 27th day of August AD 2009.

Notary Public Signature

My commission expires March 24, 2011

Notary Seal

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires 3/24/2011

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Saphire Energy** in the **8/20/2009** of the **Deming Headlight** in Deming, New Mexico on page **5A**.

Bill Pitchkolan

Advertising Director

8/27/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 27th day of August AD 2009.

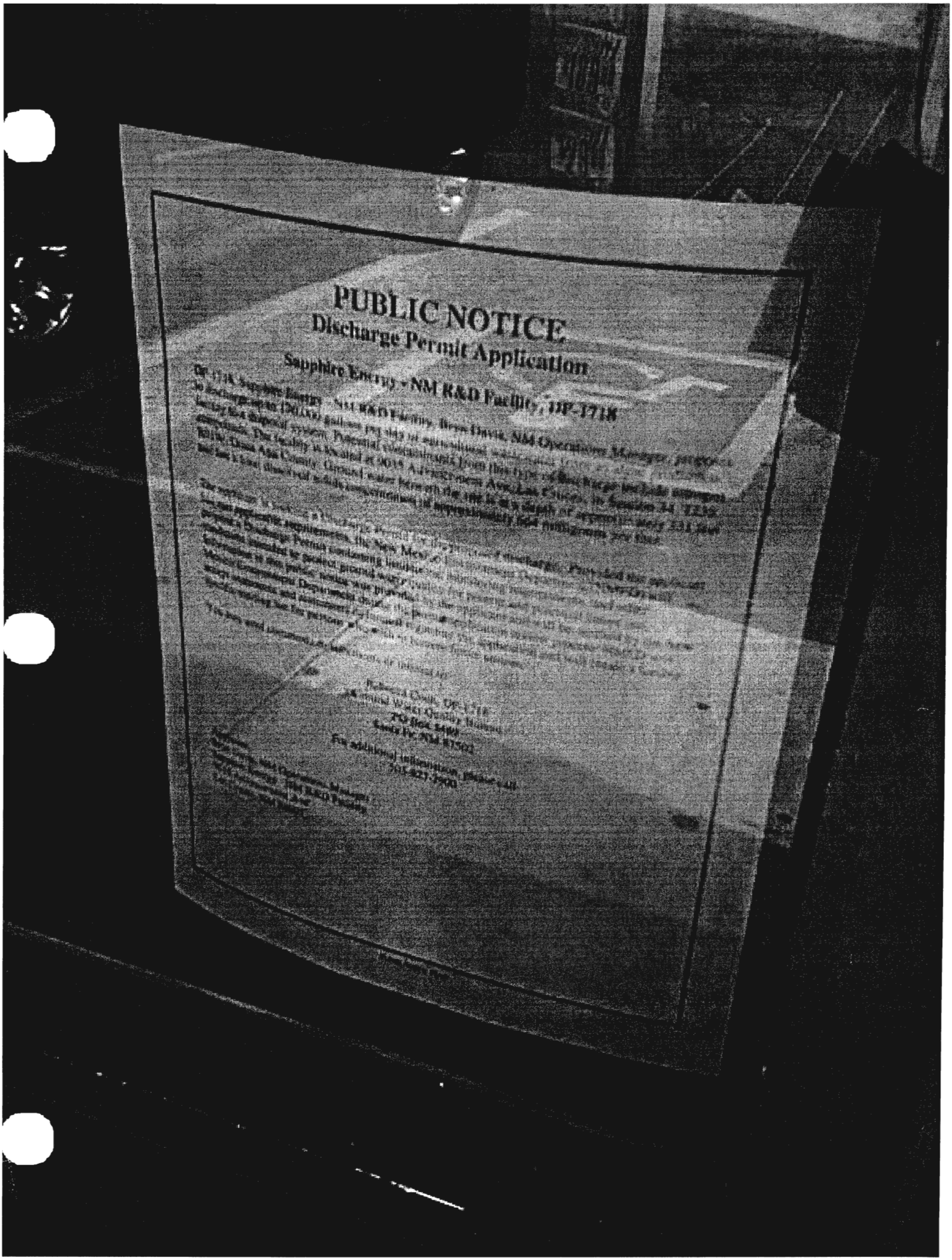
Notary Public Signature

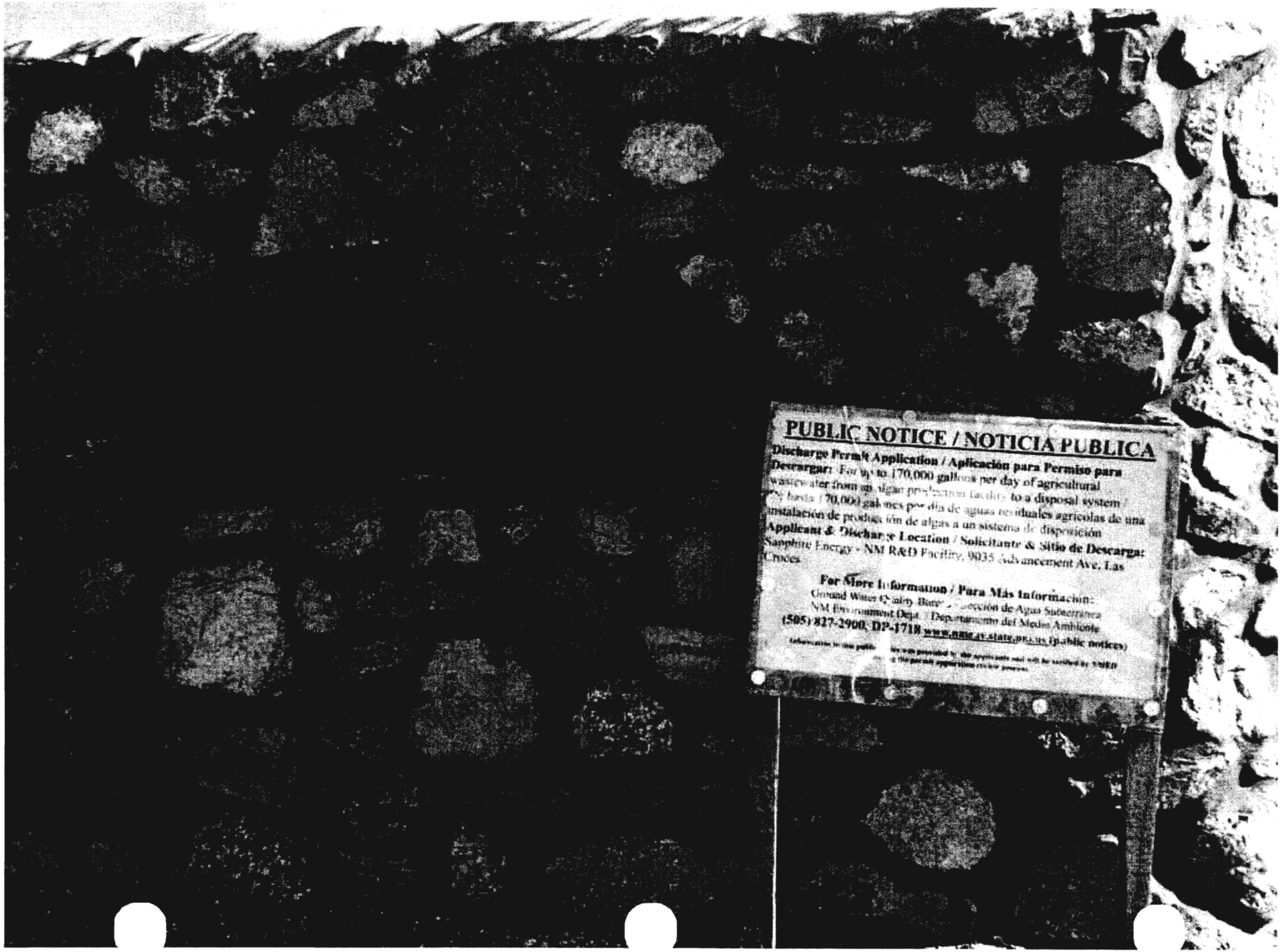
My commission expires March 29, 2011

Notary Seal

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 3/29/2011


PARKING
ONLY
VAN
ACCESSIBLE


PUBLIC NOTICE
Discharge Permit Application


PUBLIC NOTICE / NOTICIA PUBLICA
Discharge Permit Application / Aplicación para Permiso para Descargar: For up to 170,000 gallons per day of agricultural wastewater from an algae production facility to a disposal system / Por hasta 170,000 galones por día de aguas residuales agrícolas de una instalación de producción de algas a un sistema de disposición
Applicant & Discharge Location / Solicitante & Sitio de Descarga:
Sapphire Energy - NM R&D Facility, 9035 Advancement Ave, Las Cruces
For More Information / Para Más Información:
Ground Water Quality Bureau / Sección de Aguas Subterráneas
NM Environment Dept. / Departamento del Medio Ambiente
(505) 827-2900, DP-1718 www.nmenv.state.nm.us (public notices)

AFFIDAVIT OF PUBLIC NOTICE COMPLETION
New Permit or Permit Modification

DP-1718

I certify, under penalty of law, that I have fulfilled the Ground Water Discharge Permit public notice requirements of Section 20.6.2.3108(B) NMAC.

I posted a sign for 30 days displaying a synopsis of the public notice in English and in Spanish at or near the proposed facility in a conspicuous public location (or multiple locations) approved by NMED.

I posted a public notice flyer at a conspicuous off-site location approved by NMED.

I placed a synopsis of the public notice in English and in Spanish in a newspaper approved by NMED. A copy of the newspaper page containing the synopsis is enclosed.

I sent the public notice flyer via 1st class mail to *(check box)*:

- ☐ owners of all properties within a 1/3 mile of the boundary of the property of the proposed discharge locations – mailing list is enclosed.
- ☐ owners of all adjacent property (if applicant owns all property within 1/3 mile) – mailing list is enclosed.
- ☐ owner of the property of the proposed discharge locations (if applicant is not the owner) – mailing address is enclosed.

I am aware that there are significant penalties for false certification including the possibility of fines.

B T. Davis
Signature of Applicant

Bryn Davis
Printed Name

NM Operations Manager
Title

17 August 2009
Date

PROPERTY OWNER/ADDRESS	PROPERTY ADDRESS	PARCEL #	MAPCODE	SUBDIVISION	DATE LETTER SENT
LARRY BARKER	9030 ADVANCEMENT AVE	02-38977	02I3003138087303	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
PO BOX 611	350 ALLIANCE DR	02-40359	02I3003138082246	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
MESILLA PARK, NM 88047					
CITY OF LAS CRUCES	9085 ADVANCEMENT AVE	02-40905	02I3003138381453	4788 - WEST MESA INDUSTRIAL PARK #28	7/9/2009
PO BOX 20000		02-32853	02I3002138396184	4122 - WEST MESA INDUSTRIAL PARK # 5 & 12 REPLAT #1	7/9/2009
LAS CRUCES, NM 88004	380 REA BLVD	02-34315	02I3003138261306	4270 - WEST MESA INDUSTRIAL PARK #21	7/9/2009
	301 REA BLVD	02-25752	02I3003138306108	3079 - WEST MESA INDUSTRIAL PARK #7 AMENDED	7/9/2009
		02-38974	02I3002138489311	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
		02-38978	02I3003138171263	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
		02-38979	02I3003138175211	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
	331 REA BLVD	02-38980	02I3003138264200	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
	351 REA BLVD	02-38981	02I3003138260224	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
		02-39088	02I3002138071272	N/A	7/9/2009
		02-39087	02I3002138433255	4627 - WEST MESA INDUSTRIAL PARK #27	7/9/2009
		02-40354	02I3003138168110	N/A	7/9/2009
		02-40355	02I3003138077110	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
		02-40356	02I3003138173153	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
	410 ALLIANCE DR	02-40357	02I3003138075151	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
		02-40907	02I3003138134441	N/A	
TMG MANUFACTURING LLC	505 VENTURE DR	02-30043	02I3002138494398	3753 - WEST MESA INDUSTRIAL PARK #20	7/9/2009
C/O MARK MARVIN					
PO BOX 1259					
FAIRACRES, NM 88033					
CONTRACTORS LEASING LLC		02-38976	02I3003138029312	4690 - WEST MESA INDUSTRIAL PARK #26 REPLAT #1	7/9/2009
2906 BROADWAY NE					
ALBUQUERQUE, NM 87107					
FARMERS INVESTMENT CO	390 REA BLVD	02-27779	02I3003138175312	3338 - WEST MESA INDUSTRIAL PARK #14	7/9/2009
1525 E SAHUARITA					
SAHUARITA, AZ 85629					
PRO-BUILD REAL ESTATE HOLDINGS LLC		02-27922	02I3003138014269	3395 - WEST MESA INDUSTRIAL PARK #18	7/9/2009
82 DEVONSHIRE R7A		02-25460	02I3002138500240	2891 - WEST MESA INDUSTRIAL PARK #6	7/9/2009
BOSTON, MA 92109		02-27777	02I3002138500200	3337 - WEST MESA INDUSTRIAL PARK #13	7/9/2009
		02-27778	02I3003138008200	3339 - WEST MESA INDUSTRIAL PARK #15	7/9/2009
DENNIS & MARILYN MUNCRIEF	370 REA BLVD	02-34842	02I3003138261255	4366 - WEST MESA INDUSTRIAL PARK #23	7/9/2009
5655 TRES SENDAS					
LAS CRUCES, NM 88005					
F & A DAIRY PRODUCTS INC		02-23941	02I3002138352150	4122 - WEST MESA INDUSTRIAL PARK # 5 & 12 REPLAT #1	7/9/2009
355 CRAWFORD BLVD		02-27520	02I3002138370280	3335 - WEST MESA INDUSTRIAL PARK PLAT #5 AMENDED	7/9/2009
LAS CRUCES, NM 88012					

PROPERTY OWNER/ADDRESS	PROPERTY ADDRESS	PARCEL #	MAPCODE	SUBDIVISION	DATE LETTER SENT
DUCROSS INVESTMENTS LLC		02-23689	02I3003138001125	2648 - WEST MESA INDUSTRIAL PARK SUBDIVISION PLAT #4	7/9/2009
PO BOX 9825					
ALBUQUERQUE, NM 87119					
DOAK RENTAL LLC		02-24507	02I3002138525153	2648 - WEST MESA INDUSTRIAL PARK SUBDIVISION PLAT #4	7/9/2009
350 CRAWFORD BLVD					
LAS CRUCES, NM 88007					
DONALD R & M DIANNE DOAK		02-24508	02I3002138520182	2648 - WEST MESA INDUSTRIAL PARK SUBDIVISION PLAT #4	7/9/2009
350 CRAWFORD BLVD					
LAS CRUCES, NM 88007					
STATE OF NEW MEXICO		02-39559	02I3002139390263	4623 - CITY OF LC KENNON ANNEXATION DONA ANA COUNTY I	7/9/2009
310 OLD SANTA FE TRL					
SANTA FE, NM 87501					
UNITED STATES OF AMERICA		03-00532	02O3003139264263	N/A	7/9/2009
1800 MARQUESS					
LAS CRUCES, NM 88005-3371					

In the world

The Associated Press

Clozapine may have saved schizophrenics

LONDON — Thousands of people with schizophrenia worldwide could have been saved if doctors had prescribed them the little-used psychotic drug clozapine, a new study says.

Clozapine was introduced in the 1970s, but was banned for about a decade because of a rare but potentially deadly

Mexican police capture attack suspect

By Gustavo Ruiz

Associated Press

MORELIA, Mexico — Federal agents Sunday captured two suspects in connection with a series of attacks on federal forces across western Michoacan state that left five officers and two soldiers dead.

The men were arrested following a shootout with federal police in the Pacific port city of Lazaro Cardenas early Sunday in which one gunman was killed, Mexico's federal Public Safety [illegible]

on federal police stations Saturday in Michoacan and two other states.

Authorities say the attacks — one of the boldest offenses carried out against the government — were in response to the arrest of Arnoldo Rueda Medina, a reputed main operative of La Familia cartel. Rueda was arrested shortly before 5 a.m. Saturday in the Michoacan capital, Morelia.

Assailants repeatedly ambushed federal forces throughout the day, opening fire on police patrols and

and two soldiers.

The violence continued Sunday with gunmen opening fire on a Lazaro Cardenas hotel frequented by federal agents, but no one was injured. In the mountain town of Nueva Italia, the bound bodies of three men who had been shot in the head were found, according to a report from the Michoacan state attorney general's office.

Rueda and the two suspects arrested Sunday will be taken to Mex-

has sent more than 45,000 tro drug hotspots in the state throughout Mexico since he to fice in 2006. He also has arreste choacan politicians for allo protecting cartels.

Cartels have responded w vengeance, killing soldiers an lice and carrying out attacks a rival smugglers. More than people have been killed by dru lence nationwide since 2006.

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Sapphire Energy** in the **9/24/09,** of the **Las Cruces Sun News** in Las Cruces, New Mexico on page **2A**.

Bill Pitchkolan

Advertising Director

9/28/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 28 day of September AD 2009.

Adolph Mota

Notary Public Signature

My commission expires September 15, 2013

Notary Seal

OFFICIAL SEAL
ADOLPH MOTA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 9-15-13

ACORN, IRS cut ties

The Associated Press

The IRS said Wednesday it was severing ties with ACORN, joining a growing list of government agencies to end relationships with the community activist group.

The Internal Revenue Service said it would no longer include ACORN in its volunteer tax assistance program. The program offered free tax advice to about 3 million low- and moderate-income tax filers this spring. ACORN provided help on about 25,000 returns, the IRS said.

ACORN, meanwhile, said it had already suspended its tax program, raising questions about who broke up with whom.

"We had already made that decision to not deliver those services," ACORN chief executive Bertha Lewis said. ACORN officials provided reporters with a letter to the IRS, dated Monday, saying the group was suspending all tax services for 2009.

IRS spokesman Terry Lemons had a different take: "We announced last week we were conducting a thorough review and today we terminated the relationship. We stand by our statement that we terminated the relationship."

ACORN, which is short for the Association of Community Organizations for Reform Now, has long been a target of conservative activists. A hidden-camera video surfaced earlier this month showing ACORN employees in Brooklyn, N.Y., advising a couple posing as a prostitute and pimp to lie to get housing aid. The video, produced by a conservative activist, shows employees in other cities counseling the pair on tax, banking and immigration issues.

"It is absolutely critical that taxpayers have trust in our Volunteer Income Tax Assistance program partners," the IRS said in a statement. "In light of recent events, the IRS has decided to terminate its relationship with ACORN."

Lewis said the group is working to clean up its problems. The group has selected Scott Harshbarger, a former Massachusetts attorney general, to investigate its housing program and other public service projects.

Notification of the Finding of No Significant Impact (FONSI) For Sapphire Energy, Inc. Integrated Algal Biorefinery (IABR) Facility In Columbus, New Mexico

The US Department of Agriculture, Rural Development, Rural Business and Cooperative Service received a request from Sapphire Energy, Inc. for a loan guarantee in the amount of $60 Million under the USDA Rural Business and Cooperative Service Section 9003, Biorefinery Assistance Program. The Lender is Square 1 Bank. The proposed loan guarantee request is for construction of a 3-year pilot-scale integrated algal biorefinery (IABR) facility to be located on 400-acres southwest of Columbus, New Mexico. The facility would include the construction of a number of shallow engineered ponds and related infrastructure.

As required by the National Environmental Policy Act and agency regulations, the USDA Rural Development has assessed the potential environmental effects of the proposal. Upon consideration of the applicant's proposal, comments from federal and state environmental regulatory and natural resource agencies, the agency has determined that the proposal will not have a significant adverse effect on the quality of human environment. Therefore, Rural Development will not prepare an Environmental Impact Statement for this project.

For copies of the Environmental Assessment or for further information, please contact: Mr. Anthony Ashby, Loan Specialist, USDA, Rural Development, 1400 Independence Avenue SW, Room 6858-S, Washington DC, 20250 (202) 720-0661. Any person interested in commenting on the proposal should submit their comments to the Agency contact at the address identified above. Comments must be received by Rural Development within 15 days following the date of publication. Rural Development will make no further decisions regarding this proposed action during this fifteen-day period.

The project area is located in Sections 8 and 9, T29S, R8 and 9 West, approximately 7 miles west of Columbus, New Mexico, approximately one-half mile north of the US/Mexico border.

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Sapphire Energy** in the **9/25/09,** of the **Las Cruces Sun News** in Las Cruces, New Mexico on page **7C**.

Bill Pitchkolan

Advertising Director

9/28/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 28 day of September AD 2009.

Adolph Mota

Notary Public Signature

My commission expires September 15, 2013

Notary Seal

OFFICIAL SEAL
ADOLPH MOTA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 9-15-13

Notification of the Finding of No Significant Impact (FONSI)
For Sapphire Energy, Inc.
Integrated Algal Biorefinery (IABR) Facility
In Columbus, New Mexico

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www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Sapphire Energy** in the **9/24/09,** of the **Deming Headlight** in Deming, New Mexico on page **6A**.

Bill Pitchkolan

Advertising Director

9/28/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 28 day of September AD 2009.

Notary Public Signature Adolph Mota

My commission expires September 15, 2013

Notary Seal

OFFICIAL SEAL
ADOLPH MOTA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 9-15-2013

County:

$400,000

Office on Cody Road.

Notification of the Finding of No Significant Impact (FONSI) For Sapphire Energy, Inc. Integrated Algal Biorefinery (IABR) Facility In Columbus, New Mexico

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As required by the National Environmental Policy Act and agency regulations, the USDA Rural Development has assessed the potential environmental effects of the proposal. Upon consideration of the applicant's proposal, comments from federal and state environmental regulatory and natural resource agencies, the agency has determined that the proposal will not have a significant adverse effect on the quality of human environment. Therefore, Rural Development will not prepare an Environmental Impact Statement for this project.

For copies of the Environmental Assessment or for further information, please contact: Mr. Anthony Ashby, Loan Specialist, USDA, Rural Development, 1400 Independence Avenue SW, Room 6858-S, Washington DC, 20250 (202) 720-0661. Any person interested in commenting on the proposal should submit their comments to the Agency contact at the address identified above. Comments must be received by Rural Development within 15 days following the date of publication. Rural Development will make no further decisions regarding this proposed action during this fifteen-day period.

The project area is located in Sections 8 and 9, T29S, R8 and 9 West, approximately 7 miles west of Columbus, New Mexico, approximately one-half mile north of the US/Mexico border.

www.lcsun-news.com

LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Sapphire Energy** in the **9/25/09,** of the **Deming Headlight** in Deming, New Mexico on page **5A**.

Bill Pitchkolan

Advertising Director

9/28/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 25 day of September AD 2009.

Notary Public Signature

My commission expires September 15, 2013

Notary Seal

OFFICIAL SEAL
ADOLPH MOTA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 9-15-2013

Grad fair opens opportunities

FOR THE HEADLIGHT

LAS CRUCES — New Mexico State University Career Services will hold the 2009 Graduate and Professional School Fair to give all students, regardless of their major or year in school, the chance to meet with admissions representatives from various graduate and professional school programs.

The fair will be from 10 a.m. to 2 p.m. Tuesday on the first and second floor of Corbett Center Student Union.

The schools participating, which are law schools, dental schools, medical schools, general schools and more, will be from all over the country, will include Creighton University, Ohio State University, Texas Tech University and the University of Michigan. More than 55 schools are registered for the fair.

Students are encouraged to prepare for the Graduate and Professional School Fair by knowing what kind of school they are interested in and bringing any documentation, such as research, portfolios, manuscripts, etc., to show what they have to offer to a university. Students should also prepare questions they wish to ask the school, such as requirements for the school and what graduate assistant positions are available.

Students of all years, even freshmen, are invited to attend the event, as it's never too early to begin preparing, said Lizeth Vazquez, a career advisor at NMSU Career Services.

Career Services offers help for students in writing their personal statement of interest, a requirement from graduate schools in the application process. There is also a library resource center at the Career Services offices where students can use resources to prepare and research schools. The office is located at Garcia Annex in Room 224.

For more information, contact NMSU Career Services at (575) 646-1631 or gradfair@nmsu.edu, or visit the Web site career services.nmsu.edu.

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For Sapphire Energy, Inc.
Integrated Algal Biorefinery (IABR) Facility
In Columbus,New Mexico

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LAS CRUCES SUN-NEWS

AFFIDAVIT OF INSERTION

This is to certify that an ad was inserted from **Sapphire Energy** in the **9/28/09,** of the **Deming Headlight** in Deming, New Mexico on page **3A**.

Bill Pitchkolan

Advertising Director

9/28/09

Date

NOTARY PUBLIC

Sworn to and subscribe before me this 28 day of September AD 2009.

Notary Public Signature

My commission expires September 15, 2013

Notary Seal

OFFICIAL SEAL
ADOLPH MOTA
NOTARY PUBLIC - STATE OF NEW MEXICO
My commission expires: 9-15-13

No trust in health reform

Remember this song: "It's Impossible," sung by Perry Como? If Perry was alive today, he could apply that title to the health insurance pandemic of knowledge that is gripping every individual who still possesses all of his faculties, which, as we listen to the media's brain-washing techniques, and a President who is overly educated in untried methods of doing something about anything. Knowledge per-se does not solve any problem until it is wisely used. The subject of health care for every citizen of our country is in a state of being unsolvable from it's inception relative to the theory of the free enterprise system of the medical profession relieving people of their resource. It is estimated that well over three million ways are employed by the most unsupervised system the world has ever been made subject to. Every person involved in the present system of overseeing the health of a person, and making every effort to make the person well, is involved in a system that is designed to receive unregulated amounts of money for their services. Case in point: My wife got the common flu. Our local hospital didn't know how to treat it, so they sent

many times that America is not s
there are people in this world an
right here in the United States th
are trying to kill Americans. This
week has proven me right; if you
want to see the proof, all you hav
do is look at what has happened
Colorado, New York, Illinois and
now in Texas. It is by the grace o
God, the FBI, Local law enforcem
and CIA that these attacks have b
quashed in time to save lives. Thi
guy down in Texas was an illegal
alien, how did that happen? Then
have homegrown terrorists who
accepted the doctrine of these ou
side terrorists who drove those t
planes into the World Trade Cen
the plane that went into the Pent
and the one that crashed in Penn
vania in 2001. This is outrageous.
How in the world did American
homegrown citizens become so
brainwashed as to commit these
of terrorism on their own people

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Notification of the Finding of No Significant Impact (FONSI)
For Sapphire Energy, Inc.
Integrated Algal Biorefinery (IABR) Facility
In Columbus, New Mexico

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Environmental Assessment Contact Information including Individual Land Owners Notified of FONSI (mailed 9/22/09) Updated 9/30/09									
Agency/tribe	**To Whom**	**Street or PO**	**Letter / Project Description / Map Provided**	**Comments Received**	**Other Items Provided**	**Contact by Phone**	**Contact by Email**	**Contact by Meeting**	**Comments**
Energy, Minerals, Forestry and Resources Conservation Division	State Forester Butch Blazer 505.476.3200 arthur.blazer@state.nm.us	P.O. Box 1948, Santa Fe, NM 87504	3/10/2009			7/22/2009			
Governor of the Pueblo of Nambe	Lela Kaskalla 505.455.2036	Route 1, Box 117-BB Santa Fe, NM 87501	3/10/2009						
Governor of the Pueblo of Zuni	Donald Eriacho 505.282.7000	P.O. Box 339 Zuni, New Mexico 87327	3/10/2009						
National Park Service	Regional Director 505.988.6888	P.O. Box 728 Santa Fe, New Mexico 87504	3/10/2009						
New Mexico Department of Game and Fish	Director 505.476.8000	P.O. Box 25112, Santa Fe, New Mexico 87504	3/10/2009			6/5/2009			
New Mexico Environment Department	Air Quality Bureau Ted Schooley 505.827.1494 505.827.2855 505.476.4334 ted.schooley@state.nm.us	P.O. Box 26110, Santa Fe, NM 26110	3/10/2009			7/22/2009		Yes	
New Mexico Environment Department	Water and Waste Management Division George Schuman Or Marcy Leavitt 505.476.3728 marcy.leavitt@state.nm.us	P.O. Box 26110, Santa Fe, NM 26110	3/10/2009					4/16/2009	

Environmental Assessment Contact Information including Individual Land Owners Notified of FONSI (mailed 9/22/09)
Updated 9/30/09

Agency/tribe	To Whom	Street or PO	Letter / Project Description / Map Provided	Comments Received	Other Items Provided	Contact by Phone	Contact by Email	Contact by Meeting	Comments
New Mexico State Highway and Transportation Department	District Engineer, NMSHTP Frank Guzman, PE 575.544.6621	2912 E. Pine Street Deming, NM 88030	3/10/2009						
Office of the State Engineer	State Engineer John D'Antonio, PE 505.827.6091	Bataan Memorial Building, Room 101, P.O. Box 25102, Santa Fe, NM 87504-5102	3/10/2009					Yes	
State Historic Preservation Officer	Michelle Ensey Archaeologist 505.827.4064 michelle.ensey@state.nm.us Or Katherine Slick 505.827.4044 katherine.slick@state.nm.us	Bataan Memorial Building, 407 Galisteo Street, Suite 236, Santa Fe, NM 87501	3/10/2009	5/7/2009 8/13/2009			Michelle Ensey		
U.S. Army Corps of Engineers	Construction Operations Division, Regulatory Office Kelly Allen 505.342.3216 Kelly.e.allen@usace.army.mil Richard Gatewood 505.554.7943	4101 Jefferson Plaza, NE, Albuquerque, NM 87109-3435	3/10/2009	6/24/2009 6/25/2009		6/24/2009 7/22/2009	6/24/2009 6/25/2009		JD to be completed El Paso office has jurisdiction Richard Gatewood 505.554.7943
U.S. Bureau of Land Management	Las Cruces District Office Lori Allen	1800 Marquess Street Las Cruces, New Mexico 88005-3371			Notification of Land Access 5/30/2009				

Environmental Assessment Contact Information including Individual Land Owners Notified of FONSI (mailed 9/22/09)

Updated 9/30/09

Agency/tribe	To Whom	Street or PO	Letter / Project Description / Map Provided	Comments Received	Other Items Provided	Contact by Phone	Contact by Email	Contact by Meeting	Comments
U.S. Environmental Protection Agency	Director 800.887.6063	1445 Ross Avenue, Suite 1200, Dallas, Texas 75202-2733	3/10/2009						
U.S. Department of Agriculture	Rural Development - Business and Cooperative Programs Mike McDow 505.761.4400 Mike.McDow@usda.gov Ann Swanberg-Mee,PE 505.761.4972 Ann.Swanberg-Mee@nm.usda.gov	6200 Jefferson NE, Room 255 Albuquerque, NM 87109	3/10/2009		Form 1940-20 Signed 09 March 2009.pdf Cultural Report Provided 7/24/2009 Phase I Assessment Provided 7/28/2009 Site Form Dept of Cultural Affairs to George Scott 8/14/2009	2/9/2009 3/23/2009 7/14/2009 7/24/2009			
U.S. Department of Agriculture	Farm Service Agency 575.546.9692	405 E. Florida St, Deming, NM 88030-5235							To be Contacted by NRCS Louis Garcia
U.S. Department of Agriculture	Natural Resource Conservation Service Luis Garcia 575.546.9692 Luis.Garcia@nm.usda.gov	405 E Florida Street Deming, NM 88030-5235	3/10/2009	7/24/2009	Form AD-1006 8/14/2009	VM - 7/23/2009	7/24/2009		
U.S. Fish & Wildlife Service	Field Supervisor Eric Hine Wally Murphy 505.248.6911	2105 Osuna Rd NE, Albuquerque, New Mexico 87113-1001	3/10/2009			5/5/2009 7/24/2009	5/7/2009		Falcon Survey Permit

Kirk Zacheck, et ux	P.O. Box 241 Columbus, NM 88029	Land Owner	Notice of FONSI mailed 9/22/09	
Nick W. Sayah	Best Tours & Travel 2609 E. McKinley Fresno, CA 93703	Land Owner	Notice of FONSI mailed 9/22/09	
Rolando A. Ruiz	P.O. Box 1355 Loving, NM 88256	Land Owner	Notice of FONSI mailed 9/22/09	
Robert R. Cook et al	P.O. Box 1343 Columbus, NM 88029	Land Owner	Notice of FONSI mailed 9/22/09	
Lisa M. Davis et vir	8921 Vidal Rd. SW Albuquerque, NM 87109	Land Owner	Notice of FONSI mailed 9/22/09	
Jerry F. Zachek, et ux Trustees	P.O. Box 509 Columbus, NM 88029	Land Owner	Notice of FONSI mailed 9/22/09	
Rancho La Frontera A Partnership	P.O. Box 509 Columbus, NM 88029	Land Owner	Notice of FONSI mailed 9/22/09	

USDA Rural Development

United States Department of Agriculture
Rural Development

Subject: Finding of No Significant Environmental Impact and Necessary Environmental Findings for the Sapphire Energy, Inc.'s Integrated Algal Biorefinery (IABR) Facility in Columbus, New Mexico

To: Project File

The attached environmental assessment for the subject proposal has been prepared and reviewed by the appropriate Rural Development officials. After reviewing the assessment and the supporting materials attached to it, I find that the subject proposal will not significantly affect the quality of the human environment. Therefore, the preparation of an environmental impact statement is not necessary.

Mitigative measures which will be employed for this project include the following:

1) The USFWS recommends that in order to minimize the likelihood of adverse impacts to all birds protected under the Migratory Bird Treaty Act (MBTA), construction activities should occur outside the general migratory bird nesting season of March through August, or that areas proposed for construction during nesting season be surveyed, and when occupied, avoided until nesting is completed.
2) The applicant should coordinate with the USFWS and NMDGF in order to minimize potential impacts to any burrowing owls located on the site if present as outlined in the ""Guidelines and Recommendations for Burrowing Owl Surveys and Mitigation" (July 2007). "
3) The approval of this project is conditional upon receipt of the USACE Jurisdictional Determination confirming that there are no jurisdictional wetlands or waterways located on the property.
4) The approval of this project is conditional upon receipt of all other required permits and approvals (air quality, water rights, NPDES, Discharge) as stated in the EA.

I also find that the assessment properly documents the proposal's status of compliance with the environmental laws and requirements listed therein.

Judith A. Canales

JUDITH A. CANALES
Administrator
Rural Business and Cooperative Service

9/21/09
Date

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
STANDARD FLOOD HAZARD DETERMINATION FORM (SFHDF)

See The Attached Instructions

O.M.B. No. 1660-0040
Expires December 31, 2011

SECTION I - LOAN INFORMATION

1. LENDER NAME AND ADDRESS	2. COLLATERAL (Building/Mobile Home/Personal Property) PROPERTY ADDRESS (Legal Description may be attached)
USDA Rural Development 1400 Independence Avenue, SW Mail Stop 0761 Washington, DC 20250	Integrated Algal Bio-Refinery Facility 400 acres of land located 2 miles southwest of Columbus, New Mexico at Sections 8 and 9, Township 29 South, Range 8 and 9 West as depicted on the attached graphic

3. LENDER ID NO.	4. LOAN IDENTIFIER	5. AMOUNT OF FLOOD INSURANCE REQUIRED
Business Programs		$

SECTION II

A. NATIONAL FLOOD INSURANCE PROGRAM (NFIP) COMMUNITY JURISDICTION

1. NFIP Community Name	2. County(ies)	3. State	4. NFIP Community Number
Village of Columbus	Luna	NM	350037

B. NATIONAL FLOOD INSURANCE PROGRAM (NFIP) DATA AFFECTING BUILDING/MOBILE HOME

1. NFIP Map Number or Community-Panel Number (Community name, if not the same as "A")	2. NFIP Map Panel Effective/ Revised Date	3. LOMA/LOMR	4. Flood Zone	5. No NFIP Map
350037 0800	09/14/90	☐ YES Date	X	

C. FEDERAL FLOOD INSURANCE AVAILABILITY (Check all that apply)

1. ☒ Federal Flood Insurance is available (Community participates in NFIP). ☒ Regular Program ☐ Emergency Program of NFIP
2. ☐ Federal Flood Insurance is not available because community is not participating in the NFIP.
3. ☐ Building/Mobile Home is in a Coastal Barrier Resources Area (CBRA) or Otherwise Protected Area (OPA). Federal Flood Insurance may not be available.

CBRA/OPA Designation Date: _____

D. DETERMINATION

IS BUILDING/MOBILE HOME IN SPECIAL FLOOD HAZARD AREA (ZONES CONTAINING THE LETTERS "A" OR "V")? ☐ **YES** ☒ **NO**

If yes, flood insurance is required by the Flood Disaster Protection Act of 1973.
If no, flood insurance is not required by the Flood Disaster Protection Act of 1973.

E. COMMENTS (Optional)

This flood determination is provided to the lender pursuant to the flood Disaster Protection Act. It should not be used for any other purpose.

This determination is based on examining the NFIP map, any Federal Emergency Management Agency revisions to it, and any other information needed to locate the building/mobile home on the NFIP map.

F. PREPARER'S INFORMATION

NAME, ADDRESS, TELEPHONE NUMBER (If other than Lender)	DATE OF DETERMINATION
Juliet C. Bochicchio, Environmental Protection Specialist USDA Rural Development 1400 Independence Avenue, SW Mail Stop 0761 Phone (202) 205-8242 Juliet C. Bochicchio	September 21, 2009 September 21, 2009

F. Environmental Assessment

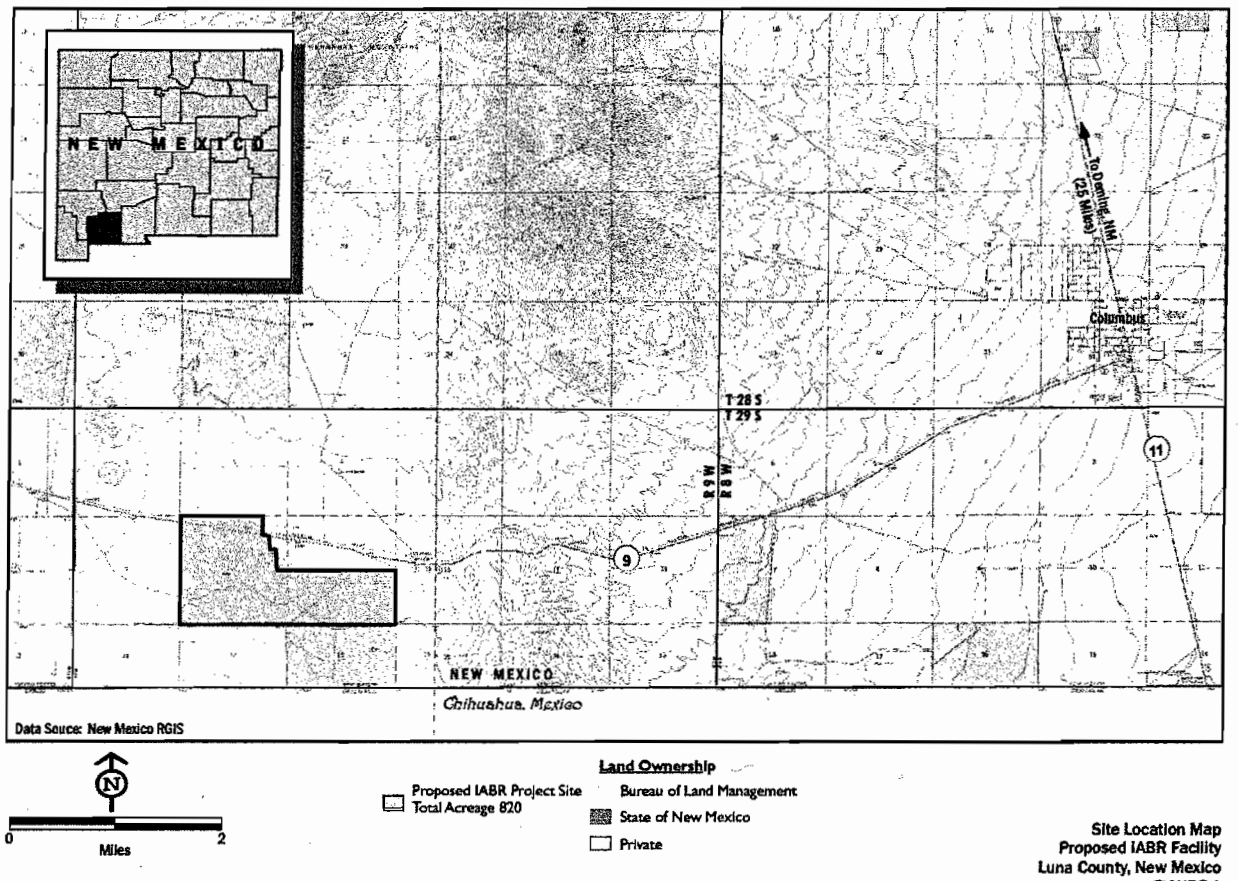
This section of the loan application describes the proposed Integrated Algal Biorefinery (IABR) project, the existing environment, and potential impacts to the environment related to the construction of the facility. In accordance with USDA guidance, this environmental evaluation was prepared pursuant to 7 CFR, Part 1940, Subpart G, Exhibit H.

F.1. Project Description and Need

F.1.1. General Project Description and Purpose

The applicant, Sapphire Energy Company (Sapphire), proposes to construct and operate an Integrated Algal Bio-Refinery Facility (IABR) to produce oil from algae, ultimately refining the oil into various types of transportation fuel. Sapphire is proposing to construct the IABR southwest of the community of Columbus in Luna County, New Mexico (Figure 1 and 2 and Exhibits 1 and 2, Oversized).

Figure 1: Map of IABR Project Site and Surrounding Area



Form RD 2006-38
(Rev. 07-07)

Rural Development
Environmental Justice (EJ) and Civil Rights Impact Analysis (CRIA)
Certification

1. Applicant's name and proposed project description: Sapphire Energy Company - Construct and operate an Integrated Algal Bio-refinery Facility to produce oil from algea.

2. Rural Development's loan/grant program/guarantee or other Agency action: Section 9003, Biorefinery Assistance Loan Guarantee

3. ☐ Attach a map of the proposal's area of effect identifying location or EJ populations, location of the proposal, area of impact or

☑ Attach results of EJ analysis from the Environmental Protection Agency's (EPAs) EnviroMapper with proposed project location and impact footprint delineated.

4. Does the applicant's proposal or Agency action directly, indirectly or cumulatively affect the quality and/or level of services provided to the community?
☐ Yes ☑ No ☐ N/A

5. Is the applicant's proposal or Agency action likely to result in a change in the current land use patterns (types of land use, development densities, etc)?
☑ Yes ☐ No ☐ N/A

6. Does a demographic analysis indicate the applicant's proposal or Agency's action may disproportionately affect a significant minority and/or low-income populations?
☑ Yes ☐ No ☐ N/A

If answer is no, skip to item 12. If answer is yes, continue with items 7 through 12.

7. Identify, describe, and provide location of EJ population Size of Hispanic/Latino populations in adjacent Luna, Dona Ana and Hidalgo counties would be considered EJ populations.

8. If a disproportionate adverse affect is expected to impact an EJ population, identify type/level of public outreach implemented. No disproportionate adverse affect is anticipated. The project will positively impact through development of high-salary jobs and associated growth.

9. Identify disproportionately high and adverse impacts on EJ populations. None.

10. Are adverse impacts appreciably more severe or greater in magnitude than the adverse impacts expected on non-minority/low-income populations?
☐ Yes ☑ No ☐ N/A

11. Are alternatives and/or mitigation required to avoid impacts to EJ populations?
☐ Yes ☑ No ☐ N/A

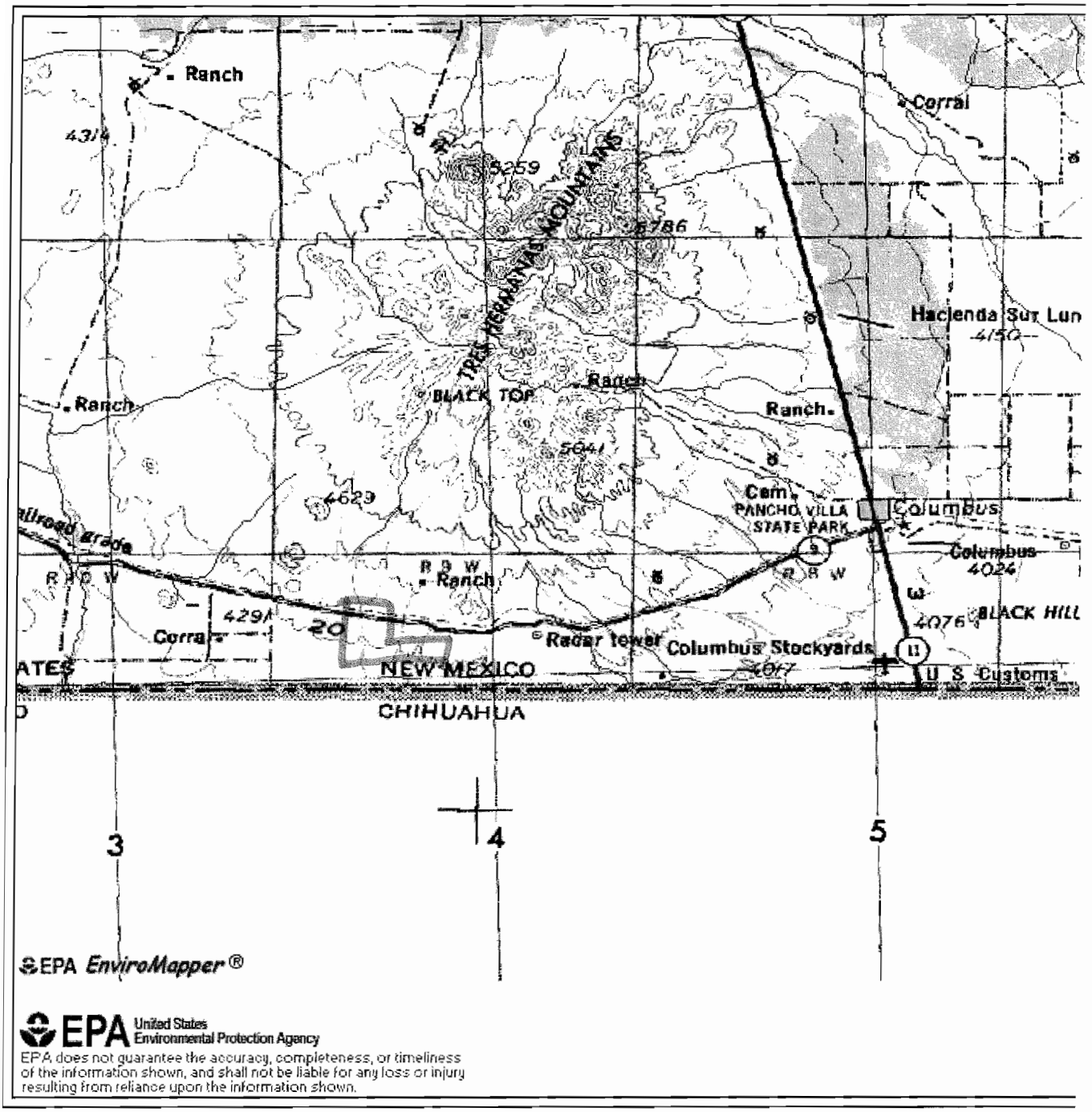
If yes, describe _____

12. I certify that I have reviewed the appropriate documentation and have determined that:
☑ No major EJ or civil rights impact is likely to result if the proposal is implemented.
☐ A major EJ or civil rights impact is likely to result if the proposal is implemented.

Juliet C. Bochicchio

Juliet C. Bochicchio, EPS
Name and Title of Certifying Official

September 21, 2009
Date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EPA United States Environmental Protection Agency
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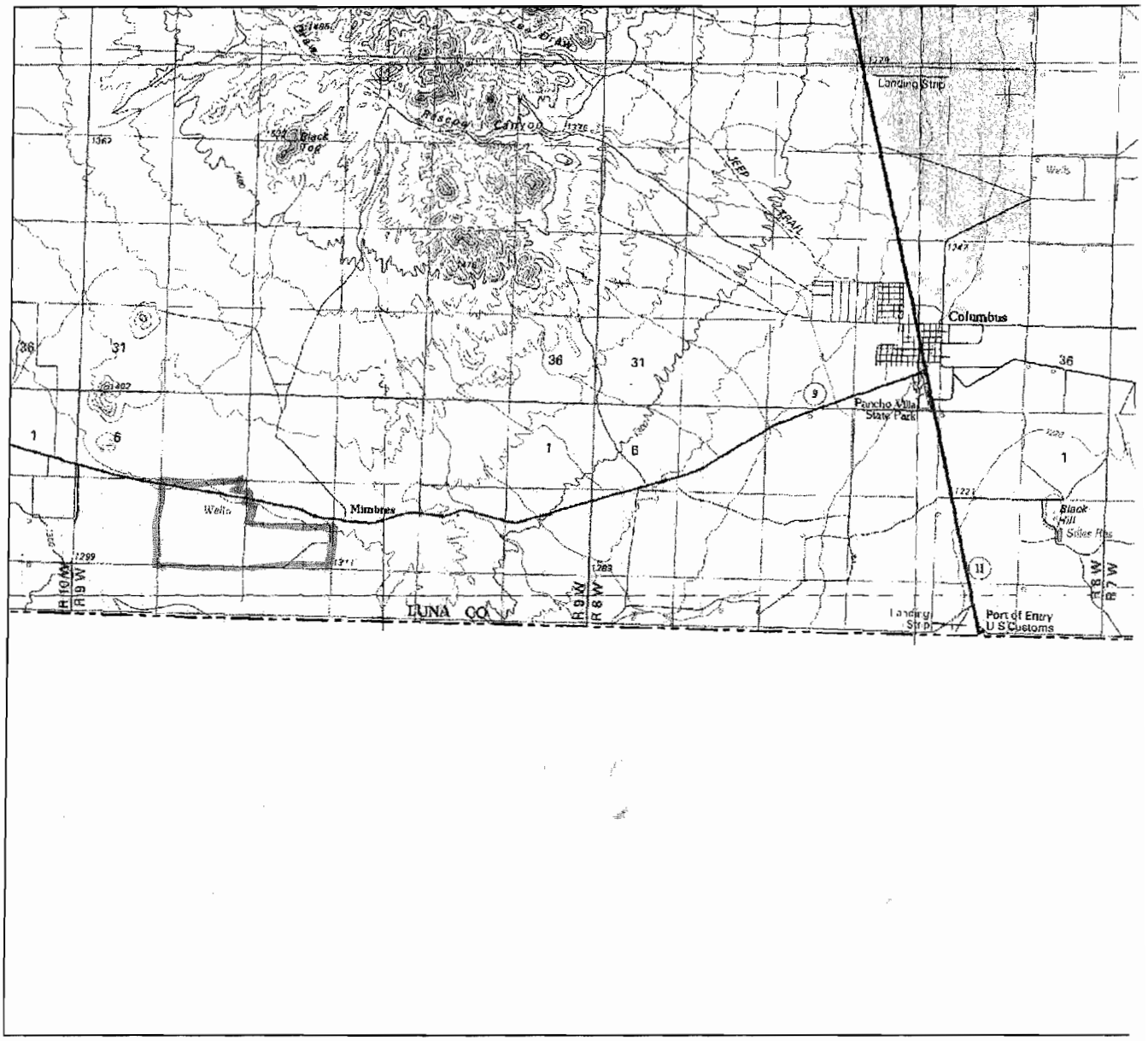

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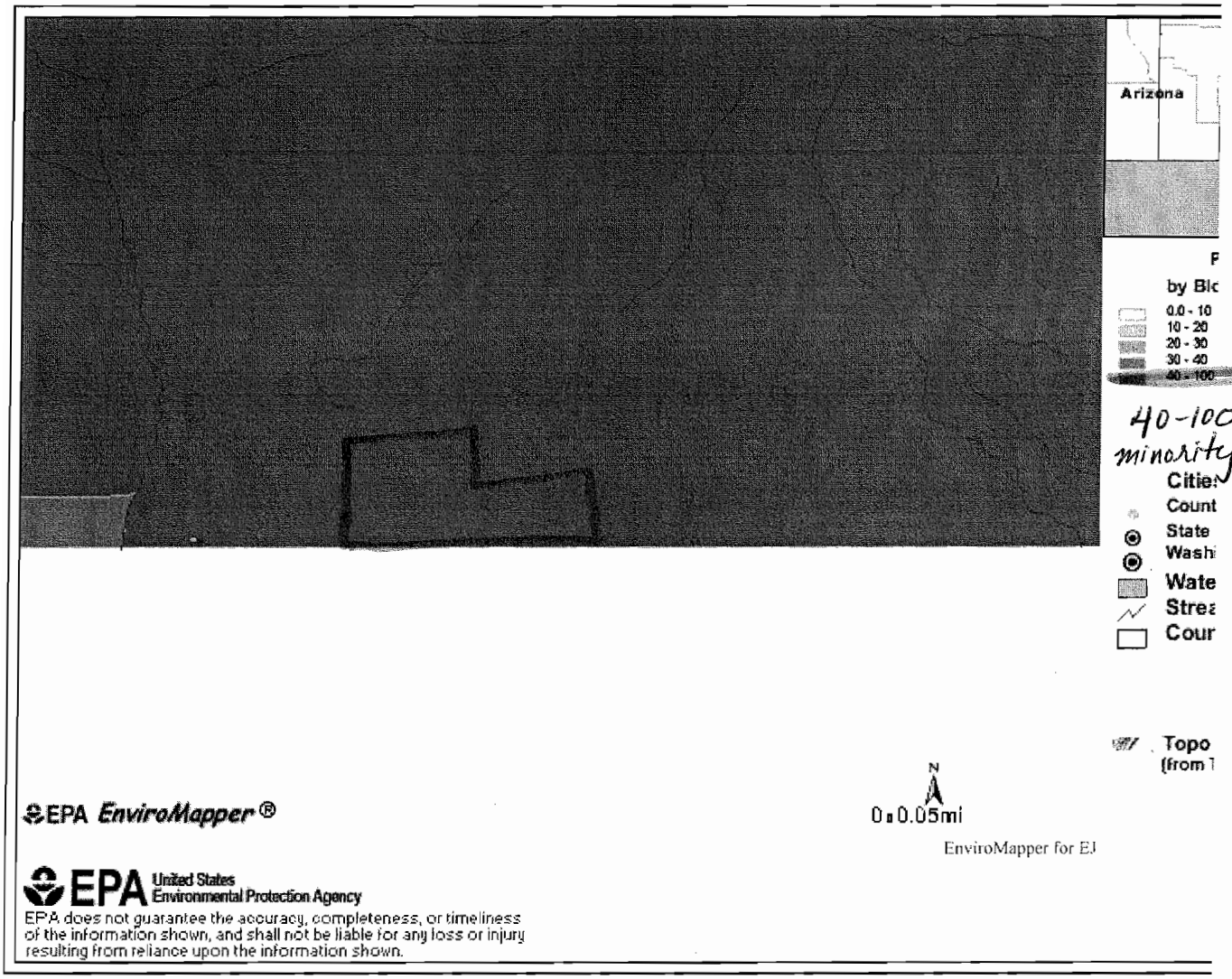
Map provided by MyTopo.com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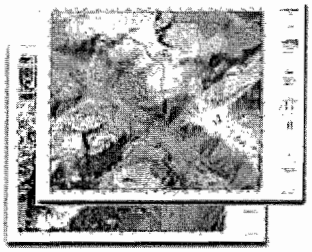

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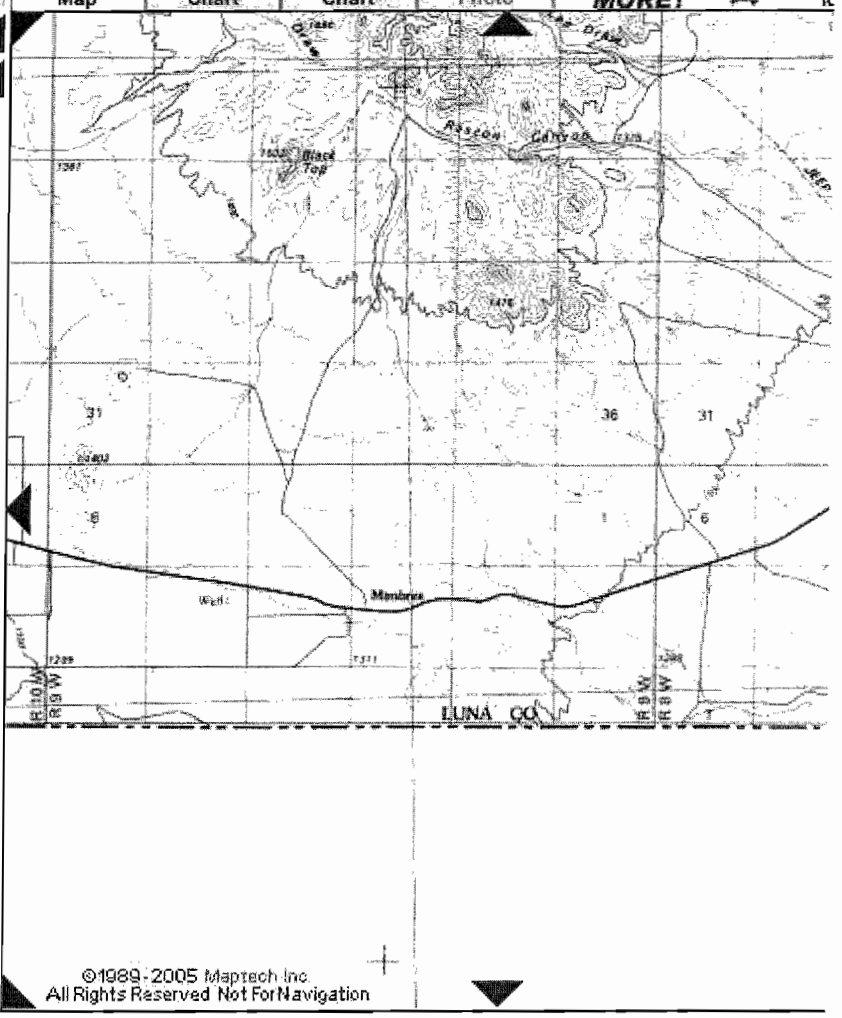

1:100,000 Scale

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