NM1 - __57___

PART 36
PERMIT
APPLICATION
Volume IV Part 1
November 7, 2013

STATE OF NEW MEXICO
DIRECTOR OF OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION OF DNCS PROPERTIES, LLC FOR A SURFACE WASTE MANAGEMENT FACILITY PERMIT

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

NOVEMBER 2013

VOLUME IV: SITING AND HYDROGEOLOGY

Prepared For:

DNCS Properties, LLC
2028 E. Hackberry Place
Chandler, AZ 85286
480.437.0044

Submitted To:

New Mexico Energy, Minerals, and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505
505.476.3440

Prepared By:

Gordon Environmental, Inc.
213 S. Camino del Pueblo
Bernalillo, NM 87004
505.867.6990

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

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1.0 INTRODUCTION

DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, DNCS Properties, LLC.

1.1 Purpose

This section provides compliance demonstrations for the Siting Criteria for Surface Waste Management Facilities specified in the NM Oil and Gas Rules, 19.15.36.13.A-C NMAC. These requirements include depth to groundwater; and proximity of watercourse, floodplains, wetlands, mines, residences/institutions, and unstable areas. The proposed DNCS site meets the Siting Requirements applicable to a Surface Waste Management Facility (i.e., 19.15.36.13.A-C NMAC).

1.2 Site Location

The DNCS site is located approximately 10.5 miles east of the US 82/NM 529 intersection east of Artesia, in unincorporated Lea County, New Mexico (NM). The DNCS site is comprised of a 562-acre ± tract of land located south of NM 529 in portions of Section 31, Township 17 South, Range 33 East; and in the northern half of Section 6, Township 18 South, Range 33 East, Lea County, NM (**Figure IV.1.1**). Site access will be provided on the south side of NM 529.

1.3 Description

A portion of the 562-acre tract is a drainage feature that will be excluded from development. The drainage feature includes a 500-ft setback and totals 67 acres ±. The DNCS Facility will include two main components; a liquid oil field waste Processing Area (177 acres ±), and an oil field waste Landfill (318 acres ±); therefore the DNCS Facility comprises 495 acres ±. Oil field wastes are anticipated to be delivered to the DNCS Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Plan provided as **Figure IV.1.2** identifies the locations of the Processing Area and Landfill facilities.

2.0 SITING CRITERIA FOR SURFACE WASTE MANGEMENT FACILITIES

In order to confirm the suitability of the proposed DNCS site for a Surface Waste Management Facility, an evaluation with respect to the Siting Requirements detailed in 19.15.36.13.A-C NMAC was performed and is presented herein. Based upon available information, the proposed DNCS site satisfies the size restriction and each of the 8 siting criteria. Following is a detailed description of the DNCS Site's compliance with the siting criteria. Each siting criterion is defined, applied and discussed individually. The following sections provide the regulatory citation for each criterion, followed by a narrative response. In most cases, a Figure or study is referenced to demonstrate compliance with applicable standard(s).

2.1 Depth to Groundwater

No landfill shall be located where ground water is less than 100 feet below the lowest elevation of the design depth at which the operator will place oil field waste. (19.15.36.13.A.(1) NMAC).

No other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste. (19.15.36.13.A.(5) NMAC).

The DNCS site is located in an area where few shallow groundwater resources are known to exist. Information obtained from six borings that were recently advanced at the DNCS site (**Volume IV.2**) provide adequate demonstration that the minimum depth to the shallowest groundwater bearing zone on the property exceeds 150 feet (ft) below ground surface (bgs); and is more than 100 ft below projected landfill base grade levels. The northwest portion of the DNCS site is planned for oil field waste processing, which has been specifically demonstrated to possess in

excess of the required 50-ft vertical setback to groundwater.

Shallow groundwater in this region is generally restricted to paleochannels and other low-lying areas that were incised into the Triassic redbeds bedrock prior to deposition of the Quaternary alluvium over the shale bedrock. Configuration of the top of the Chinle redbeds is an important control on groundwater availability that was recognized by Nicholson and Clebsch. They utilized data for the Chinle shale formation obtained from oil exploration seismic shot holes and other available data to prepare a structure contour map of the top of the Chinle Shale redbeds covering southern Lea County (Nicholson and Clebsch, 1961, Plate 1). The Nicholson and Clebsch structure contour data was projected on the project vicinity map in **Figure IV.1.3** (red isopleths).

The geometry of land surface and underlying geologic units, as well as groundwater saturations in the vicinity of the DNCS site are depicted in the hydrogeologic cross-section shown on **Figure IV.1.4**. This diagram indicates that no shallow alluvial groundwater is present at the DNCS site, consistent with site-specific drilling results. Based upon information projected from nearby petroleum wells (**Figure IV.1.3**), the shallowest potential water-bearing zone is the Santa Rosa Sandstone (lower Triassic Chinle), which is approximately 600 ft below grade at the DNCS site.

Detailed data regarding regional and site-specific hydrogeology are presented in **Volume IV.2** (Hydrogeology), including specific descriptions of the subsurface stratigraphy and water-bearing zones in the vicinity of the proposed DNCS Facility. In compliance with the requirements of 19.15.36.13.A(1) NMAC, the depth to groundwater at the DNCS Site is >100 ft below the lowest elevation of the design depth at which the operator will place oil field waste; and therefore > 50 ft below proposed processing operations.

2.2 Watercourse, Lakebed, Sinkhole, or Playa Lake

No surface waste management facility shall be located: within 200 feet of a watercourse, lakebed, sinkhole or playa lake (19.15.36.13.B.(1) NMAC).

Gordon Environmental, Inc.'s (GEI) subcontractor, Rocky Mountain Ecology (RME) conducted an investigation of the DNCS site on 04/29/2013, including review of potential watercourses, lakebeds, sinkholes, and playa lakes. Results of the field investigation are included in RME's Report, *Watercourses, Floodplains, and Wetlands Investigation* (RME 2013), provided as

Attachment IV.1.A.

In their Report, RME states that *"[n]o lakebeds or playa lakes were observed within the DNCS Site boundary, based on the field survey, and analysis of [National Hydrography Dataset] NHD data."* In addition, *[n]o sinkholes were observed on the property during the field survey."* As described in their Report, RME identified an ephemeral drainage that runs approximately northeast/southwest through the DNCS site as shown on **Figure IV.1.5**. Based on their field survey and review and analysis of topographic maps and aerial photography, RME concludes that there are no "Waters of the United States", as defined by the United States Army Corps of Engineers (USACE), located within the DNCS site boundaries. As shown on the Site Plan (**Figure IV.1.2**), the DNCS Facility has been designed with a minimum 200-ft setback from this ephemeral drainage feature. The DNCS Site is not otherwise located within 200 ft of a lakebed, sinkhole or playa lake.

2.3 Wellhead Protection Area; 100-Year Floodplain

No surface waste management facility shall be located: within an existing wellhead protection area or 100-year floodplain (19.15.36.13.B.(2) NMAC).

"Wellhead protection area" means the area within 200 horizontal feet of a private, domestic fresh water well or spring used by less than five households for domestic or stock watering purposes or within 1000 horizontal feet of any other fresh water well or spring. Wellhead protection areas does not include areas around water wells drilled after an existing oil or gas waste storage, treatment or disposal site was established. (19.15.2.7.W(8) NMAC)

Based on data provided by the Office of the State Engineer (OSE) WATERS database, there are no water wells located within the DNCS site boundary. The closest apparent well is a livestock well located approximately 2,250 ft north of the site boundary (**Figure IV.1.6**). Therefore, the proposed DNCS Facility is not located within an existing wellhead protection area.

A review of potential floodplains was also conducted by RME, as reported in **Attachment IV.1.A**. Flood Insurance Rate Maps are not available from the Federal Emergency Management Agency (FEMA) for this area; therefore RME performed a field survey and followed-up with the Lea County Floodplain Management (LCFM) Office. Based on RME's field survey, and the LCFM's Floodplain Determination (included in Appendix C of **Attachment IV.1.A**), the DNCS site is not located within a100-year floodplain.

2.4 Wetlands

No surface waste management facility shall be located: within, or within 500 feet of, a wetland (19.15.36.13.B.(3) NMAC).

"Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions in New Mexico. This definition does not include constructed wetlands used for wastewater treatment purposes. (19.15.2.7.W(9) NMAC).

The potential for wetlands at the DNCS site was also investigated by RME and is included in RME's Report (**Attachment IV.1.A)**. RME concluded that based on their field survey and review of the Natural Resources Conservation Service Web Soil Survey database, that no evidence of wetlands, as defined by the USACE, are present at or within 500 ft of the DNCS site. RME also received confirmation from the United States Fish and Wildlife Service that the surface drainage feature identified at the DNCS site is not a wetland (included in Appendix C of **Attachment IV.1.A**)

2.5 Subsurface Mines

No surface waste management facility shall be located: within the area overlying a subsurface mine (19.15.36.13.B.(4) NMAC).

The applicable section of the current NM Energy Minerals and Natural Resources Department (EMNRD) *Mines, Mills and Quarries in New Mexico* Map is provided as **Figure IV.1.7**. The closest mining operation appears to be an aggregate mining operation located in Eddy County and greater than 7.5 miles northwest of the DNCS Site. The DNCS Site is not located within an area overlying a subsurface mine.

2.6 Land Use Setbacks

No surface waste management facility shall be located: within 500 feet from the nearest permanent residence, school, hospital, institution or church in existence at the time of initial application (19.15.36.13.B.(5) NMAC).

Examination of land use surrounding the Facility, including a site reconnaissance and an aerial photo review (**Figure IV.1.8**), indicate that there are no permanent residences, schools, hospitals, institutions, or churches within 500 ft of the DNCS Site. The nearest permanent residence, school, hospital, institution, and church appear to be located in Maljamar, greater than 6 miles to the northwest of the site. No other permanent structures, other than oil and gas extraction related facilities are present within 500 ft of the DNCS site, and there is no apparent trend for development of residential, institutional, or educational facilities in the immediate vicinity of the proposed Facility.

2.7 Unstable Areas

The oil field waste disposal facility siting requirements set forth in 19.15.36.13.B(6) NMAC specify that:

> ***No surface waste management facility shall be located within an unstable area, unless the operator demonstrates that engineering measures have been incorporated into the surface waste management facility design to ensure that the surface waste management facility's integrity will not be compromised.***

An "Unstable Area" is defined in 19.15.2.7.U(6) NMAC as follows:

> ***"Unstable area" means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of a division-approved facility's structural components. Examples of unstable areas are areas of poor foundation conditions, areas susceptible to mass earth movements and karst terrain areas where karst topography is developed as a result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features of karst terrain include sinkholes, sinking streams, caves, large springs or blind alleys.***

This section addresses regulatory requirements for defining site characteristics related to earth stability at the proposed facility.

2.7.1 Karst Potential

Karst terrains and intermittent subsidence and collapse features are present in Eddy County and in southern Lea County. The DNCS site was evaluated for potential karst by review of published and unpublished information on the area, then by detailed review of terrain maps, aerial photographs and site reconnaissance to identify potential evidence of karst features in the area.

Davies and Others (1984) mapped karst potential in the United States based upon the presence of soluble geologic units underlying areas having potential to develop karst terrains. Subsidence features related to dissolution of underlying geologic units and other areas of karst potential in the region of the DNCS site are identified on the physiographic map in **Figure IV.1.9** (Nicholson and Clebsch, 1961). Davies and Others (1984) identified karst potential in areas to the southwest of the DNCS site due to the presence of exposed or shallow beds of gypsum. Two significant subsidence features known as Nash Draw and Clayton Basin are present in this area. Several playas (Laguna Plata, Laguna Gatuna, Laguna Tonto and Laguna Toston) are present approximately 12-15 miles south of the DNCS site in an area underlain by a thin veneer of alluvium on Triassic redbeds of the Chinle Formation. Nicholson and Clebsch (1961) speculated that these features could be the result of dissolution of gypsum and/or halite in Permian sediments below. Another large subsidence feature known as San Simon Swale is present approximately 20 miles south of the DNCS site. Nicholson and Clebsch (1961) reported that seismic exploration drill holes in this feature have penetrated more than 400 ft of unconsolidated materials above the Triassic redbeds.

Davies and Others (1984) identified the area east of Mescalero Ridge as having features analogous to karst where fissures or voids may be present in areas of subsidence where meteoric waters infiltrate into thick unconsolidated material. This area is highlighted and identified as the Llano Estacado in **Figure IV.1.9**. The Llano Estacado is underlain by the Tertiary Ogallala Formation, which contains significant thickness of secondary calcite, or calcrete and is susceptible to dissolution. Numerous shallow subsidence features form playas in this area. Oosterkamp and Wood (1987) characterized the playas on the Llano Estacado as subsidence features that are aligned along structural and drainage alignments where dissolution of secondary calcite caprock had taken place.

Nicholson and Clebsch (1961, plate 1) prepared a structure contour map on the upper surface of the Triassic redbeds in southern Lea County; numerous closed depressions were identified in the upper redbed surface and were interpreted to indicate the potential presence of sinkholes that formed from dissolution of underlying evaporates prior to the deposition of the Ogallala. The Triassic redbed structure contours of Nicholson and Clebsch (1961) are shown on the map in **Figure IV.1.3**. This diagram indicates that two closed depressions in the redbed surface are

present approximately 4 miles southwest of the DNCS site.

Karst Environments and Features

Thornbury (1969) identified a number of geologic and hydrologic conditions favorable to the development of karst terrain as follows:

- Presence of soluble rock such as limestone, gypsum, dolomite or halite at or near land surface
- Dense, highly jointed and/or thinly bedded soluble rock units
- Stream valleys deeply incised into soluble rock
- Moderate to high rainfall rates

Thornbury (1969) also identified a number of characteristic karst geomorphic land forms as follows:

- Sinkholes and associated forms, including solution sinks with broad shallow sinkhole ponds and collapse sinks, with steep rocky margins
- Karst plain, as a broad flat area with no laterally extensive drainages
- Sinking creeks, or creeks that end abruptly, typically in sinkholes
- Blind valleys, or ephemeral washes that end abruptly
- Rise and resurgence of streams
- Artesian springs
- Haystack hills or hums
- Caverns
- Voids and lost drilling circulation
- Tension cracks

Karst Features in the Vicinity of the DNCS Site

No mapped subsidence or karst features are present in the immediate vicinity of the DNCS site. Comparison of conditions at the DNCS site with those conditions favorable to karst development identified by Thornbury (1969) indicates that conditions at the site are not conducive to karst development. Approximately 10 ft of calcrete or caliche were identified near land surface in several of the DNCS site borings; however no thick sections of soluble rock are present at or near land surface in the vicinity of the DNCS site. Logs of the site borings are included in **Attachment IV.2.A**. The shallowest soluble bedrock materials in the area are anhydrite beds in the Rustler Formation which were penetrated at 675 ft below land surface in a nearby oil well known as the Conoco Oil MCA Battery 4 #214 (**Table IV.2.4**). Summary lithologic logs of nearby oil wells

and water wells taken from the New Mexico Office of the State Engineer are included in **Attachment IV.2.C**.

No playas, sinkholes, or other drainage features indicative of karst are present in the area of the DNCS site. Additionally, rainfall rates in the area are low - less than 15 inches per year (Nicholson and Clebsch, 1963).

Site Reconnaissance

During site reconnaissance, the property was examined for evidence of karst or active subsidence, including closed depressions, playas, slumps or tension cracks in surface soil and rock on margins of low-lying areas. Older cultural features such as roads, powerlines, fences, oil wells and well location markers were examined for evidence offset and/or displacement. None were detected. Based upon the above referenced literature review and site reconnaissance, it is concluded that no evidence of active karst or land subsidence was discovered during these investigations.

2.7.2 Pleistocene Faults

There are no known active or geologically recent faults in the vicinity of the DNCS site. Quaternary faults and folds in New Mexico and adjacent areas were catalogued by Machette and Others (1998). The nearest Quaternary fault to the DNCS site identified by Machette and Others (1998) is the Alamogordo Fault, which is located approximately 130 miles to the west.

2.7.3 Seismic Zones

The DNCS site was also evaluated for geologic faults that have experienced movement during the last 11,000 years [i.e., Holocene Period] (**Figure IV.1.10**) and areas susceptible to potential seismic impacts (**Figure IV.1.11**) to verify the physical stability of this location. The Quaternary Faults Map (**Figure IV.1.10**) is based on the United States Geological Survey (USGS) *Map of Quaternary faults and folds in New Mexico and adjacent areas*. The DNCS site is located within an area that is described as an area of "no Quaternary Faults" or an area that is "unmapped". No faults are shown in the vicinity of the site. The seismic impact zones map (**Figure IV.1.11**) is based on seismic data from the USGS National Seismic Hazard Mapping Project data. The seismic impact zone map indicates that the site is located within an area with no more than a 10% probability of peak horizontal ground acceleration of 0.06-0.08 g in 250 years. A "seismic impact

zone" is an area with a 10% or greater probability of peak horizontal ground acceleration of 0.10 g in 250 years. Therefore, the site is not located in a seismic impact zone.

2.8 Maximum Size

"No surface waste management facility shall exceed 500 acres" per 19.15.36.13.C NMAC.

The DNCS Facility will not exceed 500 acres. Total acreage for the DNCS site is 562 ± acres. However, as described in Section I.3, a portion of the 562-acre tract is a drainage feature that will be excluded from development. The drainage feature includes a 500-ft setback and totals 67 acres ±. The DNCS Facility will include two main components; a liquid oil field waste Processing Area (177 acres ±), and an oil field waste Landfill (318 acres ±); therefore the DNCS Facility comprises 495 acres ±. A copy of the Boundary Survey (Pettigrew & Associates PA, 12/13/2012) for the DNCS site which describes the size of the site and the site boundary is provided in **Attachment IV.1.B**. **Table IV.1.1** provides details regarding site facilities and acreages.

TABLE IV.1.1
Site Acreages
DNCS Environmental Solutions

Description	**Acres (±)**
DNCS Site: Total Tract	562
Drainage Feature (including setbacks)	67
Surface Waste Management Facility Boundary	495
Surface Waste Management Facility: Processing Area (West Tract)	177
Surface Waste Management Facility: Landfill (East Tract)	318
Landfill: Disposal Footprint	234
Processing Area: Operations Footprint	98

3.0 REFERENCES

Davies, W.E., Simpson, J.H., Ohlmacher, G.C., Kirk, W.S., and Newton, E.G., 1984, Engineering Aspects of Karst: U.S. Geological Survey, National Atlas of the United States of America, Scale 1:7,500,000

Thornbury, W.D., 1969, Principles of Geomorphology: John Wiley and Sons, New York, NY

Machette, M.N, Personius, S.F., Kelson, K.I., Haller, K.M., and Dart, R.L., 1998, Map of Quaternary faults and folds in New Mexico and adjacent areas, U.S. Geological Survey, Open-File Report 98-521

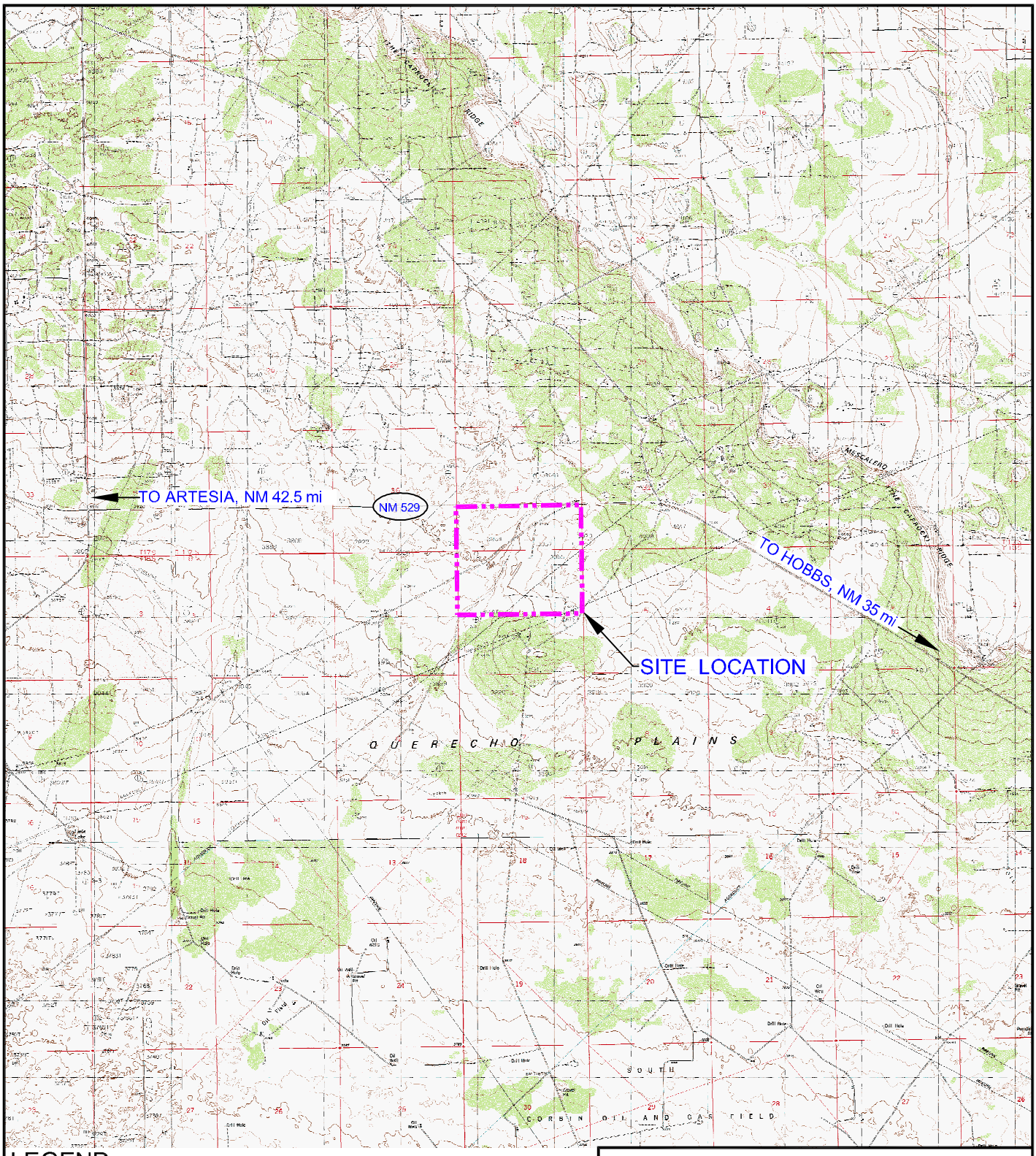
Nicholson, A., Alfred Clebsch. "Geology and Ground-Water Conditions in Southern Lea County, New Mexico". Ground-Water Report 6. State Bureau of Mines and Minerals

Oosterkamp, W.R., and Wood, W.W., 1987, Playa-Lake basins on the Southern High Plains of Texas and New Mexico: Part I. Hydrologic, geomorphic and geologic evidence for their development: Geological Society of America Bulletin, v. 99, p. 215-223

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

FIGURES



LEGEND

SITE BOUNDARY

NORTH

0 3000' 6000'

MAP REFERENCE:
LAGUNA GATUNA NW 1984,
MALJAMAR 1985 PROVISIONAL EDITION,
GREENWOOD LAKE 1985 PROVISIONAL EDITION, AND
DOG LAKE 1985 PROVISIONAL EDITION,
USGS 1:24000, 7.5 MINUTE SERIES, TOPOGRAPHIC MAPS

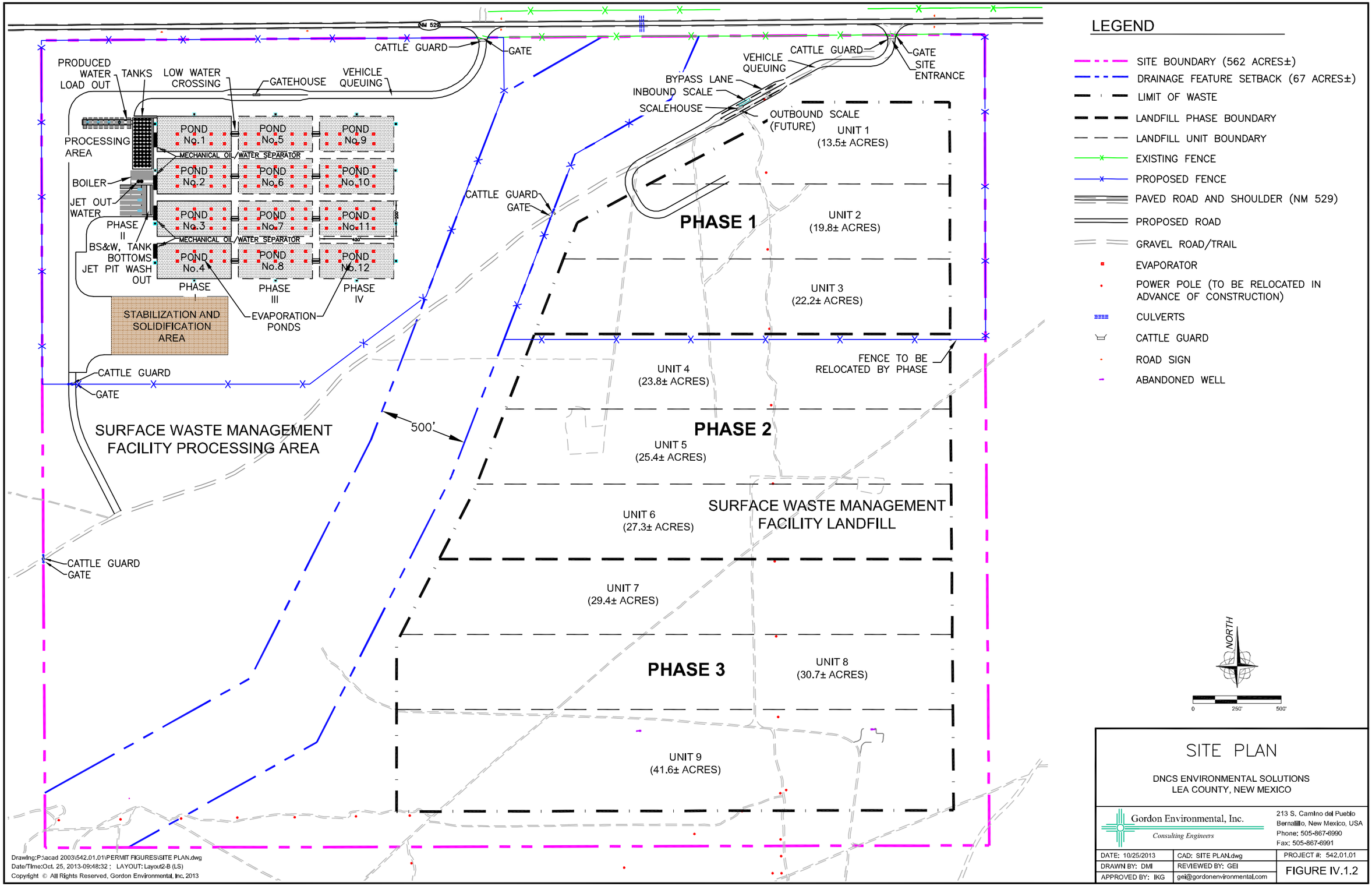
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SITE LOC MAP.dwg
Date/Time:Oct. 18, 2013-15:17:53 ; LAYOUT: A (P)

SITE LOCATION MAP

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE IV.1.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

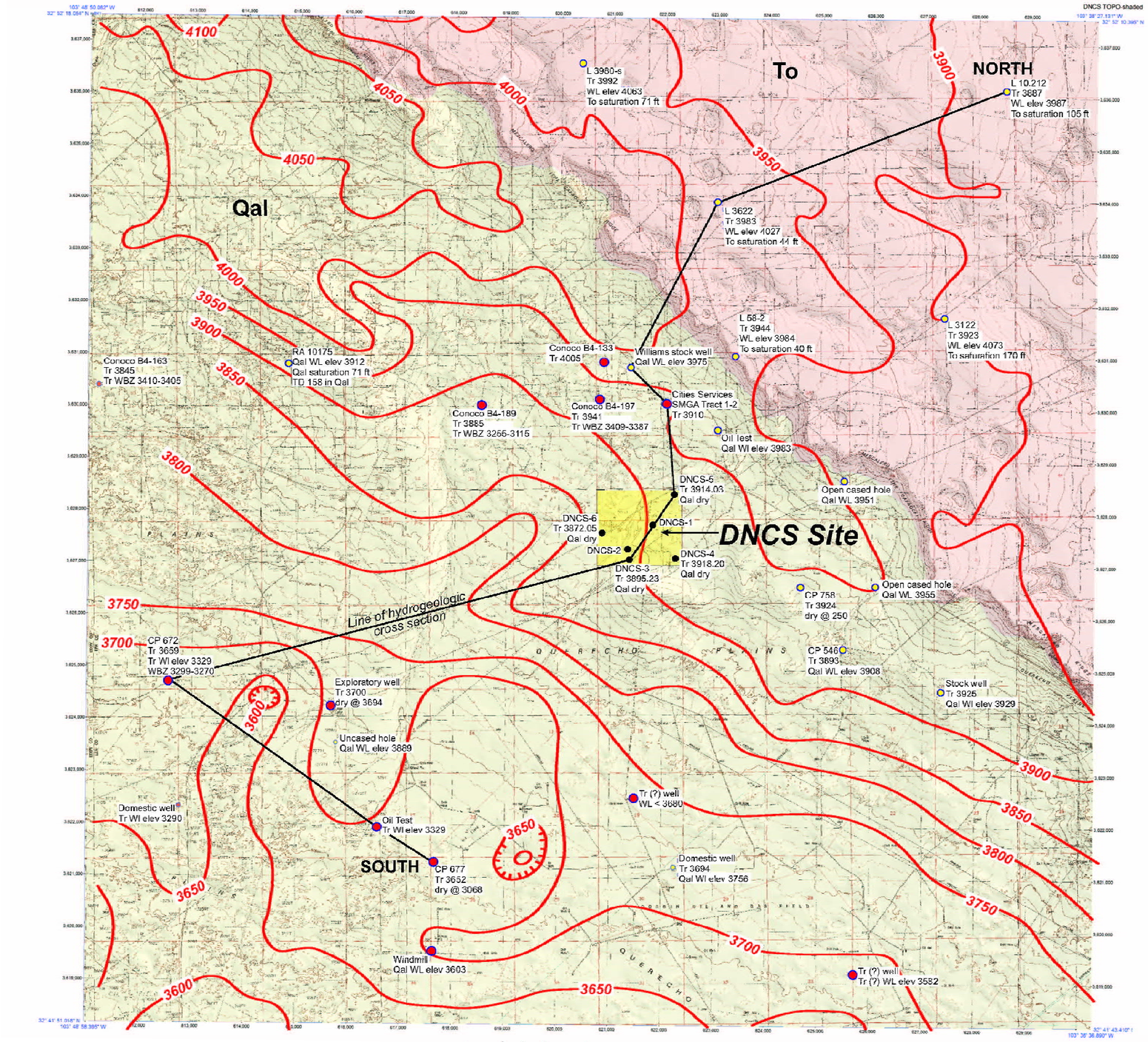


SITE PLAN

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/25/2013	CAD: SITE PLAN.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.1.2
APPROVED BY: IKG	gei@gordonenvironmental.com	



LEGEND

- Location of well having Triassic bedrock top elevation or Triassic water bearing zones and/or water levels
- Location of well completed in alluvium or Ogallala Formation
- Location of hydrogeologic boring on the DNCS site
- 3600 — Isopleth on line of equal elevation (feet above MSL) on the top of Triassic bedrock units (from Nicholson and Clebsch, 1961)
- To — Outcrop of Terfiary Ogallala Formation
- Qal — Outcrop of Quaternary alluvium

NORTH

Scale, miles
0 1.0 2.0

SURFACE GEOLOGY AND WELL LOCATIONS

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/04/2013	CAD: UPDATED FIGURE 2.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.1.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\UPDATED FIGURE 2.dwg
Date/Time:Nov. 04, 2013-11:24:38 ; LAYOUT: B (LS)

Hydrogeologic Cross Section
DNCS Permit Site, Lea County, New Mexico

SOUTH

NORTH

Elevation (ft) above Mean Sea Level

4300
4200
4100
4000
3900
3800
3700
3600
3500
3400
3300
3200

DNCS Tract boundaries

DNCS HYDROGEOLOGIC CROSS SECTION

Caprock

Conoco B4-197 projected

Williams Well

Cities Serv SMGA Tract 1-2

L-3622

L-3622

Tertiary Ogallala sand, gravel, silt clay, caliche

DNCS B-3

DNCS B-5

Land surface

CP-677

Oil Test

CP-672

Quaternary alluvium

Triassic Chinle shale, siltstone

Sandstone

WL: 70 ft

WL: 180 ft

WL: 168 ft

WL: 434 ft

WL: 460 ft

Unknown depth and completion

TD: 226 ft

TD: 273 ft

TD: 150 ft dry

TD: 150 ft dry

TD: 700 ft dry

Unknown Depth

TD: 524 ft

Cased to 1199 ft

Cased to 3963 ft

Vertical exaggeration: 42X

HYDROGEOLOGIC CROSS SECTION THROUGH THE DNCS SITE

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 09/24/2013	CAD: FIGURE 3.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.1.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

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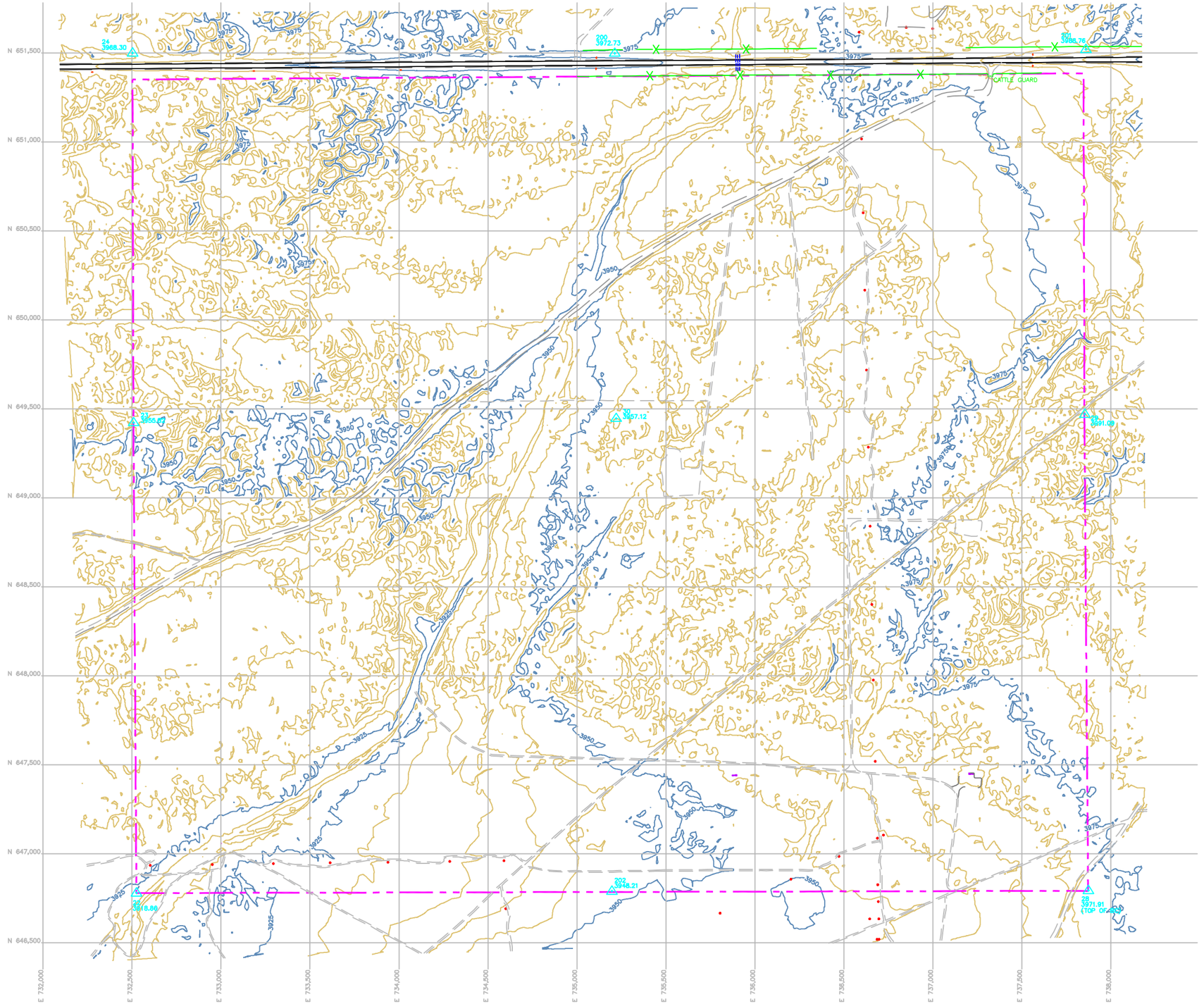

LEGEND

- SITE BOUNDARY (562 ACRES±)
- 25' TOPOGRAPHIC CONTOUR
- 5' TOPOGRAPHIC CONTOUR
- EXISTING FENCE
- PAVED ROAD AND SHOULDER (NM 529)
- GRAVEL ROAD/TRAIL
- POWER POLE
- CULVERTS
- CATTLE GUARD
- ROAD SIGN
- ABANDONED WELL
- 201 3968.76 — SURVEY CONTROL POINT
- N 646,500 / E 732,000 — SITE GRID

AERIAL SURVEY BY DALLAS AERIAL SURVEYS, INC. (D.A.S.)
MAPPING AND SURVEYING
10220 Forest Lane
Dallas, Texas 75243
(214)349-2200 (800)862-2190
(214)349-2193 Fax
www.dasmaps.com
D.A.S. JOB No. 13113
DATE OF PHOTOGRAPHY: 02-28-2013

NORTH

0 300' 600'

SITE TOPOGRAPHY

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/11/2013	CAD: SITE TOPO.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE IV.1.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

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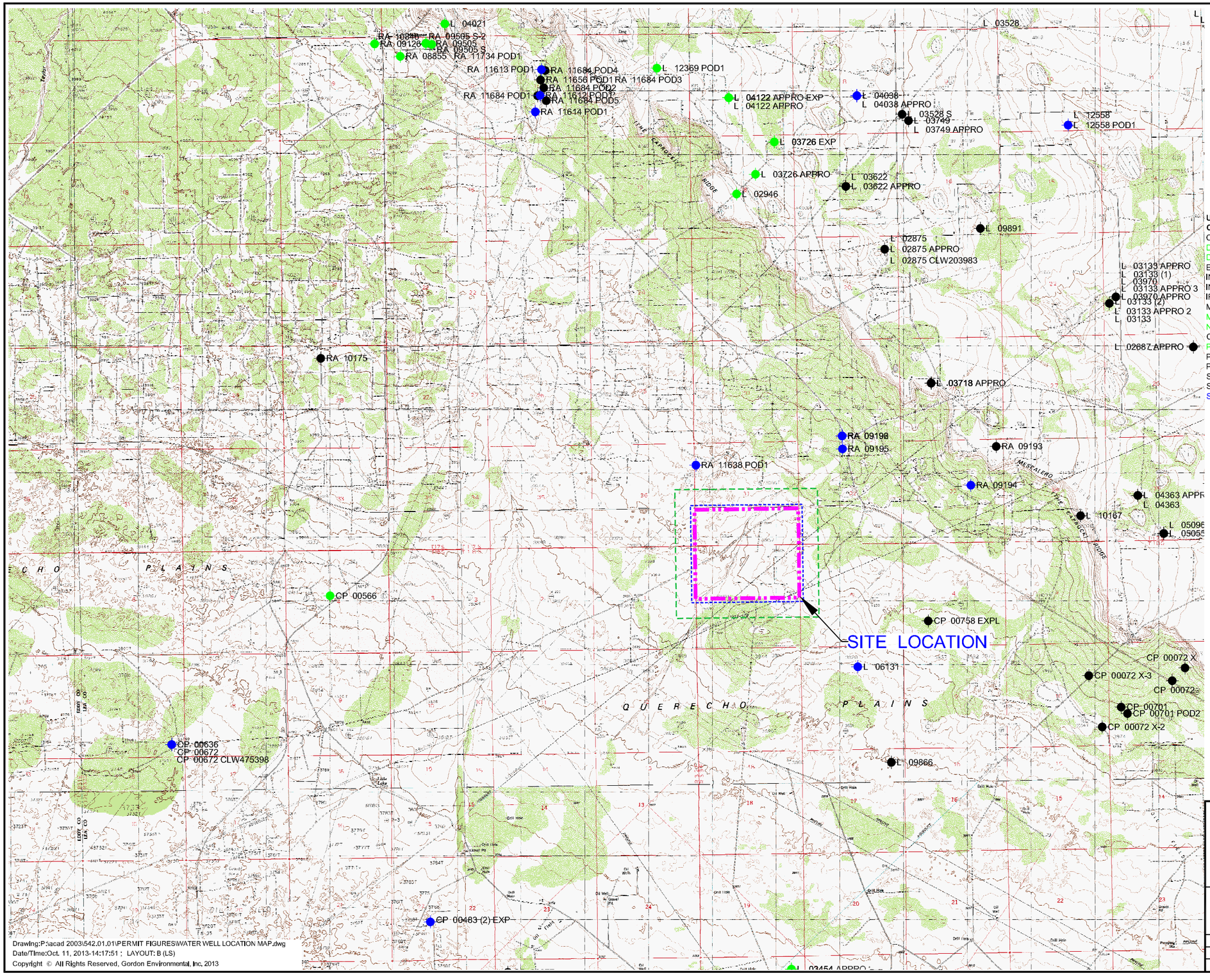

LEGEND

- SITE BOUNDARY (562 ACRES±)
- 200' SETBACK
- 1000' SETBACK
- L 12558 POD1 — WATER WELL LOCATION WITH WELL NUMBER

POD BASIN- POD NUMBER-POD SUFFIX

(POD= POINT OF DIVERSION)
POD BASIN CODES: L=LEA COUNTY
CP=CAPITAN
RA=ROSWELL ARTESIAN

USE CODE	USE DESCRIPTION
COM	COMMERCIAL
DOL	72-12-1 DOMESTIC AND LIVESTOCK WATERING
DOM	72-12-1 DOMESTIC ONE HOUSEHOLD
EXP	EXPLORATION
IND	INDUSTRIAL
INJ	INJECTION
IRR	IRRIGATION
MIN	MINING OR MILLING OR OIL
MUN	MUNICIPAL - CITY OR COUNTY SUPPLIED WATER
NON	NON-PROFIT ORGANIZATIONAL USE
OIL	OIL PRODUCTION
PDL	NON 72-12-1 DOMESTIC & LIVESTOCK
PRO	72-12-1 PROSPECTING OR DEVELOPMENT OF NATURAL RESOURCE
PUB	72-12-1 CONSTRUCTION OF PUBLIC WORKS
SAN	72-12-1 SANITARY IN CONJUNCTION WITH A COMMERCIAL USE
SRO	SECONDARY RECOVERY OF OIL
STK	72-12-1 LIVESTOCK WATERING

WATER WELL DATA REFERENCE:
NEW MEXICO OFFICE OF THE STATE ENGINEER/
INTERSTATE STREAM COMMISSION (OSE/ISC)
WATER WELL ESRI SHAPEFILE DATABASE
(ose_wells_July_2011.shp)
http://www.ose.state.nm.us/water_info_data.html
DATED:July, 2011

MAP REFERENCE:
LAGUNA GATUNA NW 1984,
MALJAMAR 1985 PROVISIONAL EDITION,
GREENWOOD LAKE 1985 PROVISIONAL EDITION, AND
DOG LAKE 1985 PROVISIONAL EDITION,
USGS 1:24000, 7.5 MINUTE SERIES, TOPOGRAPHIC MAPS

NORTH

0 2500' 5000'

WATER WELL LOCATION MAP

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/11/2013	CAD: WATER WELL LOCATION MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: MLH	REVIEWED BY: DRT	FIGURE IV.1.6
APPROVED BY: IKG	gel@gordonenvironmental.com	

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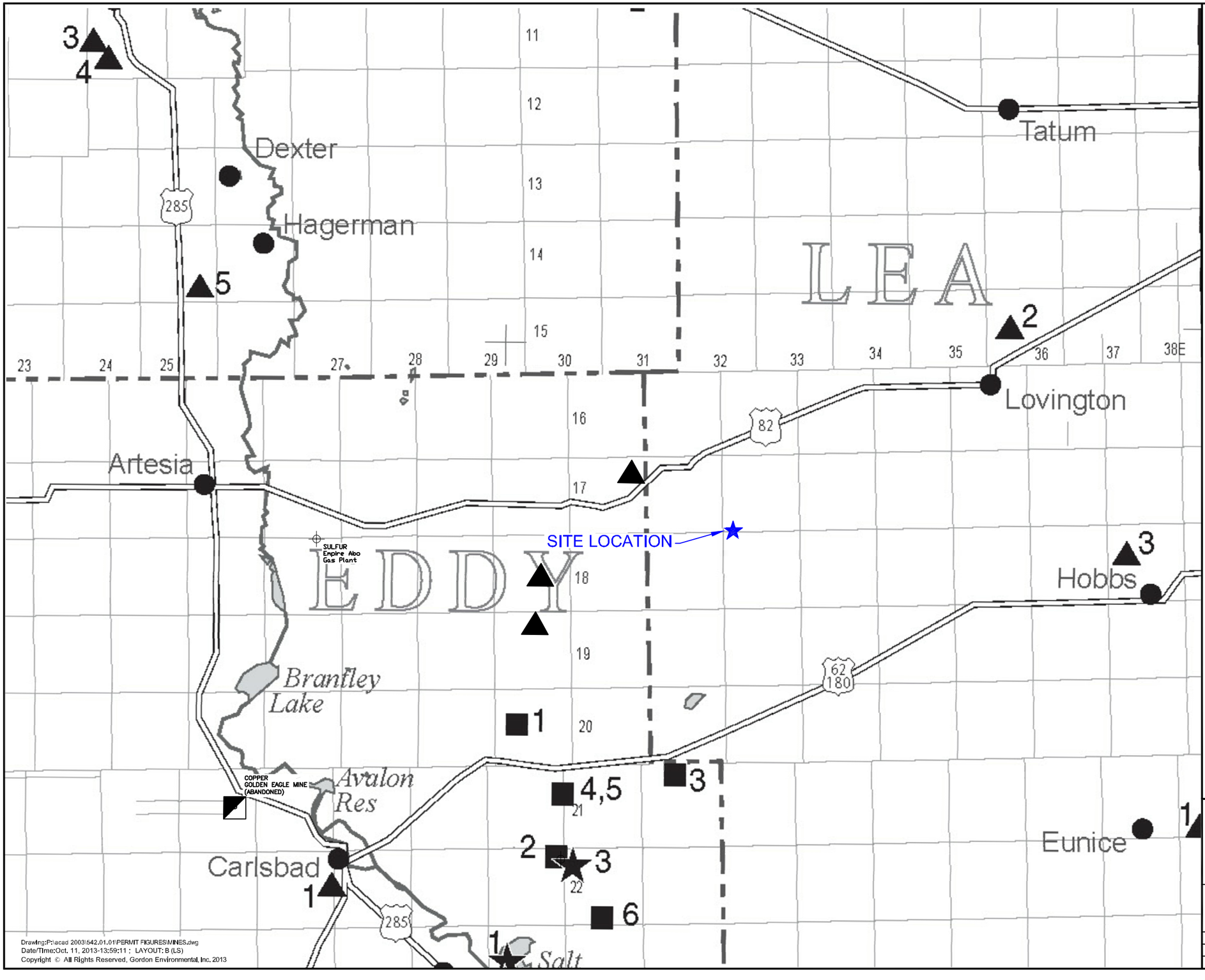

LEGEND

★ SITE LOCATION

- ▲ Aggregate and stone mining
- ◊ Coal mining
- ★ Industrial minerals, mining, and milling
- ◩ Metals
- ■ Potash mining and milling
- □ Smelters, converters, and refineries
- ♦ Uranium mining and milling

MINES DATA FROM: 2001 MINES MILLS AND QUARRIES MAP, MINING AND MINERALS DIVISION, NM ENERGY, MINERALS AND NATURAL RESOURCES DEPT.
NMBGMR NMIMT, AND
NM BUREAU OF MINE INSPECTION.
AND HOBBS, NM-TX, 2007, 1:100000 30X60 SERIES TOPOGRAPHIC SURFACE MANAGEMENT BLM MAP.

NOTE:
THIS MAP WAS COMPARED TO THE CURRENT (01-10-2013) ONLINE VERSION OF THE MINES, MILLS AND QUARRIES WEB MAP @ (http://www.emnrd.state.nm.us/MMD/MRRS/MinesMillsQuarriesWebMap.htm) AND NO NEW ACTIVE MINES OR ABANDONED MINES WERE DEPICTED NEAR THE SITE.

NORTH

0 20000' 40000'

MINES, MILLS, AND QUARRIES MAP

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/11/2013	CAD: MINES.dwg	PROJECT #: 542.01.01
DRAWN BY: MLH	REVIEWED BY: ANY	FIGURE IV.1.7
APPROVED BY: IKG	gek@gordonenvironmental.com	

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LEGEND

- SITE BOUNDARY (562 ACRES±)
- 500' SETBACK FROM SITE BOUNDARY
- 29 Z 3991.1 SURVEY CONTROL POINT

AERIAL SURVEY BY DALLAS AERIAL SURVEYS, INC. (D.A.S.)
MAPPING AND SURVEYING
10220 Forest Lane
Dallas, Texas 75243
(214)349–2200 (800)862–2190
(214)349–2193 Fax
www.dasmaps.com
D.A.S. JOB No. 13113

IMAGE:
2011 NAIP COLOR MOSAIC
RESOLUTION: 1PIXEL = 1 METER

NORTH

0 300' 600'

AERIAL PHOTOGRAPH

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

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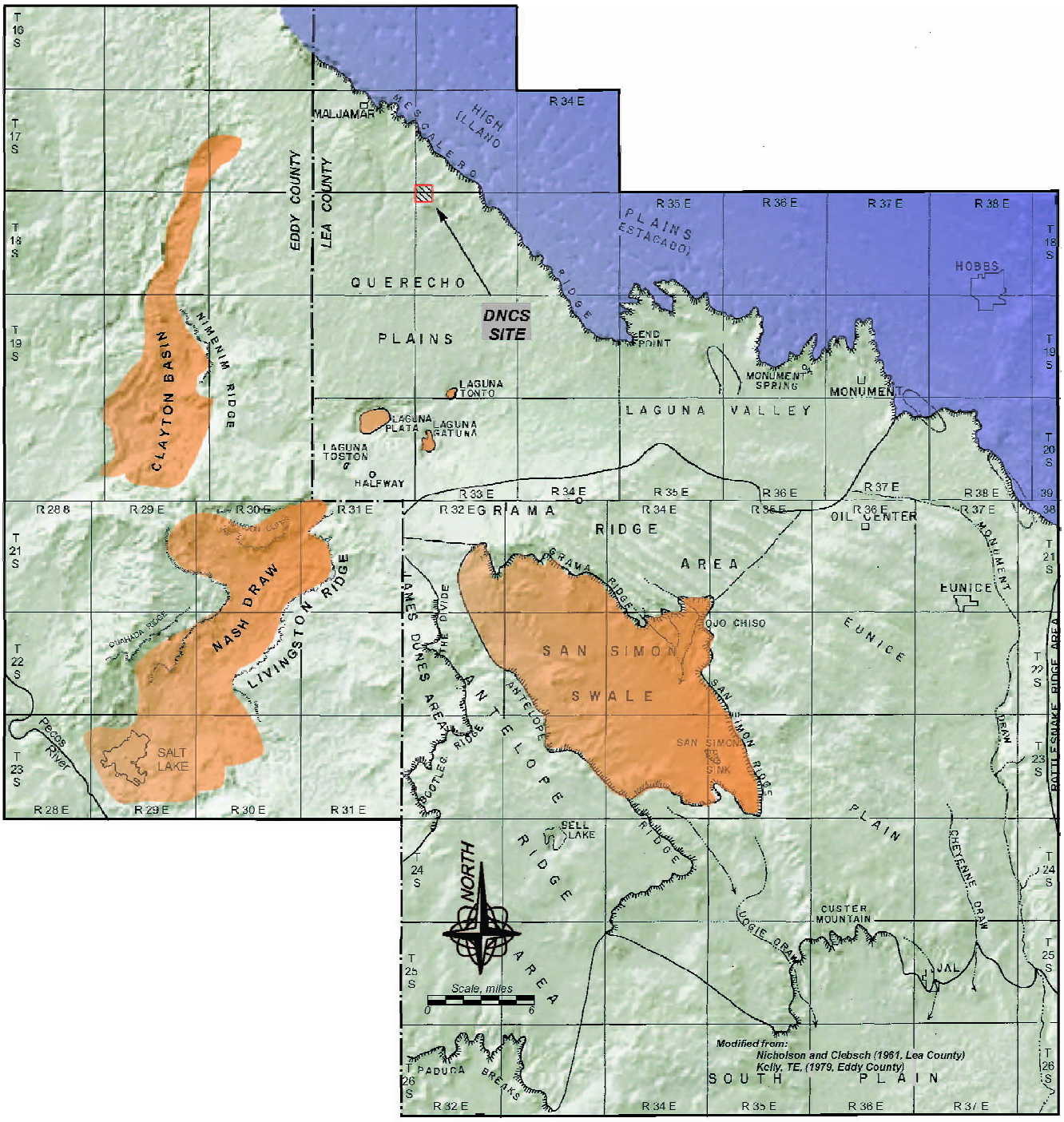
APPROVED BY: IKG	gei@gordonenvironmental.com	



PHYSIOGRAPHY OF SOUTHERN LEA COUNTY AND EASTERN EDDY COUNTY

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: PHYSIOGRAPHY.dwg	PROJECT #: 542.01.01
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APPROVED BY: IKG	gei@gordonenvironmental.com	

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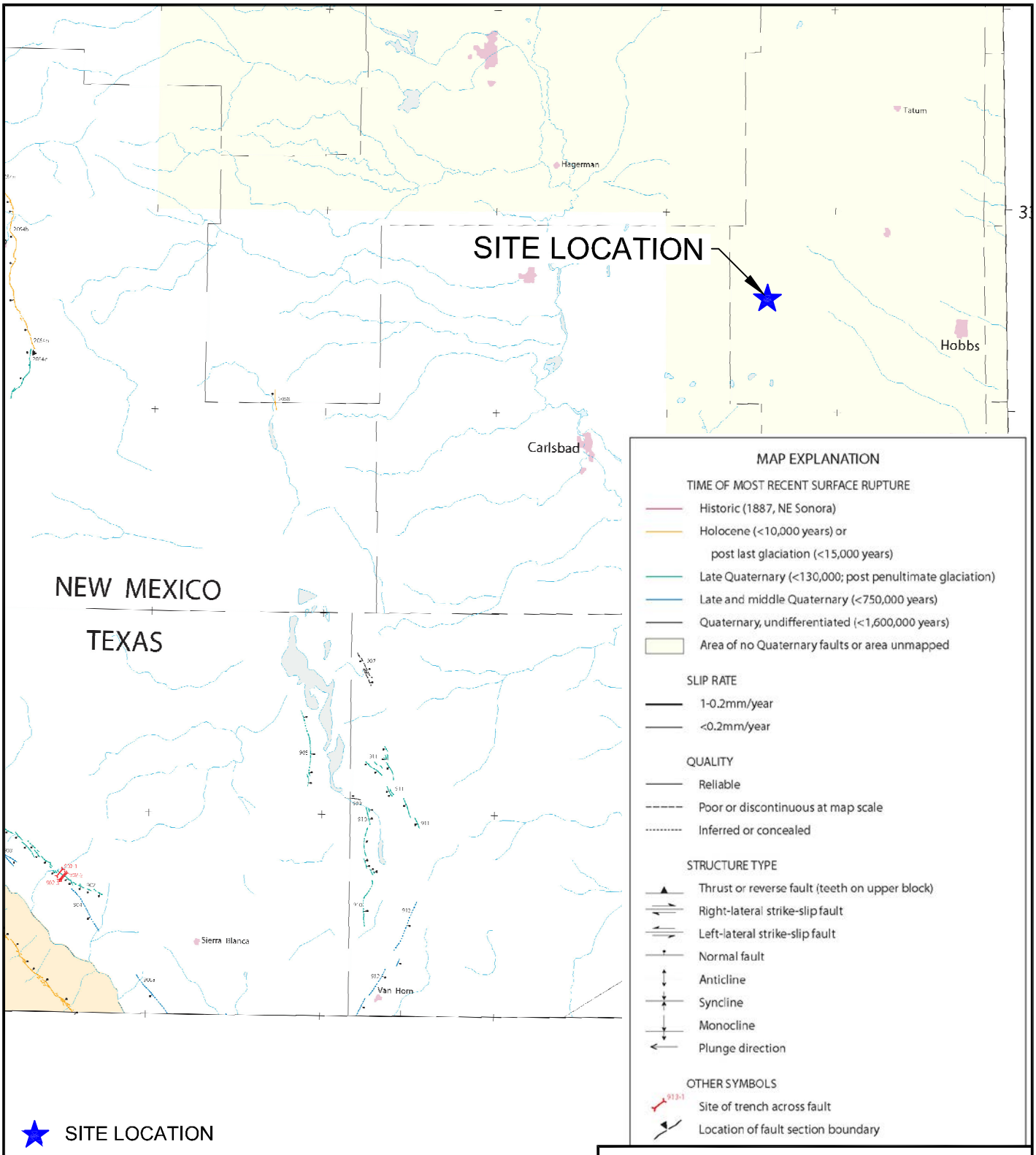

★ SITE LOCATION

FAULT DATA FROM:
USGS Open File Report OFR 98–521
(digital version)
Map of Quaternary faults and folds in New Mexico and adjacent areas, 1998, by Michael N. Machette, Stephen F. Personius, Keith I. Kelson. Kathleen M. Haller, and Richard L. Dart.

NORTH

0 12 24 MILES

QUATERNARY FAULTS MAP

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/11/2013	CAD: FAULTS.dwg	PROJECT #: 542.01.01
DRAWN BY: MLH	REVIEWED BY: DRT	FIGURE IV.1.10
APPROVED BY: IKG	gei@gordonenvironmental.com	

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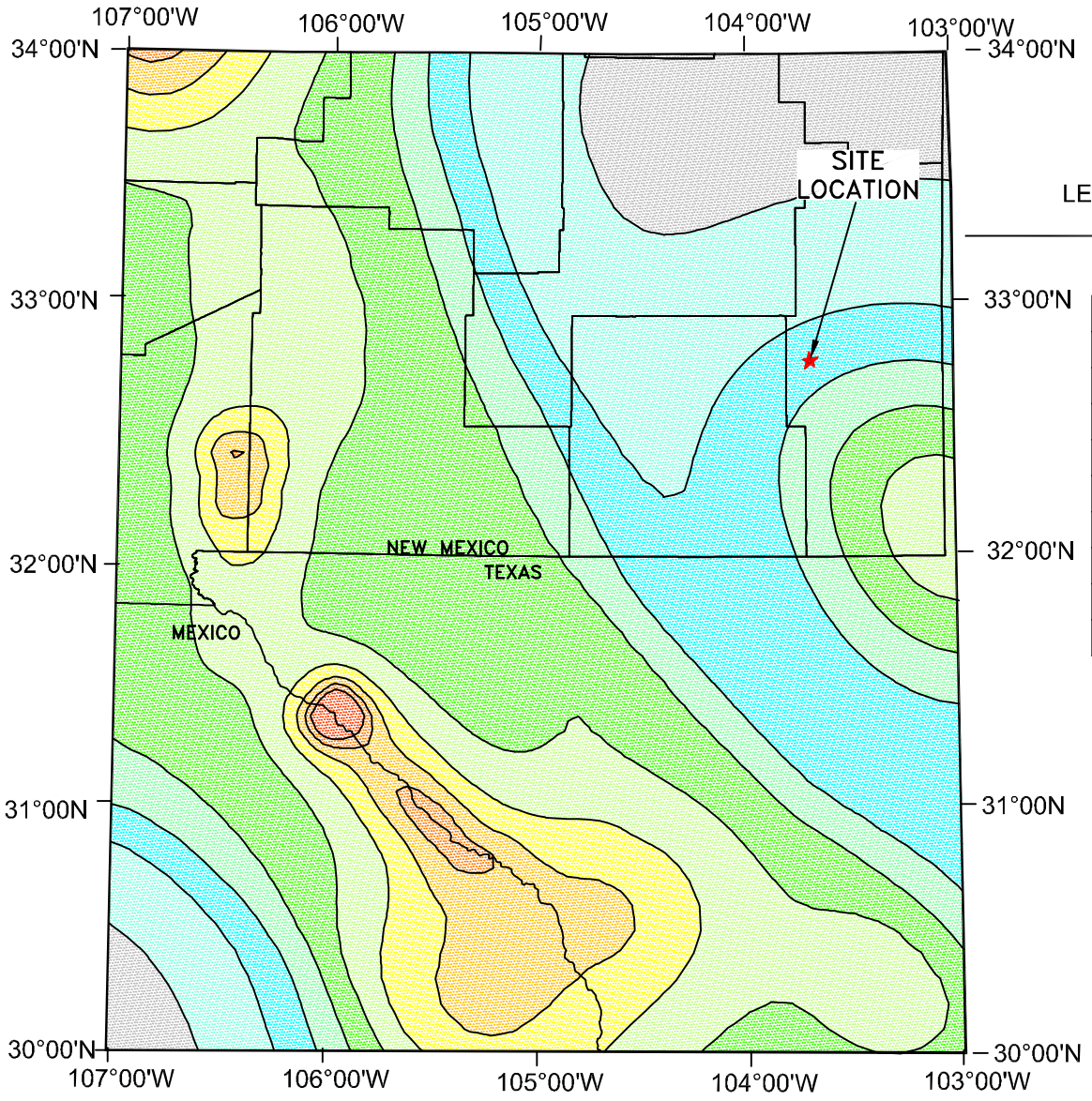
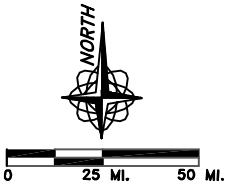


Peak Horizontal Ground Acceleration (g) with 10% Probability of Exceedance in 250 Years



NOTES:

1. SEISMIC DATA FROM: USGS NATIONAL HAZARD MAPPING PROJECT GIS DATA and Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61.

2. GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE: 32.7828° N, 103.7026° W

3. Peak Horizontal Ground Acceleration (g) with 10% Probability of Exceedance in 250 Years For the Site = 0.0704 (g)

SEISMIC IMPACT ZONES MAP

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/11/2013	CAD: SEISMIC.dwg	PROJECT #: 542.01.01
DRAWN BY: MLH	REVIEWED BY: DRT	FIGURE IV.1.11
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SEISMIC.dwg
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APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.A

WATERCOURSES, FLOODPLAINS, AND WETLANDS INVESTIGATION

(ROCKY MOUNTAIN ECOLOGY 05/09/2013)

WATERCOURSES, FLOODPLAINS, AND WETLANDS INVESTIGATION

FOR A SURFACE WASTE MANAGEMENT FACILITY ON 562 ACRES IN PORTIONS OF SECTION 31, TOWNSHIP 17 SOUTH, RANGE 33 EAST, AND SECTION 6, TOWNSHIP 18 SOUTH, RANGE 33 EAST, LEA COUNTY, NM FOR DNCS PROPERTIES, LLC

PREPARED FOR:

GORDON ENVIRONMENTAL, INC.
213 S. CAMINO DEL PUEBLO
BERNALILLO, NM 87004

PREPARED BY:

ROCKY MOUNTAIN ECOLOGY, LLC
5 ALCALDE ROAD
SANTA FE, NM 87508

WATERCOURSES, FLOODPLAINS, AND WETLANDS INVESTIGATION

FOR A SURFACE WASTE MANAGEMENT FACILITY ON 562 ACRES IN PORTIONS OF SECTION 31, TOWNSHIP 17 SOUTH, RANGE 33 EAST, AND SECTION 6, TOWNSHIP 18 SOUTH, RANGE 33 EAST, LEA COUNTY, NM FOR DNCS PROPERTIES, LLC

PREPARED FOR:

GORDON ENVIRONMENTAL, INC.
213 S. CAMINO DEL PUEBLO
BERNALILLO, NM 87004

PREPARED BY:

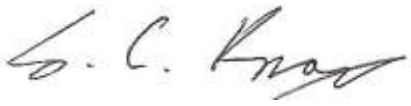
ROCKY MOUNTAIN ECOLOGY, LLC
5 ALCALDE ROAD
SANTA FE, NM 87508

PREPARATION DATE:

MAY 9, 2013

INVESTIGATOR/S:

SHAWN C. KNOX, M.S., C.W.B
DIRECTOR, ROCKY MOUNTAIN ECOLOGY, LLC



Signature

Table of Contents

1.0. INTRODUCTION

This document describes results of an investigation for presence and extent of watercourses, floodplains and wetlands on a ± 562-acre a tract of land in Lea County, New Mexico (NM). The property is owned by DNCS Properties, LLC (DNCS Site). DNCS plans to pursue a permit, issued by the Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department (OCD), for a "Surface Waste Management Facility" per the Oil & Gas Rules (19.15.2.7.S(11) NMAC). The permit would authorize establishment of an oil and gas waste landfill, and processing facilities. As a proposed Surface Waste Management Facility, the DNCS Site would be subject to the siting requirements set forth in 19.15.36.13(A-C) NMAC. This report specifically addresses those requirements in 19.15.36.13.B, excluding "existing wellhead protection areas."

> *SITING AND OPERATIONAL REQUIREMENTS APPLICABLE TO ALL PERMITTED SURFACE WASTE MANAGEMENT FACILITIES: Except as otherwise provided in 19.15.36 NMAC.*
>
> *B. No surface waste management facility shall be located:*
> *(1) within 200 feet of a watercourse, lakebed, sinkhole or playa lake;*
> *(2) within an existing wellhead protection area or 100-year floodplain;*
> *(3) within, or within 500 feet of a wetland.*

The DNCS Site is located in portions of Section 31, Township 17 South, Range 33 East, and Section 6, Township 18 South, Range 33 East. The project area occurs on the Dog Lake, NM U.S. Geological Survey (USGS) 7.5-minute quadrangle map (Figures 1-3).

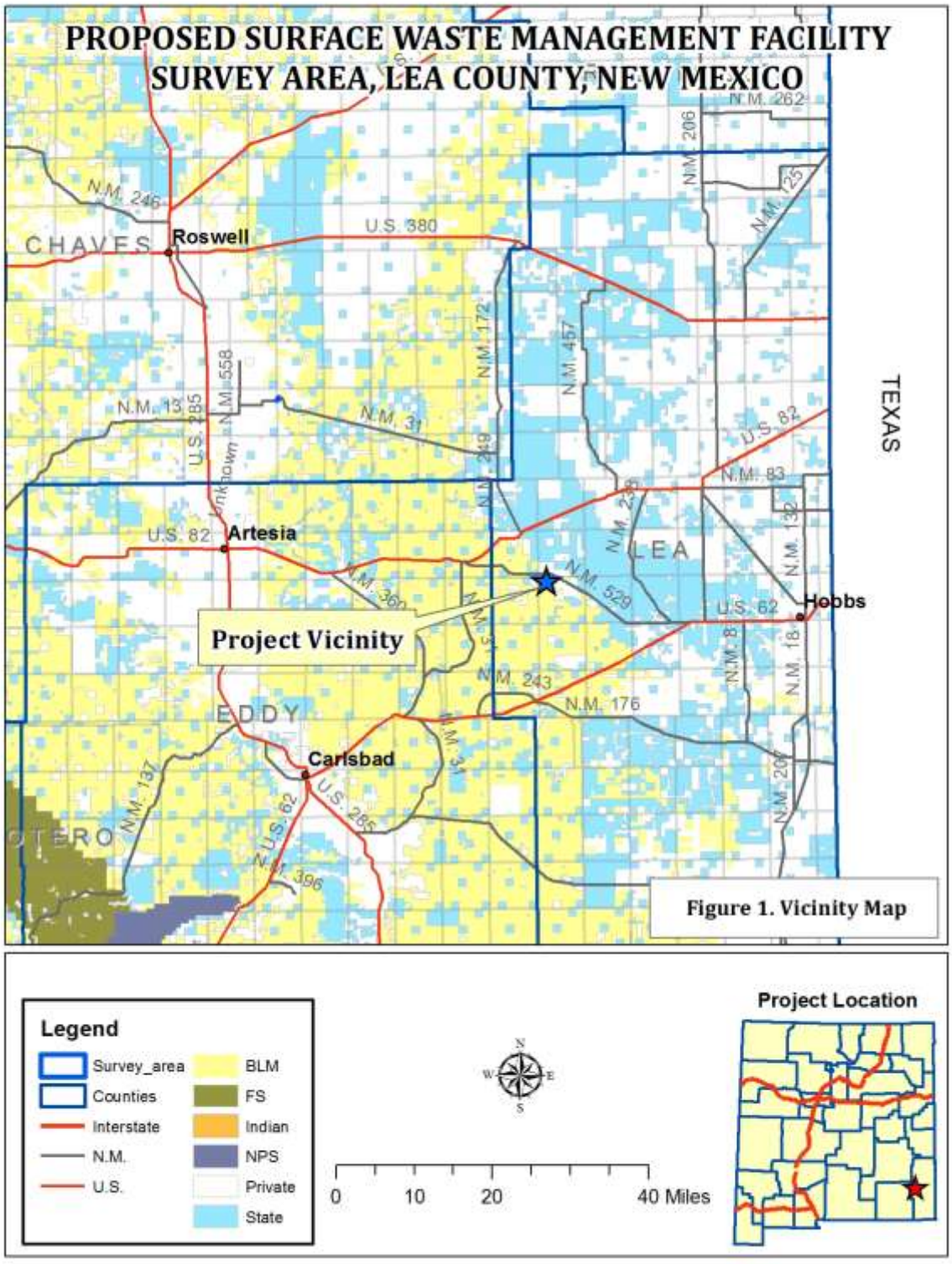


Figure 1. Vicinity Map

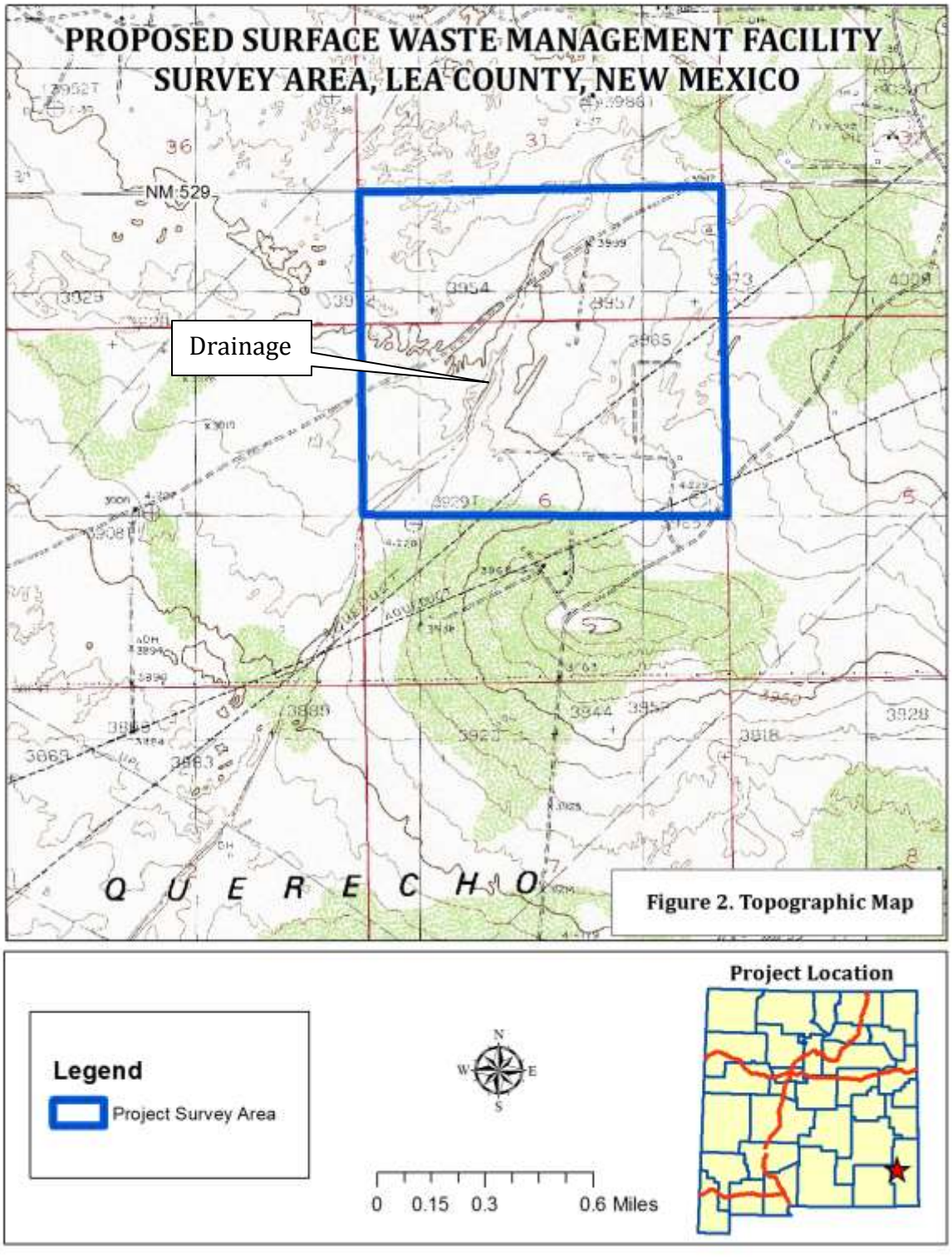


Figure 2. Topographic Map

Figure 3. Aerial Photo

2.0 METHODS

Shawn C. Knox, from Rocky Mountain Ecology, LLC (RME) conducted a field survey of the DNCS Site on 29-30 April 2013. Portions of the property were inspected through vehicular survey and others via a pedestrian survey (Appendix A. Photos). Prior to the field survey, topographic maps and US Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP) ortho-photography were evaluated to ascertain where depressions exist on the landform which could channel or pond water. Further, the National Wetland Inventory (NWI) (http://www.fws.gov/wetlands/data) and USDA Natural Resource Conservation Service Web Soil Survey (http://websoilsurvey.nrcs.usda.gov) databases were queried to gather existing data on potential wetlands and wetland soils that could occur. Moreover, the National Hydrography Dataset (NHD)(USGS 1999) was assessed in a Geographical Information System (GIS) to gather data regarding watercourses in the project area. Finally, the Federal Emergency Management Agency (FEMA) Map Service Center database (https://msc.fema.gov) (FEMA 2013), and Lea County Floodplain Administrator were consulted for information regarding the 100-year floodplain. A search for watercourses, lakebeds, sinkholes, playa lakes, wetlands and floodplains was conducted in the field.

3.0 GENERAL ENVIRONMENTAL SETTING

The project area occurs within the Shinnery Sands subregion of the High Plains Ecoregion (Griffith, et. al 2006). "The Shinnery Sands subregion includes sand hills and dunes as well as flat sandy recharge areas. These sand beds lie at the western edge of the High Plains where winds rising onto the plateau drop the heavier sand grains and carry the finer material further east onto the flat expanse of the Llano Estacado (25i). These dunes serve as a major recharge area for the Pecos River" (Griffith et al 2006).

The project area is located within the eight-digit Hydrologic Unit Code (HUC) #13010005 (USGS 1999). The specific twelve-digit watershed that encompasses the DNCS Site is the Williams Sink basin, HUC # 130600111501. This is a closed basin watershed according to the NHD (USGS 1999) (Figure 4). Water within the Williams Sink basin percolates into the groundwater table and does not directly exit the watershed boundary via surface runnoff. Surface runnoff through the DNCS Site flows in a southwestern direction.

The DNCS Site is located within the Plains-Mesa Scrub vegetation type as defined by Dick-Peddie (1993). Dominant plant species include shin oak (*Quercus havardii*), sand sage (*Artemesia filifolia*) and various species of dropseeds (*Sporobolus* spp.).

The project area is located on slopes ranging from 0 to 15 percent. Elevation above sea level within the project area ranges from 3,995 to 3,917 ft above sea level in the Northeast and Southwest portions, respectively. The warmest average daily maximum temperature in Maljamar, NM occurs in July at 98.0 degrees Fahrenheit (°F); while the coldest average daily minimum temperature of 59.0 °F occurs in December and January. Annual precipitation averages 16.27 inches (in) (The Weather Channel 2013).

The soil map units represented in the project area are the SR—Simona-Upton association(0-3% slopes), PY—Pyote soils and dune land (0-3% slopes), and PU—Pyote and maljamar fine sands (0-3%), . MN—Midessa and wink fine sandy loams (0-3%), KM—Kermit soils and dune land, (0 to 12%

slopes), and BE—Berino-Cacique loamy fine sands (0-3% slopes) (USDA-NRCS 2013). No hydric soils are present; nor is ponding probable on any of the soils in the project area (Appendix B). All soils within the project area are labeled as excessively drained or well drained. Moreover, depth to water table across the project area is greater than 200 centimeters (USDA-NRCS 2013). Detailed information regarding soil characteristics is located in Appendix B.

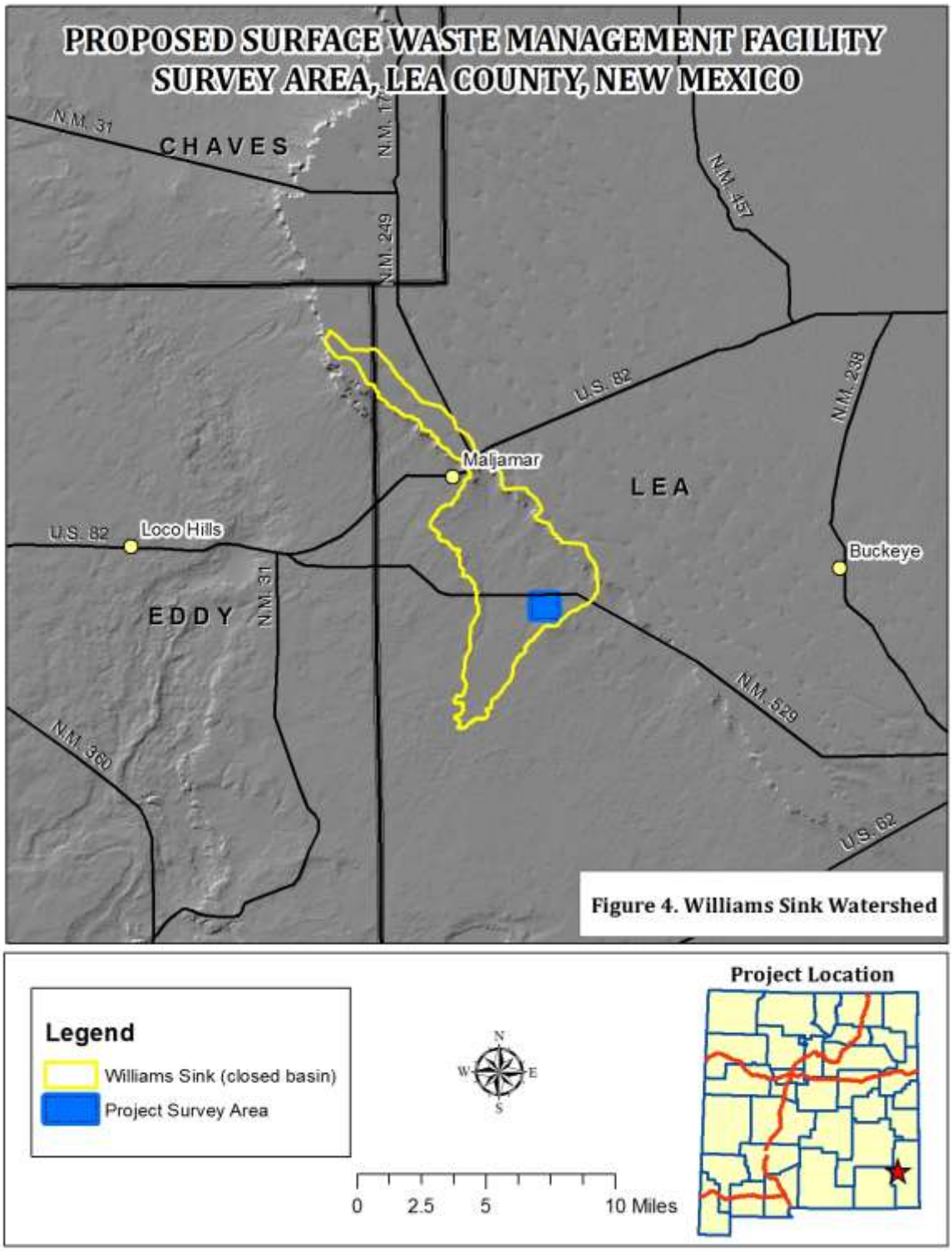


Figure 4. Williams Sink Watershed

4.0 RESULTS

4.1 Watercourses

One noteworthy, un-named ephemeral drainage flows from the Northeast, to the Southwest corner of the DNCS Site (Figure 2). No surface water was located within this drainage during the field survey. The Oil & Gas Rules define a "watercourse" as a "*river, creek, arroyo, canyon, draw or wash or other channel having definite banks and bed with visible evidence of the occasional flow of water*" (19.15.27.W(4) NMAC). Based on the field investigation, the un-named ephemeral drainage identified within the site may be a defined as a watercourse, as it does have definite banks and a bed with visible evidence of occasional water flow.

The U.S. Army Corps of Engineers (USACE) was not consulted regarding a preliminary jurisdictional determination (PJD) via this scope of work. However, it appears there is no possibility that any Waters of the U.S., as defined by the USACE, occur within the project boundary. There is no possibility that the subject drainage described above, could provide "interstate commerce."

A pipeline is located on the surface in the bottom of this drainage. Based on the USGS (1999), the DNCS Site is located entirely within the Williams Sink closed basin. Accordingly, runnoff from this site drains to the Southwest, beyond the property boundary, ultimately percolating into the ground within the basin boundary (Figure 4). Further, two aqueducts are located across the southeast portion of the DNCS property, as depicted in Figure 2.

4.2 100-Year Floodplain

The FEMA Map Service Center database indicated that the project area has not been mapped for floodplain occurrence. However, the Lea County Floodplain Administrator, Cassie Corely, indicated that the DNCS Site does is not located within a floodplain (Lea County 2013) (Appendix C).

4.3 Lakebeds

No lakebeds were observed on the property during the field survey.

4.4 Playa lakes

No playa lakes were observed on the property during the field survey. The region contains thousands of playa lakes, though the DNCS Site does not contain any based on NHD data (USGS 1999) and the field survey.

4.5 Sinkholes

No sinkholes were observed on the property during the field survey.

4.6 Wetlands

The DNCS Site was evaluated in the field for the presence of some wetland indicators (i.e., hydrophytic vegetation and wetland hydrology) by RME during the field surveys. The NWI database, pre-survey review indicated that the main drainage (described in Section 4.1 and depicted in Figure 2) is classified as a "dry wash/ arroyo"(USDI-FWS 2013). Jim Dick, from the

USFWS, indicated on 6 May 2013, that this drainage is not a wetland (USDI-FWS 2013b) (Appendix C).

A formal, wetland delineation was not conducted on the DNCS property because it did not show signs of wetland occurrence, which could warrant a more detailed assessment. No signs of wetlands exist within the proposed area. No Facultative Wetland or Obligate Wetland plant species, as defined by the USACE (2012), were observed during the field survey, within the DNCS Site. One minor depression (~ 60 x 60 ft), was observed near the eastern project boundary (Appendix B - Photo 6). This depression contained a stand of vine mesquite (*Panicum obtusum*), rated as a "Facultative" species, according to the 2012 National Wetland Plant List (USACE 2012). However, this site did not show any signs of wetland occurrence, as described above, and does not warrant further assessment.

5.0 Discussion & Recommendations

The DNCS Site is located within the Williams Sink closed basin, according to the USGS (1999), and all surface runnoff percolates into the groundwater table within the basin boundary (Figure 4). From NHD data, it appears the basin is not connected to any other drainages. One main ephemeral wash drains in a southwesterly direction across the DNCS Site (Figure 2). To the best of my knowledge, based on field surveys and analysis of topographic maps and aerial photography, I (Shawn Knox) believe that no Waters of the U.S., as defined by the USACE, are located within the DNCS Site. If a definitive determination is desired, it is recommended that the USACE be contacted regarding an official PJD or Jurisdictional Determination (JD).

Based on the definition of a "watercourse", as defined by the Oil & Gas Rules (19.15.27.W(4) NMAC), the un-named ephemeral drainage identified within the site may be a defined as a watercourse. This drainage does have definite banks and a bed with visible evidence of occasional water flow.

No floodplains are located within the DNCS Site, based on the field survey and determination by the Lea County Floodplain Administrator (Appendix C).

No lakebeds or playa lakes were observed within the DNCS Site boundary, based on the field survey, and analysis of NHD data.

No sinkholes were observed on the property during the field survey.

No evidence of wetlands, as defined by the USACE, was observed during the field survey, or detected from the pre-survey soil analysis in the USDA-NRCS Web Soil Survey database.

6.0 REFERENCES

Dick-Peddie, W.A. 1993. New Mexico Vegetation: Past, Present, and Future. UNM Press.

Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S.,Mercer, D., Hill, R., and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Lea County. 2013. Floodplain Administrator, Cassie Corely. Letter of Floodplain Determination. May 2013.

The Weather Channel. 2013.Weather data for Maljamar, NM accessed May 2013.

USDHS-FEMA. 2013. Federal Emergency Management Agency Map Service Center. Database accessed May 2013.

USDA-FSA. 2011. Farm Service Agency. National Agricultural Imagery Program. NAIP 2011.

USDA-NRCS. 2013. Natural Resource Conservation Service Web Soil Survey database. Accessed May 2013.

USDI-FWS. 2013. US Fish and Wildlife Service. Personal communication with Jim Dick, Regional Wetlands Coordinator. May 6, 2013.

USDI-FWS. 2013b. US Fish and Wildlife Service National Wetland Inventory. Database accessed May 2013.

USGS 1999. National Hydrography Dataset. US Geological Survey.

APPENDICES
APPENDIX A - PHOTOS

Photo 1. View of drainage, facing to the Southwest from the North-Central portion of the property.

Photo 2. View of drainage from the central portion of the property.

Photo 3. View of pipeline, located in bottom of the subject drainage.

Photo 4. Representative view of the property, facing to the Northwest from the central portion of the property.

Photo 5. Typical view of a small sand blowout depression in the southeast portion which likely channels water during runnoff events.

Photo 6. View of minor depression with vine mesquite in the bottom, located near the western boundary.

Photo 7. View of the northeast portion of the property.

Photo 8. View of the south-central portion of the property, facing southeast.

Photo 9. View of the east-central portion of the property, facing east.

APPENDIX B – NRCS SOILS DATA

Lea County, New Mexico

BE—Berino-Cacique loamy fine sands association

Map Unit Setting

Landscape: Uplands
Elevation: 3,000 to 3,400 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 195 to 205 days

Map Unit Composition

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

Description of Berino

Setting

Landform: Plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian deposits derived from sedimentary rock over calcareous sandy alluvium derived from 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
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7c
Hydrologic Soil Group: B
Ecological site: Loamy Sand (R042XC003NM)

Typical profile

0 to 6 inches: Loamy fine sand
6 to 60 inches: Sandy clay loam

Description of Cacique

Setting

Landform: Plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous eolian deposits derived from sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to petrocalcic
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: 5 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7c
Hydrologic Soil Group: C
Ecological site: Sandy (R042XC004NM)

Typical profile

0 to 12 inches: Loamy fine sand
12 to 28 inches: Sandy clay loam
28 to 38 inches: Cemented material

Data Source Information

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

Lea County, New Mexico

KM—Kermit soils and dune land, 0 to 12 percent slopes

Map Unit Setting

Landscape: Sandhills
Elevation: 3,000 to 4,400 feet
Mean annual precipitation: 10 to 15 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 195 to 205 days

Map Unit Composition

Dune land: 45 percent
Kermit and similar soils: 45 percent

Description of Kermit

Setting

Landform: Dunes
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex
Parent material: Calcareous sandy eolian deposits derived from sedimentary rock

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Sandhills (R042XC022NM)

Typical profile

0 to 8 inches: Fine sand
8 to 60 inches: Fine sand

Description of Dune Land

Setting

Landform: Dunes
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, concave, convex
Across-slope shape: Convex

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8e
Hydrologic Soil Group: A

Typical profile

0 to 6 inches: Fine sand
6 to 60 inches: Fine sand

Data Source Information

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

Lea County, New Mexico

MN—Midessa and wink fine sandy loams

Map Unit Setting

Landscape: Uplands
Elevation: 3,100 to 3,400 feet
Mean annual precipitation: 10 to 15 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 190 to 205 days

Map Unit Composition

Midessa (ratliff) and similar soils: 45 percent
Wink and similar soils: 40 percent

Description of Midessa (ratliff)

Setting

Landform: Plains
Landform position (three-dimensional): Dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous alluvium and/or calcareous eolian deposits derived from 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: 50 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 6c
Hydrologic Soil Group: B
Ecological site: Loamy (R042XC007NM)

Typical profile

0 to 4 inches: Fine sandy loam
4 to 22 inches: Clay loam
22 to 60 inches: Clay loam

Description of Wink

Setting

Landform: Plains
Landform position (three-dimensional): Dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous sandy alluvium and/or calcareous sandy eolian deposits derived from 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): 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: 30 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Very low (about 2.9 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Sandy (R042XC004NM)

Typical profile

0 to 12 inches: Fine sandy loam
12 to 23 inches: Sandy loam
23 to 60 inches: Sandy loam

Data Source Information

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

Lea County, New Mexico

PU—Pyote and maljamar fine sands

Map Unit Setting

Landscape: Uplands
Elevation: 3,000 to 3,900 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 190 to 200 days

Map Unit Composition

Maljamar and similar soils: 45 percent
Pyote and similar soils: 45 percent

Description of Pyote

Setting

Landform: Plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian deposits derived from 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): 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
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 6e
Land capability (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Loamy Sand (R042XC003NM)

Typical profile

0 to 30 inches: Fine sand
30 to 60 inches: Fine sandy loam

Description of Maljamar

Setting

Landform: Plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian deposits derived from sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 40 to 60 inches to petrocalcic
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: 5 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 6e
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Loamy Sand (R042XC003NM)

Typical profile

0 to 24 inches: Fine sand
24 to 50 inches: Sandy clay loam
50 to 60 inches: Cemented material

Data Source Information

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

Lea County, New Mexico

PY—Pyote soils and dune land

Map Unit Setting

Landscape: Sandhills
Elevation: 3,000 to 4,400 feet
Mean annual precipitation: 10 to 15 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 190 to 205 days

Map Unit Composition

Dune land: 45 percent
Pyote and similar soils: 45 percent

Description of Pyote

Setting

Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy eolian deposits derived from 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): 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
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 6e
Land capability (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Loamy Sand (R042XC003NM)

Typical profile

0 to 30 inches: Fine sand
30 to 60 inches: Fine sandy loam

Description of Dune Land

Setting

Landform: Dunes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8e
Hydrologic Soil Group: A

Typical profile

0 to 6 inches: Fine sand
6 to 60 inches: Fine sand

Data Source Information

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

Lea County, New Mexico

SR—Simona-Upton association

Map Unit Setting

Landscape: Tablelands
Elevation: 3,000 to 4,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 59 to 62 degrees F
Frost-free period: 190 to 205 days

Map Unit Composition

Simona and similar soils: 50 percent
Upton and similar soils: 35 percent

Description of Simona

Setting

Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Calcareous eolian deposits derived from sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
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: 50 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Very low (about 1.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Shallow Sandy (R042XC002NM)

Typical profile

0 to 8 inches: Gravelly fine sandy loam
8 to 16 inches: Fine sandy loam
16 to 26 inches: Cemented material

Description of Upton

Setting

Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Calcareous eolian deposits derived from sedimentary rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 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: 75 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Very low (about 0.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 6e
Land capability (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: Shallow (R042XC025NM)

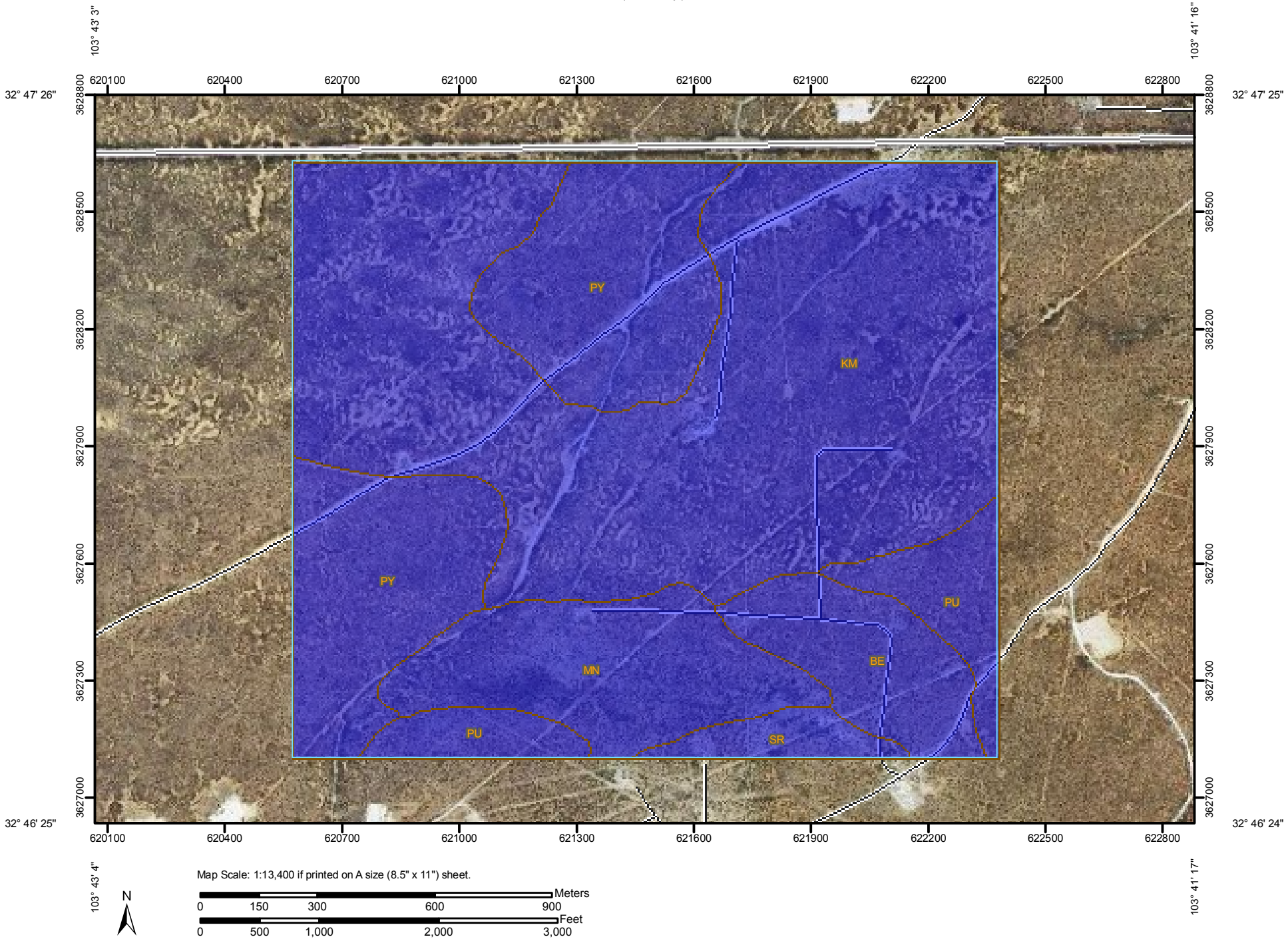
Typical profile

0 to 8 inches: Gravelly loam
8 to 18 inches: Cemented material
18 to 60 inches: Very gravelly loam

Data Source Information

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

Depth to Water Table—Lea County, New Mexico
(Soil Map)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:13,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Lea County, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Date(s) aerial images were photographed: Data not available.

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.

Depth to Water Table

Depth to Water Table— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
BE	Berino-Cacique loamy fine sands association	>200	43.7	6.4%
KM	Kermit soils and dune land, 0 to 12 percent slopes	>200	363.4	53.4%
MN	Midessa and wink fine sandy loams	>200	73.3	10.8%
PU	Pyote and maljamar fine sands	>200	40.2	5.9%
PY	Pyote soils and dune land	>200	145.4	21.4%
SR	Simona-Upton association	>200	14.2	2.1%
Totals for Area of Interest			**680.2**	**100.0%**

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

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.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

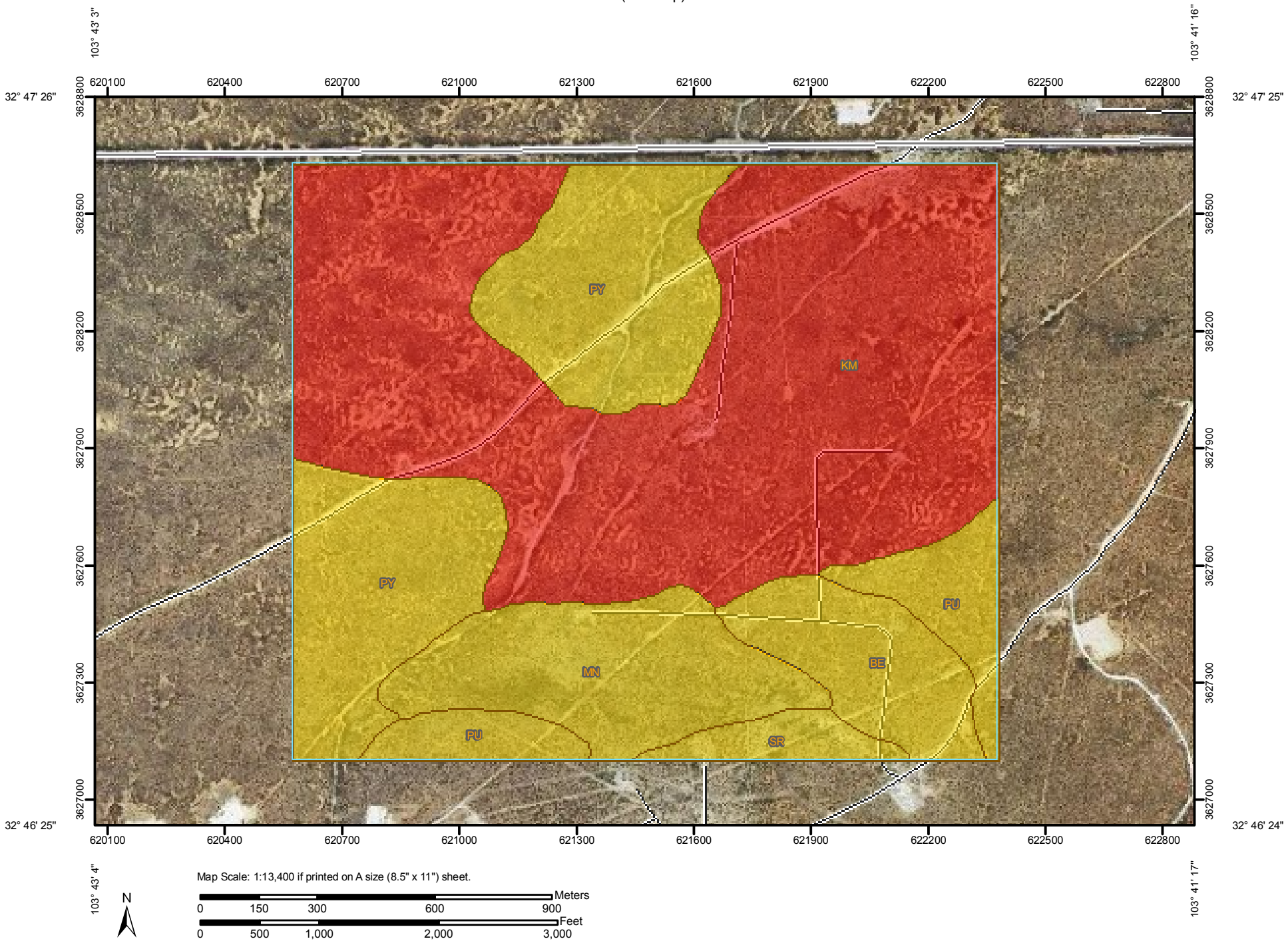
Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

Drainage Class—Lea County, New Mexico
(Soil Map)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:13,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Lea County, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Date(s) aerial images were photographed: Data not available.

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.

Drainage Class

Drainage Class— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BE	Berino-Cacique loamy fine sands association	Well drained	43.7	6.4%
KM	Kermit soils and dune land, 0 to 12 percent slopes	Excessively drained	363.4	53.4%
MN	Midessa and wink fine sandy loams	Well drained	73.3	10.8%
PU	Pyote and maljamar fine sands	Well drained	40.2	5.9%
PY	Pyote soils and dune land	Well drained	145.4	21.4%
SR	Simona-Upton association	Well drained	14.2	2.1%
Totals for Area of Interest			**680.2**	**100.0%**

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

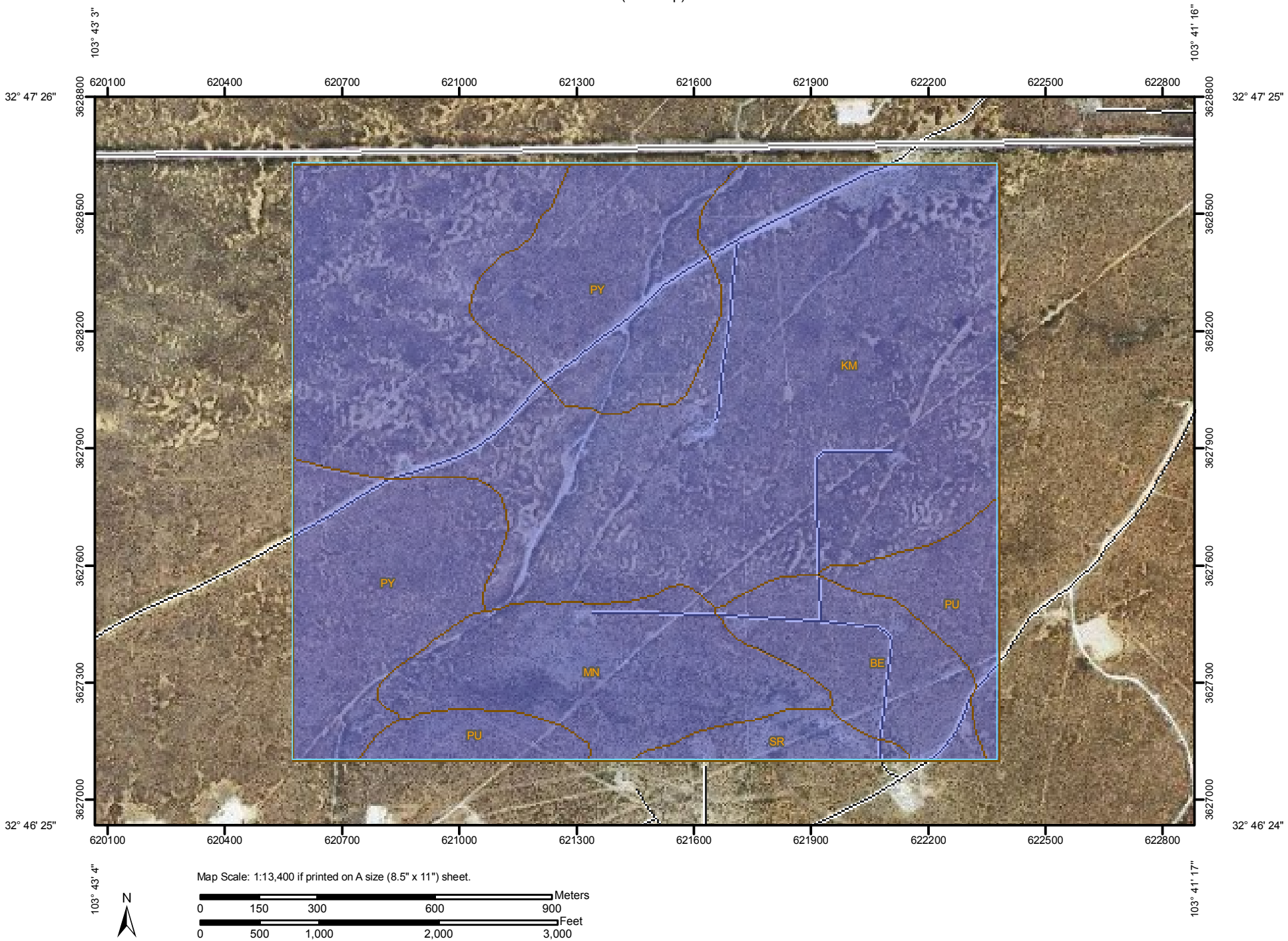
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydric Rating by Map Unit—Lea County, New Mexico
(Soil Map)



MAP LEGEND

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

Soils
- Soil Map Units

Soil Ratings
- All Hydric
- Partially Hydric
- Not Hydric
- Unknown Hydric
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:13,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Lea County, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Date(s) aerial images were photographed: Data not available.

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.

Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BE	Berino-Cacique loamy fine sands association	Not Hydric	43.7	6.4%
KM	Kermit soils and dune land, 0 to 12 percent slopes	Not Hydric	363.4	53.4%
MN	Midessa and wink fine sandy loams	Not Hydric	73.3	10.8%
PU	Pyote and maljamar fine sands	Not Hydric	40.2	5.9%
PY	Pyote soils and dune land	Not Hydric	145.4	21.4%
SR	Simona-Upton association	Not Hydric	14.2	2.1%
Totals for Area of Interest			**680.2**	**100.0%**

Description

This rating indicates the proportion of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is designated as "all hydric," "partially hydric," "not hydric," or "unknown hydric," depending on the rating of its respective components.

"All hydric" means that all components listed for a given map unit are rated as being hydric, while "not hydric" means that all components are rated as not hydric. "Partially hydric" means that at least one component of the map unit is rated as hydric, and at least one component is rated as not hydric. "Unknown hydric" indicates that at least one component is not rated so a definitive rating for the map unit cannot be made.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

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.

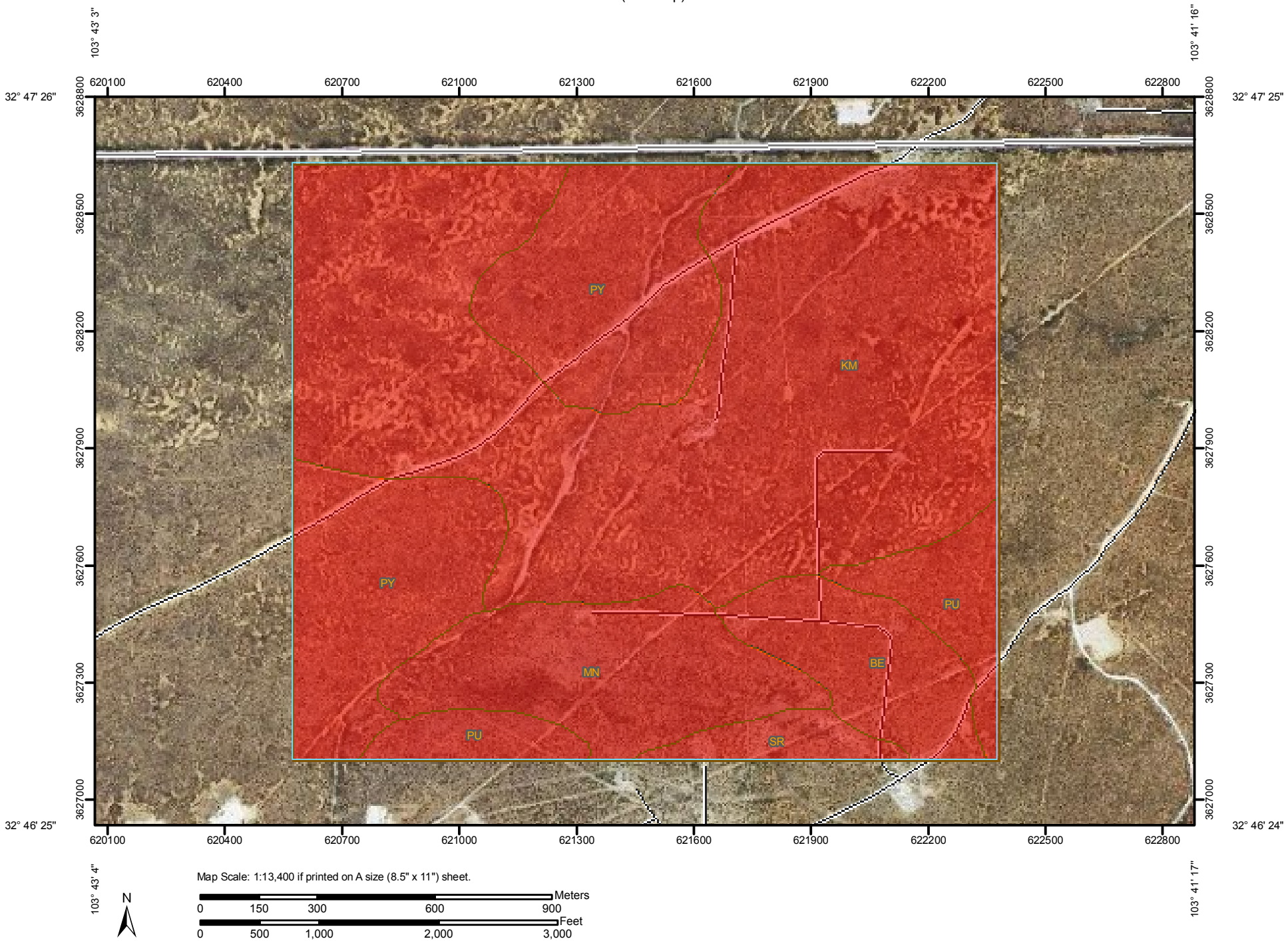
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

Aggregation Method: Absence/Presence

Tie-break Rule: Lower

Ponding Frequency Class—Lea County, New Mexico
(Soil Map)



MAP LEGEND

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

Soils
- Soil Map Units

Soil Ratings
- None
- Rare
- Occasional
- Frequent

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:13,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Lea County, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Date(s) aerial images were photographed: Data not available.

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.

Ponding Frequency Class

Ponding Frequency Class— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BE	Berino-Cacique loamy fine sands association	None	43.7	6.4%
KM	Kermit soils and dune land, 0 to 12 percent slopes	None	363.4	53.4%
MN	Midessa and wink fine sandy loams	None	73.3	10.8%
PU	Pyote and maljamar fine sands	None	40.2	5.9%
PY	Pyote soils and dune land	None	145.4	21.4%
SR	Simona-Upton association	None	14.2	2.1%
Totals for Area of Interest			**680.2**	**100.0%**

Description

Ponding is standing water in a closed depression. The water is removed only by deep percolation, transpiration, or evaporation or by a combination of these processes. Ponding frequency classes are based on the number of times that ponding occurs over a given period. Frequency is expressed as none, rare, occasional, and frequent.

"None" means that ponding is not probable. The chance of ponding is nearly 0 percent in any year.

"Rare" means that ponding is unlikely but possible under unusual weather conditions. The chance of ponding is nearly 0 percent to 5 percent in any year.

"Occasional" means that ponding occurs, on the average, once or less in 2 years. The chance of ponding is 5 to 50 percent in any year.

"Frequent" means that ponding occurs, on the average, more than once in 2 years. The chance of ponding is more than 50 percent in any year.

Rating Options

Aggregation Method: Dominant Condition

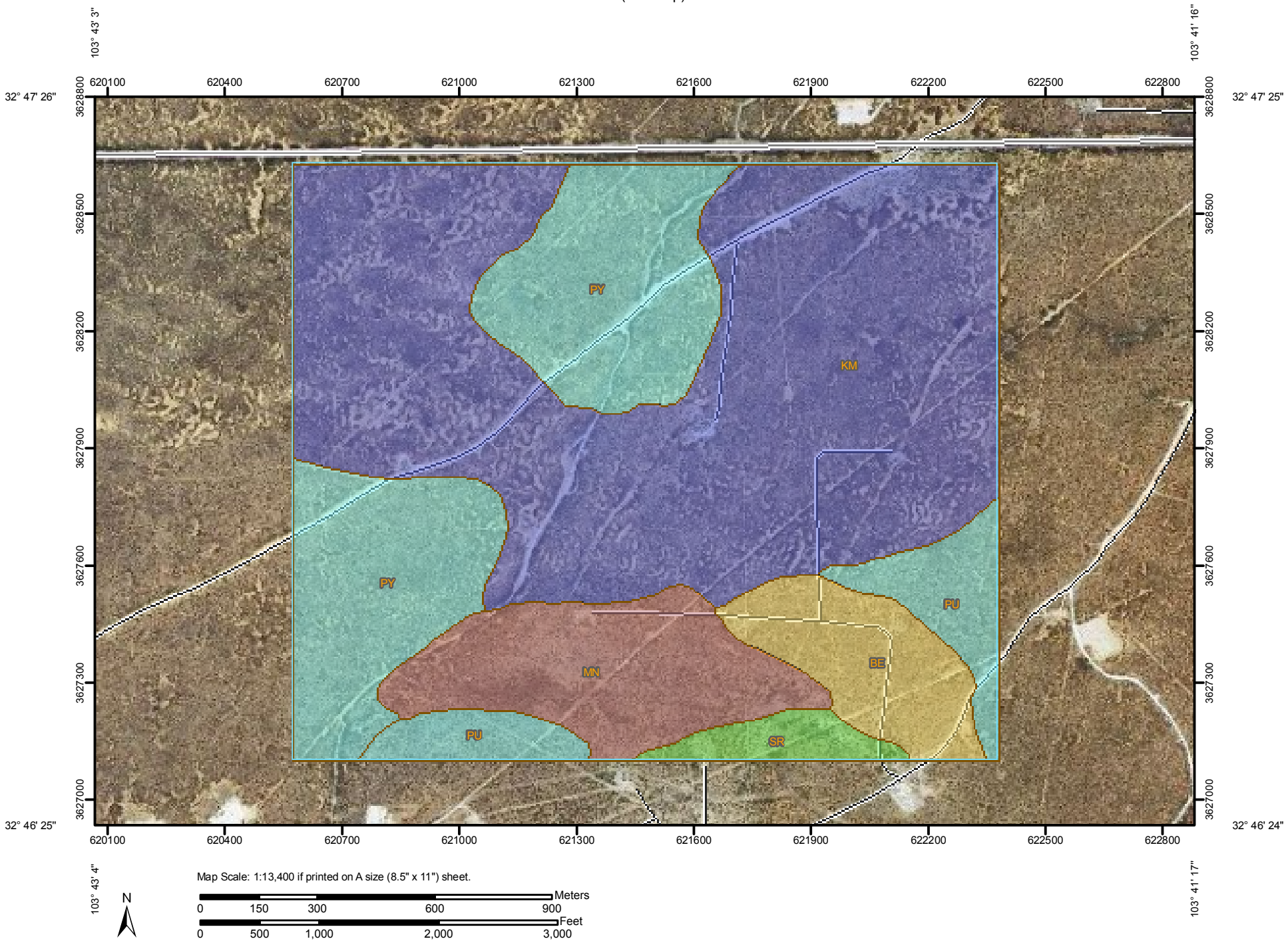
Component Percent Cutoff: None Specified

Tie-break Rule: More Frequent

Beginning Month: January

Ending Month: December

Parent Material Name—Lea County, New Mexico
(Soil Map)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- calcareous alluvium and/ or calcareous eolian deposits derived from sedimentary rock
- calcareous eolian deposits derived from sedimentary rock
- calcareous sandy eolian deposits derived from sedimentary rock
- sandy eolian deposits derived from sedimentary rock
- sandy eolian deposits derived from sedimentary rock over calcareous sandy alluvium derived from sedimentary rock
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:13,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Lea County, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Date(s) aerial images were photographed: Data not available.

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.

Parent Material Name

Parent Material Name— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BE	Berino-Cacique loamy fine sands association	sandy eolian deposits derived from sedimentary rock over calcareous sandy alluvium derived from sedimentary rock	43.7	6.4%
KM	Kermit soils and dune land, 0 to 12 percent slopes	calcareous sandy eolian deposits derived from sedimentary rock	363.4	53.4%
MN	Midessa and wink fine sandy loams	calcareous alluvium and/or calcareous eolian deposits derived from sedimentary rock	73.3	10.8%
PU	Pyote and maljamar fine sands	sandy eolian deposits derived from sedimentary rock	40.2	5.9%
PY	Pyote soils and dune land	sandy eolian deposits derived from sedimentary rock	145.4	21.4%
SR	Simona-Upton association	calcareous eolian deposits derived from sedimentary rock	14.2	2.1%
Totals for Area of Interest			**680.2**	**100.0%**

Description

Parent material name is a term for the general physical, chemical, and mineralogical composition of the unconsolidated material, mineral or organic, in which the soil forms. Mode of deposition and/or weathering may be implied by the name.

The soil surveyor uses parent material to develop a model used for soil mapping. Soil scientists and specialists in other disciplines use parent material to help interpret soil boundaries and project performance of the material below the soil. Many soil properties relate to parent material. Among these properties are proportions of sand, silt, and clay; chemical content; bulk density; structure; and the kinds and amounts of rock fragments. These properties affect interpretations and may be criteria used to separate soil series. Soil properties and landscape information may imply the kind of parent material.

For each soil in the database, one or more parent materials may be identified. One is marked as the representative or most commonly occurring. The representative parent material name is presented here.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

APPENDIX C – AGENCY RESPONSES

USFWS Correspondence re: Wetlands

From: Dick, Jim <jim_dick@fws.gov>
To: Shawn Knox <knox@rockymountainecology.com>
Sent: Mon 5/6/2013 10:35 AM

Re: Request from Shawn Knox re: review and email verification

Hi Shawn,
The feature in question is a linear feature generated from other data sources (probably USGS NHD data) as part of a national effort to "fill-in" NWI data gaps. We call this "scalable" data. Since it was not created through standardized NWI mapping processes, this data may or may not meet national wetland mapping standards. This is a new data layer for us, and is still "under construction". Probably way there's no classification description or metadata yet. I can tell you the feature is representative of a section of a dry wash or arroyo, which would have no regular flow. It is very unlikely that this feature would meet U.S. Army Corps of Engineers (USACE) jurisdictional criteria for legally defined wetlands. Any official decision concerning the status of this feature would need to come from the USACE, though. Let me know if you need more info, or any further explanation.

Please see official disclaimer for NWI data below;

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.
.

On Mon, May 6, 2013 at 9:44 AM, Shawn Knox <knox@rockymountainecology.com> wrote:

Hi Jim:

Attached is a map of the project area we discussed, along NM 529 southeast of Maljamar, NM, in Lea County.

The ephemeral drainage (depicted with a purple line) is of interest. This was noted in the Google Map function of NWI as a wetland of some sort, though I could not pull up the metadata. I

conducted a thorough field survey and absolutely no evidence of wetlands as defined by the USACE was observed.

*Anyway, could you please confirm via email, per our conversation that this is not a wetland?

I sincerely appreciate your assistance.

Best,

Shawn Knox

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Shawn C. Knox

Co-owner/ Director

Rocky Mountain Ecology LLC

5 Alcalde Rd. | Santa Fe, NM 87508

505.992.6150

www.rockymountainecology.com

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

LEA COUNTY FLOODPLAIN MANAGEMENT

Lorenzo Velasquez CFM Director
Cassie Corley CFM Coordinator
1923 N. Dal Paso Suite A
Hobbs, NM 88240

Phone (575) 391-2983
Phone (575) 391-2976
Fax (575) 397-7413
lvelasquez@leacounty.net
ccorley@leacounty.net

FLOODPLAIN DETERMINATION

Date: May 9, 2013

Physical Address: NM Hwy 529 Mile Marker 10-11 on the South Side

Owner: DNCS Properties LLC **Agent:** Dacia R. Tucholke, Gordon Environmental, Inc.

Mailing Address: 2028 E Hackberry **Phone:** (505)867-6990

PlaceChandler, AZ 85286

[X] NON-SFHA [ ] PROPERTY PARTIAL SFHA AREA-STRUCTURE NON SFHA

[ ] PROPERTY IN SFHA: ZONE D BFE _____

FIRM PANEL 1075 DATED 12/16/08 Map Index _____

S/T/R _____ BLD PERMIT _____ DOI _____

[ ] SITE BUILT [ ] MOBILE HOME [X] COMMERCIAL [ ] MOD [ ] GEN. MAINT

[ ] INSURANCE [ ] REAL ESTATE [ ] OWNER [ ] BANK [ ] ADDRESSING [X] BUILDING [ ] MH CO

COMMENTS: PROPERTY IS NOT IN FLOOD ZONE

County Floodplain Manager Cassie Corley, CFM Date 5-9-13

FLOODPLAIN PERMIT ISSUE DATE: _____ PERMIT NUMBER _____

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

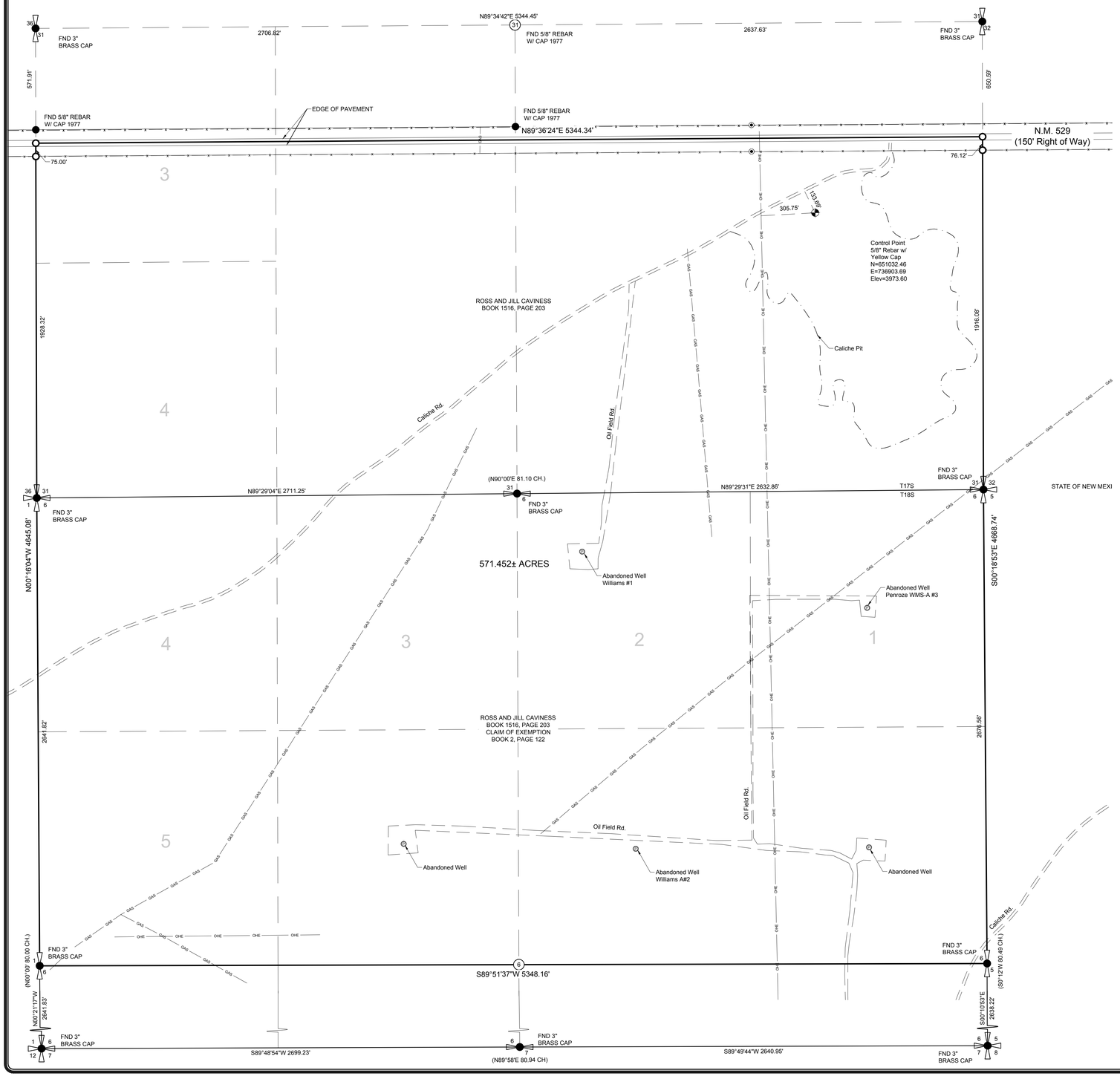
VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.B

BOUNDARY SURVEY (PETTIGREW & ASSOCIATES PA, 12/13/2012)

BOUNDARY SURVEY

LOCATED IN PART OF THE S1/2, OF SECTION 31, T17S, R33E, AND N1/2 SECTION 6, T18S, R33E, N.M.P.M., LEA COUNTY, NEW MEXICO



RECORD DESCRIPTION AS RECORDED IN BOOK 1516, PAGE 203, LEA COUNTY RECORDS

The Southwest Quarter of the Southwest Quarter (SW/4SW/4), the Northwest Quarter of the Northwest Quarter (NW/4NW/4), the East Half of the Northwest Quarter (E2NW/4), the West Half of the Northeast Quarter (W/2NE/4) of Section 15 and All of Section 16, all in Township 18 South, Range 33 East, N.M.P.M., Lea County, New Mexico.

The East Half (E/2), the Southwest Quarter (SW/4) and the South Half of the Northwest Quarter (S/2NW/4) of Section 1; the Southwest Quarter (SW/4) of Section 14; the Northeast Quarter (NE/4) of Section 22; the Northwest Quarter (NW/4) of Section 23; and the East Half of the Northeast Quarter (E/2NE/4) of Section 34, all in Township 18 South, Range 32 East, N.M.P.M., Lea County, New Mexico.

The North Half (N/2) of Section 9; all of Section 6, all in Township 18 South, Range 33 East, N.M.P.M., Lea County, New Mexico.

Section 31,32 & 33, Township 17 South, Range 33 East and Section 3, 4, 10 &11, Township 18 South, Range 33 East, N.M.P.M., Lea County, New Mexico, lying South of the pavement centerline of State Highway #529.

SURVEYED DESCRIPTION

A tract of land located in the Section 31, T17S, R33E, and Section 6, T18S, R33E, N.M.P.M., Lea County, New Mexico and being more particularly described as follows:

That part of the S1/2 of Section 31, T17S, R33E, lying south of the centerline of the pavement in New Mexico State Highway 529 and the North 1/2 of Section 6, T18 S, R33 E, N.M.P.M., Lea County, New Mexico, as shown on an exemption plat recorded in Book 2, Page 122, Lea County Records, and containing 562.367 acres, more or less.

BASIS OF BEARING

The basis of bearing for this survey is Grid North based on the New Mexico State Plane Coordinate System East Zone, as determined by an OPUS solution at the control point shown on survey plat. Coordinates are based on the New Mexico State Plane Coordinate System East Zone. Ground coordinates are modified by scaling about a control point located at N32°47'17.17235", W103°41'49.02833" by a combined scale factor of 0.99976629. All drawing coordinates are scaled to ground. Elevations shown hereon are referenced to NAVD 1988. This map complies with the National Map Accuracy Standards.

CERTIFICATE OF SURVEY

I, William M. Hicks III, New Mexico Professional Surveyor, hereby certify that this Boundary Survey Plat was prepared from an actual ground survey performed by me or under my supervision, that this survey is true and correct to the best of my knowledge and belief, that this Boundary Plat and the field survey upon which it is based meet the Minimum Standards for Surveying in New Mexico.

William M. Hicks, III NMPS #12348

December 13, 2012
Date

NOTE

Boundary Survey was performed without Title Commitment.

LEGEND

●	Found as noted
○	Set 5/8" rebar with red plastic cap marked "HICKS NMPS 12348"
⊡	Calculated point
	Section corner
	Quarter section corner
	Found section corner
	Found quarter section corner
(#)	Section corner
	Right of way marker
—— x ——	Barbed wire fence
XX°XX'XX" XX.XX'	Measured bearing and distance
(X°XX' XX.XX CH.)	Record GLO bearing and distance

State of New Mexico, County of _____
I here by certify that this instrument was filed for record on:

The _____ Day of _____,
20 _____ A.D.
At _____ O'Clock _____M.
Cabinet _____ Slide _____
Book _____ Page _____

By _____
County Clerk

By _____
Deputy

PETTIGREW & ASSOCIATES PA
ENGINEERING | SURVEYING | TESTING
DEFINING QUALITY SINCE 1965
100 E. Navajo, Suite 100 Hobbs New Mexico 88240
T 575 393 9827 F 575 393 1543
Pettigrew.us

WILLIAM M. HICKS III — NEW MEXICO — 12348 — REGISTERED PROFESSIONAL SURVEYOR

PROJECT SURVEYOR: M. Ivey
DRAWN BY: C. Johnson

NORTH
SCALE 1" = 300'
0' 150' 300' 600'

INDEXING INFORMATION FOR COUNTY CLERK

OWNER:
ROSS CAVINESS

LOCATION:
PART OF THE S1/2, SECTION 31, T17S, R33E, SOUTH OF HWY. 529, AND N1/2, SECTION 6, T18S, R33E, N.M.P.M., LEA COUNTY, NEW MEXICO

REVISIONS

No.	DATE	DESCRIPTION

BOUNDARY SURVEY
OF
Part of the S1/2, Sec 31 T17S, R33E, & N1/2, Sec6 T18S, R33E, N.M.P.M.
FOR
DNCS PROPERTIES

PROJECT NUMBER: 2012.1258

SHEET: 1 of 1
SU - 101

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

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LIST OF ATTACHMENTS

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

1.0 INTRODUCTION

DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oilfield waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, DNCS Properties, LLC.

1.1 Site Location

The DNCS site is located approximately 10.5 miles east of the US 82/NM 529 intersection and 6.3 miles southeast of Maljamar in unincorporated Lea County, New Mexico (NM). The DNCS site is comprised of a 562-acre ± tract of land located south of NM 529 in portions of Section 31, Township 17 South, Range 33 East; and in the northern half of Section 6, Township 18 South, Range 33 East, Lea County, NM (**Figure I.1**). Site access will be provided via the south side of NM 529.

1.2 Facility Description

The DNCS Facility is a proposed new Surface Waste Management Facility that will include two main components; a liquid oil field waste Processing Area (177 acres ±), and an oil field waste Landfill (318 acres ±). Oil field wastes are anticipated to be delivered to the DNCS Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Development Plan provided in the **Permit Plans**, **Sheet 3**, identifies the locations of the Processing Area and Landfill facilities.

2.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

The DNCS site is situated in a mature oil and gas producing province in the Permian Basin of southeastern New Mexico. The site is also in proximity to a mature potash mining and refining province, as well as to the Waste Isolation Pilot Project (WIPP) site. Pursuant to these activities, the regional geology and hydrogeology in the vicinity of the DNCS site has been studied by numerous entities.

2.1 Climate

The climate at the DNCS site is typical of a semi-arid region with generally mild temperatures, low precipitation and humidity, and a high evaporation rate. The nearest weather station (i.e., Maljamar 4 SE) is located approximately 6.3 miles northwest of the DNCS site in Maljamar, NM. Climate data for the Maljamar station are provided in **Table IV.2.1**. The climate is hot during summer months when the daytime temperatures are typically in the high 70's; and cool to cold during winter months when temperatures are typically in the low 40's. The warmest month of the year is July with an average maximum temperature of 92.4 degrees Fahrenheit (°F), while the coldest month of the year is January with an average minimum temperature of 25.8 °F. The annual average precipitation in Maljamar is 14.18 inches (in.). The majority of the precipitation falls July through September. The wettest month of the year is September with an average rainfall of 2.42 in. Annual snowfall averages 6.4 in. for the area.

2.2 Physiographic Setting

The proposed DNCS disposal facility is located on the Querecho Plains near the boundary between the Southern High Plains Section (Llano Estacado) and the Pecos Valley Section of the Great Plains Physiographic Province (Hawley, 1993b). The Great Plains Physiographic Province is characterized by low relief and lightly deformed Permian and Triassic sedimentary bedrock units overlain by variable thicknesses of late Tertiary and Quaternary age unconsolidated to semiconsolidated deposits of sand, silt, clay, gravel and calcrete (caliche) of the Ogallala Formation and younger Quaternary deposits of unconsolidated or aeolian sands and silts.

TABLE IV.2.1
Climate Data
DNCS Environmental Solutions

Station:(295370) MALJAMAR 4 SE[1]							
From Year=1942 To Year=2012							
Month	Precipitation			Total Snowfall		Temperature (Monthly Averages)	
	Mean	High	Low	Mean	High	Max.	Min.
Unit	in.	in.	in.	in.	in.	°F	°F
January	0.42	2.55	0	1.7	14	56.1	25.8
February	0.4	1.86	0	1.4	12	61.7	29.7
March	0.4	1.83	0	0.7	13.3	68.7	35.2
April	0.44	2.34	0	0.2	8.5	77.9	43.2
May	1.59	7.69	0	0	0	85.8	52.3
June	1.59	7.38	0	0	0	93.3	60.6
July	2.37	10.26	0	0	0	94.3	64.1
August	2.3	10.88	0	0	0	92.4	62.9
September	2.42	7.71	0	0	0	86.3	56.3
October	1.17	5.99	0	0.1	2	77.1	45.6
November	0.52	3.9	0	0.5	9.5	65.1	33.8
December	0.57	3.7	0	1.9	15.7	57.5	27.1
Annual	14.18	27.54	5.78	6.4	23.8	76.3	44.7

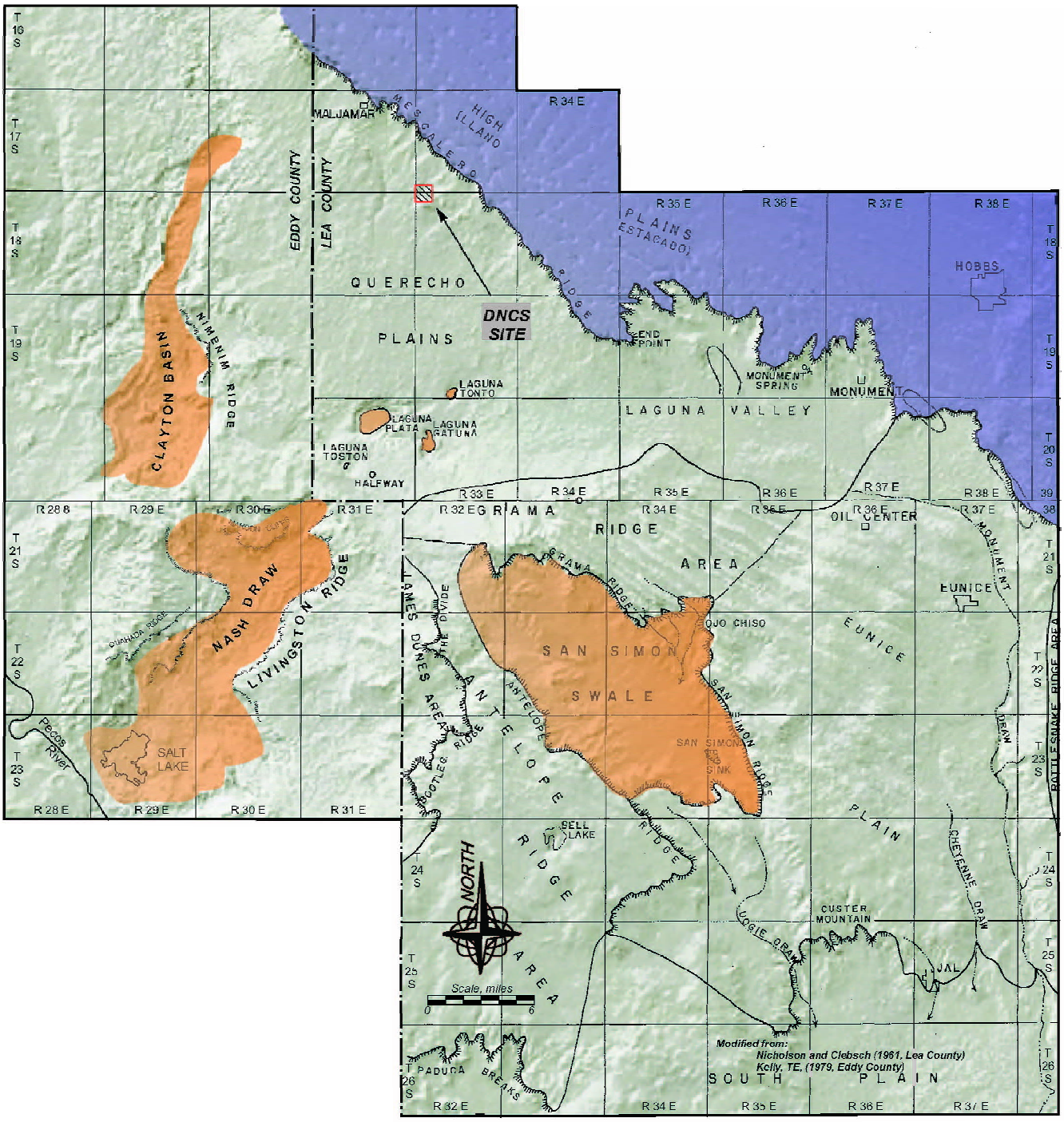
Note:

[1] *Data obtained from the Western Regional Climate Center (http://www.wrcc.dri.edu/)*

Physiography of the DNCS site vicinity in southern Lea County and eastern Eddy County was described by Nicholson and Clebsch (1961) and Kelly (1979) and is summarized in the physiographic map in **Figure IV.2.1**. The site is situated in the Upper Pecos-Black watershed (USGS cataloging Unit 1306001), near the western boundary of the Monument-Seminole Draws watershed (USGS cataloging unit 12080003). The boundary between the Upper Pecos-Black and Monument-Seminole Draws is formed by the Mescalero Ridge (alternately called "the Caprock"), which trends north-south along the Chaves and Lea County line from northwest Lea County approximately to Maljamar, where it turns southeast, passing approximately 1.75 miles east of the DNCS site, continuing southeast past the Texas state line east of Eunice. Mescalero Ridge is also the boundary between the Southern High Plains Section of the Great Plains Province to the east and the Querecho Plains area of the Pecos Valley Section of the Great Plains Province to the west.

Mescalero Ridge is the western terminus of the Tertiary Ogallala Formation, which is a thick sequence of unconsolidated to semiconsolidated sand, silt and gravel which were deposited on an erosional surface incised into Triassic Chinle shale in much of southeastern New Mexico. In the Querecho Plains area, the Ogallala has been removed by erosion west of Mescalero Ridge and a veneer [generally less than 100 feet (ft)] of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle the Triassic Chinle in this area. Well-cemented sections (caliche) of the Ogallala Formation are the ledge-forming units of the Caprock bluffs.

The Querecho Plains terminate to the west and south toward the Pecos River in a series of subsidence features, including San Simon Swale, Nash Draw, Clayton Basin and a series of playas, including Laguna Plata, Laguna Gatuna, Laguna Tonto and Laguna Toston (**Figure IV.2.1**). The subsidence features principally result from groundwater dissolution of evaporates in the Permian bedrock units in the Rustler and Salado Formations. Dissolution occurs in areas where the Permian evaporates outcrop, or are very near land surface.



PHYSIOGRAPHY OF SOUTHERN LEA COUNTY AND EASTERN EDDY COUNTY

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: PHYSIOGRAPHY.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

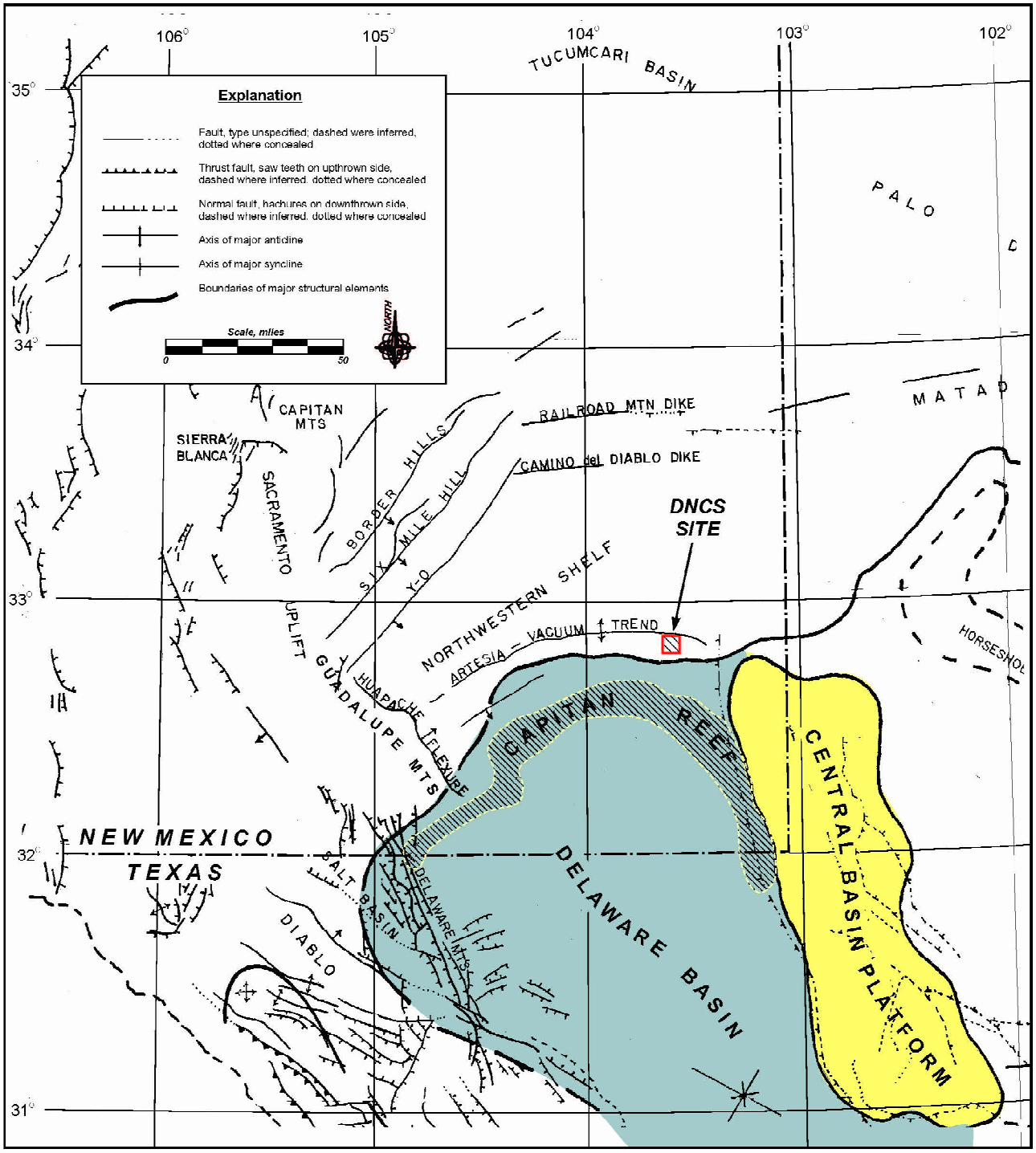
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\PHYSIOGRAPHY.dwg
Date/Time:Nov. 01, 2013-08:56:46 ; LAYOUT: A (P)

2.3 Structural Setting

The DNCS site is situated on the northern margin of a deep sedimentary basin feature known as the Delaware Basin. During most of the Permian period, the Delaware Basin was the site of a deep marine canyon that extended across southeastern New Mexico and west Texas. Major structural elements of the Delaware Basin area are shown in **Figure IV.2.2** (Powers, 1978). The major structures of the basin include the Guadalupe Mountains on the west side, the Central Basin Platform on the east side, and the Capitan Reef Complex on the west and north side of the basin.

The Central Basin Platform forms an abrupt eastern terminus to the Delaware Basin; it is a steeply fault-bound uplift of basement rocks that grew through the early and middle Paleozoic period such that most of the pre-Permian sedimentary section is missing from its apex. Great thickness of organic-rich marine deposits in the basin and the presence of abrupt structural thinning in the Capitan Reef Complex and Central Basin Platform combined to result in a prolific oil and gas producing province. These areas have been the focus of intense petroleum exploration and development activities since approximately 1920.

Surficial geology and generalized stratigraphy across the Delaware Basin and at the DNCS site are depicted in the map and cross section in **Figure IV.2.3** (New Mexico Bureau of Geology and Minerals, 2003 and Duchene and Cunningham, 2006). Tectonic development of the Delaware Basin began by the late Pennsylvanian period and major basin subsidence took place during the late Pennsylvanian period and early Permian period. Basin development ended in the late Permian period (Brokaw, et al, 1972). Thickness of sediments in the basin exceeds 20,000 ft, and Permian strata alone account for more than 13,000 ft of basin fill materials (Oriel, et al., 1967). During the Triassic period, the area was uplifted, resulting in deposition of clastic continental shales (redbeds). Continuing uplift resulted in erosion and/or non-deposition until the middle to late Cenezoic period, when regional eastward tilting completed structural development of the basin as it exists today (Stipp, 1954). Locations of reef deposits which form the northern structural terminus of the Delaware Basin, as well as stratigraphic units present in the area of the DNCS site are shown on the stratigraphic cross section in **Figure IV.2.4** (Roswell Geological Society, 1956 and Brokaw and Others, 1972).



Major Regional Structural Features of Southeastern New Mexico
Modified from Powers, 1978

MAJOR STRUCTURAL FEATURES OF SOUTHEASTERN NEW MEXICO

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: STRUCTURAL.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\STRUCTURAL.dwg
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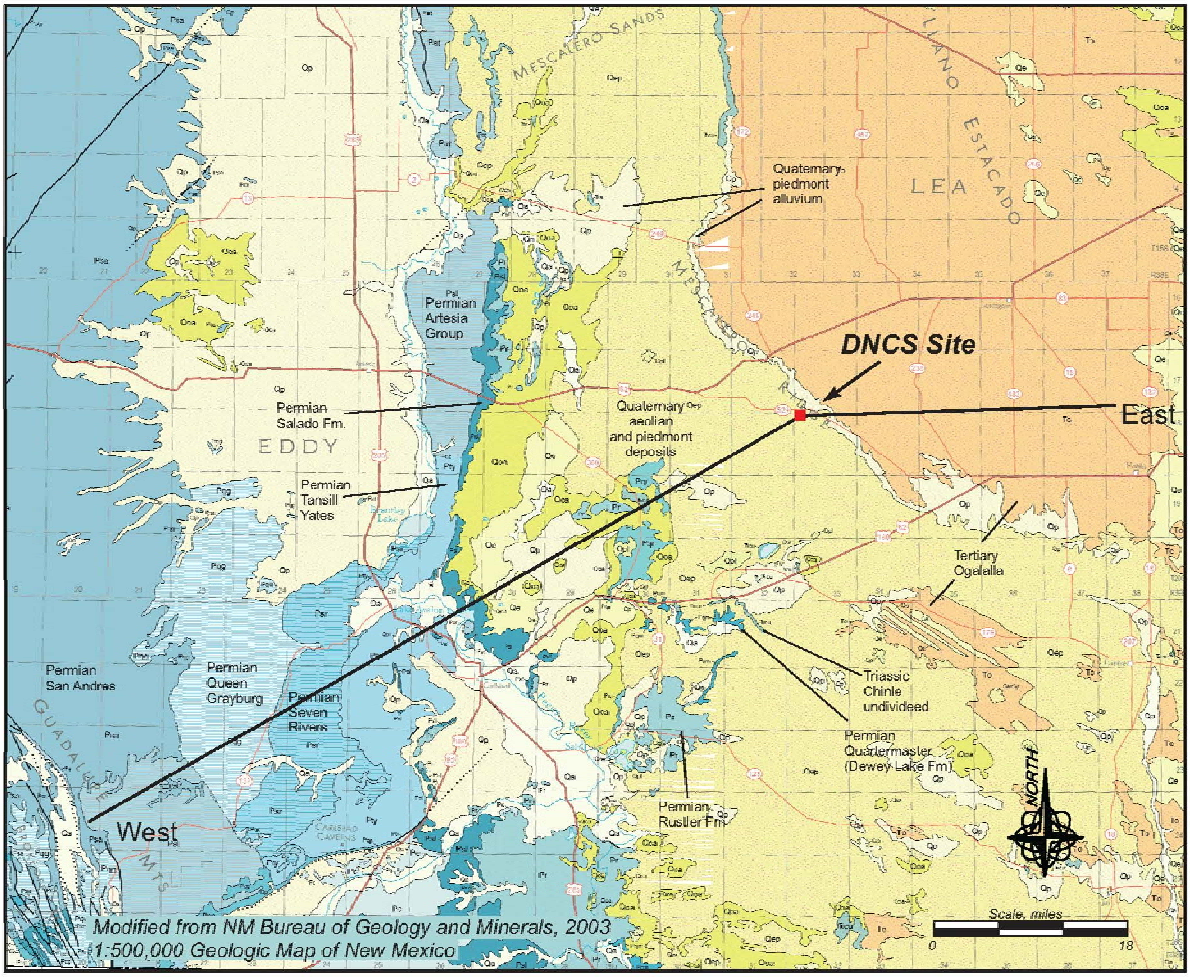
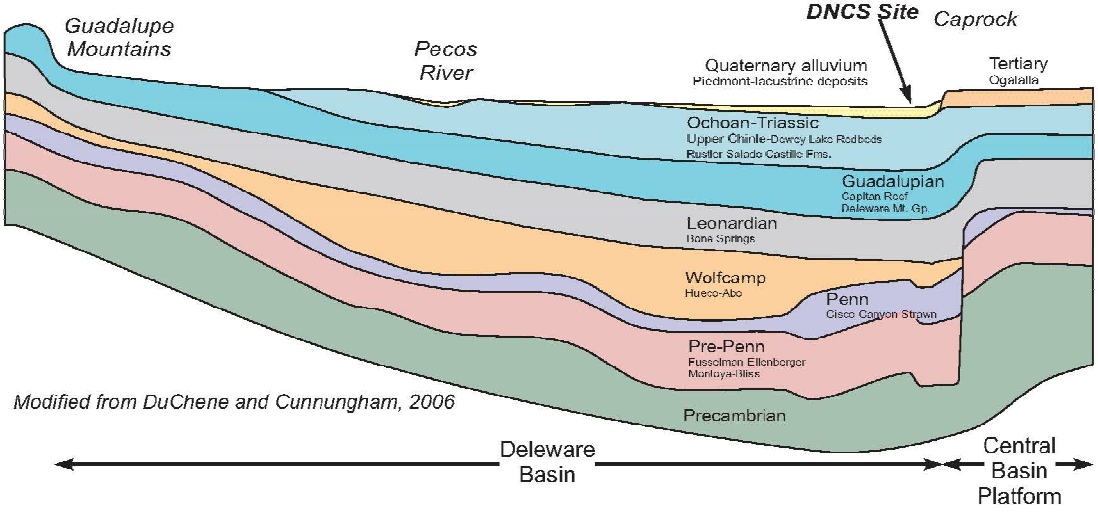


West East



REGIONAL SURFACE GEOLOGY AND GENERAL STRATIGRAPHY OF SOUTHEASTERN NEW MEXICO

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: SURFACE GEOLOGY.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

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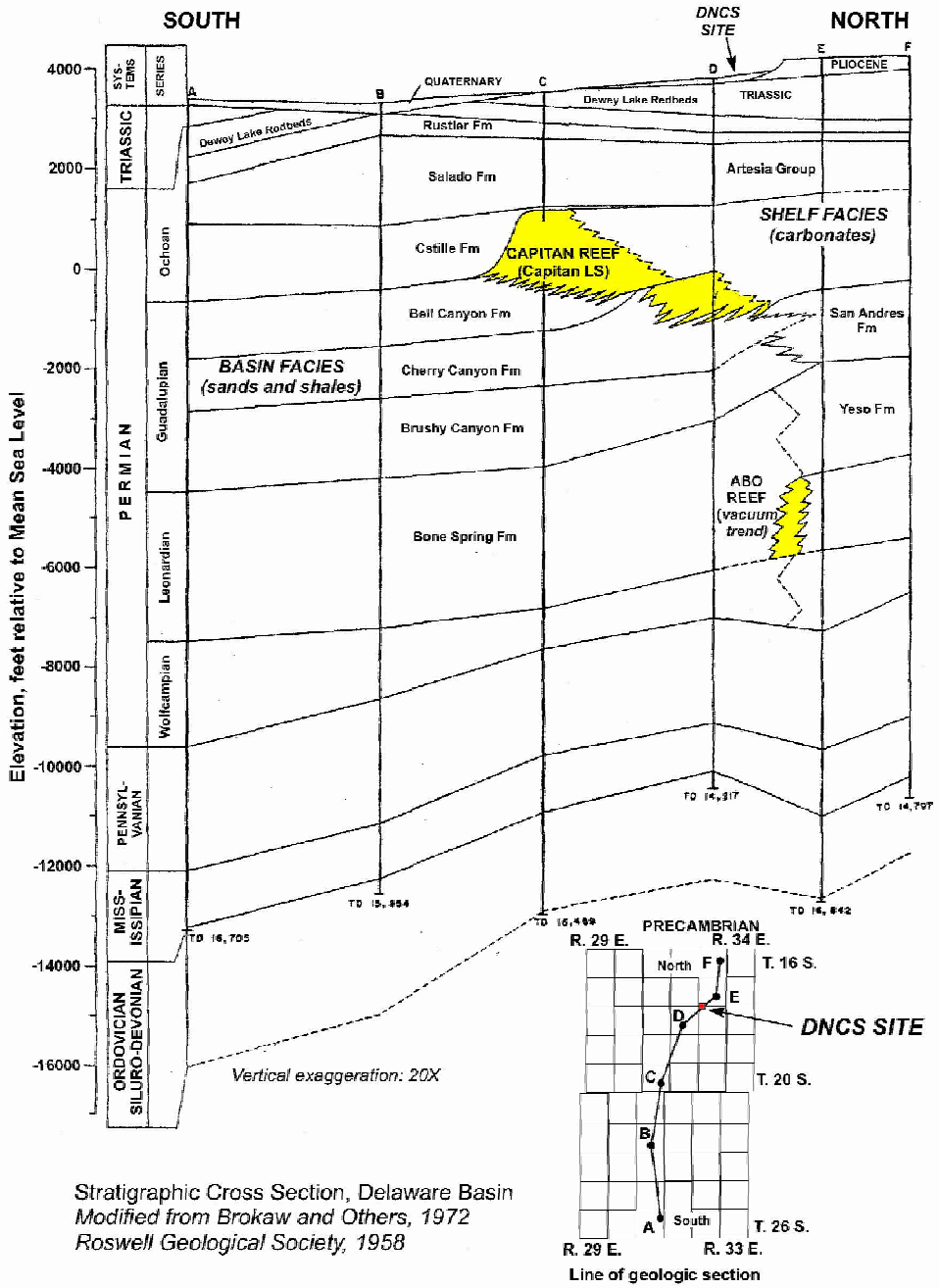

Stratigraphic Cross Section, Delaware Basin
Modified from Brokaw and Others, 1972
Roswell Geological Society, 1958

STRATIGRAPHIC CROSS SECTION, NORTHERN DELAWARE BASIN

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: DELAWARE X SEC.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

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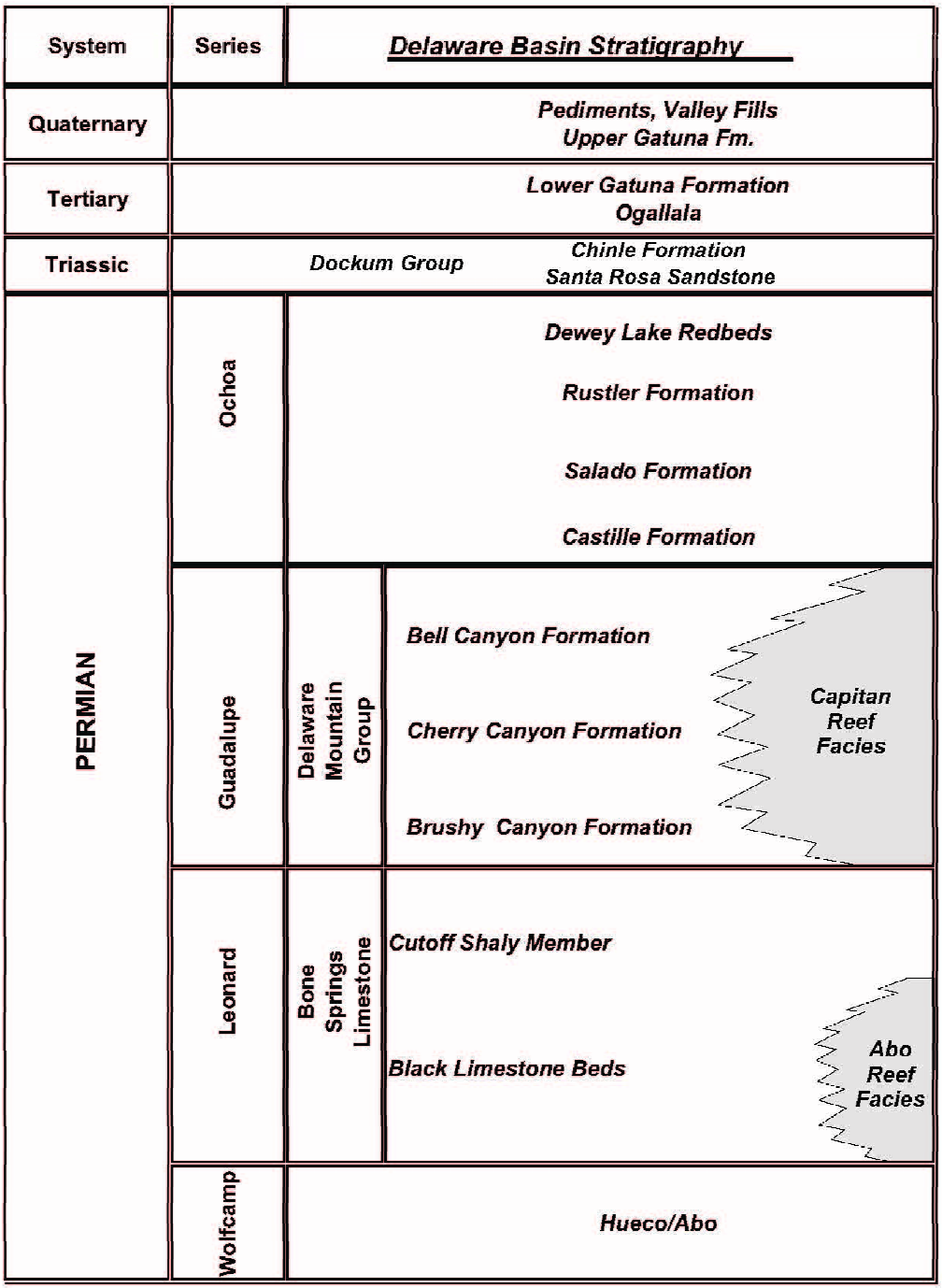
Date/Time:Nov. 01, 2013-10:54:39 ; LAYOUT: A (P)

2.4 Surface Geology and Stratigraphy

Geologic units that are present at land surface or in the shallow subsurface in the vicinity of the DNCS site include unconsolidated Quaternary alluvial and aeolian deposits, semiconsolidated clastics of the Tertiary Ogallala Formation, Triassic bedrock shale and sandstone units of the Chinle/Dockum Group. Post-Pennsylvanian stratigraphic units of the Delaware Basin are summarized in the stratigraphic nomenclature chart in **Figure IV.2.5** (Hendrickson and Jones, 1952, and Hawley, et al, 1993). The Ogallala Formation was deposited across an erosional surface incised into Triassic shale bedrock deposits of the Chinle Formation/Dockum Group in the vicinity of the DNCS site, as well as across much of southeastern New Mexico. West of Mescalero Ridge on the Querecho Plains in the vicinity of the DNCS site, the Ogallala was subsequently removed by erosion and a veneer (generally less than 100 ft) of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle the Triassic in this area. Well-cemented sections (i.e., caliche or calcrete) of the Ogallala Formation are the ledge-forming units of the Caprock bluffs. Shallow stratigraphic units in the vicinity of the DNCS site are described below.

- ***Piedmont Alluvial Deposits*** (Qp, Holocene to lower Pleistocene) - Unconsolidated sands, silts and gravels deposited in alluvial veneers on piedmont slopes and alluvial fans.
- ***Aeolian and Piedmont Deposits*** (Qep, Holocene to middle Pleistocene) - Unconsolidated sands, silts and gravels deposited as Interlayered aeolian sands and piedmont slope detritus derived from nearby salients.
- ***Ogallala Deposits*** (To, lower Pliocene to Middle Miocene) - Semiconsolidated fluvial and aeolian sands, silts, gravels and clays deposited on unconformable Permian or Triassic surfaces. Commonly contains well cemented to petrocalcic soils which are ledge-forming units.
- ***Upper Chinle/Dockum Group Deposits*** (Trcu, upper Triassic) - Red indurated shales with minor siltstones and sandstone stringers.
- ***Lower Chinle/Dockum Group Deposits*** (Trs, lower Triassic) - Santa Rosa Formation, lenticular cross-bedded grey to red sandstone with interbedded red shale, locally conglomeratic.



Post-Pennsylvanian stratigraphy of the Delaware Basin
from Hendrickson and Jones, 1952, Nicholson and Clebsch, 1961 and Hawley, et al., 1993

POST PENNSYLVANIAN STRATIGRAPHY OF THE DELAWARE BASIN

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: DELAWARE STRAT.DWG	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\DELAWARE STRAT.dwg
Date/Time:Nov. 01, 2013-10:59:05 ; LAYOUT: A (P)

2.5 Hydrogeology

Water-bearing geologic units in southern Lea County and Eastern Eddy County in the vicinity of the DNCS site include the Tertiary Ogallala Aquifer, shallow Quaternary alluvial aquifers, and the Santa Rosa Sandstone unit of the lower portion of the Triassic Chinle/Dockum Group. The Ogallala Aquifer is locally a prolific water-bearing unit in the region east of Mescalero Ridge, but it is absent west of Mescalero Ridge in the area of the DNCS site. In the Querecho Plains area, thin laterally discontinuous groundwater saturations are occasionally present in the basal alluvium overlying the Triassic shale bedrock units. The Santa Rosa Sandstone is present at depth below the DNCS site and throughout much of southern Lea County and eastern Eddy County, and this unit can locally produce modest quantities of groundwater. The Santa Rosa Sandstone is a significant source of groundwater for domestic and livestock wells in portions of Lea County (Leedshill-Herkenhoff, et, al, 1999) where drilling depths are feasible; however in much of the area, the unit has not been tapped by wells due to prohibitive depth, or to the availability of shallower aquifers.

Based upon review of available water well and oil well information in the vicinity of the DNCS site, as well as information obtained from site characterization borings performed on the DNCS tract, only the Santa Rosa Sandstone is considered to be a potential aquifer at the site. Oil well drilling logs of wells in the immediate vicinity of the DNCS site indicate that numerous wells penetrated sandstones interpreted to be the Santa Rosa Sandstone at more than 500 ft below land surface. No water wells in the vicinity of the DNCS site have been completed in the Santa Rosa Sandstone; however based upon regional projections of potentiometric head values in the Lower Dockum Group (Santa Rosa Sandstone) made by Dutton and Simkins (1986), the head value in the Santa Rosa Sandstone at the DNCS site is approximately 3,450 ft above mean sea level, or approximately 500 ft below land surface.

Water quality in the Santa Rosa Sandstone is poorly documented in southern Lea County and eastern Eddy County (Leedshill-Herkenhoff et al, 1999). Nicholson and Clebsch (1961) reported total dissolved solids (TDS) values ranging from 635 to 1,950 milligrams per liter (mg/L) for water samples collected from wells completed in the Santa Rosa Sandstone. Sulfate concentrations in samples from these wells ranged from 71 mg/L to 934 mg/L; higher

concentrations were noted in the deeper wells. Dutton and Simkins (1986) prepared a projection of TDS of waters from the Lower Dockum Group (Santa Rosa Sandstone); this projection indicates that the TDS concentration of water in the Santa Rosa Sandstone in the vicinity of the DNCS site is expected to exceed 3,000 mg/L.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

3.1 Site Investigations

Investigations were performed on the DNCS property to characterize geologic and hydrogeologic conditions of the site in conformance with provisions set forth in 19.15.36.8.C.15 NMAC. Hydrogeologic site characterization on the DNCS site was performed in accordance with subsurface investigation workplans submitted to the New Mexico (NM) Energy, Minerals and Natural Resources Department (EMNRD) Oil Conservation Division (OCD) in January 2013 and May 2013 (Gordon Environmental, Inc.). The January 2013 workplan was developed using published resources on shallow stratigraphy of the area, as well as results of two preliminary soil borings that were drilled on the DNCS property in February 2012 to determine the presence or absence of shallow groundwater within 150 ft of land surface at the site. Three additional soil borings were advanced at the site (B-3, B-4 and B-5) in accordance with the January 2013 investigation workplan; a final boring (B-6) was drilled in accordance with the May 2013 investigation workplan.

Subsurface hydrogeologic investigations were performed at the DNCS site using hollow-stem auger and air rotary drilling. Data that was accumulated during boring and testing at the DNCS site, as well as published and agency file data on local geology and groundwater were compiled into a *Proposal for Vadose Zone Monitoring, DNCS Environmental Solutions, Lea County, NM* (Golder Associates, Inc., 2013). Gordon Environmental, Inc. (GEI), on behalf of DNCS Properties, LLC., directed the site drilling operations. Precision Sampling Company (Precision) of Albuquerque, NM was contracted by GEI to perform the drilling.

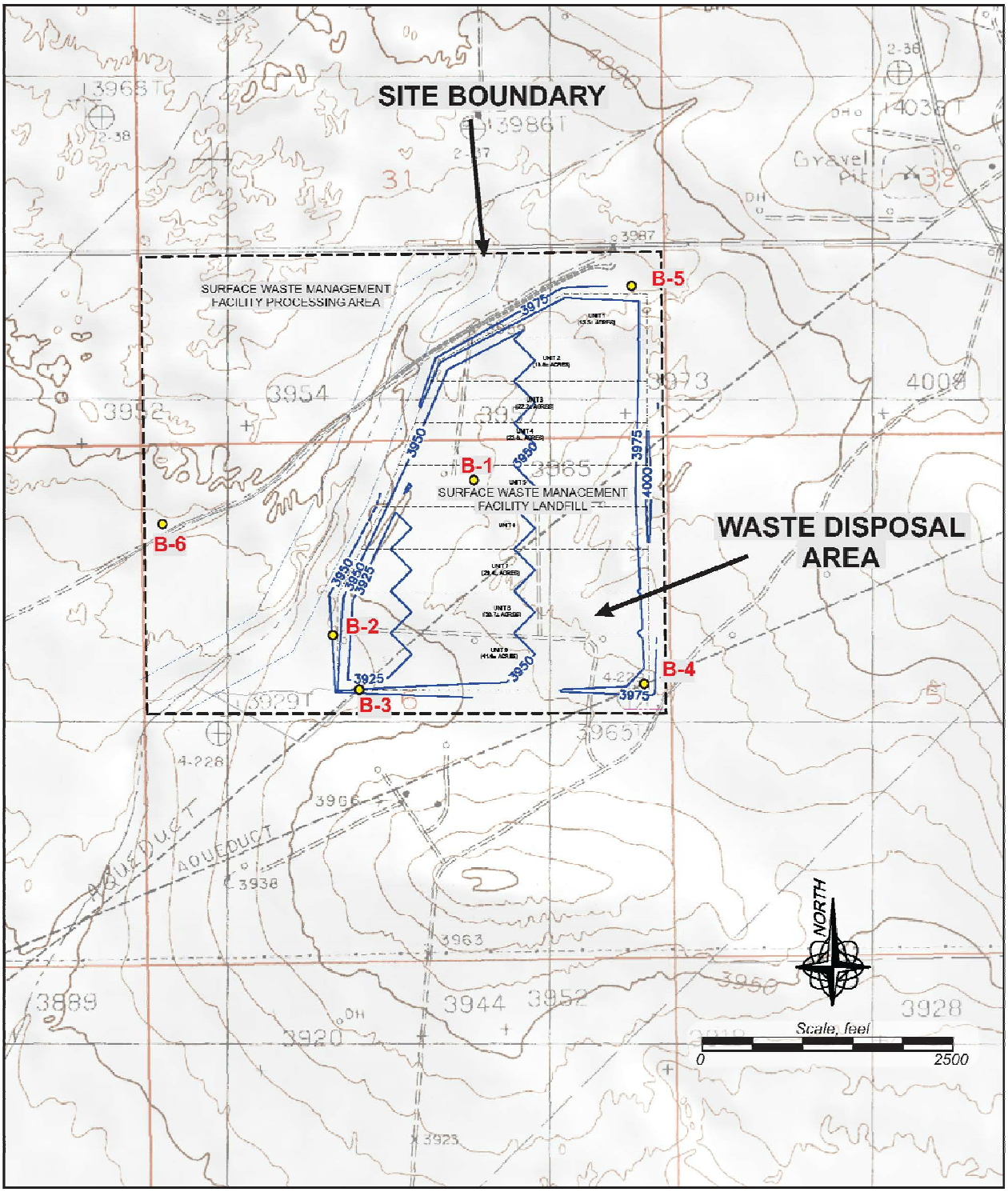
Six soil borings were advanced on the DNCS property at locations shown on the map in **Figure IV.2.6.** Two borings were drilled in February 2012, three additional borings were drilled in February 2013 and a sixth boring was drilled in June 2013. The six borings (B-1 through B-6) were drilled using a CME 75 drill rig capable of drilling using hollow stem auger (HSA) and air rotary drilling methods. Generally, HSA methods were used to penetrate and sample unconsolidated alluvium to the top of the Triassic Chinle shale bedrock, where auger refusal was encountered; air rotary drilling methods were used to complete borings into the Chinle shale to final depths of 150 ft. During HSA drilling, a core barrel was run in the lead auger to provide a continuous core of the penetrated materials; a split spoon drive sampler was run inside the augers on five-foot intervals to provide penetration blow counts, as well as to provide brass ring samples for geotechnical analysis. Upon auger refusal, drilling was switched to air rotary and circulated cutting samples were collected in a cyclone and split spoon samples were collected on five foot intervals. Depth-referenced formation samples collected during drilling were visually examined in the field to determine the lithology, texture color, degree of lithification, plasticity, moisture content of penetrated materials. Borings were generally left overnight after penetrating the Chinle shale bedrock and sounded the next morning for water; holes were also left overnight after reaching total depth in the Chinle Shale and sounded the next morning for water. No groundwater was detected in any of the site borings. Logs of borings B-2, B-3, B-4, B-5 and B-6 and are included in **Attachment IV.2.A**.

3.2 Geotechnical Evaluation

Table IV.2.2 provides the results of site-specific soils laboratory testing, which demonstrate the dramatic change in soils characteristics between the near-surface (i.e., 0-50 ft) coarse-grained deposits; and the thick and dense impermeable redbed deposits below. This site-specific characterization of the onsite soils is entirely consistent with other focused site studies in the area; as well as the documented regional database.

The surface soils consist of dune sands and caliche materials, ideally suited for specific environmental applications:

- PSL – protective soil layer
- Vegetative layer – final cover establishment of erosion control
- Caliche – ideal for temporary road base construction and permanent road subgrade.



LEGEND

B-5 — Location and designation of site hydrogeologic characterization boring

3950 — Landfill basegrades

Permit property boundary

LOCATION OF SITE CHARACTERIZATION BORINGS

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/01/2013	CAD: SITE BORINGS.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.6
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SITE BORINGS.dwg
Date/Time:Nov. 01, 2013-09:27:12 ; LAYOUT: A (P)

TABLE IV.2.2
Soils Laboratory Analyses Summary
DNCS Environmental Solutions

Sample Number[1]	Sample Depth (ft bgs)	USCS Class[2]	Grain Size Distribution			Atterberg Limits[3]	Natural Dry Density (PCF)	Natural Moisture[4] (%)	Standard Proctor		Permeability (cm/sec)	Porosity (%)
			Pass #4 (%)	Pass #40 (%)	Pass #200 (%)	LL - PI			Max. Dry Density (PCF)	Optimum Moisture (%)		
B3-5	5-6.5	SP-SC	100	98	9.0			2.8				
B3-20	20-21.5	SC	100	93	13.0			4.7				
B3-35SS	35-36.5	SC	100	97	14.0			4.6				
B3-35CC	35-40	SP-SC	99	95	11.0			2.2	121.1	11.7		
B3-50.25BR	50.25-50.75	SC	100	94	47.1	32-18	112.3	7.6			9.72E-07	32.1
B3-65	65-66	SC	100	77	18.0			11.6				
B3-85	85-90	CL	100	88	82.1	38-24	112.3	3.3			1.01E-07	32.1
B3-115	115-120	SC	100	66	21.0			12.8				
B3-130	130-135	SC	100	62	20.0			8.7				
B3-145	145-150	SC	100	75	31.0			7.4				
B4-0	0-5	SP-SC	99	92	8.0			11.4				
B4-15	15-20	SP-SC	100	98	7.3			6.8				
B4-30CC	30-35	SP-SC	100	98	7.9			4.8	119.9	12.1		
B4-30SS	30-31.5	SP-SC	100	98	8.9			4.9				
B4-55BR	55-55.75	CL	100	88	85.0	42-19	100.8	9.7			7.89E-07	39.1
B4-80	80-85	SC	100	80	27.0			13.9				
B4-100	100-105	SC	100	83	34.0			13.8				
B4-120	120-125	CL	100	95	93.7	38-23	100.9	2.9				39.0
B4-145	145-150	SC	100	83	34.0			7.9				

Notes:

Blank field indicates test not conducted

[1] *See* ***Figure 5*** *for locations of borings and* ***Attachment A-1*** *for boring logs.*

[2] *Unified Soil Classification System: SM = silty sand; SP = poorly graded sand; SC = clayey sand; ML = low-plasticity silt; CL = low-plasticity clay; CH = high-plasticity clay*

[3] *LL = liquid limit; PI = plasticity index; NV = non viscous; NP = non plastic*

[4] *Gravimetric basis*

R = remolded sample; I = in-situ sample; (DS) = direct shear test on sample X

Combined Samples used for Standard Proctor on Boreholes 3,4,5

For Porosity a Specific Gravity of 165.4 PCF was used; where Porosity = 1 - (Natural Dry Density / Specific Gravity)

TABLE IV.2.2
Soils Laboratory Analyses Summary
DNCS Environmental Solutions

Sample Number[1]	Sample Depth (ft bgs)	USCS Class[2]	Grain Size Distribution			Atterberg Limits[3]	Natural Dry Density (PCF)	Natural Moisture[4] (%)	Standard Proctor		Permeability (cm/sec)	Porosity (%)
			Pass #4 (%)	Pass #40 (%)	Pass #200 (%)	LL - PI			Max. Dry Density (PCF)	Optimum Moisture (%)		
B5-10	10-15'	SC	98	87	13.0			4.2				
B5-25	25-30	SP-SC	98	92	11.0			0.7				
B5-30CC	30-35	SP-SC	100	97	8.8			4.3	123.3	9.9		
B5-30SS	30-31.5	SP-SC	99	88	11.0			4.8				
B5-45	45-50	SP-SC	100	85	7.2			6.1				
B5-70SS	70-70.5	CL	100	93	84.4	41-22	90.6	13.1				45.2
B5-80	80-85	SC	100	66	19.0			12.2				
B5-90	90-95	SC	100	69	22.0			12.5				
B5-105	105	SC	100	67	21.0			14.4				
B5-125	125-130	SC	100	59	27.0			6.6				
B5-145	145-150	CL	100	90	85.5	36-21	107.2	8.4			7.54E-07	35.2
B6-0	0-5	SP	100	99	3.7			2.1				
B6-7	07-13'	SC	100	93	15.0			7.0				
B6-13	13-27	SC	88	70	21.0			3.5				
B6-20	20-40	SC	95	83	14.0			4.1	118.2	11.0		
B6-27	27-48	SC	97	86	16.0			4.0				
B6-60	60-75	SC	100	90	32.9	25-11	106.2	3.1			1.13E-05	35.1

Notes:

Blank field indicates test not conducted

[1] *See* ***Figure 5*** *for locations of borings and* ***Attachment A-1*** *for boring logs.*

[2] *Unified Soil Classification System: SM = silty sand; SP = poorly graded sand; SC = clayey sand; ML = low-plasticity silt; CL = low-plasticity clay; CH = high-plasticity clay*

[3] *LL = liquid limit; PI = plasticity index; NV = non viscous; NP = non plastic*

[4] *Gravimetric basis*

R = remolded sample; I = in-situ sample; (DS) = direct shear test on sample X

Combined Samples used for Standard Proctor on Boreholes 3,4,5

For Porosity a Specific Gravity of 165.4 PCF was used; where Porosity = 1 - (Natural Dry Density / Specific Gravity)

The lower soils, horizons (i.e., 40-50 ft) are effective aquitards to vertical flow, and represent the selected positions for vadose monitoring points.

3.3 Site Geology

The site borings confirmed that site conditions are consistent with understanding of shallow stratigraphy and hydrogeology in the area based upon published literature and previous drilling performed in the vicinity. **Figure IV.2.6** is a map showing the locations of site characterization borings. **Table IV.2.3** contains a summary of the DNCS site boring locations, elevations, total depths and depths at which Triassic shale bedrock was penetrated in each boring. The site borings penetrated various thicknesses of alluvial deposits above the Triassic Chinle shale bedrock ranging from 45 ft to 67 ft. Shallow alluvium penetrated by the site borings was poorly graded fine sand with fragments of calcrete (caliche) and minor gravel. Based upon the lithologic logs, as well as drive blow counts for split spoon samples, the alluvium is moderately indurated and up to two caliche zones were identified within the alluvium near land surface and near the shale bedrock interface. Basal gravels were typically penetrated along the unconformity above the shale bedrock. The Chinle shale, penetrated by all site borings, was variegated reddish brown, purple and green claystone and siltstone. No sandstones or sandy zones were identified in the Chinle shale in any of the site borings.

Surficial terrain and geology in the vicinity of the DNCS site are shown on the map in **Figure IV.2.7**. Locations of the DNCS site and site characterization borings, as well as locations of nearby oil wells and water wells with significant available lithologic or hydrogeologic data are also shown within one mile of the site. Hydrogeologic well data included in **Figure IV.2.7** was obtained from several sources, including: information on nearby wells published by Nicholson and Clebsch (1961) and Geohydrology Associates, Inc, (1978), and Well Records obtained from New Mexico Office of the State Engineer (NMOSE) files. Copies of applicable portions of the Geohydrology Associates (1978) data, as well as the NMOSE Well Records are included in **Attachments IV.2.B** and **IV.2.C**, respectively. Records of wells obtained from all sources are included in **Table IV.2.4**.

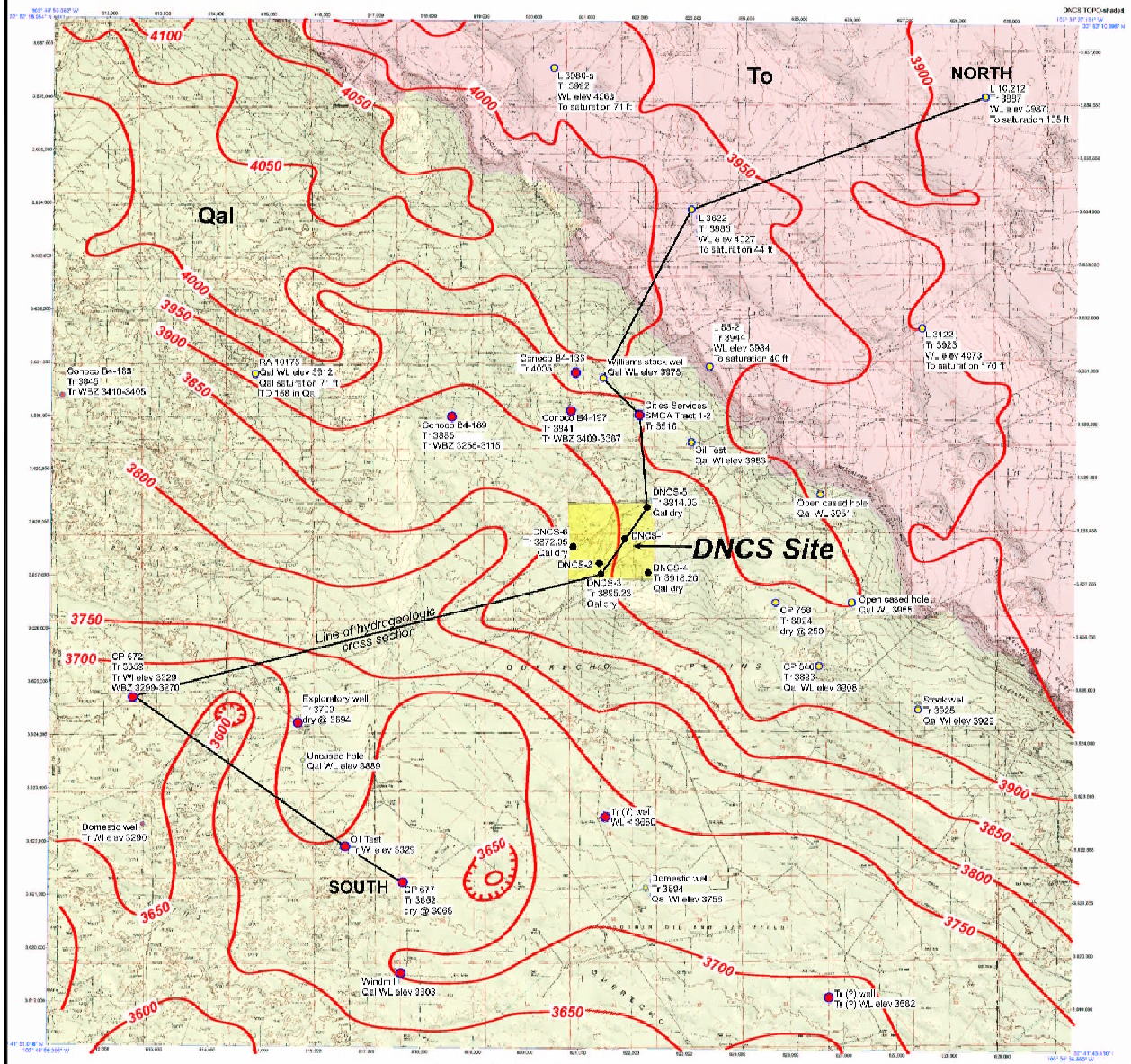
TABLE IV.2.3
Summary of DNCS Site Soil Boring Locations, Total Depths, Drill Dates, and Chinle Shale Depths
DNCS Environmental Solutions

Boring Number	**B-1**	**B-2**	**B-3**	**B-4**	**B-5**	**B-6**
Northing	649096.52	647595.88	646949.6	646996.15	651053.32	648645.35
Easting	735916.89	734481.08	734727.7	737635.78	737531.4	732760.38
*Latitude	32.7828	32.778703	32.77692	32.77700	32.78815	32.7816102
*Longitude	-103.7002	-103.704897	-103.7042	-103.69465	-103.69491	-103.7104799
Elevation (ft above MSL)	3957.32	3942.76	3940.23	3968.2	3979.03	3939.5
Date	Feb-12	Feb-12	2/8/2013	2/9/2013	2/11/2013	6/12/2013
Total Depth (ft)	150	50	150	150	150	75
Depth to top of Chinle	--	--	45	50	65	67

Notes:

**coordinates in WGS-84*

State plane coordinates in NAD83 and NAVD88



SURFACE GEOLOGY, WELL LOCATIONS AND STRUCTURE ON THE UPPER TRIASSIC REDBED SURFACE

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/31/2013	CAD: WELL LOCATIONS.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.7
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\WELL LOCATIONS.dwg
Date/Time:Nov. 01, 2013-11:02:48 ; LAYOUT: A (LS)

TABLE IV.2.4
Records of Wells in the Vicinity of the DNCS Site
DNCS Environmental Solutions

Owner or OCD Designation	OSE Permit Number	Location PLS	Location Lat D.dddd	Location Long D.dddd	Use	LS Elev	TD	WL	WL Elev.	Date	WBZ	Top WBZ	Bottom WBZ	WBZ thickness	Trc top	Trc elev	Tsr	Driller Yield	Comments or source
Water Flood Assoc Inc: #2 Mal 2-127-2	L 03980	17.32.1.22233			flood	4251	270	200		3/6/1960	To/Qal	210	265	70	265	3986			OSE Well Record
Water Flood Assoc Inc: #2 Mal 2-127-2	L 03980-s	17.32.1.42213			SRO	4242	255	179	4063	9/21/1962	To/Qal	205	250	76	250	3992			OSE Well Record
Maljamar Repressuring Ag. #5	L 04019	17.32.2.43424			SROO	4195	182	126 est		6/6/1948	To/Qal	126	180		180	4015			OSE Well Record
Maljamar Repressuring Ag. #6	L 04020	17.32.1.43343			SROO	4195	200	100 est		6/2/1950	To/Qal	139	195		195	4000		100	OSE Well Record
Maljamar Repressuring Ag. #7	L 04021	17.32.2.44335			SROO	4203	190	160 est		6/14/1950	To/Qal	160	185		185	4018		100	OSE Well Record
Mescalero Ridge Water Coop	L 04021-s	17.32.3.23422			PS	4282	260	180 est		1/21/2002	To/Qal	180	260		257	4025			OSE Well Record
Chevron: Maljamar Grayburg Unit #12		17.32.3.4323334			OCD	4284	casing to 1384, redbeds to 990								150	4134			OCD Record
Chevron: Maljamar Grayburg Unit #14		17.32.3.44300			OCD	4285	casing to 1275, redbeds to 990								115? 290?				OCD Record
BE Pashall	L 04038	17.32.1.32343			com/dom	4225	225	175		3/3/1960	To/Qal	192	224	50	224	4001			OSE Well Record
Larry Wooton	No permit no	17.32.10.122			dom	4186	156	132		2/6/1959	To/Qal	132	156	24	156 est				OSE Well Record
George Kenemore	RA 8855	17.32.10.11421			dom	4153	158	dry		8/4/1994				0	157	3996			OSE Well Record
Maljamar Coop Repressuring Ag.	L 00051-2	17.32.11.23142			SROO	4142	140	NA		9/10/1947	To/Qal	NA	NA	0	131	4011		100	OSE Well Record
Conoco Pillips	No permit no	17.32.21.300			monitor	4009 est	125	dry		5/15/2007	To/Qal			0	TD in To/Qal				OSE Well Record
Conoco Oil MCA Battery 4 #189		17.32.26.41000	32.803679	103.735041	OCD	3965	1024 Log, cased to 1062				Trc	710	850	0	80	3885			OCD Record 5/11/78
Flo CO2 Inc	RA 10175	17.32.28.12	32.81102	103.773641	dom	3999	158	87 est	3912	2/4/2002	To/Qal	87	124	71	TD in To/Qal				OSE Well Record
Conoco Oil MCA Battery 4 #109		17.32.29.11000			OCD	3937	casing to 873								70	3867			OCD Record 5/11/78
Contoco Oil MCA Battery 4 #154		17.32.29.32000			OCD	3984	casing to 860								105	3879			OCD Record
Conoco Oil MCA Battery 4 #170		17.32.29.32000			OCD	3933	casing to 990								55	3878			OCD Record
Conoco Oil MCA Battery 4 #214		17.32.29.33000			OCD	4091	casing to 1050								214	3877			OCD Record 5/11/78
Conoco Oil MCA Battery 4 #163		17.32.30.13000	32.807566	103.812556	OCD	3895	casing to 870, redbeds to 675				Trc	575	580		50	3845			OCD Record 5/11/78
							anyhdrite 675-810				Pr	810	820						Rustler FM?
Conoco Oil MCA Battery 1 #218		17.32.30.33000			OCD		casing to 1018, redbeds to 590					545	590		50				OCD Record
Continental Oil Pearsall BX #2		17.32.34.241111			OCD	3952	casing to 3515, redbeds to 792								64	3888			OCD Record
Warton Drilling Co	L 03750	17.33.1.140			OWD	4150	180	150		12/21/1957	To/Qal	150	180	30					OSE Well Record
Denver Drilling Company	L 03782	17.33.2.444			OWD	4155	183	152		2/6/1958	To/Qal	151	183	31					OSE Well Record
Yates Petroleum	L 00010.212	17.33.2.44423	32.857521	103.626451	OWFR	4155	273	168	3987	7/7/1994	To/Qal	168	268	105	268	3887		120	OSE Well Record
Carper Co: Daya Operating State B No. 2	L 04935	17.33.2.120			OWD	4167	204	162		7/12/1962	To/Qal	162	201	42					OSE Well Record
Lomax Drilling Co	L 03012	17.33.3.140			Oil	4182	210	155		11/1/1955	To/Qal	186	198	55	198	3984			OSE Well Record
Conoco #2 Caprock 2-174-25	L 03528-s-3	17.33.3.1443			OWD	4183	271	155		12/12/1968	To/Qal	150	265	116	265	3918			OSE Well Record
Maljamar Coop #1 Maljamar 2-137-1	L 03528	17.33.4.44322			OWD	4179	265	158		12/11/1957	To/Qal	160	225	107	240	3939			OSE Well Record
Yucca Water Co	L 03598-x	17.33.5.22220			SR	4198	272	160		6/25/1959	To/Qal	160	260	112	260	3938			OSE Well Record
Yucca Water Co	L 03598	17.33.6.11110			SRO	4243	287	210		6/18/1962	To/Qal	230	280	77	280	3963			OSE Well Record
RE Paschall	L 04524	17.33.6.440			dom	4227	100	90		9/28/1960	To/Qal	--	--	10	--				OSE Well Record
Dual Drilling Co	L 04122	17.33.7.32322			OWD	4229	249	214		5/3/1959	To/Qal	214	249	35	247	3982			OSE Well Record
Kewanee Oil Co	L 02771	17.33.7.4000			PS	4217	227	182		6/28/1955	To/Qal	164	215	45	222	3995			OSE Well Record
Thunderbird Drilling Co	L 03749	17.33.9.342113			OWD	4195	230	160		12/19/1957	To/Qal	160	230	70					OSE Well Record
Continental Oil Company	L 03528-s-2	17.33.9.331432			SRO	4200	262	180		7/19/1967	To/Qal	198	262	82	252	3948			OSE Well Record
Potash Company of America: PCA No. 8	L 01880-s-3	17.33.12.14110			Min Dev	4148	268	155		5/4/1981	To/Qal	159	230	113	258	3890			OSE Well Record
Potash Company of America	L 01880-1884 comb	17.33.12.33444			Min Dev	4135	259	115		5/2/1966	To/Qal	115	250	144	250	3885			OSE Well Record
Donnelly Drilling Co	L 04333	17.33.13.110			OWD	4136	217	165		12/4/1959	To/Qal	165	202	52	--				OSE Well Record
Potash Company of America	L 01880-s-2	17.33.13.31413			Min Dev	4124	235	151		3/16/1972	To/Qal	154	230	84	230	3894			OSE Well Record
Potash Company of America	L 01880	17.33.13.343			Min Dev	4129	245	--		8/18/1955	To/Qal	--	--		--				OSE Well Record (clean-out)
Potash Company of America	L 01882	17.33.13.43444			Min Dev	4128	245	144		3/16/1948	To/Qal	162	228	101	228	3900			OSE Well Record
Potash Company of America	L 01882	17.33.13.434			Min Dev	4128	245			9/22/1964	To/Qal								OSE Well Record (workover)
Potash Company of America	L 01883	17.33.13.44444			Min Dev	4123	259	147		7/24/1952	To/Qal	120	239	112	241	3882			OSE Well Record
Potash Company of America	L 01883	17.33.13.444			Min Dev					9/26/1955									OSE Well Record (workover)
Midland Drilling Co	L 03622	17.33.17.12444	32.838584	103.685601	OWD	4207	226	180	4027	7/25/1957	To/Qal	180	200	46	224	3983			OSE Well Record
Kewanee Oil Co	L 02770	17.33.18.24111			PS	4215	214	179		6/28/1955	To/Qal	169	213	35	213	4002			OSE Well Record
Kewanee Oil Co	L 02773	17.33.18.322			PS	4218	214	184		6/6/1955	To/Qal	196	214	30		4218			OSE Well Record
Kewanee Oil Co	L 02773	17.33.18.322			PS	4225	220	202		7/16/1955	To/Qal	202	215	18	215	4010			OSE Well Record
Henry Black Drilling Co	L 03726	17.33.18.22113			OWD	4216	208	188		11/30/1957	To/Qal	188	207	20	207	4009			OSE Well Record
Warren-Bradshaw Exploration	L 02785	17.33.20.220			OWD	4171	250	190		5/20/1955	To/Qal	190	235	60	235	3936			OSE Well Record
Phillips Petroleum Co	L 03133	17.33.23.31320			OWD	4143	230	160	3983	3/4/1956	To/Qal	158	198	70	220	3923			OSE Well Record
Phillips Petroleum Co	L 03133	17.33.23.310	32.81832	103.6395	OWD	4143	230	70	4073	9/3/1958	To/Qal	158	198	160	220	3923			OSE Well Record (workover)
Southwest Potash Co	L 01695	17.33.25.24444			Min Dev	4093	230	137		4/21/1950	To/Qal	137	187	93	190	3903			OSE Well Record
Zapata Petroleum Co	L 03713	17.33.28.143			OWD	4180	210	dry		10/23/1957	To/Qal	--	--		--				OSE Well Record
El Paso Natural Gas Co	L 00058-2 misc	17.33.29.222221	32.811945	103.682131	Ind-Dom	4188	244	204	3984	7/22/1958	To/Qal	185	228	40	244	3944			OSE Well Record
								201.35		3/14/1961									GAI BLM 1978
Oil Test		17.33.29.34411			Oil Test	4044		61.43	3982.57	2/16/1971	To/Qal								GAI BLM 1978

TABLE IV.2.4
Records of Wells in the Vicinity of the DNCS Site
DNCS Environmental Solutions

Owner or OCD Designation	OSE Permit Number	Location PLS	Location Lat D.dddd	Location Long D.dddd	Use	LS Elev	TD	WL	WL Elev.	Date	WBZ	Top WBZ	Bottom WBZ	WBZ thickness	Trc top	Trc elev	Tsr	Driller Yield	Comments or source
Conoco MCA Unit Battery 4 #133		17.33.30.11000	32.801966	103.709129	OCD	4033	casing to 3913, redbeds to 515, anhydrite 515-533								28	4005			OCD Record 5/11/78
Conoco MCA Unit Battery 4 #134		17.33.30.12000			OCD	4057	casing to 1185, redbeds to 1145								45	4012			OCD Record 5/11/78
Conoco MCA Unit Battery 4 #135		17.33.30.14000			OCD	4062	casing to 20								85	3977			OCD Record 5/11/78
Conoco MCA Unit Battery 4 #197		17.33.30.31111	32.80457	103.710241	OCD	4037	casing to 3963, redbeds to 791, sandstone 628-650								96	3941			OCD Record 5/11/78
Walter Williams stock well		17.33.30.124	32.810128	103.703623		4045		70	3975	7/29/1954									Nicholson & Clebsch
		17.33.30.12432				4053		69.14		2/16/1971									GAI BLM 1978
Cities Svc SMGSA Unit Tract 1 #2		17.33.30.42000	32.803774	103.696154	OCD	4055	casing to 1199								145	3910			OCD Record 5/11/78
DNCS Properties LLC Boring 5		17.33.31.	32.78815	103.69491		3979.03	150	dry						0	65	3914.03			DNCS Site Boring Log
DNCS Properties LLC Boring 6			32d46m54.1s	103d42m27.1s		3939.5	75	dry						0	67	3872.5			DNCS Site Boring Log
Open Cased Hole		17.33.33.4224				4082		130.96	3951.04	2/16/1971	To/Qal								GAI BLM 1978
Dillard & Walterader Drilling Co	L 04363	17.33.35.32142			OWD	4122	226	160		1/5/1960	To/Qal	170	200	66	222	3900			OSE Well Record
Gulf Oil Corp	L 05096	17.33.35.433			OWD	4124	233	150		4/6/1968	To/Qal	150	230	83	230	3894			OSE Well Record
Gulf Oil Corp	L 05096	17.33.35.43332			OWD	4120	233	150		3/15/1963	To/Qal	150	230	83	230	3890			OSE Well Record
BE Frizzell	CP 566	18.32.4.144			dom	3864	133	65		6/3/1977	To/Qal	65	133	68	129	3735			OSE Well Record
Virgil Linam	CP 672	18.32.7.44233	32.756902	103.79895	stock	3759	524	430	3329	8/7/1992	Trc	460	489	29	100	3659			OSE Well Record
Virgil Linam	CP 672	18.32.7.44144			stock	3767	540	460	3307	1/29/1985	Trc	498	510		64?			12	OSE Well Record
Billy Williams	Not permitted	18.32.16.223433	35.752	103.7652	exp	3794	100	dry		9/3/1991	--	--	--	0	94	3700			OSE Well Record
Uncased open hole		18.32.16.22433				3973	100	84.18	3888.82	3/18/1968	To/Qal								GAI BLM 1978
Domestic Well		18.32.20.13311			dom	3470	270	179.35	3290.65	2/23/1971	Trc								GAI BLM 1978
Oil test		18.32.22.32322				3763		434.41	3328.59		Trc								GAI BLM 1978
TXO Production	CP 677	18.32.26.11143	32.724776	103.744505	OWD	3768	700	dry		5/9/1985	Sandstone 500-605			0	116	3652			OSE Well Record
Duval Corp.	O 13 002	18.32.32.111244			exp	3701	2060			6/22/1977	2 WBZ's Trc @ 274, Tsr @ 575					3701	575		OSE Well Record
Windmill		18.32.34.22241			stock	3721		117.46	3603.54	4/6/1971	Trc								GAI BLM 1978
Open Cased Hole		18.33.3.34133				4015		60.1	3954.9	4/5/1966	To/Qal								GAI BLM 1978
OXY USA Inc.	CP 758	18.33.4.34233	32.771967	103.669204	exp	3989	250	dry		5/10/1991	--	--	--		65	3924			OSE Well Record
DNCS Properties LLC Boring 3			32.77692	103.70411	exp	3940.23	150	dry		2/6/2013					45	3895.23			DNCS Site Boring Log
DNCS Properties LLC Boring 4			32.777	103.69465	exp	3968.20	150	dry		2/9/2013					50	3918.2			DNCS Site Boring Log
BJ Wooley	CP 546	18.33.9.42241	32.76111	103.660559	Com	3978	90	70	3908	6/3/1975	To/Qal	70	85	20	85	3893			OSE Well Record
	L 6131	18.33.8.213	32.766525	103.68429			194	100				130	193	63					OSE Waters POD summary
Heyco	CP 702	18.33.11.314112			OWD	4054	100			10/21/1986	To/Qal	52	82	100	82	3972		40	OSE Well Record
Heyco	CP 701	18.33.11.314121			OWD	3997	100			10/20/1986	To/Qal	54	84	100	84	3913		40	OSE Well Record
BJ Wooley	L 8288	18.33.12.33334			Com	3997	79	60		5/11/1982	To/Qal	60	80	19		3997			OSE Well Record
Yates Drilling Co	L 2878	18.33.12.440			OWD	4089	205	150		5/30/1955	To/Qal	150	205	55	200	3889			OSE Well Record
Scharbauer Cattle Co	L 6347	18.33.12.440			stock		170	130		7/12/1968	To/Qal			40					OSE Well Record (clean-out)
BJ Wooley	CP 623	18.33.13.11112			Com	3989	82	60		5/10/1982	To/Qal	70	80	22	80	3909		40	OSE Well Record
Sun Oil	CP 689	18.33.13.12122			OWD	4003	100			12/7/1985	To/Qal	70	95	100	95	3908		100	OSE Well Record
KMR Inc	CP 768 exp	18.33.13.21142			exp	4018	115	70		5/6/1992	To/Qal	80	110	45	110	3908		20	OSE Well Record
Unnamed well (Nicholson)		18.33.14.111	32.753778	103.640397	stock	3965	40	35.8	3929.2	6/3/1954	Qal			4.2	40	3925			Nicholson and Clebsch
Unnamed well (Nicholson)		18.33.19.142	32.735618	103.703433	stock	3820		>140	<3680		Tr(?)								Nicholson and Clebsch
Unnamed well (Nicholson)		18.33.34.133	32.704955	103.658439		3760	200	177.4	3582.6	12/9/1958	Tr(?)								Nicholson and Clebsch
W.E. Ellison	L 3454	18.33.30.220			dom	3791	100	35	3756	3/30/1957	To/Qal	70	97	65	97	3694			OSE Well Record

The map in **Figure IV.2.7** illustrates the elevation and terrain of the upper surface of the Chinle shale bedrock mapped by Nicholson and Clebsch (1961). Note that the Triassic shale top elevations determined by the DNCS onsite borings comport with the unaltered Nicholson and Clebsch (1961) isopleths on the upper redbed surface. **Figure IV.2.8** is a hydrogeologic cross section that was prepared using data from the DNCS site characterization borings, as well as the above referenced sources. **Figures IV.2.7** and **IV.2.8** illustrate the distribution and thickness of the Ogallala, the Quaternary alluvium, the Triassic Chinle bedrock shale and a significant sandstone unit (interpreted to be Santa Rosa Sandstone) that is projected to be laterally extensive in the area. On the DNCS site, the alluvium thickness ranges from 45 ft to 67 ft; based upon data projected from nearby wells, the depth to the Santa Rosa Sandstone beneath the DNCS site is approximately 580 ft.

3.4 Site Hydrogeology

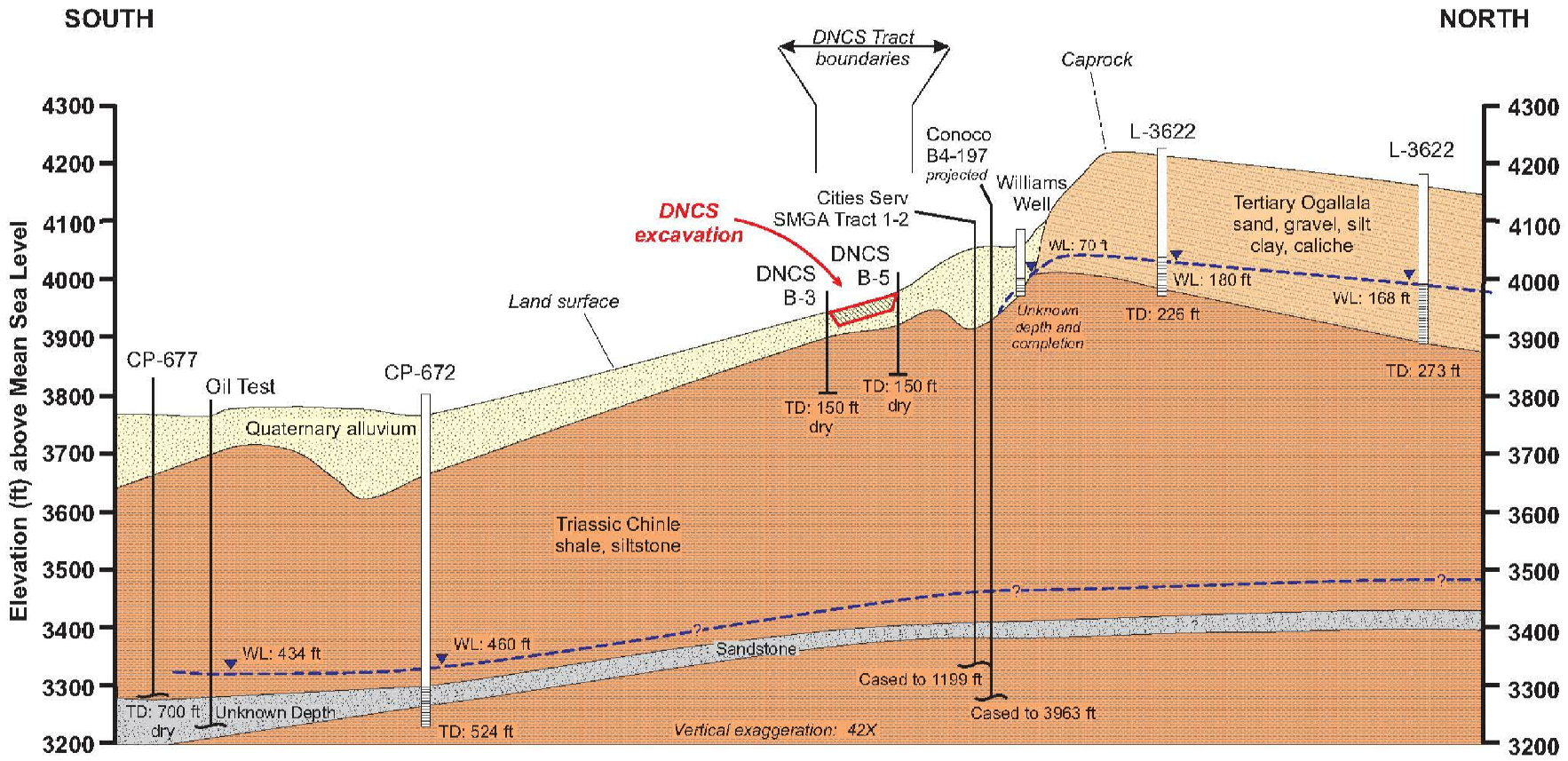
This section addresses regulatory requirements for basic hydrogeologic site data, as well as for demonstration of compliance with siting requirements relative to minimum depth to groundwater, as follows:

> ***19.15.36.8.C.15 NMAC***
>
> *(a) a map showing names and locations of streams, springs and other watercourses and water wells within one mile of the site;*
>
> *(b) laboratory analyses, performed by an independent commercial laboratory, for major cations, and anions; BTE;, RCRA metals; and TDS of groundwater samples of the shallowest fresh water aquifer beneath the proposed site;*
>
> *(c) depth to, formation name, type and thickness of the shallowest fresh water aquifer;*
>
> *(d) soil types beneath the proposed surface waste management facility; including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;*
>
> *(e) geologic cross sections;*
>
> *(f) potentiometric maps for the shallowest fresh water aquifer;*

and

> ***19.15.36.13.A(1) NMAC***
>
> *Depth to groundwater: no landfill shall be located where groundwater is less than 100 feet below the lowest elevation of the design depth at which the operator will place oil field waste*

Hydrogeologic Cross Section
DNCS Permit Site, Lea County, New Mexico



HYDROGEOLOGIC CROSS SECTION THROUGH THE DNCS SITE

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/01/2013	CAD: HYDRO X-SEC.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.8
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\HYDRO X-SEC.dwg
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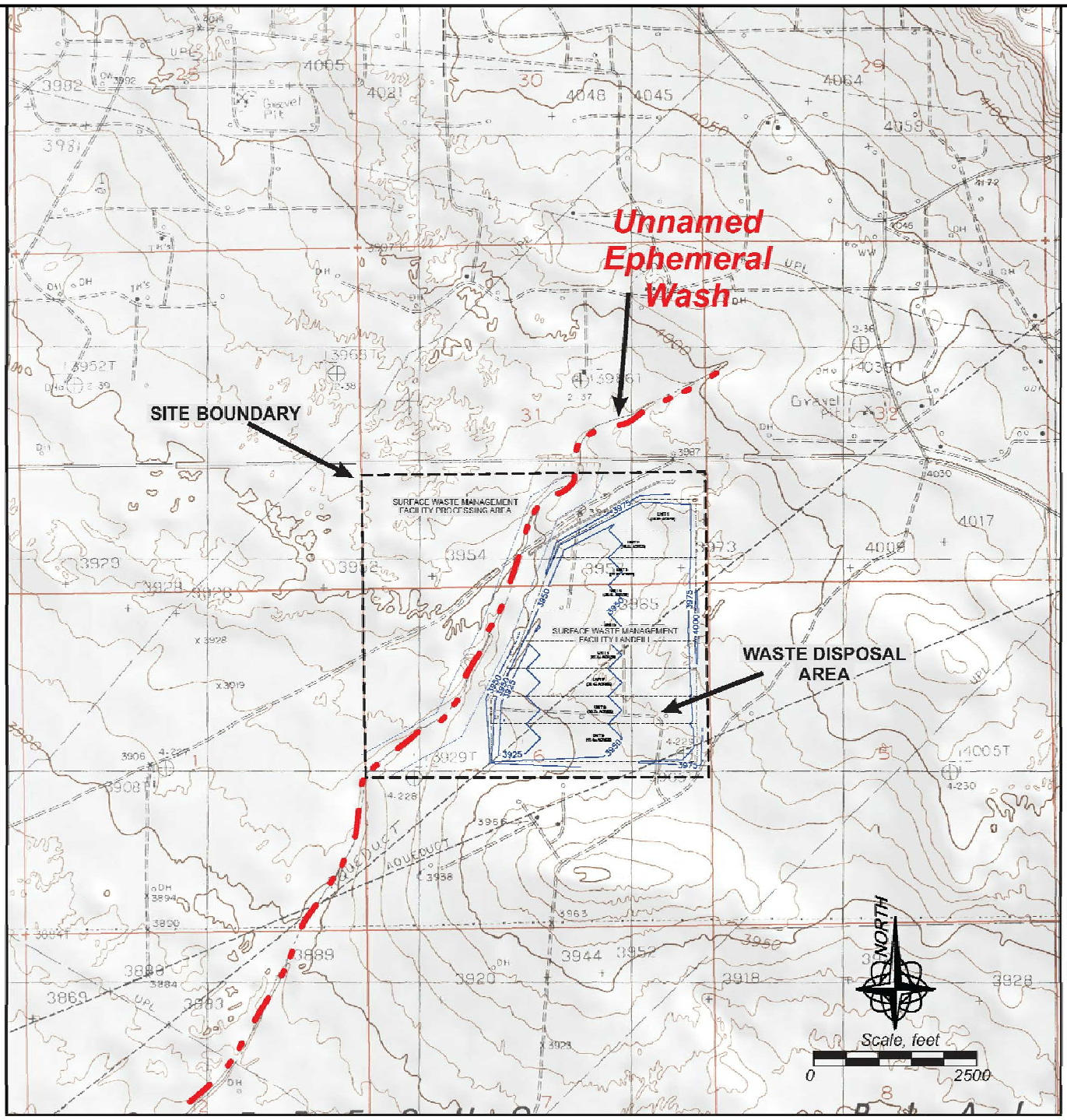
Section 3.3 describes the shallow stratigraphy at the DNCS site. Due to the great depth to the Santa Rosa Sandstone, which is the shallowest fresh groundwater bearing zone in the vicinity of the site, as well as high impedance to vertical movement of fluids present in the upper Triassic Chinle Formation, a *Proposal for Vadose Zone Monitoring, DNCS Environmental Solutions, Lea County, NM* (Golder Associates, Inc, 2013) was submitted to OCD in August 2013. No site demonstration wells have been completed in the Santa Rosa Sandstone and no site specific water level or water quality data are available. Where appropriate, published and agency file data on the Santa Rosa Sandstone relevant to permit application and siting requirements set forth in NMOCD regulations are presented.

3.4.1 Streams, Springs, Watercourses and Water Wells Within One Mile of the Site

No perennial streams or springs are present within one mile of the proposed DNCS site. One unnamed ephemeral wash transects the property; the location of this feature is shown on the map in **Figure IV.2.9**, and discussed in Section 2.2 of this text. There are no water wells within one mile of the proposed DNCS site. Locations of water wells in the vicinity of the DNCS site are shown in **Figure IV.2.7**; a summary of vicinity wells is also included in **Table IV.2.4**. The nearest water wells in the area of the DNCS site include a well completed in alluvium (CP-546), located approximately 2 miles southeast of the site and another well (Williams Stock Well), located approximately 1.5 miles north of the site.

3.4.2 Laboratory Analyses of Shallow Groundwater Samples

The nearest water well to the DNCS site that is completed in Triassic bedrock (presumably Santa Rosa Sandstone) is located approximately 8 miles south of the DNCS site in Section 8, Township 19 South, Range 32 East. Nicholson and Clebsch (1961) reported data from a chemical analysis of a sample from this well; results of the analysis indicated a TDS of 3,680 mg/L and a sulfate concentration of 1,680 mg/L. The TDS concentration reported for this well is comparable to projected TDS values mapped by Dutton and Simkins, (1986) for the area of the DNCS site, which exceeds 3, 000 mg/L.



LEGEND

- Location of drainage feature within one mile of proposed site
- 3950 Landfill basegrade
- Permit property boundary

SURFACE WATER COURSES IN THE VICINITY OF THE DNCS SITE

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/01/2013	CAD: SURFACE WATER.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.9
APPROVED BY: IKG	gei@gordonenvironmental.com	

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3.4.3 Depth, Formation Name, Type and Thickness of the Shallowest Fresh Water Aquifer

Copies of New Mexico Office of the State Engineer (NMOSE) Records of Wells in the vicinity of the DNCS site are included in **Attachment IV.2.C**. Several of the NMOSE Well Records contain depth and elevation data for the Triassic redbed tops, as well lower Triassic sandstone intervals from oil well logs obtained from OCD files. Numerous oil wells in the vicinity of the DNCS site penetrated significant sandstone beds in the lower Triassic section. Locations of these wells are shown on the map in **Figure IV.2.7**. Several water wells in the vicinity of the DNCS site which were completed in Triassic bedrock were identified by Nicholson and Clebsch (1961) and Geohydrology Associates, Inc. (1978). Locations of these wells are shown in **Figure IV.2.7**. Projected geometry of the Santa Rosa Sandstone, as well as the potentiometric surface of this unit are illustrated on the hydrogeologic cross section in **Figure IV.2.8**. Well locations and summary formation and water level data for these wells are listed in **Table IV.2.4**. An oil well located approximately 1 mile north of the DNCS site (Conoco B4-197) penetrated 22 ft of Santa Rosa Sandstone in the depth interval of 628 ft to 650 ft below land surface. A water well located approximately 5 miles southwest of the DNCS site (CP-672) penetrated 29 ft of Santa Rosa Sandstone in the depth interval of 460 ft to 489 ft below land surface. Based upon projected Santa Rosa Sandstone data, it is anticipated that the Santa Rosa Sandstone is approximately 550 ft below land surface and is approximately 25 ft thick at the DNCS site.

3.4.4 Lithology of Stratigraphic Units Above the Santa Rosa Sandstone at the DNCS Site

Stratigraphic units which are above the Santa Rosa Sandstone in the vicinity of the DNCS site include Quaternary alluvium piedmont deposits and upper Triassic Chinle shale. Site characterization borings drilled on the DNCS site penetrated predominantly fine silty gravelly sands with calcrete (caliche) zones in the alluvial section. The site borings penetrated dense siltstone and claystone in the upper Triassic bedrock section to depths of 150 ft below land surface. Available data from nearby oil wells contain only formation top depths for the Triassic redbeds and lower Triassic sandstones; however significant sand developments were noted only in the lower Triassic section.

3.4.5 Geologic Cross Sections

A geologic and hydrogeologic cross section depicting stratigraphy and geometry of the Santa Rosa Sandstone and its potentiometric surface is included in **Figure IV.2.8**. This diagram indicates that the depth to the Santa Rosa Sandstone at the DNCS site is projected to be approximately 550 ft.

3.4.6 Potentiometric Map of the Santa Rosa Sandstone

Potentiometric head value for the Santa Rosa Sandstone is unknown. Dutton and Simkins (1986) prepared a regional projection of the potentiometric surface of the lower Dockum Group aquifer (Santa Rosa Sandstone). The Dutton and Simkins map data is included in **Figure IV.2.10**. Based upon the Dutton and Simkins projection, the head elevation at the DNCS site is expected to be approximately 3475 ft or approximately 490 ft below grade. The artesian head on the Santa Rosa Sandstone at the DNCS location is expected to be approximately 60 ft.

3.4.7 Depth to Shallow Fresh Groundwater

The DNCS site characterization boring investigation results demonstrate that no shallow groundwater is present above a depth of 150 ft below land surface at any of the boring locations.

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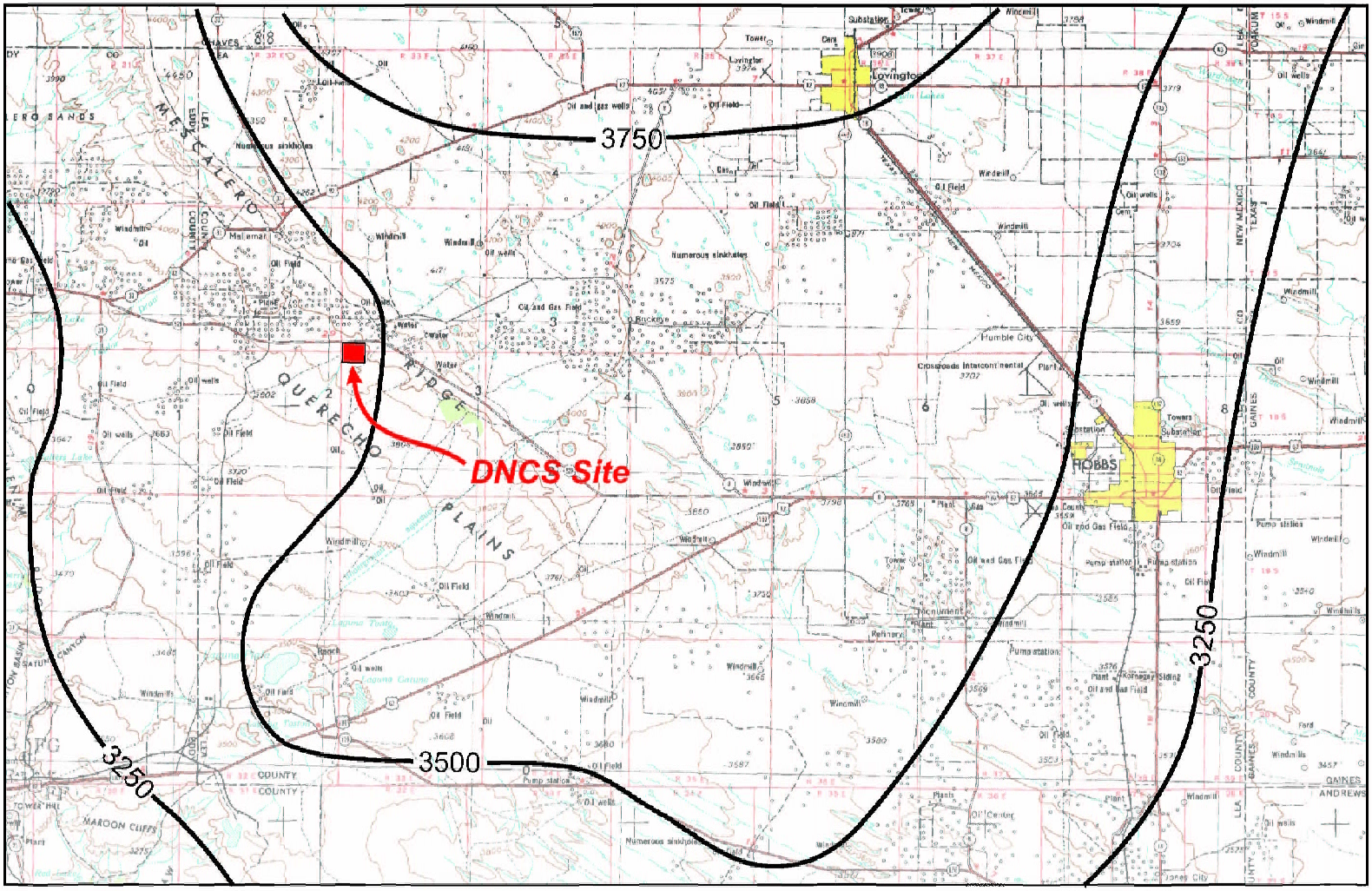

LEGEND

—3500— Isopleth on potentiometric surface of the lower Dockum aquifer (Santa Rosa Sandstone) showing elevation (ft) above MSL
(from Dutton and Simkins, 1986)

NORTH

Scale, miles
0 6

POTENTIOMETRIC SURFACE OF THE SANTA ROSA SANDSTONE AQUIFER

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/01/2013	CAD: POTENTIOMETRIC.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE IV.2.10
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\POTENTIOMETRIC.dwg
Date/Time:Nov. 01, 2013-11:12:27 ; LAYOUT: A (LS)

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APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

ATTACHMENT IV.2.A

LOGS OF GEOTECHNICAL BORINGS AT THE DNCS SITE

Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: B3 | Total Depth 150' | Page 1 of 2

DRAFT

Client: DNCS PROPERTIES, LLC | Project No.: 542.01.01

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: 32.77692°	Date Started: 02-06-2013	Drilling Co.: PRECISION SAMPLING	GEI Rep.: MLH
NONE Ft. at completion (below ground surface)	E: -103.70411	Date Comp: 02-08-2013	Rig Type: CME 85	Drill Meth.: HSA, AIR ROTARY
water level data approximate	Elevation: 3940.23	Location: DNCS SITE, LEA COUNTY SE/4, N/2, SEC 6, T18S, R33E, N.M.P.M.	Driller: JUAN BARRAZA	Sampling Meth.: SS/BR/CC/ARC/AC
	COORD REF SYS WGS84		Helper: TINO V.	

Depth (ft. BGS)	Graphic Lithology	Sampling Method (SS BR CC ARC AC)	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
0'			0–1' SAND, FINE AND SILT; BROWN (WINDBLOWN, LOOSE)		UNCONFORMITY AS BASE OF DUNE SAND
			1'–5', SAND; FINE, AND CALICHE LIGHT BROWN (7.5YR 6/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED)		VARIABLY CALICHEFIED FROM 4' TO 40'
5'				13	
			5'–10', SAND; FINE, WITH CALICHE AND TRACE GRAVEL TO 1"; PINK (7.5YR 7/2), (POORLY GRADED; POORLY TO MODERATELY INDURATED)		
10'				33	
					SPARSE GRAVEL TO 2"; ABUNDANT CALICHE FRAGMENTS
15'				31	
			10'–25', SAND; FINE, WITH SILT, CALICHE FRAGMENTS, AND ROUNDED GRAVEL TO 1"; PINK (5YR 8/3), (POORLY GRADED; POORLY TO MODERATELY INDURATED/CALICHEFIED)		
20'				23	
25'				45	
30'				29	TRACE GRAVEL TO 0.5" DIA.
			25'–45', SAND; FINE, WITH SILT, CALICHE FRAGMENTS, AND ROUNDED GRAVEL TO 3.5"; LIGHT REDDISH BROWN (5YR 6/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED/CALICHEFIED)		
35'				20	
					TRACE GRAVEL TO 3.5" DIA.
40'				32	
					INCREASE IN COARSE SAND AND GRAVEL @ CONTACT WITH UNDERLYING CLAYSTONE AND SILTSTONES
45'			UNCONFORMITY	58	CLAYSTONE AND SILTSTONE BEGINS @ 45' GRAVEL TO 2" DIA. (ABUNDANT WEATHERED IGNEOUS ROCK [TERTIARY AGED SIERRA BLANCA VOLCANICS?] AND LIMESTONE CLASTS AT TOP OF CLAYSTONE–SILTSTONE CONTACT / UNCONFORMITY)
			45'–55', CLAYSTONE AND SILTSTONE; WITH CALICHE FRAGMENTS, AND ROUNDED GRAVEL TO 2"; REDDISH BROWN (2.5YR 5/4), (POORLY GRADED; MODERATELY INDURATED)		
50'				100+	
55'				100+	
60'			55'–70', CLAYSTONE AND SILTSTONE; WITH CALICHE FRAGMENTS, AND ROUNDED GRAVEL TO 2"; REDDISH BROWN (2.5YR 4/4), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)	95	HOLE CHECKED FOR WATER AFTER SITTING OVERNIGHT (15.5 HOURS), NO WATER DOWN-HOLE.
65'				84+	
70'			70'–85', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 6/8), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)	93+	SWITCHING TO AIR-ROTARY DRILLING AT 80' BGS, NO MORE CONTINUOUS CORING
75'					

KEY

BGS = BELOW GROUND SURFACE SS = SPLIT SPOON ARC = AIR ROTARY CUTTINGS AC = AUGER CUTTINGS CC = CONTINUOUS CORE
HSA = HOLLOW STEM AUGER BR = BRASS RING (SPLIT BARREL "MODIFIED CALIFORNIA SAMPLER")

Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: **B3** Total Depth **150'** Page **2** of **2**

Client: **DNCS PROPERTIES, LLC** Project No.: **542.01.01**

DRAFT

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: **32.77692'**	Date Started: **02-06-2013**	Drilling Co.: **PRECISION SAMPLING**	GEI Rep.: **MLH**
NONE Ft. at completion (below ground surface)	E: **-103.70411**	Date Comp: **02-08-2013**	Rig Type: **CME 85**	Drill Meth.: **HSA, AIR ROTARY**
water level data approximate	Elevation: **3840.23**	Location: **DNCS SITE, LEA COUNTY SE/4, N/2, SEC 6, T18S, R33E, N.M.P.M.**	Driller: **JUAN BARRAZA**	Sampling Meth.: **SS/BR/CC/ARC/AC**
	COORD REF SYS **WGS84**		Helper: **TINO V.**	

Depth (ft. BGS)	Graphic Lithology	Sampling Method (SS BR CC ARC AC)	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
			70'–85', (CONTINUED) CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 6/8), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)	160+	BRASS RING SAMPLER BROKE DOWN-HOLE ; SMALL DAMAGED BRASS RING SAMPLE RECOVERED. DRILLHOLE CHECKED FOR WATER AFTER SITTING OVERNIGHT, NO WATER.
80'				100+	NEW "ANVIL" INSTALLED FOR SS SAMPLES
85'			85'–90', CLAYSTONE AND SILTSTONE; PALE RED (2.5YR 6/2), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)	100+	
90'				100+	SOME MnOx-CALCITE VEINLETS AND PARTING COATINGS
95'			90'–110', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 7/8), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		NO MORE SPLIT-SPOON SAMPLING ONLY AIR-ROTARY CUTTINGS FROM 90.25' TO 150' BGS
100'					
105'					
110'			110'–115', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 7/6), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		
115'					
120'			115'–125', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		
125'					
130'					
135'			125'–150'=TD, CLAYSTONE AND SILTSTONE; RED (2.5YR 4/8), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		
140'					
145'					DRILLHOLE CHECKED FOR WATER AFTER SITTING OVERNIGHT; NO WATER. NO WATER SATURATION OF ANY MATERIAL ON AUGERS PRIOR TO PLUGGING HOLE.
150'					TD=150'

KEY

BGS = BELOW GROUND SURFACE SS = SPLIT SPOON ARC = AIR ROTARY CUTTINGS AC = AUGER CUTTINGS CC = CONTINUOUS CORE
HSA = HOLLOW STEM AUGER BR = BRASS RING (SPLIT BARREL "MODIFIED CALIFORNIA SAMPLER")

Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: **B4** Total Depth **150'** Page **1** of **2**

DRAFT

Client: **DNCS PROPERTIES, LLC** Project No.: **542.01.01**

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: **32.77700°**	Date Started: **02-08-2013**	Drilling Co.: **PRECISION SAMPLING**	GEI Rep.: **MLH**
NONE Ft. at completion (below ground surface)	E: **-103.69465°**	Date Comp: **02-09-2013**	Rig Type: **CME 85**	Drill Meth.: **HSA, AIR ROTARY**
water level data approximate	Elevation: **3968.2**	Location: **DNCS SITE, LEA COUNTY CENTRAL SEC 6, T18S, R33E, N.M.P.M.**	Driller: **JUAN BARRAZA**	Sampling Meth.: **SS/BR/CC/ARC**
	COORD REF SYS **WGS84**		Helper: **TINO V.**	

Depth (ft. BGS)	Graphic Lithology	Sampling Method (SS BR CC ARC AC)	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
0'			0–2' SAND, FINE AND SILT; BROWN (WINDBLOWN, LOOSE)		
			2'–5', SAND; FINE, RED (2.5YR 4/6), (POORLY GRADED; POORLY TO MODERATELY INDURATED/CALICHEFIED)		UNCONFORMITY CALICHEFIED FROM 4' TO 40'
5'			5'–10', CALICHE AND SAND; FINE, WHITE (2.5YR 8/1), (POORLY GRADED; MODERATELY INDURATED)	84+	
10'			10'–15', CALICHE AND SAND; FINE, PINKISH WHITE (2.5YR 8/2), (POORLY GRADED; MODERATELY INDURATED)	82+	
15'			15'–20', CALICHE AND SAND; FINE, LIGHT REDDISH BROWN (2.5YR 6/4), (POORLY GRADED; MODERATELY INDURATED)		NO SS SAMPLE COLLECTED
20'			20'–25', SAND; FINE, AND CALICHE, LIGHT REDDISH BROWN (2.5YR 7/3), (POORLY GRADED; POORLY TO MODERATELY INDURATED)	34	
25'			25'–30', SAND; FINE, AND CALICHE, LIGHT REDDISH BROWN (2.5YR 7/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED)	35	
30'			30'–55', SAND; FINE, AND CALICHE, LIGHT REDDISH BROWN (2.5YR 6/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED)	39	DUNE SAND?
35'			30'–40', CALICHE AND SAND; FINE, PINKISH WHITE (2.5YR 8/2), (POORLY GRADED; MODERATELY INDURATED)	90	UNCONFORMITY? ABUNDANT ROOT CASTS AND VOIDS
40'			30'–40', CALICHE AND SAND; FINE, AND GRAVEL TO 1"; PINK (2.5YR 8/3), (POORLY TO MODERATELY GRADED; MODERATELY INDURATED)	84+	
45'			30'–40', CALICHE, SAND; FINE, AND GRAVEL TO 1", PINKISH WHITE (2.5YR 8/2), (POORLY TO MODERATELY GRADED; MODERATELY INDURATED)	93+	
50'			UNCONFORMITY	70	UNCONFORMITY
55'			50'–65', CLAYSTONE AND SILTSTONE; WITH CALICHE FRAGMENTS, AND ROUNDED GRAVEL TO 0.5" AT TOP; DARK REDDISH BROWN (2.5YR 3/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)	70+	
60'				64+	
65'				90+	GOING TO AIR-ROTARY DRILLING FROM 65' TO 150' BGS.
70'			65'–75', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 4/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
75'					

KEY

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HSA = HOLLOW STEM AUGER BR = BRASS RING (SPLIT BARREL "MODIFIED CALIFORNIA SAMPLER")

Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: **B4** Total Depth **150'** Page **2** of **2**

Client: **DNCS PROPERTIES, LLC** Project No.: **542.01.01**

DRAFT

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: **32.77700°**	Date Started: **02-08-2013**	Drilling Co.: **PRECISION SAMPLING**	GEI Rep.: **MLH**
NONE Ft. at completion (below ground surface)	E: **-103.69465°**	Date Comp: **02-09-2013**	Rig Type: **CME 85**	Drill Meth.: **HSA, AIR ROTARY**
water level data approximate	Elevation: **3968.2**	Location: **DNCS SITE, LEA COUNTY CENTRAL SEC 6, T18S, R33E, N.M.P.M.**	Driller: **JUAN BARRAZA**	Sampling Meth.: **SS/BR/CC/ARC**
	COORD REF SYS **WGS84**		Helper: **TINO V.**	

Depth (ft. BGS)	Graphic Lithology	Sampling Method (SS BR CC AC)	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
75'					AIR ROTARY CUTTINGS ONLY, NO MORE AC, SS, OR BR SAMPLES
80'			75'–85', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
85'			85'–95', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 4/3) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; POORLY TO MODERATELY INDURATED)		
90'					
95'			95'–100', CLAYSTONE AND SILTSTONE; RED (2.5YR 5/6) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
100'			100'–105', CLAYSTONE AND SILTSTONE; RED (2.5YR 5/8) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
105'			105'–115', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/3) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
110'					
115'			115'–120', CLAYSTONE AND SILTSTONE; RED (2.5YR 5/6) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; POORLY TO MODERATELY INDURATED)		
120'			130'–130', CLAYSTONE AND SILTSTONE; RED (2.5YR 5/8) WITH SPARSE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
125'					
130'			130'–135', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4) WITH TRACE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
135'			135'–140', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/3) WITH TRACE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; POORLY TO MODERATELY INDURATED)		
140'					
145'			140'–150'=TD, CLAYSTONE AND SILTSTONE; LIGHT REDDISH BROWN (2.5YR 6/4) WITH TRACE VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
150'					CHECKED DRILLHOLE FOR WATER AFTER SITTING OVERNIGHT, NO WATER; OBSERVED AUGER CUTTING, NO SATURATED MATERIAL ON AUGERS TD=150'

KEY

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HSA = HOLLOW STEM AUGER BR = BRASS RING (SPLIT BARREL "MODIFIED CALIFORNIA SAMPLER")

Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: **B5** Total Depth **150'** Page **1** of **2**

DRAFT

Client: **DNCS PROPERTIES, LLC** Project No.: **542.01.01**

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: **32.78815°**	Date Started: **02-10-2013**	Drilling Co.: **PRECISION SAMPLING**	GEI Rep.: **MLH**
NONE Ft. at completion (below ground surface)	E: **-103.69491°**	Date Comp: **02-11-2013**	Rig Type: **CME 85**	Drill Meth.: **HSA, AIR ROTARY**
water level data approximate	Elevation: **3979.03**	Location: **DNCS SITE, LEA COUNTY EAST CENTRAL SEC 31, T17S, R33E, N.M.P.M.**	Driller: **JUAN BARRAZA**	Sampling Meth.: **SS/BR/CC/ARC**
	COORD REF SYS **WGS84**		Helper: **TINO V.**	

Depth (ft. BGS)	Graphic Lithology	Sampling Method	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
0'			0–3' SAND, FINE AND SILT; BROWN (POORLY TO MODERATELY INDURATED)		"BERMS" SOIL HORIZONT 0–3' BGS; MOST DUNE SAND HAS BEEN REMOVED BY MINING FROM THIS LOCATION
			3'–5', CALICHE AND SAND; FINE, WHITE (5YR 8/1), (POORLY GRADED, MODERATELY INDURATED)		UNCONFORMITY
5'					STRONGLY CALICHIFIED FROM 3' TO 10'
			5'–10', CALICHE AND SAND; FINE, PINKISH WHITE (5YR 8/2), (POORLY GRADED; MODERATELY INDURATED)	100+	
10'				44	
			10'–20', SAND, FINE, AND CALICHE; LIGHT REDDISH BROWN (2.5YR 7/4), (POORLY GRADED; MODERATELY INDURATED)		
15'				23	
20'	Qo		20'–25', CALICHE AND SAND, FINE, AND GRAVEL TO 0.5"; PINKISH WHITE (5YR 8/2), (POORLY GRADED; MODERATELY INDURATED)	42	TRACE MnOx STAINED SPOTS TO 3mm DIA.
25'	Qo			29	
30'	Qo		25'–45', SAND, FINE, CALICHE, GRAVEL AND CALCITE CLASTS TO 1"; PINK (5YR 7/4), (POORLY GRADED; MODERATELY INDURATED)	36	
35'				100+	MnOx–CALCITE VEINLETS, VENTIFACTS AND ROOT CASTS @ 35'–38' (UNCONFORMITY OR PEDOGENIC HORIZON?)
40'				60	
45'	Qo			74+	
			45'–50', SAND, FINE, CALICHE AND GRAVEL TO 2"; LIGHT REDDISH BROWN (2.5YR 6/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED)		
50'			50'–55', CALICHE, SAND, FINE, AND GRAVEL TO 2"; PINKISH WHITE (2.5YR 8/2), (POORLY TO MODERATELY GRADED; MODERATELY INDURATED)	88+	
55'				100+	HAMMER WEIGHT PROBLEMS (FIXED)
60'	Qo		55'–65', SAND, FINE, CALICHE, AND GRAVEL TO 2" TRACE CLAY AND SILT @ 64–65'; LIGHT REDDISH BROWN (2.5YR 7/3), (POORLY TO MODERATELY GRADED; MODERATELY INDURATED)	100+	
65'			UNCONFORMITY	83+	UNCONFORMITY MnOx–DRUSY CALCITE VEINLETS @ 65'–66'
70'			65'–75', CLAYSTONE AND SILTSTONE; WITH CALICHE FRAGMENTS; DARK REDDISH BROWN (2.5YR 3/3) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)	100+	DOWN TO AIR-ROTARY DRILLING FROM 70' TO 150' BGS.
75'					

KEY

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Gordon Environmental, Inc.
Consulting Engineers

Log of Borehole No.: B5 | Total Depth 150' | Page 2 of 2

Client: DNCS PROPERTIES, LLC | Project No.: 542.01.01

DRAFT

Water Level Data	Location COORDS's and Elevation (NAVD88)	Borehole Information		
NONE Ft. While Drilling (below ground surface)	N: 32.78815°	Date Started: 02-10-2013	Drilling Co.: PRECISION SAMPLING	GEI Rep.: MLH
NONE Ft. at completion (below ground surface)	E: -103.69491°	Date Comp: 02-11-2013	Rig Type: CME 85	Drill Meth.: HSA, AIR ROTARY
water level data approximate	Elevation: 3979.03	Location: DNCS SITE, LEA COUNTY EAST CENTRAL SEC 31, T17S, R33E, N.M.P.M.	Driller: JUAN BARRAZA	Sampling Meth.: SS/BR/CC/ARC
	COORD REF SYS WGS84		Helper: TINO V.	

Depth (ft. BGS)	Graphic Lithology	Sampling Method (SS BR CC AC)	Soil/Lithology Description	Rig Blow Counts/ft	Notes:
75'			75'–80', CLAYSTONE AND SILTSTONE; WEAK RED (2.5YR 4/2) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)	100+	
80'			80'–95', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
85'					
90'					
95'			95'–105', CLAYSTONE AND SILTSTONE; RED (2.5YR 5/6) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
100'					
105'			105'–115', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
110'					
115'			155'–120', CLAYSTONE AND SILTSTONE; LIGHT REDDISH BROWN (2.5YR 6/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
120'			120'–125', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/3) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
125'			125'–135', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 6/6) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
130'					
135'			135'–140', CLAYSTONE AND SILTSTONE; REDDISH BROWN (2.5YR 5/4) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
140'			140'–150'=TD, CLAYSTONE AND SILTSTONE; RED (2.5YR 5/6) WITH SOME VARIEGATED BROWN–PURPLE AND GREEN LAYERS AND SPOTS, (POORLY GRADED; MODERATELY INDURATED)		
145'					
150'					CHECKED DRILLHOLE FOR WATER AFTER SITTING OVERNIGHT, NO WATER; OBSERVED AUGER PULLING, NO SATURATED MATERIAL ON AUGERS TD=150'

KEY

BGS = BELOW GROUND SURFACE SS = SPLIT SPOON ARC = AIR ROTARY CUTTINGS AC = AUGER CUTTINGS CC = CONTINUOUS CORE
HSA = HOLLOW STEM AUGER BR = BRASS RING (SPLIT BARREL "MODIFIED CALIFORNIA SAMPLER")

Monitor Well/Piezometer Log

Golder Associates

SITE NAME AND LOCATION: name and location
DNCS Properties
Hobbs, NM

NORTHING 32° 46' 54.1"
EASTING -103° 42' 37.1"
DATUM: amsl NAD 83
ELEVATION:

DRILL RIG: CME-75
ANGLE: 90 BEARING: -

DRILLING METHOD: Hollow Stem Auger 6 1/2" O.D.

SAMPLING METHOD: 1.5" I.D Split Spoon
1.5" I.D Brass Ring

WATER LEVEL: Dry
TIME: 1200
DATE: 6/12/2013
CASING DEPTH: 74'

SURFACE CONDITIONS: Dry, Wind blown Fine sand & shrub/ Grass cover. Near Caliche cover Road.

BORING NO. B-6
SHEET 1 of 2
DRILLING START: 0930 DATE: 6/11
DRILLING FINISH: 1130 DATE: 6/11

DRILLING CONTRACTOR Precision Sampling - Alex Bonken
LOGGED BY: Michael Petersen
DATE: 6/11-6/12/2013
JOB NO. 13044144
FILE NAME:

DEPTH IN FEET (ELEVATION)	WELL COMPLETION DETAILS	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, lam.)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PERMEABILITY (np, l, m, h)	Blows OTHER TESTS[5] Counts
		0-2 Silty Sand, Fine Wind blown Red (2.5YR4/6) Dry to 1'6", then slightly moist								
-2		2-7 Sand, Fine, with Caliche + Trace Gravels to 1", Light Brown (7.5YR6/4) Dry - Poorly Graded, Poorly to Mod. Indurated								23 22
-7	5-6 split spoon	7-13 Sand, Fine, with Caliche + Trace Gravel to 1". Reddish Brown, (7.5YR6/6) Poorly Graded, Poorly to moderately Indurated / Caliche Fied. Dry.								20 43 46
-13	10-11.5 split spoon	13-27 Sand, Fine, with Caliche + Some Gravel to 1". Reddish Yellow (7.5YR7/4) Well Graded, Moderately Indurated / Caliche Fied. Dry.								23 50+
	15-16.5 split spoon									21 32 #1
	20-21.5 split spoon									5 5 11
-27	25-26.5 split spoon	27-48 Sand, Fine, with Silt + Caliche, Trace Gravels up to 1". Light Brown (7.5YR6/4) Poorly Graded, Poorly Indurated. Dry.								23 29 35
	30-31.5 split spoon									18 31 31
	35-36.5 split spoon									

Monitor Well/Piezometer Log

Golder Associates

SITE NAME AND LOCATION: name and location: DNCS Gordon Environmental, Hobbs, NM	DRILLING METHOD: 6 1/2" OD HSA	BORING NO. B-6
	SAMPLING METHOD: 1.5" ID Split Spoon, 1.65" ID Brass Ring	SHEET 2 of 2
NORTHING	WATER LEVEL	DRILLING START: 9:20
EASTING:	TIME	DRILLING FINISH: 11:30
DATUM: amsl	DATE	DATE: 6/11
ELEVATION:	CASING DEPTH	DATE: 6/12
DRILL RIG: CME75	SURFACE CONDITIONS:	
ANGLE: 90 BEARING: -		

DRILLING CONTRACTOR: Precision Sampling - Alex Bonham

LOGGED BY: Michael Petersen

DATE: 6/11 - 6/12/2013

JOB NO. 13004144

FILE NAME:

DEPTH IN FEET (ELEVATION)	WELL Samples COMPLETION DETAILS	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL (i.e., angularity, moisture, HCL reaction, cementation, max. particle size, gravel/cobble hardness, odor, interbeds, lam.)	% OVERSIZE[1]	% GRAVEL[2]	% SAND[2]	% FINES[2]	COLOR	CONSISTENCY[3]/ CEMENTATION[4]	PLASTICITY (np, l, m, h)	BGU OTHER TESTS[5] Counts
37		27-48 Sand, Fine, with silt & Caliche, Trace gravels up to 1". Light Brown (7.5YR 6/4) Poorly Indurated, Dry- * Finely layered (2-5 mm) horizons beginning 35' Similar soil characteristics.								
	40-41.5 Split Spoon									18 19 14
	45-46.5 Split Spoon									10 10 11
48		48-67 Sand, Well Graded w/ Caliche. Trace Gravels up to 1". White (2.5Y 8/1) Well Indurated / Calcrete. Dry. * Decreased Penetration Rate								
	50-51.5 Split Spoon									22 50+
	55-56.5 Split Spoon									32 21 23
	60-61.5 Split Spoon									12 28 50+
	65-66.5 Split Spoon									22 50+
		Unconformity								
67		67-75 Claystone and Siltstone, with Caliche fragments, Dark Reddish Brown (2.5YR 3/3) Poorly to moderately Graded, Moderately Indurated, Dry-								
	70-70.5 Split Spoon									50+
	70.5-71 Brass Ring	* No Recovery from Brass Ring Sample, Split-Spoon sample								70+
75		75' Total Depth								

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

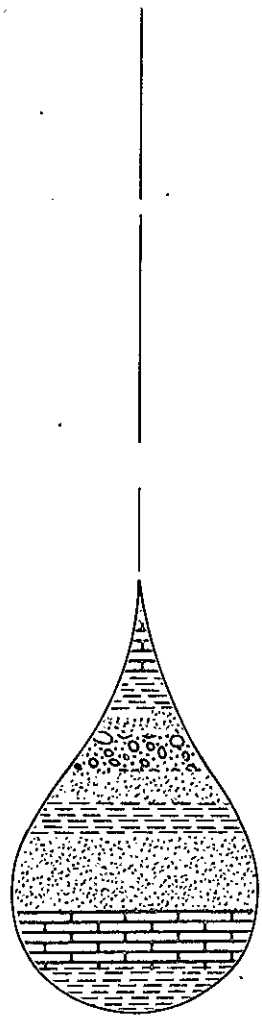
ATTACHMENT IV.2.B

SELECTED WELL DATA FROM WELLS IN THE VICINITY OF THE DNCS SITE (GEOHYDROLOGY ASSOCIATES, 1978)

COLLECTION OF HYDROLOGIC DATA
EASTSIDE ROSWELL RANGE EIS AREA
NEW MEXICO

by

Geohydrology Associates, Inc.



for

BUREAU OF LAND MANAGEMENT

Denver, Colorado

Contract No. YA-512-CT7-217

1201 Childers Dr., N. E., Albuquerque, N. M. 87112
505-293-6971

3225 Candelaria Rd., N.E., Albuquerque, N.M. 87107
505-345-5713

June 1978

COLLECTION OF HYDROLOGIC DATA
EASTSIDE ROSWELL RANGE EIS AREA
NEW MEXICO

by

GEOHYDROLOGY ASSOCIATES, INC.

Albuquerque, New Mexico

for

BUREAU OF LAND MANAGEMENT

Denver, Colorado

Contract No. YA-512-CT7-217

June 1978

CONTENTS

Page

ILLUSTRATIONS

Page

TABLES

L E A C O U N T Y

Records of wells from Lea County, New Mexico

Location	Well Status	Altitude (feet)	Depth of Well(ft.)	Depth to Water(ft.)	Aquifer	Date of Measurement	Remarks
16.38.30.211	Irrigation		118.0	57.48	Ogll	Jan.7,1975	
30.31111	Irrigation	3755		56.29	Ogll	Feb.17,1971	
30.41334	Irrigation	3749		58.74	Ogll	Feb.17,1971	
31.24434	Used windmill	3737		66.44	Ogll	Feb.18,1966	
32.42113	Irrigation	3722		81.72	Ogll	Feb.17,1971	
34.131	Irrigation		140.0	61.22	Ogll	Mar.18,1958	
34.131	Irrigation			97.42	Ogll	Jan.7,1975	
35.110	Used well			41.33	Ogll	Jan.6,1952	
35.124114	Irrigation	3693		62.92	Ogll	Feb.11,1971	
35.21112	Irrigation	3694		62.34	Ogll	Feb.11,1971	
35.33122	Irrigation	3702		71.68	Ogll	Feb.11,1971	
16.39. 5.31132	Abandoned irrigation	3702		62.98	Ogll	Feb.12,1971	
6.31111	Irrigation	3704		45.09	Ogll	Feb.12,1971	
7.33132	Irrigation	3695		54.85	Ogll	Feb.12,1971	
17.311142	Irrigation	3685		69.03	Ogll	Feb.11,1971	
17.34422	Irrigation	3680		75.90	Ogll	Feb.11,1971	
19.133121	Irrigation	3684		57.76	Ogll	Feb.11,1971	
20.13311	Irrigation	3673.02	132.0	54.74	Ogll	Feb.26,1963	
20.31111	Irrigation	3673		60.50	Ogll	Feb.26,1963	
20.41143	Open cased hole			68.84	Ogll	Feb.11,1971	
29.23332	Irrigation	3678.7	172.0	83.54	Ogll	Jan.7,1975	
29.343344	Irrigation	3681		77.22	Ogll	Feb.11,1971	
30.11413	Irrigation	3682		60.30	Ogll	Feb.11,1971	
30.43424	Abandoned stock	3661		51.89	Ogll	Feb.15,1961	
17.32. 1.32343	Irrigation	4225		165.85	Ogll	Mar.15,1966	

Records of wells from Lea County, New Mexico

Location	Well Status	Altitude (feet)	Depth of Well(ft.)	Depth to Water(ft.)	Aquifer	Date of Measurement	Remarks
17.32. 1.32343	Used oil test	4225		173.19	Ogll	Mar.10,1966	
2.433	Industrial/domestic	4240	200	60	Ogll	1948	Yield:50gpm(est)
2.434	Industrial/domestic	4240	192	60	Ogll	Jun.1,1950	
2.434343	Industrial	4195		148.33	Ogll	Mar.14,1961	
2.443	Industrial/domestic		190		Ogll		Yield:50gpm(est)
3.13443	Unused industrial	4239		168.14	Ogll	Feb.10,1966	
3.140	Industrial				Ogll		
3.320	None	4250		175.6	Ogll	Jul.21,1954	
3.32114	Industrial	4232		162.21	Ogll	Feb.8,1971	Oil test
3.43333	Industrial	4200		136.89	Ogll	Feb.8,1971	
4.442	None	4180		82.9	Qtal	Jun.3,1954	
11.231	Industrial/domestic	4180	139		Ogll		
11.233	Industrial/domestic	4200	140	70	Ogll ?	Sep.20,1947	Yield:9gpm(est)
11.34332	Open hole	4096		47.11	Ogll	Feb.8,1971	
11.411	Industrial/domestic	4170	200	70	Ogll ?	Jun.15,1946	Yield:90gpm(est)
11.411	Industrial/domestic		130	70	Ogll ?	Sep.23,1947	Yield:50gpm(est)
12.44414	Abandoned stock	4168		120.13	Ogll	Feb.11,1966	
14.12121	Domestic	4092		31.53	Ogll	Feb.8,1971	
17.33. 3.14134	Unused	4184		146.98	Ogll	Feb.14,1966	
4.241441	Oil test	4183		159.58	Ogll	Feb.18,1971	
4.44322	Unused	4179		149.72	Ogll	Feb.6,1961	
4.4444	Shot hole	4173	152.0	145.20	Ogll	Mar.14,1961	
5.22221	Industrial	4198		162.20	Ogll	Mar.31,1971	
6.11111	Used floodwell	4198	310.0	209.87	Ogll	Mar.31,1971	
6.42411	Unused	4223		181.94	Ogll	Feb.18,1971	

Records of wells from Lea County, New Mexico

Location	Well Status	Altitude (feet)	Depth of Well(ft.)	Depth to Water(ft.)	Aquifer	Date of Measurement	Remarks
17.33. 7.141221	Open hole	4234		192.54	Ogll	Feb.15,1971	
7.323221	Open hole	4229		188.61	Ogll	Feb.15,1971	
9.342113	Open cased hole	4191		171.39	Ogll	Feb.15,1971	
12.24333	Used windmill	4118		122.79	Ogll	Feb.16,1971	
13.341	Observation	4124	252	165.46	Ogll	Jan.8,1975	
13.434	Industrial	4123		175.54	Ogll	Jan.17,1961	
16.24242	Stock	4176		165.43	Ogll	Feb.11,1966	
18.22133	Domestic	4216		182.83	Ogll	Feb.15,1971	
18.322	Industrial/domestic	4230	220		Ogll		
18.3223	Industrial	4224		196.59	Ogll	Mar.13,1961	
20.221443	Open hole	4165	160.0	147.39	Ogll	Mar.14,1961	
20.24143	Used windmill	4173		163.45	Ogll	Feb.15,1971	
22.43233	Used windmill	4140		155.17	Ogll	Feb.16,1971	
23.3132	Open cased hole	4143		157.62	Ogll	Feb.16,1971	
25.244	Industrial		230.0	140.07	Ogll	Jan.3,1967	
26.422	Abandoned industrial	4125	200.3	162.35	Ogll	Sep.7,1956	
28.110	None	4185	241	198.0	Ogll	May 11,1954	
29.222221	Industrial	4188		201.35	Ogll	Mar.14,1961	
29.34411	Used oil test	4044		61.43	Ogll	Feb.16,1971	
30.12432	Domestic	4053		69.14	Ogll	Feb.16,1971	
33.4224	Open cased hole	4082		130.96	Ogll	Feb.16,1971	
17.34. 2.1310	Used windmill	4057		85.94	Ogll	Feb.16,1971	
2.343442	Abandoned	4048		86.15	Ogll	Feb.16,1971	
4.4320	Used windmill	4079		99.79	Ogll	Feb.16,1971	
7.213242	Open cased hole	4123		130.33	Ogll	Feb.16,1971	

Records of wells from Lea County, New Mexico

Location	Well Status	Altitude (feet)	Depth of Well(ft.)	Depth to Water(ft.)	Aquifer	Date of Measurement	Remarks
17.38.21.41211	Irrigation	3682	112.0	48.23	Ogll	Feb.3,1971	
23.111141	Irrigation	3673.9		48.0	Ogll	Aug.3,1971	
27.133	Irrigation		125.0	33.92	Ogll	Jan.23,1962	
30.113	Used well			37.10	Ogll	Jan.11,1957	
30.12111	Irrigation	3704		56.97	Ogll	Feb.3,1971	
30.312			56.0	41.12	Ogll	May 22,1953	
31.21111	Irrigation	3691		56.97	Ogll	Feb.3,1971	
31.31111	Irrigation		110.0	50.32	Ogll	Jan.7,1975	
31.41422	Irrigation	3684		59.61	Ogll	Aug.3,1971	
32.232432	Irrigation	3689		66.90	Ogll	Feb.3,1971	
34.113	Irrigation	3660	126.0	48.18	Ogll	Jan.7,1975	
35.14413	Irrigation	3659		56.93	Ogll	Feb.4,1971	
36.212	Irrigation			68.37	Ogll	Jan.23,1962	
17.39.18.13314	Used windmill	3674		78.07	Ogll	Feb.3,1971	
18.33242	Irrigation	3663		64.04	Ogll	Feb.3,1971	
19.31332	Abandoned stock	3648		50.04	Ogll	Feb.22,1966	
30.23444	Abandoned irrigation	3657	165.0	66.20	Ogll	Feb.22,1966	
31.42121	Irrigation	3640		64.39	Ogll	Feb.4,1971	
32.111	Irrigation			87.78	Ogll	Jan.6,1970	
32.41322	Irrigation	3642		80.17	Ogll	Feb.4,1971	
18.32.16.22433	Uncased open hole	3793	100	84.18	Ogll	Mar.18,1968	
20.13311	Domestic	3470	270.0	179.35	Trcl	Feb.23,1971	
22.32322	Oil test	3763		434.41	Trcl	Apr.6,1971	
34.22241	Windmill	3721		117.46	Trcl	Apr.6,1971	
18.33. 3.34133	Open cased hole	4015		60.10	Qtal	Apr.5,1966	

Records of wells from Lea County, New Mexico

Location	Well Status	Altitude (feet)	Depth of Well(ft.)	Depth to Water(ft.)	Aquifer	Date of Measurement	Remarks
18.33. 3.343	Domestic/stock	4012	64	59.18	Qtal	Feb.19,1971	
10.23244	Domestic	4005	75	41.64	Qtal	Feb.9,1971	
10.44211	Stock	3985	60	41.64	Ogll	Feb.9,1971	
11.4433	Irrigation	3986		42.40	Qtal	Feb.9,1971	
12.44211	Windmill	4089		137.48	Qtal	Feb.5,1971	
13.13144	Open cased hole	3968		31.85	Qtal	Feb.8,1971	
13.44244	Open cased hole	3973		46.66	Qtal	Feb.8,1971	
14.111	None	3965	40.0	35.8	Qtal	Jun.3,1954	
14.1114	Windmill	3976		35.20	Qtal	Feb.9,1971	
14.11140	Stock	3976	46.0	35.84	Qtal	Mar.6,1968	
19.142	Stock	3820		140+	Trsc ?	Dec.9,1958	
23.23140	Open cased hole	3881	58	45.65	Qtal	Feb.9,1971	
34.133	None	3760	200.0	177.4	Trsc	Dec.9,1958	
18.34. 1.12222	Industrial	3991		79.70	Ogll	Mar.6,1961	
2.223333	Industrial	4009		98.03	Ogll	Feb.4,1971	
4.11124	Open cased hole	4064		126.78	Ogll	Feb.4,1971	
8.23213	Windmill	4042		104.20	Ogll	Feb.4,1971	
11.43212	Industrial	4000	211.0	110.78	Ogll	Feb.23,1971	
12.42333	Industrial	3982	204.0	111.01	Ogll	Feb.19,1971	
15.24130	Windmill	4015		103.28	Ogll	Feb.5,1971	
18.413212	Open cased hole	4076		143.30	Ogll	Feb.5,1971	
20.323323	Windmill	4015		98.92	Ogll	Feb.5,1971	
20.323333	Domestic/stock	4020	111.0	100.19	Ogll	Mar.6,1968	
22.343				109.92	Ogll	Jan.8,1975	
25.13111	Uncased shot hole	3977		94.88	Qtal	Mar.9,1961	

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

ATTACHMENT IV.2.C

NEW MEXICO OFFICE OF THE STATE ENGINEER WELL RECORDS FOR WELLS IN THE VICINITY OF THE DNCS SITE

SECTION _____

TOWNSHIP 17S

RANGE 32E

Form WR-23 FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

#2	Mo. 2-127-2		

(Plat of 640 acres)

(A) Owner of well Water Flood Assoc., Inc.

Street and Number 3017 Lubbock St.

City Ft Worth 9, State Texas

Well was drilled under Permit No. L-3980 and is located in the NE ¼ NE ¼ NE ¼ of Section 1 Twp. 17S Rge. 32E

(B) Drilling Contractor O. R. Musslewhite License No. WD99

Street and Number Box 56

City Hobbs, State New Mexico

Drilling was commenced March 6, 1960

Drilling was completed March 15, 1960

Elevation at top of casing in feet above sea level 4257 Unkown Total depth of well 270

State whether well is shallow or artesian Shallow Depth to water upon completion 200

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	210	265	55	Sand, grey tight
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
10 3/4	40	8	0	270	270	Shoe collar	122	260

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received MAR 22 1960

File No. L-3980 Use Water Flood Location No. 17.32.1.22233

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1	Brown	Soil & rock
1	20	19	White	Caliche & rock
20	90	70	Grey	Sandy shale
90	120	30	"	Sand
120	150	30	"	Sand, hard
150	165	15	"	Sand
165	180	15	Red	Sand
180	185	5	Grey	Sandy shale
185	210,	25	"	Sand
210	265	55	"	Sand, hard tight
265	270	5	Red	Sandy shale

L S Elev 4251'
Depth to K Trc 265'
Elev of K Trc 3986'

Loc. No. 17.32 1. 33322

Hydro. Survey Field Check X

SOURCE OF ALTITUDE GIVEN

Interpolated from Topo. Sheet ✓

Determined by Inst. Leveling

Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

O. R. Musselwhite
Well Driller

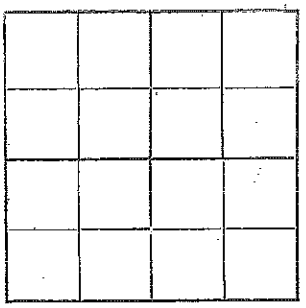
change the location on map
to read Sec. 1. 22233
Was plotted @ 1. 33322

Form WR-23 FIELD ENGR. LOG STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1



(Plat of 640 acres)

(A) Owner of well B.E. Paschall

Street and Number 412 Central St.

City Artesia State New Mexico

Well was drilled under Permit No. L - 4079 and is located in the ¼ ¼ ¼ of Section I Twp. 17 S Rge. 32 E

(B) Drilling Contractor G.O. Aldredge License No. WD. 79

Street and Number Box 379

City Lovington State New Mexico

Drilling was commenced Feb. 18 19 60

Drilling was completed March 3 19 60

Elevation at top of casing in feet above sea level Total depth of well 225 Ft.

State whether well is shallow or artesian Shallow Depth to water upon completion 175 Ft.

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	192	210	18	Red water sand
2	212	224	12	Brown Water sand
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
8"		welded	0	225	225	Collar	182	225
							Gravel packed	

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
		12			10 sacks mud used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE 1960 MAR 25 AM 8:22

File No. L-4079 Use Comm & Dom Location No. 17.32.1.32343

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2	Gray	Surface soil
2	5	3	White	Caliche rock
5	70	65	Red	Sand
70	110	40	Brown	Sand
110	125	15	Brown	Sand rock
125	192	67	Brown	sand
192	210	18	Red	Water sand
210	212	2	Red	Shale
212	224	12	Brown	Water sand
224	225	1	Red	Shale

L S Elev 4225'
Depth to K Trc 224'
Elev of K Trc 4001'

Loc. No. 17.22.1.322345

Hydro. Survey X Field Check

SOURCE OF ALTITUDE GIVEN

Interpolated from Topo. Sheet X

Determined by Inst. Leveling

Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

G. B. Wheelage
Well Driller

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well [illegible] Co.

Street and Number Box 125

City Maljamar, State New Mex.

Well was drilled under Permit No. L-3980-X and is located in the [illegible] 1/4 660 of E LINE of Section 1 Twp. 17 Rge. 32

(B) Drilling Contractor [illegible] License No. [illegible]

Street and Number Box 579

City Lovington, State New Mexico.

Drilling was commenced Sept. 21 1962

Drilling was completed Oct. 12 1962

Elevation at top of casing in feet above sea level 4242 Total depth of well 255

State whether well is shallow or artesian Shallow Depth to water upon completion 179

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	205	225	20	Gray water sand
2	228	250	22	[illegible] water sand
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
[illegible]	Heavy	[illegible]	0	255	255	Halliburton	215	255
						open end		

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in In.	Tons Clay	No. Sacks of Cement	Methods Used
		16	Gravel	packed	[illegible] sacks of gravel [illegible]
					in hole while drilling.

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX. 1962 NOV -7 AM 8:15

File No. L-3980-X Renumbered L-3980-S Use SRO Location No. 17.32.1.42213

#3 Maljamar 2-127-2

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1	Brown	Top Soil
1	20	19	White	Caliche rock
20	228	108	Brown	Sandy clay
228	250	22	Gray	Water Sand
250	255	5	Red	Shale
328	250	22	brown	Water Sand
250	255	5	Brown	Shale
				Top of red bed

4242'

L S Elev

Depth to K Trc 250'

Elev of K Trc 3992'

SP 17.32.1.432 13

Loc. No.

Hydro. Survey X Field Check

SOURCE OF ALTITUDE GIVEN

Interpolated from Topo. Sheet X

Determined by Inst. Leveling

Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well

C.O. Aldredge
Well Driller

L-3980-X

17.32.1.420

Form WR-23 FIELD ENGR. LOG STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Maljamar Repressuring Agreement #6

Street and Number

City State

Well was drilled under Permit No. L-4020 and is located in the SW ¼ SW ¼ SE ¼ of Section 2 Twp. 17 Rge. 32

(B) Drilling Contractor George Pennington License No.

Street and Number

City Loco Hills, State New Mexico

Drilling was commenced 19

Drilling was completed June 2, 19 50

Elevation at top of casing in feet above sea level Total depth of well 200 ft.

State whether well is shallow or artesian shallow Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	139	195	60	Sand and little gravel
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7			0	196	196		153	196
10 3/4			0	145	145	Pulled as well was gravel packed.		

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. L-4020 Use S. R. O. O. Location No. 17.32.2.43343

#5 well file 2-132-1

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20		brown	Top soil
20	45			Caliche
45	100		red	Sandrock
100	135			Sand and little gravel (water section)
195	200		red	Shale
				Driller estimated that well was good for
				100 gallons of water per minute.
				This well is located in State Section 2,
				T. 17 S., R. 32 E., N.M.P.M., Lea County,
				New Mexico.
				L S Elev 4195
				Depth to K Trc 135
				Elev of K Trc 4060
				L-4020 17.32.2.433
				Loc. No.
				Hydro. Survey Field Check X
				SOURCE OF ALTITUDE GIVEN
				Interpolated from Topo. Sheet X
				Determined by Inst. Leveling
				Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

George Pennington
Well Driller

L-4020

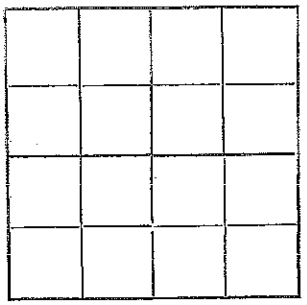
17.32.2.433

Form WR-23 FIELD ENGR. LOG STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1



(Plat of 640 acres)

(A) Owner of well Maljamar Repressuring Agreement #5

Street and Number

City State

Well was drilled under Permit No. L-4019 and is located in the SE ¼ SW ¼ SE ¼ of Section 2 Twp. 17 Rge. 32

(B) Drilling Contractor Ed. Burke License No.

Street and Number

City Hobbs, State New Mexico

Drilling was commenced 19

Drilling was completed May 6, 19 48

Elevation at top of casing in feet above sea level Total depth of well 182 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	126	180		Red water sand
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7			0	182	182		113	182

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
0	182	10			

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. L-4019 Use S.R.O.O. Location No. 17.32.2.434 3M

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20		brown	Top Soil
20	38		brown	Loose sand
38	70		grey	Firm sand
70	82		brown	Loose sand
82	98		red.	Sandrock
98	126		brown	Sand and gravel
126	180		red	Water sand
180	182		red	Shale

This well is located in State Section 2, T-17 S., R. 32 E., N.M.P.M., Lea County, New Mexico.

L S Elev 4195

Depth to K Trc 180

Elev of K Trc 4015

Loc. No. 17.32.2. 4 3434

Hydro. Survey Field Check X

SOURCE OF ALTITUDE GIVEN

Interpolated from Topo. Sheet X

Determined by Inst. Leveling

Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Ed. Burke
Well Driller

L-4019

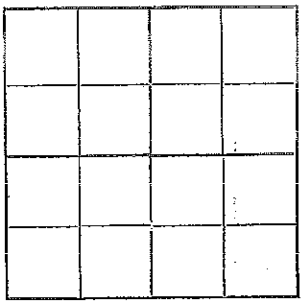
17.32.2.434

Form WR-23 FIELD ENGR. LOG STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1



(Plat of 640 acres)

(A) Owner of well Maljamar Co-op Repressuring Agreement #7

Street and Number

City State

Well was drilled under Permit No. L-4021 and is located in the SW ¼ SE ¼ SE ¼ of Section 2 Twp. 17 S. Rge. 32 E.

(B) Drilling Contractor George Pennington License No.

Street and Number

City State

Drilling was commenced 19

Drilling was completed June 14, 19 50

Elevation at top of casing in feet above sea level Total depth of well 190 ft.

State whether well is shallow or artesian shallow Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	160	185	25	Sand and little gravel.
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7			0	197	197		153	197
10 3/4			0	155	155	Pulled as well was gravel packed.		

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. L-4021 Use S. R. O. Q. Location No. 17.32.2.44332

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20		brown	Top soil
20	50			Caliche
50	120		Brown	Loose sand
120	160		red	Sand rock
160	185			Sand and little gravel (water section)
185	190		red	Shale
				Eight yards of pea gravel was placed between
				10-3/4" pipe and 7" pipe; 10-3/4" pipe runs
				to 155' and pulled as well was graveled.
				Driller estimated that well was good for
				100 gallons of water per minute.
				This well is located in State Section #2,
				T-17S, R-32E, NMPM, Lea County, New Mexico.
				10" hole was drilled by George Pennington
				of Loco Hills, New Mexico. Completed
				June 14, 1950.
				L S Elev 4203'
				Depth to K Trc 185'
				Elev of K Trc 4018'
				Fr 17.32.2.44333
				Loc. No.
				Hydro. Survey Field Check X
				SOURCE OF ALTITUDE GIVEN
				Interpolated from Topo. Sheet X
				Determined by Inst. Leveling
				Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

George Pennington
Well Driller

L-4021

17.32.2.443

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Mescalero Ridge Water Coop. Owner's Well No. _____
Street or Post Office Address P.O. Box 49
City and State Maljamar, NM 88264-0002

Well was drilled under Permit No. L-4021-S and is located in the:

a. _____ ¼ NE ¼ SE ¼ SE ¼ of Section 3 Township 17S Range 32E N.M.P.M.
in Lea County.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Alan Eades License No. WD1044

Address 1200 E. Bender Blvd., Hobbs, NM 88240

Drilling Began 1-21-02 Completed 1-21-02 Type tools rotary Size of hole 9 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 260 ft.

Completed well is XX shallow ☐ artesian. Depth to water upon completion of well _____ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
185	257	72	Sand & SAndy Brown Clay	
			Stringers	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6	160psi				260		180	260

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY #215199

Date Received 02/05/02

Quad _____ FWL _____ FSL _____

File No. L-4021-S Use Suppl Location No. 17.32.3 445

23422

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	1	1	Top Soil
1	26	25	Caliche
26	90	64	Sand
90	132	42	Sandy Brown Clay & Sandstone Stringers
132	185	53	Sand & Sandstone Stringers
185	257	72	Sand & SAndy Brown Clay Stringers
257	260	3	Red Clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Alan Eades by Andrea Root
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well _____ Owner's Well No. _____
Street or Post Office Address _____
City and State _____

Well was drilled under Permit No. _____ and is located in the:

a. _____ ¼ _____ ¼ _____ ¼ _____ ¼ of Section _____ Township _____ Range _____ N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor _____ License No. _____

Address _____

Drilling Began _____ Completed _____ Type tools _____ Size of hole _____ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well _____ ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well _____ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:
_____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received Typed 5/11/78

Quad _____ FWL _____ FSL _____

File No. _____ Use 011 Location No. 17.32.3.4323334

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	40		Caliche
40	116		Anhydrite and sand
116	150		Sand
150	363		Red bed
363	695		Red bed and shells
695	990		Red shale with shells

Section 7. REMARKS AND ADDITIONAL INFORMATION

This well record is an excerpt from Oil Conservation Commission files at Hobbs, N.M.

Location: 17.32.3.4323334 Elevation: 4284' GL
Owner: Chevron U.S.A. Inc.
Maljamar (Grayburg) Unit #12
Record of Casing: 8 5/8" - 1344'

Rotary

660' FSL - 1905' FEL

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All questions, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 6 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well _____ Owner's Well No. _____
Street or Post Office Address _____
City and State _____

Well was drilled under Permit No. _____ and is located in the:

a. _____ ¼ _____ ¼ _____ ¼ _____ ¼ of Section _____ Township _____ Range _____ N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor _____ License No. _____

Address _____

Drilling Began _____ Completed _____ Type tools _____ Size of hole _____ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well _____ ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well _____ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:
_____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received Typed 5/11/78

Quad _____ FWL _____ FSL _____

File No. _____ Use 011 Location No. 17.32.3.44300

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	115		Caliche
115	255		Red rock
255	290		Sand
290	1055		Red rock
			L S Elev 4285 4285
			Depth to K 290 Trc 115
			Elev of K 3995 Trc 4170

Section 7. REMARKS AND ADDITIONAL INFORMATION

This well record is an excerpt from Oil Conservation Commission files at Hobbs, N.M.

Location: 17.32.3.44300 Elevation: 4285' DF
Owner: Chevron Oil Co.
Maljamar (Grayburg) Unit #14
Record of Casing: 8 5/8" - 1275'

Rotary

330' FSL - 990' FEL

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All questions, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section [illegible] need be completed.