NM1 - __57___

PART 36 PERMIT APPLICATION

Volume II

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 II: FACILITY MANAGEMENT PLANS

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Submitted To:

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Oil Conservation Division
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APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

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1.0 INTRODUCTION

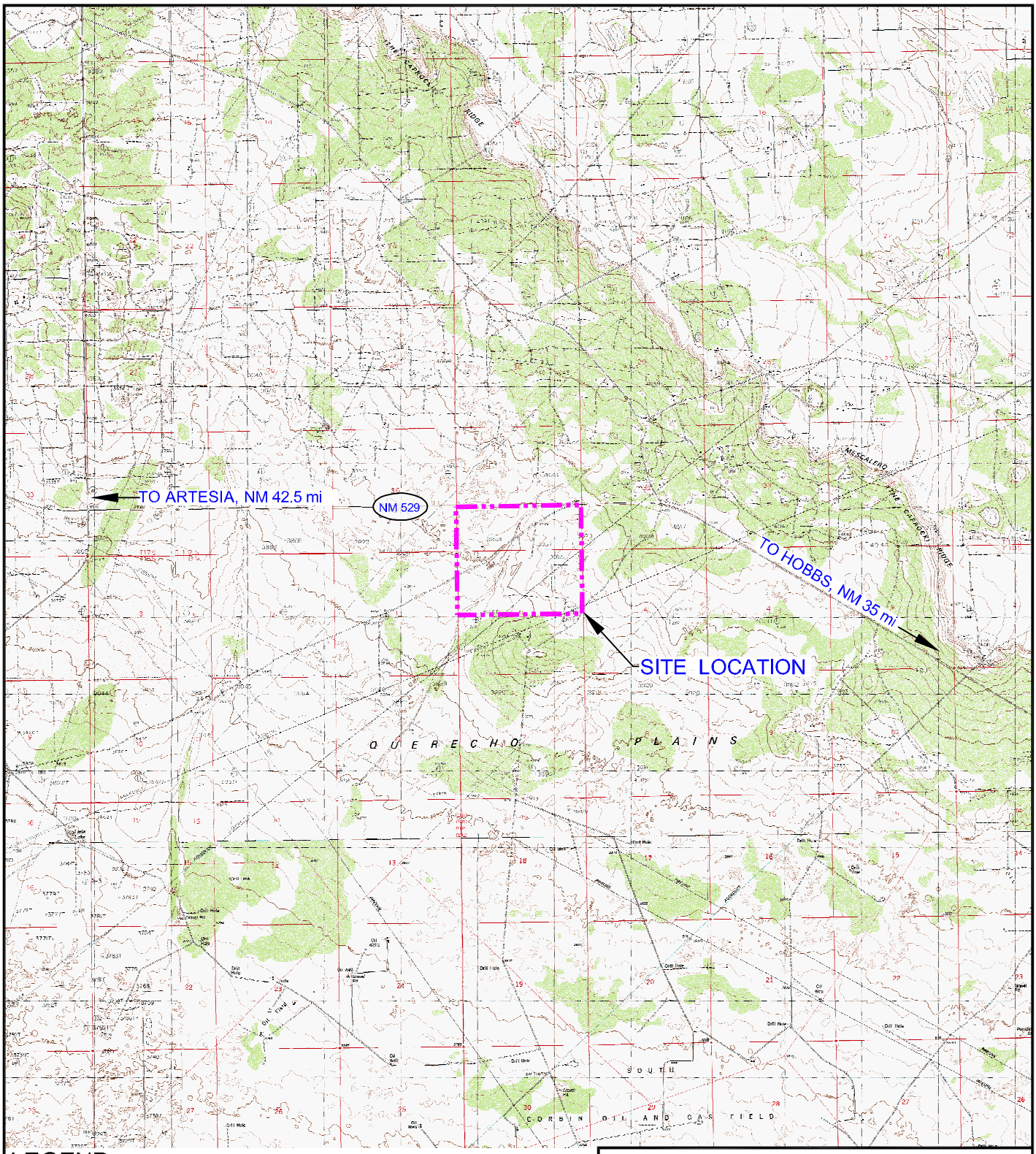
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 Purpose

The purpose of this Operations, Inspection & Maintenance Plan (the Plan) is provide guidance to the DNCS Facility staff in the daily operational procedures that have been established in compliance with 19.15.36.8 and 19.15.36.13 NMAC to provide protection of fresh water, public health, safety, and the environment. **Table II.1.1** (OCD Requirements) provides an outline of the specific 19.15.36 NMAC requirements addressed by this Plan.

1.2 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 II.1.1**). The areas proposed for waste processing (177 acres ±) and landfilling (318 acres ±) comprise a total facility footprint of 495 acres ±. Site access will be provided on the south side of NM 529.



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, 2013-15:10:52 ; 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

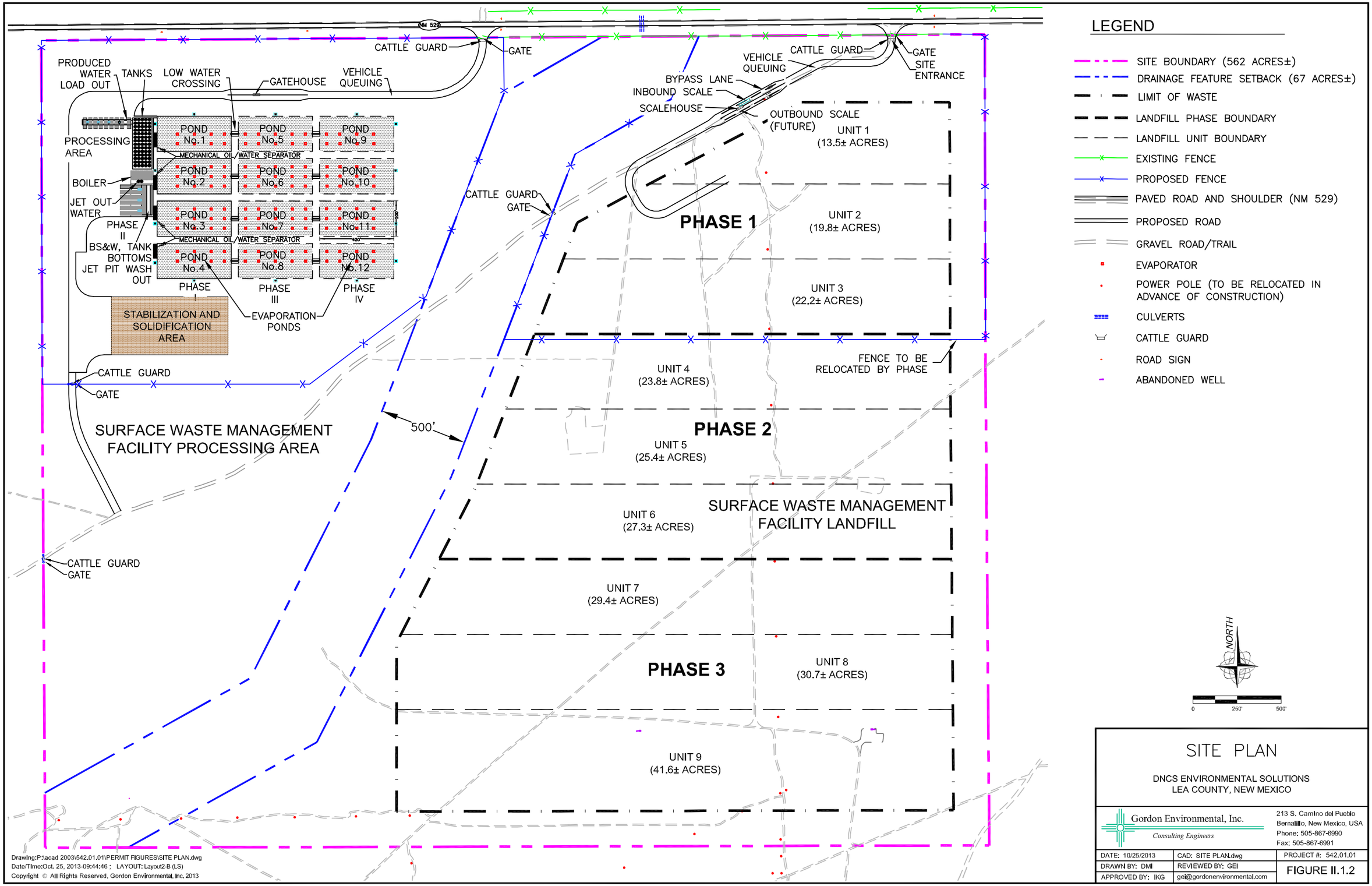
DATE: 10/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.1.1
OCD Requirements: 19.15.36 NMAC
DNCS Environmental Solutions

19.15.36.8.C(4)	*a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas;*
19.15.36.8.C(7)	*an inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC;*
19.15.36.8.C(14)	*a best management practice plan to ensure protection of fresh water, public health, safety and the environment;*
19.15.36.13.L	*Each operator shall have an inspection and maintenance plan that includes the following:*
	(1) *monthly inspection of leak detection sumps including sampling if fluids are present with analyses of fluid samples furnished to the division; and maintenance of records of inspection dates, the inspector and the leak detection system's status;*
	(3) *inspections of the berms and the outside walls of pond levees quarterly and after a major rainfall or windstorm, and maintenance of berms in such a manner as to prevent erosion.*

1.3 Facility Description

The DNCS Facility is a proposed new Surface Waste Management Facility that will include two main components; an 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 Plan provided as **Figure I.1.2** identifies the locations of the Processing Area and Landfill facilities, which are further detailed on the **Permit Plans** (**Volume III.1**). The proposed facilities are detailed in **Table II.1.2**, and are anticipated to be developed in four primary phases as described in **Table II.1.3**.



SITE PLAN

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
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DATE: 10/25/2013	CAD: SITE PLAN.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.1.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.1.2
Proposed Facilities[1]
DNCS Environmental Solutions

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	9
Produced water receiving tanks	12
Produced water settling tanks	48
Mechanical oil/water separation unit	4
Evaporation ponds	12
Stabilization and Solidification Area	1
Oil treatment plant	1
Crude oil recovery tanks	5
Oil sales tanks	5
Customer jet wash	1 (6 bays)

Note:
[1]Subject to change. The proposed facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, market conditions, technology, etc.

TABLE II.1.3
DNCS Development Sequence[1]
DNCS Environmental Solutions

Description	Summary	Year No.[2]
Phase I - Initial Landfill & Produced Water Processing Operation.		
• Initial Landfill Cell (13.5-acres) • Produced water load-out points (4) • Tank farm berm (complete) • Boiler (75 HP) running a heat transfer fluid tank farm • Produced Water Receiving Tanks (4), 1,000 bbl capacity[3] • Settling Tanks (16), 1,000 bbl capacity • Crude Oil Recovery Tank (1), 1,000 bbl capacity • Oil Sale Tank (1), 1,000 bbl capacity • Mechanical Oil/Water Separation Unit • Ponds (4) capable of evaporating 3,000 bbl of liquid per day	The oil recovered from the Produced Water Processing Operations process is anticipated to be 6 bbl per day. This material will be pumped to the heated crude oil recovery tank for further processing before being pumped to the oil sale tank.	1
Phase II - Jet-Out Pit Operation.		
• Jet-Out Pit (six-station) for handling basic sediment and water (BS&W), tank bottoms, oily drilling muds and tank wash-outs • Additional crude oil recovery tank (1), 1,000 bbl capacity • Install 5-acre Stabilization and Solidification area	The oil recovered from the top of the Jet-Out Pit will be pumped to a heated Crude Oil Recovery Tank installed in the Tank Farm. Oil recovery from the Produced Water Tanks will also be plumed to this tank. Water recovered from the Pit will be pumped to the Produced Water Receiving Tanks. Sediments from the Pit will be bucket-loaded out of the pit and transferred to the Stabilization and Solidification Area for processing prior to landfilling.	2
Phase III - Expanded Produced Water Processing Operation.		
• Produced water load-out points (4) • Additional Produced Water Receiving Tanks (4), 1,000 bbl capacity • Additional Settling Tanks (16), 1,000 bbl capacity • Additional Crude Oil Recovery Tanks (3), 1,000 bbl capacity • Additional Oil Sales Tanks (2), 1,000 bbl capacity • Additional (2) Mechanical Oil/Water Separation Units • Additional ponds (4) capable of evaporating an additional 5,000 bbl per day of liquid	The additional oil recovered from the expanded Produced Water Processing Operation process, anticipated to be 6 bbl per day, will pumped to the Crude Oil Recovery tanks for further processing.	3
Phase VI - Ultimate Produced Water Processing Facility.		
• Additional Produced Water Receiving Tank (4), 1,000 bbl capacity • Additional Settling Tanks (16), 1,000 bbl capacity • Additional Oil Sales Tanks (1), 1,000 bbl capacity • Additional Mechanical Oil/Water Separation Unit • Additional ponds (4) capable of evaporating an additional 4,000 bbl per day of liquid	The additional oil recovered from the ultimate Produced Water Processing Facility will be pumped to the Crude Oil Recovery Tank for further processing.	4

Notes:

[1] *The DNCS site development sequence is subject to change. Different combination of these improvements may be constructed at any time.*

[2] *Estimated number of years after OCD Surface Waste Management Facility Permit issued*

[3] *bbl = barrels of oil*

2.0 GENERAL FACILITY INFORMATION

2.1 Land Use and Zoning

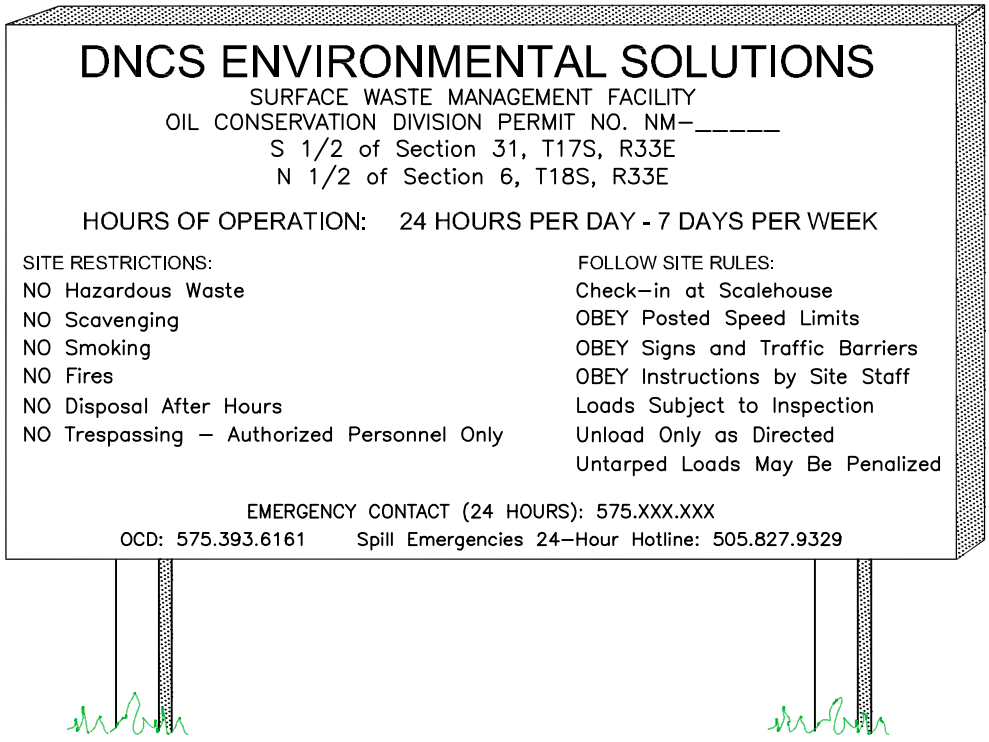
The DNCS Facility is located within a 562 acre ± tract in unincorporated eastern Lea County, approximately 10.5 miles east of the US 82/NM 529 intersection and 6.3 miles south of Maljamar, NM (**Figure II.1.1**). The Facility is surrounded by undeveloped space on all sides with NM 529 situated along the northern boundary and mineral exploration (oil and gas) the only local development. The closest permanent residence is located in Maljamar, NM, approximately 6.3 miles to the northwest. Lea County does not have zoning specifications on land use in unincorporated areas.

2.2 Access Control

Access control for DNCS will be provided by perimeter fencing for both the Processing Area and the Landfill; cattle guards; locking gates; and employee presence when open for waste receipts. No oil field waste will be accepted unless an attendant is on duty. The Facility will be gated and locked when the site is not attended. The Site Location Map is plotted on the most recent United States Geological Survey (USGS) map (**Figure II.1.1**) and shows the Facility location in relation to state roads and adjacent features. The Site Plan, provided as **Figure II.1.2,** provides a plan view of the Facility showing the proposed layout, fencing, gates, and cattle guards.

2.3 Site Signs

A sign will be posted at the Facility entrance which identifies the location of the site, hours of operation, emergency telephone numbers, and delivery instructions (**Figure II.1.3A**). Additional site rules that are applicable to both Facility personnel and customers will be posted at the receiving areas and along the access roads to advise drivers concerning speed limits, prohibited activities, acceptable waste types, delivery instructions, and other health and safety precautions. Example signs are provided in **Figure II.1.3B**. Identification and cautionary signs for pits, ponds, and tanks in the Processing Area will also be installed at the Facility as needed.



SITE ENTRANCE SIGN (TYPICAL)

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: 10/16/2013	CAD: ENTRANCE SIGN.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.3A
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\ENTRANCE SIGN.dwg
Date/Time:Oct. 22, 2013-14:52:43

DNCS ENVIRONMENTAL SOLUTIONS

LEA COUNTY, NEW MEXICO

S ½ SECTION 31, T17S, R 33E
N ½ SECTION 6, T18S, R 33E

OIL CONSERVATION DIVISION PERMIT NO. NM-_____

SITE SIGNS (TYPICAL)

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

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213 S. Camino del Pueblo
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Phone: 505-867-6990
Fax: 505-867-6991

DATE: 10/23/2013	CAD: SITE SIGNSdwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.3B
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SITE SIGNS.dwg
Date/Time:Oct. 23, 2013-14:48:58

2.4 Traffic

Traffic will arrive at the DNCS Facility by traveling east or west on NM 529, turning south at the site access points into the Processing Area or Landfill. Traffic for the Facility is not anticipated to have an impact on current public transportation patterns. Vehicles accessing the Facility, including staff, are anticipated initially to average 100 vehicles per day (vpd). Daily traffic flow into the Facility may increase to over 500 vpd as oil field production activities continue to increase and more companies utilize the Facility. Traffic flow for the DNCS Facility is depicted on **Figures II.1.4A** (Processing Area) and **II.1.4B** (Landfill).

3.0 FACILITY PERSONNEL

3.1 Requirements and Duties

Daily operations at the Facility will be supervised by the DNCS management team located onsite in the Processing Area Gatehouse and the Landfill Scalehouse (**Figure II.1.2**). Management and administrative support will be provided by DNCS personnel routinely on-site. Acceptance criteria for the oil field waste are described in the Oil Field Waste Management Plan (**Volume II.2**). The initial general staffing list for the Facility is provided in **Table II.1.4**, subject to adjustment in response to changes in incoming waste volumes, market demands, technology updates, etc.

TABLE II.1.4
Facility Staffing List
DNCS Environmental Solutions

Description	Number
General Manager	1
Plant Supervisor	1-2
Equipment Operator	4-6
Laborer	2-4

NM 529

CATTLE GUARD

GATE

GATEHOUSE

VEHICLE QUEUING

PRODUCED WATER LOAD OUT

PROCESSING AREA

TANKS

JET OUT WATER

BS&W, TANK BOTTOMS JET PIT WASH OUT

MECHANICAL OIL/WATER SEPARATOR

MECHANICAL OIL/WATER SEPARATOR

EVAPORATION POND POND No.1

EVAPORATION POND POND No.5

EVAPORATION POND POND No.9

EVAPORATION POND POND No.2

EVAPORATION POND POND No.6

EVAPORATION POND POND No.10

EVAPORATION POND POND No.3

EVAPORATION POND POND No.7

EVAPORATION POND POND No.11

EVAPORATION POND POND No.4

EVAPORATION POND POND No.8

EVAPORATION POND POND No.12

PHASE I

PHASE III

PHASE IV

STABILIZATION AND SOLIDIFICATION AREA

CATTLE GUARD

GATE

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- EXISTING FENCE
- PROPOSED FENCE
- PAVED ROAD AND SHOULDER (NM 529)
- PROPOSED ROAD
- GRAVEL ROAD/TRAIL
- CATTLE GUARD
- ROAD SIGN
- INBOUND TRAFFIC ROUTE
- OUTBOUND TRAFFIC ROUTE

NORTH

0 125' 250'

PROCESSING AREA TRAFFIC FLOW 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: 10/23/2013	CAD: TRAFFIC FLOW A.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.4A
APPROVED BY: IKG	gel@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\TRAFFIC FLOW A.dwg
Date/Time:Oct. 23, 2013-13:41:03 ; LAYOUT: B (LS)

NM 529

GATE

CATTLE GUARD

SITE ENTRANCE

VEHICLE QUEUING

INBOUND SCALE

SCALEHOUSE

OUTBOUND SCALE (FUTURE)

UNIT 1
(13.5± ACRES)

PHASE 1

UNIT 2
(19.8± ACRES)

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- PAVED ROAD AND SHOULDER (NM 529)
- PROPOSED ROAD
- GRAVEL ROAD/TRAIL
- CATTLE GUARD
- ROAD SIGN
- POWER POLE
- INBOUND TRAFFIC ROUTE
- OUTBOUND TRAFFIC ROUTE

NORTH

0 75' 150'

LANDFILL TRAFFIC FLOW PLAN

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

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

DATE: 10/23/2013	CAD: TRAFFIC FLOW B.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.1.4B
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\TRAFFIC FLOW B.dwg
Date/Time:Oct. 23, 2013-13:54:25 ; LAYOUT: LayoutB-B (LS)

3.2 Training Requirements

Training for personnel will include health and safety protection, waste screening, fire prevention, emergency response, etc. Emergency Coordinators for the proposed Facility are identified in the Contingency Plan (**Volume II.5**). A trained operator or designated representative with full knowledge of the 19.15.36 NMAC Rules and the DNCS Permit requirements will be present at all times while the Facility is in operation. Facility staff will be required to read this Plan, the Oil Field Waste Management Plan (**Volume II.2**), the Hydrogen Sulfide (H_2S) Prevention and Contingency Plan (**Volume II.3**), and the Contingency Plan (**Volume II.5**). Signature sheets acknowledging that this requirement has been met will be retained in the Facility Operating Record in accordance with the Safety Communications Program (**Attachment II.1.A**).

4.0 FACILITY OPERATIONAL PROCEDURES

The operational procedures for the DNCS Facility are designed to maximize the efficiency of waste receiving, processing, and disposal; and to protect the health and safety of Facility staff and delivery personnel. Detailed operational procedures are enumerated in each of the applicable sections of this Plan for oil field waste stream processing, landfill disposal, contingency planning, recordkeeping, personnel training, etc. Oil field waste disposal operations will be conducted in a safe and environmentally sound manner in accordance with 19.15.36 NMAC.

4.1 Noise Control

There are no permanent residences within 6 miles of the Facility, and most heavy equipment operations (i.e., the Landfill) will be conducted below grade and behind berms, which will aid in noise control. Surrounding lands are unoccupied, or consist of cattle grazing and development related to oil and gas exploration.

4.2 Odor Control

Prior to oil field waste acceptance, vehicles will be randomly screened for the presence of hydrogen sulfide (H_2S). If H_2S is detected above 10 parts per million (ppm), the load will be treated with calcium hypochlorite [$Ca(ClO)_2$] to lower the H_2S to acceptable levels prior to unloading operations. In addition, at least 1,000 gallons of chemicals such as bleach will be maintained on-site to control H_2S and its associated odors originating from the evaporation ponds or other operating units. Downwind land uses (i.e., primarily to the north and northwest) are vacant.

4.3 Dust Control

The access roads and active areas within the Facility will be treated with water, approved recycled waters or dust palliatives, as needed, from a water truck to reduce dust. The posted speed limit will be 15 miles per hour (mph) inside the property which will assist in limiting the amount of dust generated by onsite traffic. Routine operations listed on **Table II.1.5** are the most likely sources of dust, along with recommended primary and secondary control measures:

TABLE II.1.5
Dust Control
DNCS Environmental Solutions

A water truck will be available to apply water, approved recycled waters, or dust palliatives to the access roads and active areas within the DNCS Facility as needed to reduce dust. In addition, the posted speed limit will be 15 mph inside the property. Listed below are routine operations that are the most likely sources of dust, along with recommended primary and secondary control measures:

- **Disposal Operations -**
    - Primary Control Measure: Paving of high-traffic areas, apply water to unpaved roads as necessary, enforce speed limit posted on-site.
    - Secondary Control Measure: Apply dust palliatives to unpaved portions of the Facility, provide additional pavement.
- **Excavations -**
    - Primary Control Measure: Water areas prior to and during excavation. Water areas of excavation and haul roads during and at the end of each day to form a dust-binding soil crust.
    - Secondary Control Measure: Phase work to reduce the amount of disturbed surfaces, apply additional water, work at lower elevations and higher areas when wind velocity is low.

- **Stockpiles -**
    - Primary Control Measure: Pre-water areas prior to excavation. Apply water to short-term stockpiles and when transporting soils, stockpile below-grade or behind berms.
    - Secondary Control Measure: Control vehicle access to the area. Apply dust surfactant to long-term stockpiles or apply seed/mulch to prevent erosion.
- **Track out extending onto public roadways –**
    - Primary Control Measure: Pave permanent on-site entrance roadways, sweep as necessary.
    - Secondary Control Measure: Apply recycled asphalt, caliche/gravel pads or similar materials at the transition from unpaved to paved roadways.
- **Unpaved roadways and parking areas –**
    - Primary Control Measure: Limit vehicle speed via posting speed limits; apply water, use aggregate or caliche.
    - Secondary Control Measure: Apply water and surfactants to unpaved roads and parking lots, as needed, provide additional pavement.

4.4 Minor Spills/Releases

The spill or release of a potentially hazardous material at the Facility is most likely to involve fuel or various vehicle fluids (i.e., engine oil, hydraulic oil, antifreeze, etc.). Other materials most likely to present a concern as a result of normal operations include petroleum products and petroleum wastes delivered to the Facility. Spills involving these types of materials could occur during fueling, routine maintenance operations or during unloading for processing/disposal of waste. These minor spills will be cleaned up immediately upon discovery.

The Facility will maintain spill clean-up kits on-site that include absorbent materials, shovels, and small containment buckets. Waste materials resulting from minor spills and clean-up will be managed and disposed of in accordance with the Oil Field Waste Management Plan (**Volume II.2**). Although highly unlikely, large spill/releases from onsite ponds and tanks may occur. The response procedures for this type of release are detailed in the Contingency Plan (**Volume II.5**).

5.0 LANDFILL OPERATIONS

The proposed DNCS Landfill operation will provide for the permanent disposal of exempt and non-hazardous waste generated in the development and production of oil and gas resources. The Landfill operation will be guided by the Landfill design presented in **Volume III** (Engineering Design and Calculations); and detailed in the **Permit Plans** (**Volume III.1**).

5.1 Landfill Equipment

Table II.1.6 identifies the equipment proposed for the landfill operations. This inventory has proven effective at similar facilities in managing ongoing construction and operations. Pieces of equipment may be added or subtracted from the list corresponding to the rate of waste flow, projected earthmoving activities, changes in technology, etc. Some operating and construction functions, such as mass excavation and geosynthetic liner installation, will be subcontracted to qualified firms. The equipment inventory demonstrates both the redundancy and back-up capabilities of the on-site Landfill equipment. Following is a summary of functions and capabilities of the major units:

- The compactors are high-ground-pressure pieces of equipment specially designed for waste receiving; compaction, daily cover application, and related fill face activities.
- The scrapers are used primarily for earthmoving activities, such as excavation of new cells and hauling of cover material from designated stockpiles. Scrapers will often deliver soil directly from the excavation of a new cell to an area near the active fill face. The scrapers can apply daily, intermediate, and final cover at a high rate of delivery.
- Dozers are tracked pieces of equipment that are used to move soil and waste, usually for short distances. The dozers assist the scrapers in preparation of new cells, and can apply cover at the fill face. Dozers are versatile pieces of equipment that are also valuable in cover maintenance, road grading, and waste compaction as back-ups to the compactors, graders, and front-end loaders.
- Front-end loaders are used for earthmoving activities and cell construction tasks. They can be used for excavation of soil or movement of waste, and for delivery and application of cover material. Front-end loaders can provide back-up to scrapers and dozers, and can be used for road and drainage maintenance, if necessary.
- The water wagon will be used on a daily basis to control dust that could originate from on-site roads, active excavations, covered areas, etc. The water sources for the wagon will be on-site tanks and ponds.
- The motor grader is effective is temporary roadway construction, maintenance, and drainage improvements.

TABLE II.1.6
Landfill Equipment
DNCS Environmental Solutions

Type	Number	Primary Purpose
CAT 970 Loader	1	Earthmoving
CAT 950 Loader	1	Earthmoving
CMI 390 Compacter	2	Waste compaction
CAT 627 Scrapers	2	Daily cover operations/earthmoving
CAT 621 Water Wagon	1	Dust control
CAT D8 Dozer	1	Waste and soil spreading/compaction
CAT D7 Dozer	1	Waste and soil spreading/compaction
CAT MG140 Motor Grader	1	Road and drainageway maintenance

Notes:

1. *Equivalent models may be substituted.*
2. *The number of each equipment type is matched to the projected waste types and volumes; the list may be modified in response to changes in waste streams, technology, etc.*
3. *Equipment is subject to routine replacement.*
4. *There will be arrangements made with local equipment vendors for maintenance and back-up leasing.*

5.2 Waste Characteristics

DNCS Landfill will accept exempt and non-hazardous oil field wastes generated from oil and gas exploration and production operations. No hazardous waste will be accepted at DNCS. The Facility will require documentation for accepting oil field wastes, including OCD Form C-138 *(Request for Approval to Accept Solid Waste)*, and will screen incoming waste in accordance with the Oil Field Waste Management Plan (**Volume II.2**). **Table II.1.7** lists proposed waste receipts sorted by type with a corresponding estimate of volume and proportion. The initial average daily solid waste disposal (oil field waste) acceptance rate is anticipated to be 500 cubic yards (yd^3) per day, equal to approximately 500 tons per day (2,000 pounds per yd^3).

TABLE II.1.7
Landfill Waste Characterization and Anticipated Daily Waste Receipts[1]
DNCS Environmental Solutions

Origin	Approximate Proportion	Daily Average (yd^3)[1,2]
Contaminated Soil	60%	300
Drilling Mud	30%	150
Stabilized Tank Bottoms	5%	25
Other Wastes	5%	25
Totals	**100%**	**500**

Notes:

[1]Values based on anticipated initial volumes of waste that will be delivered from area oil field production activities.

[2]yd^3 = cubic yards

[3]1 yd^3 oil field waste = 2,000 pounds (lbs)

5.3 Sequence of Landfill Development

The DNCS Landfill site development plan is presented on the Site Plan (**Figure II.1.2**) and on **Permit Plans, Sheet 3** (**Volume III.1**); and is further described in **Table II.1.8**. The Landfill will consist of three Units (I-III), each of which will contain several waste cells. Landfill development will commence with the "North Phase" as shown on **Permit Plans, Sheets 6** and **7** (**Volume III.1**). Unit I will be developed first with the construction of Cell 1 in the northeast corner of Unit I. Cell development will progress southward through Unit I before continuing in Units II and III. The proposed disposal process is the "area fill" method for all cells. Each cell will be equipped with a composite liner/leachate collection system and stormwater controls demonstrated to meet applicable engineering standards and OCD requirements.

Cells may be developed in segments and combinations, and more than one cell may be in operation at any one time in response to incoming waste volumes, the progress of site development, and providing available disposal volume below-grade. The objective is to provide a sufficient area for disposal while keeping the total disturbed area to a minimum. When cells reach interim or final grade, additional cover will be applied as needed to achieve the required cover thickness, and the area will be graded and vegetated within twenty-four months once the final grade is achieved. Soils and wastes may be temporarily stored and covered above interim or final grade.

TABLE II.1.8
Landfill Development Sequence
DNCS Environmental Solutions

1. **Planning**
   a. Confirm that the cell area has been cleared for excavation (e.g., utilities).
   b. Review Permit Plans, Construction Plans, and any pertinent Permit Documents and Permit Conditions.
   c. Establish survey line/grade controls, construction benchmarks, etc.
   d. Develop cell-specific sequence of development, contractor coordination, equipment, and staffing requirements.
2. **Earthwork**
   a. Clear and dispose of vegetation.
   b. Stockpile select surface soils for later use as topsoil.
   c. Excavate cell to design grades.
   d. Install stormwater management systems (e.g., drainage basins and drainageways).
   e. Extend on-site access roads to provide cell ingress and egress.
3. **Environmental Control Systems**
   a. Compact and test subgrade, prepare for liner installation (CQA Plan, **Volume II.7**).
   b. Notify OCD via a milestone schedule and at least 72 hours prior to liner installation.
   c. Install FML composite liner system on cell floor.
   d. Construct leachate collection systems for cells, including risers and sumps as shown on the **Permit Plans** (**Volume III.1**).
   e. Install protective soil layer from designated stockpile (and stormwater segregation systems if applicable).
   f. Submit Engineering Certification of completed construction to OCD.
4. **Operations**
   a. Use excavated soil from next cell for daily, intermediate, and final cover for current or previously filled cells.
   b. Use stockpiles as necessary to supplement cover supplies.
   c. Install subsequent cells consistent with 1, 2, and 3 above.
   d. Extend roadways, drainage systems, etc., in advance of need.

5.4 Daily Landfill Operating Procedures

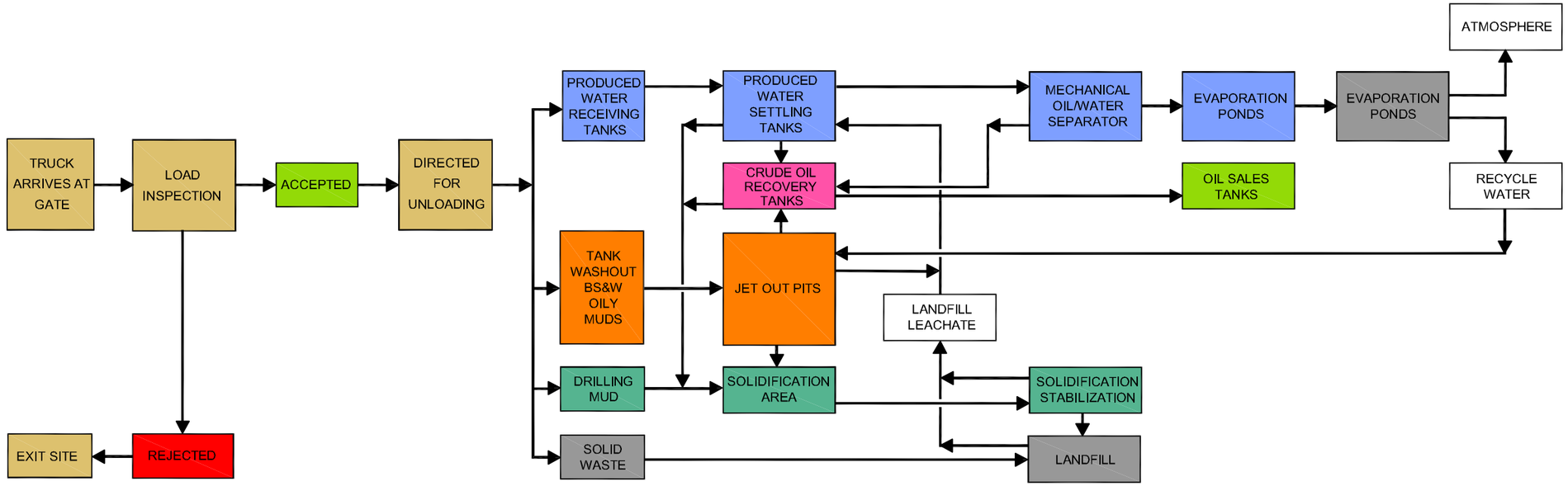
Vehicles delivering waste will approach the DNCS Facility entrance from the east or west on NM 529, which is located adjacent to the northern boundary of the site. NM 529 is a paved, two-lane highway with no special weight restrictions, and paved, full-width shoulders. The site entrance sign will identify prohibited materials and rules of conduct on-site (**Figure II.1.3**). At the Landfill Scalehouse, waste loads will be screened to confirm that the solid waste

materials are acceptable for disposal at DNCS. Waste identification, tracking, and screening are addressed in the Oil Field Waste Management Plan provided in **Volume II.2**. Vehicles with acceptable loads will be directed to proceed on the interior roads in accordance with signs and direction by facility personnel to the working face for unloading. A description of the solid waste disposal process is included on the Process Flow Diagram (**Figures II.1.5A** and **II.1.5B**).

Unacceptable waste loads will be managed in accordance with the Contingency Plan (**Volume II.5**). If a load is rejected it will be returned to the generator. The width of the daily cell and working face will be maintained to the minimum dimensions necessary to accommodate traffic. At the initial anticipated rate of waste receipts (500 gate yd^3/day), the unloading area will generally be maintained at a width of 50-100 ft to accommodate peak hourly traffic flow. Soil cover (or an appropriate alternate cover) will be applied to the Landfill's active face on an as-needed basis to control dust, debris, odors, vectors or other potential nuisances.

The **Permit Plans** (**Volume II.1**) illustrate that the Facility will utilize the "area method" of filling in vertical lifts. The first lift of waste placed over a newly constructed liner segment will be a minimum of 5 ft in thickness, and will then be carefully worked out over the leachate collection protective soil layer from the edge of the cell (i.e., uncompacted). The first lift of waste over the leachate pipe may be pushed off from prior fill areas to avoid landfill equipment traffic over the pipe. If necessary, temporary "ramps" of waste and/or clean fill will be constructed over the leachate pipes and protective layer in order to facilitate traffic flow. The waste in the first lift will be carefully inspected to ensure that waste types that could impact the liner system (e.g., pipes and metal debris) are excluded from the initial lift. This layer will be placed in a manner that protects the liner and leachate collection system.

Waste placement will generally move from the lower (downgradient) portions of the cell to the higher (upgradient) elevations. With the exception of the first lift of oil field waste being spread on a newly constructed cell, waste will be compacted in shallow lifts (e.g., 2 – 3 ft thick) by specialized waste compaction equipment. Repeated passes by the waste compactor



PROCESS FLOW DIAGRAM

DNCS ENVIRONMENTAL SOLUTIONS
LEA, COUNTY, NEW MEXICO

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

DATE: 10/22/2013	CAD: PROCESS FLOW.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.5A
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\PROCESS FLOW .dwg
Date/Time:Oct. 22, 2013-09:27:30 ; LAYOUT: B (LS)

PROCESS DESCRIPTION:

1. A WASTE VEHICLE ARRIVES AT THE GATE.
2. PAPERWORK IS CHECKED AGAINST DNCS ENVIRONMENTAL SOLUTIONS RECORDS TO CONFIRM ACCEPTABLE DOCUMENTATION.
3. THE WASTE LOAD IS VISUALLY AND PHYSICALLY INSPECTED, AND EITHER ACCEPTED TO PROCEED FOR UNLOADING, OR REJECTED AND RETURNED TO THE GENERATOR.
4. ACCEPTED LOADS ARE DIRECTED TO ONE OF FIVE LOCATIONS:

TANKERS CONTAINING PRODUCED WATER ARE DIRECTED TO ONE OF SIX LOAD OUT POINTS AT THE PRODUCED WATER SETTLING TANKS MANIFOLD.
PRODUCED WATER IS DISCHARGED INTO A 1,000 BBL SURGE TANK FOR INITIAL SETTLING AND SEPARATION.
OIL ACCUMULATING AT THE TOP OF THE TANKS IS TRANSFERRED TO THE CRUDE OIL RECOVERY TANKS IF ADDITIONAL PROCESSING IS REQUIRED.
PRODUCED WATER IS TRANSFERRED IN SERIES THROUGH FOUR 1,000 BBL OIL SEPARATION TANKS.
UP TO FIVE DAYS TOTAL SETTLING TIME IS PROVIDED FOR THE PRODUCED WATER WITH AT LEAST ONE DAY HEATED.
LIQUIDS ARE REMOVED FROM THE PRODUCED WATER SETTLING TANKS AND TRANSFERRED TO THE EVAPORATION PONDS THROUGH A MECHANICAL OIL/WATER SEPARATOR.
SLUDGES AND SEDIMENT SETTLING TO THE BOTTOM OF THE TANK IS TRANSFERRED TO THE SOLIDIFICATION AND STABILIZATION AREA.
MECHANICAL EVAPORATORS CIRCULATE THE WATER WITHIN THE EVAPORATION PONDS TO ENHANCE EVAPORATION TO THE ATMOSPHERE.
SOME WATER IS RECYCLED TO THE TANKER JET OUT FOR TANK CLEANING.

TANKERS CONTAINING BS&W PROCESS WATER AND LIQUID TANK BOTTOMS ARE DIRECTED TO THE JET OUT PIT.
ALL BS&W TANK BOTTOM LIQUIDS RECEIVED ARE DISCHARGED INTO THE JET OUT PIT.
TANK TRUCKS ACCEPTED FOR WASHOUT ARE DIRECTED TO ONE OF SIX JET OUT PITS.
APPROXIMATELY 10 BBLS OF FRESH/RECYCLED WATER ARE PROVIDED TO RINSE OUT THE INTERIOR OF THE TANKS.
THE CLEANED TANK TRAILER IS RETURNED FOR SERVICE.
OIL THAT ACCUMULATES AT THE TOP OF THE JET OUT PITS IS TRANSFERRED TO THE CRUDE OIL RECOVERY TANK FOR PROCESSING, IF REQUIRED.
WATER THAT SETTLES TO THE BOTTOM OF THE TANKS IS TRANSFERRED TO THE PRODUCED WATER SETTLING TANKS.
SLUDGES AND SEDIMENT SETTLING TO THE BOTTOM OF THE TANK IS TRANSFERRED TO THE SOLIDIFICATION AND STABILIZATION AREA.

THE CRUDE OIL RECOVERY TANKS SEPARATE THE OIL FROM ANY REMAINING WATER AND RETURNS THE WATER TO THE PRODUCED WATER SETTLING TANKS.
SOLIDS RECOVERED FROM THE CRUDE OIL RECOVERY TANKS ARE REMOVED TO THE STABILIZATION/SOLIDIFICATION PROCESSING AREA.
OIL RECOVERED FROM THE CRUDE OIL RECOVERY TANKS IS TRANSFERRED TO THE OIL SALES TANKS.

TANKERS CONTAINING DRILLING MUD AND CUTTINGS ARE DIRECTED TO THE SOLIDIFICATION AND STABILIZATION AREA.
SLUDGES AND SEDIMENT COLLECTED FROM THE BOTTOM OF THE TANKS ARE SOLIDIFIED WITH A BULKING MATERIAL LIKE SAND OR FLY ASH.
DRILLING MUDS ARE SOLIDIFIED AND STABILIZED USING THREE PARTS SOIL TO ONE PART MUD PRIOR TO LANDFILLING.
LIQUIDS RECOVERED FROM THE SOLIDIFICATION/STABILIZATION PROCESS ARE TRANSFERRED TO THE PRODUCED WATER SETTLING TANKS.

LOADS OF CONTAMINATED SOIL AND SOLID WASTE ARE DIRECTED TO THE LANDFILL FOR DISPOSAL.
LEACHATE GENERATED BY LANDFILL OPERATION MAY BE TRANSFERRED TO PRODUCED WATER SETTLING TANKS.

PROCESS FLOW DESCRIPTION

DNCS ENVIRONMENTAL SOLUTIONS
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DATE: 09/18/2013	CAD: PROCESS FLOW DESCRIPTION.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.5B
APPROVED BY: IKG	gei@gordonenvironmental.com	

or dozer will consolidate the material to the smallest practical volume. This practice will confine the dimensions of the working face, maximize the use of available capacity, reduce the potential for future settlement, and limit the amount of cover required.

5.5 Waste Capacity and Longevity

Table II.1.6 provides a projection of daily waste receipts and lists the categories of anticipated wastes that will be received at this facility. This estimate uses initial projected daily waste receipts of 500 yd^3 per day average. Volumetrics (**Volume III.2**), summarizes the capacity and longevity calculations for the engineering design provided in this Application for Permit. The volume of excavation (cut) from the cells and drainage basins is designed to provide more than sufficient soil for daily, intermediate, and final cover for all Units. The DNCS Landfill (Phases I-III) gross airspace is approximately 39,669,800 yd^3, with approximately 33,666,826 yd^3 (i.e., 33,666,826 tons) of net airspace (i.e., waste capacity). The longevity of the Landfill, operating 365 days per year, is projected as follows:

- 184.5 years @ 500 tons per day
- 92.2 years @ 1,000 tons per day
- 36.9 years @ 2,500 tons per day

There are many factors that can have an impact on the duration of operations of the DNCS Landfill. Oil field activity, the price of oil in the marketplace spurring new development activities, closure of other disposal facilities, new processing technologies and the introduction of new waste streams have the potential to increase or decrease the rate at which airspace is depleted. In response to these factors, DNCS may make arrangements for the lease of additional equipment to accommodate variations in waste receipts.

5.6 Landfill Gas Safety Management

Surface waste management facilities that include a landfill are required to have a gas safety management plan per 19.15.36.13.O NMAC. The Plan should describe in detail the procedures and methods that will be used to prevent landfill-generated gases from interfering or conflicting with the landfill's operation, and methods to protect fresh water, public health, safety and the environment.

Landfill Gas (LFG) is typically produced when there is a significant supply of readily putrescible organic material, moisture; and a lack of oxygen in the fill. Oil field wastes do not contain significant amounts of putrescible (organic) wastes and will not provide a suitable environment for LFG production. Typical oil field wastes do not generate significant quantities of LFG, nor the requisite pressure to promote migration. Conventional landfill gas monitoring and control systems will not be effective at the DNCS Facility. The waste matrix itself will inhibit migration or collection of LFG if it is comprised primarily of soils with <5% degradable organics, as anticipated; therefore no conventional LFG monitoring or controls are proposed in this Application for Permit.

However, DNCS will implement a gas monitoring program consisting of testing incoming vehicles during unloading to ensure that hydrogen sulfide (H_2S) gas concentrations do not exceed 10 ppm on-site or at the property boundary. H_2S monitors that issue a visual and audible signal at 10 ppm H_2S will be installed in areas around the solid waste disposal cells, treating plant, liquid solidification, and evaporation ponds to ensure compliance with regulatory alert levels. Monitoring points may be added or replaced as operations are extended. Details of the H_2S gas monitoring program are presented in the Hydrogen Sulfide (H_2S) Prevention Contingency Plan provided in **Volume II.5.** In addition, the proposed vadose zone monitoring wells will be monitored for methane as part of routine vadose zone monitoring activities as described in the Vadose Zone Monitoring Plan (**Volume II.8**). These wells are capable of detecting gas in the in the flow zone before it reaches the property line.

5.7 Leachate Monitoring

A leachate management plan that describes the anticipated amount of leachate, leachate handling, storage and disposal is required for new landfills per 19.15.36.8.C(12) NMAC. A Leachate Management Plan for the DNCS Landfill is provided as **Volume II.9**. The Leachate Management Plan details the procedures that will be used to manage contact waters generated at the DNCS Landfill during the permit period and following closure. The Leachate Management Plan has been developed to address the design and performance requirements of 19.15.36.14 NMAC; and to addresses leachate management, including amounts and rates of leachate generation, treatment alternatives, disposal options, etc.

5.8 Waste Disposal Alternatives

DNCS Landfill is designed to operate as an all-weather facility under most foreseeable conditions. The site's proposed layout, paved roadways, and operating practices will provide flexibility with regard to fill face location and access. In the event of a temporary disruption to service such as storms or high winds, the following alternatives may be implemented:

- In the event of inclement weather, select a daily fill face location that is readily accessible to established roadways.
- The proposed equipment available for daily operations (see **Table II.1.5**) includes significant back-up for any unplanned downtime.
- Additional waste compacting and earthmoving equipment can be leased under routine arrangements with suppliers.
- Temporary storage of waste at the fill face could be implemented to address short-term equipment shortages.
- Waste compaction and covering tasks could be extended beyond normal hours to complete the day's activities.

In the unlikely event of a complete disruption of access, the Facility would be temporarily closed and the customers notified. The commercial waste flow could be temporarily stored at generator sites, or diverted to other OCD permitted facilities.

5.9 Operating Hours

DNCS plans to have continuous waste disposal services available twenty-four hours per day, seven days per week. These hours will be posted at the site entrance and will be subject to routine review and adjustment as required to match the availability of waste for disposal. DNCS may truncate operating hours due to reduced waste receipts, inclement weather conditions (e.g., high winds), etc. Site maintenance and construction activities, including cell preparation and application of cover, may take place at any time, even if the Landfill is not open for receiving waste.

6.0 LIQUID WASTE PROCESSING

6.1 Operational Rate

Liquid oil field wastes will be accepted for processing at the DNCS Facility. The average operational rate for the fully developed DNCS Facility is estimated at 9,000 barrels per day (bbl/day) of liquid oil field waste. The operational rate may increase to over 12,000 bbl/day dependent upon market conditions and the rate of facilities development.

6.2 Processing

The equipment that anticipated to be used for liquid oil field waste processing is listed in **Table II.1.9**. Oil field waste receiving and processing activities will take place within the fenced and bermed Facility (**Figures II.1.2** and **II.1.6**). A description of the liquid waste processing operation is provided on the Process Flow Diagram (**Figures II.1.5A** and **II.1.5B**). The location of the liquid waste processing facilities at DNCS is provided on the Processing Facility Layout provided as **Figure II.1.6** and detailed in the **Permit Plans** (**Volume III.1**).

TABLE II.1.9
Processing Equipment
DNCS Environmental Solutions

Description	Number	Capacity
Stationary		
Produced Water Tanks	60	1,000 bbl
Crude Oil Receiving Tanks	5	1,000 bbl
Oil Sales Tanks	5	1,000 bbl
Mechanical oil/water separation unit	4	100 bbl
Evaporation Ponds (1-12)	12	73,700 bbl
Mechanical Evaporation Units	130	340 bbl/day/unit
Jet-Out Pit	1	1,200 bbl
Stabilization and Solidification Area	-	10 Acres
Boiler/Heat exchanger	1	Each
Burner fuel tanks	1	238 bbl
Mobile		
Rubber Tired Loader	1	CAT 950 or equivalent
Floatation Track-Dozer	1	CAT D-6 or equivalent
Off Road Dump Truck	1	CAT 725 or equivalent
Roll-off Boxes	5	5-40 cy
Roll-off Tilt-frames	1	Up to 40 cy boxes

Note: The number, type, and capacity of the processing may be adjusted in response to changes in waste receipts, waste types, new technologies, etc.

CATTLE GUARD
GATE
GATEHOUSE
QUEUING
3975
LOW WATER CROSSING
PRODUCED WATER LOAD OUT
TANKS
PROCESSING AREA
BOILER
JET OUT WATER
BS&W, TANK BOTTOMS
JET PIT WASH OUT
MECHANICAL OIL/WATER SEPARATOR
MECHANICAL OIL/WATER SEPARATOR
EVAPORATION POND
POND No.1
POND No.2
POND No.3
POND No.4
POND No.5
POND No.6
POND No.7
POND No.8
POND No.9
POND No.10
POND No.11
POND No.12
200'
420'
PHASE I
PHASE III
PHASE IV
STABILIZATION AND SOLIDIFICATION AREA
MATCH LINE
MATCH LINE
CATTLE GUARD
GATE
3950

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- EVAPORATOR
- M MONITORING LOCATION
- N 650,500 SITE GRID
- E 734,500

NORTH

0 100' 200'

PROCESSING FACILITY LAYOUT

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

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Bernalillo, New Mexico, USA
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Fax: 505-867-6991

DATE: 10/22/2013	CAD: PROCESS FACILITY.dwg	PROJECT #: 452.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.1.6
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\PROCESS FACILITY.dwg
Date/Time:Oct. 22, 2013-07:54:05 ; LAYOUT: Layout1-B (LS)

The operational processing rate is highly dependent upon evaporation, which is also influenced by climate and seasonal fluctuations (Evaporation Calculations, **Volume III.10**). When tanks and ponds are approaching capacity, acceptance of liquid oil field waste may be temporarily suspended. Specifications for the proposed treatment plant equipment, including the produced water processing tanks, the diffused air floatation system, mechanical evaporation systems and the centrifuge are included in **Attachment II.1.B**. Receiving and storage tanks used at the Facility will be leak-proof; compatible with the proposed waste stream; and manufactured of non-biodegradable materials (e.g., fiber reinforced plastics or steel).

7.0 FACILITY INSPECTION AND MAINTENANCE

General inspection of the overall physical condition of the DNCS Facility, including pit and pond operations, treatment plant, tank farm, evaporation spray system, and the landfill will be conducted on an ongoing daily basis by DNCS personnel when operations are active. Additional formal daily, weekly, or quarterly inspections will be conducted and recorded on the appropriate recordkeeping forms as listed in **Table II.1.10**. Templates for the inspection forms are provided as **Attachments II.1.C** and **II.1.D** and will include the inspection date, and the name and signature of the inspector. Inspections and maintenance operations will be completed in compliance with 19.15.36.13.L NMAC. The following sections describe the formal inspections for each component of the DNCS Facility.

7.1 Mechanical Evaporation System (Processing Area)

The evaporation ponds will rely on mechanical evaporators to enhance the rate of evaporation of the overall system. Specifications for the spray systems are included in **Attachment II.1.B**. The mechanical evaporation system will be inspected on a daily basis when operations are active with maintenance performed on an as-needed basis. The inspections will be documented on the Inspection Form included as **Attachment II.1.C**. At a minimum, the mechanical evaporation system weather station (set at a wind velocity threshold of 12 mph) and spray system plume height will be checked during the daily inspection. The plume height will be adjusted to an elevation that prevents overspray from leaving the confines of the bermed portion of the Facility.

TABLE II.1.10
Facility Inspections
DNCS Environmental Solutions

Section	Component/Details	Frequency[1]	Recording Form
7.1	**Evaporation Spray System** Weather station Plume height	Daily	Facility Inspection Form (Attachment II.1.C)
7.2	**Solid Waste Disposal Landfill** Disposal operations and location Free liquids Stormwater controls Litter, vectors, odors Daily cover	Daily	Facility Inspection Form (Attachment II.1.C)
7.3	**Overall Facility Operation** Signs Security (fencing/gates) Stormwater control systems (runon/runoff) Access roads OCD Permit compliance Construction activity	Weekly	Facility Inspection Form (Attachment II.1.C)
7.4	**Treatment Plant, Tanks and Sumps** Containment berm Tank condition Tank leak test (annual) Signage Pipe and valve condition Sump condition	Weekly	Facility Inspection Form (Attachment II.1.C)
7.5	**Tank Farm and Pump System** Containment berm and liner Tank condition Tank leak test (annual) Signage Pipe and valve condition Sump condition	Weekly	Facility Inspection Form (Attachment II.1.C)
7.6	**Pit and Pond Operation** Depth of liquids in sumps Piping condition and status	Weekly	Pond Integrity/Leak Detection Inspection Form (Attachment II.1.D)
7.7	**Pond Containment System** Rainfall Wind speed/direction Damage assessment	Quarterly	Pond Integrity/Leak Detection Inspection Form (Attachment II.1.D)

Notes:

[1] *When operations are active.*

7.2 Solid Waste Disposal Landfill

The solid waste disposal area will typically be inspected on a daily basis when operations are active. The inspections will be documented on the Inspection Form, included as **Attachment II.1.C**. At a minimum, the items listed in **Table II.1.10** will be checked during the daily inspection. During the inspection, current disposal locations and operations will be compared to the OCD-approved DNCS Permit, with any deviations recorded and reported to the Facility Manager. The inspector will also evaluate and record the potential presence of free liquids derived from disposal activities; the condition of stormwater run-on/runoff controls; and the presence of windblown debris, vectors, or odors. Finally, the inspector will record the condition of previously applied soil cover and need for additional cover, grading or vegetation. Deficiencies will be repaired or addressed as soon as practical.

7.3 Overall Facility Operation

A thorough inspection of the specific processing areas, landfill, and sumps will be conducted on a weekly basis when operations are active and documented on the Facility Inspection Form included as **Attachment II.1.C.** The overall Facility inspection portion of the form will, at a minimum, document the items listed in **Table II.1.10**. Should the inspector note on the inspection form construction, planned construction or major design or operational changes, OCD will be notified and approvals obtained, if necessary. Inspection forms will be kept and maintained at the DNCS Facility Administrative Office or other secure location and be made available for OCD review upon request.

7.4 Treatment Plant, Tanks and Sumps (Processing Area)

The treatment plant physically separates oil from water through the use of tanks and other equipment. Weekly inspections of the treatment plant, tanks, and associated leak detection sumps will be conducted when operations are active. The inspections will be documented on the Inspection Form included as **Attachment II.1.C**. At a minimum, the inspections will include and document the items listed in **Table II.1.10**. Any equipment identified during inspections or mechanical testing which require corrective action will be taken offline until repairs are completed as necessary.

The Treatment Plant will be inspected for proper function of the boiler plant, piping and proper liquid flow operation. Should any defect that seriously jeopardizes the plant operation or safety of the operation be identified, the system will be shut down until repairs are completed. Underground leak detection sumps will be inspected at least weekly, and fluid will be removed as necessary to prevent overflow. If the sump integrity has failed, OCD will be notified within 48 hours of discovery, and the sump contents and associated contaminated soil will be removed and disposed of in the solid waste disposal area. A report describing subsequent investigations and remedial actions taken will be submitted to OCD.

7.5 Tank Farm and Pump System (Processing Area)

The Tank Farm is designed to contain the capacity of the maximum number of interconnected tanks plus 30%. In this case, there is a maximum of five 1,000 bbl tanks connected for a total of 5,000 bbl. The tank farm is designed to accommodate in excess of 6,500 bbl before flowing to the evaporation ponds. Once the DNCS Facility is permitted; a Spill Prevention, Control, and Countermeasures (SPCC) Plan that applies to petroleum product storage and distribution systems will be developed. Monthly inspections of the tank farm will be conducted in compliance with the SPCC Plan. At a minimum the inspections will include and document the items listed in **Table II.1.10**. The inspections will be documented on the Inspection Form included as **Attachment II.1.C**. Any items identified during inspections which require corrective action will be addressed immediately, and if required, the specific process equipment will be taken offline until repairs are completed. Leak detection sumps will be inspected monthly. If the sump integrity has failed, OCD will be notified within 48 hours of discovery, and the sump contents and contaminated sediments will be removed and disposed of at DNCS or another OCD-approved facility. A report describing subsequent investigations and remedial actions taken will be submitted to the OCD.

7.6 Pit and Pond Operation (Processing Area)

A thorough inspection of the leak detection system and sump will be conducted on a monthly basis and documented on the Pond Integrity/Leak Detection Inspection Form included in **Attachment II.1.D**. At a minimum, the items listed in **Table II.1.10** will be documented. Prior to placing a newly constructed pond or a pond that has undergone repair or cleaning into service, liquids will be removed from above the primary liner and from the leak detection

system. Once in service, it is anticipated liquid may be present at all times due to condensation and nominal leakage through the primary liner. The sumps are 2 ft deep and have a capacity of >1,200 gallons (gal) using a porosity of 35% for the granular material. **Attachment II.1.E** is a summary table from an authoritative publication on potential geomembrane liner leakage for 40 mil high density polyethylene (HDPE) lined ponds. As shown on the table, the combined projected permeation/pinhole leakage rate ranges from 9.5 to 138 gal/acre/day. Using a very conservative value of 75 gal/acre/day for the combined leakage/permeation rate (**Attachment II.1.E**), this provides 16 days of storage at a depth of 2 ft in the sump. The rate of 75 gal/acre/day is considered very conservative as it is based on 40 mil HDPE (vs. the actual 60 mil HDPE pond liner provided); a fluid depth of 10 ft; and a high number of large pin holes. As additional protection, a geosynthetic clay liner (GCL) will be installed under the leak detection sumps (**Volume III.1**, **III.3,** and **Permit Plans**).

The liquid levels in the sumps will be monitored approximately every 2 weeks immediately after ponds are put into service and documented. Should the lack of liquids become apparent after a series of inspections, the monitoring frequency may be extended to monthly. Upon discovery of excessive liquid presence in a leak detection system (i.e., > 2 ft), OCD will be notified within 24 hours and the affected pond area drained. Prior to placing the pond back into service, DNCS will initiate corrective action which may include but is not limited to:

- Actions undertaken to locate source(s) of leakage
- Repair procedures
- More frequent sump liquid level monitoring and/or pumping
- Liquids testing
- Vadose monitoring (if required)

7.7 Pond Containment System (Processing Area)

A thorough inspection of the berms and the outside walls of pond levees will be conducted at least quarterly, and after any major rainfall or windstorm. For purposes of this inspection frequency, a major rainfall is defined as a documented 25-year, 24-hour rainfall event, and a major windstorm is defined as sustained wind speeds in excess of 45 mph for a one hour period. The inspections will be documented and retained on the Pond Integrity/Leak Detection Inspection Form included in **Attachment II.1.D**. At a minimum, the inspection shall consist of the items listed in **Table II.1.10**. The inspection will address any erosion, liner damage and

maintenance required with a timeframe to complete required repairs. In addition, the depth of sludge build-up in the bottom of the pond will be measured during the quarterly inspections and documented. Sludge in excess of 12 inches will be removed, dewatered, stabilized and disposed of on-site or at an OCD-approved facility.

7.8 Below-grade Tanks and Sumps

No below-grade tanks or sumps, other than the sumps previously mentioned with the leak detection system, are proposed for the DNCS Facility.

8.0 EMERGENCY SITUATIONS AND EQUIPMENT BREAKDOWN

Response to emergency situations involving the actions of the Emergency Coordinator, fire prevention and protection, incident response, and notification procedures are described in detail in the Contingency Plan (**Volume II.5**).

8.1 Equipment Breakdown

In the case of unplanned equipment downtime, the following measures will be deployed:

- Delivery of liquid oil field waste will be delayed if storage capacity is unavailable in the receiving tanks.
- Downtime associated with mobile equipment (i.e., skid-steer loader, forklift) will be addressed by deploying alternative on-site units (e.g., end loaders) and arrangements with local equipment vendors for immediate maintenance and lease of temporary replacement units.
- DNCS's proposed preventive maintenance plan has proven to be highly effective at preventing unplanned downtime through routine inspection and regular maintenance of processing equipment.

9.0 RECORD KEEPING REQUIREMENTS

DNCS is required to keep detailed records for the DNCS Facility as described throughout this Application. In addition, the Facility will meet the OCD requirements for reporting as detailed in the Management Plans provided in **Volume II** of this Application. Records will be retained for a minimum of 5 years and will be made available for OCD review and inspection upon request.

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ATTACHMENT II.1.A

SAFETY COMMUNICATIONS PROGRAM (TYPICAL)

ATTACHMENT II.1.A
Safety Communications Program (Typical)
DNCS Environmental Solutions

Safety Meeting Attendance Sheet

Date: _____ Time: _____

Topic: _____

Presenter: _____ Department: _____

Instructions:

1. This form must be completed at each safety meeting.
2. Make additional copies as required.
3. Keep copy of completed attendance sheets in binder.

Printed Name	Signature

Absent	Date Covered

ATTACHMENT II.1.A
Safety Communications Program (Typical)
DNCS Environmental Solutions

Annual Training Schedule[1]

Month	Yard Topics	Office Topics
January	Lockout/Tagout Program	Lockout/Tagout Program
	SWPPP	SWPPP
	Good Housekeeping	Good Housekeeping
February	Material Acceptance & Handling	Material Acceptance & Handling
	Form C-133 & C-138 reconciliation	Form C-133 & C-138 reconciliation
	H_2S screening	H_2S screening
March	Non-exempt liquids recognition	Non-exempt liquids recognition
	H_2S Treatment Procedures	H_2S Treatment Procedures
April	Site Contingency Plan	Site Contingency Plan
	H_2S Contingency Plan	H_2S Contingency Plan
	Hazard Communications	Hazard Communications
	Emergency Evacuation Drill	Emergency Evacuation Drill
May	Spill Prevention & Control	Spill Prevention & Control
	Site Generated Waste Disposal	Site Generated Waste Disposal
	Heat Stress	Heat Stress
June	Confined Space	Confined Space
	Site Inspection	Site Inspection
	Incident & Injury reporting	Incident & Injury reporting
	First Aid/Bloodborne Pathogens	First Aid/Bloodborne Pathogens
July	Migratory Bird Prevention	Migratory Bird Prevention
August	Employee Safety	Employee Safety
	PPE	PPE
	3-Point Contact	3-Point Contact
September	Industrial Powered Trucks	Recordkeeping
	Skid Loader	
	Sky Trak	
	Loader	
	High Voltage Training	
October	Cold Weather Stress	Cold Weather Stress
	Fire Extinguisher Use	Fire Extinguisher Use
November	Sexual Harassment	Sexual Harassment
	Drug & Alcohol	Drug & Alcohol
	Cell Phone usage	Cell Phone usage
December	Employee Benefits	Employee Benefits
	Temp. Employee Safety	Temp. Employee Safety

Note:
[1] Typical training schedule and content subject to change

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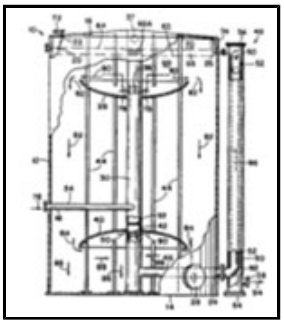
ATTACHMENT II.1.B

EQUIPMENT SPECIFICATIONS

High-Tech Consultants, Inc.

Earning the Right to Work for You

- HOME
- OIL FIELD PRODUCTION FACILITIES
- VAPOR EMISSION CONTROL SYSTEMS
- WATER CLARIFICATION
- TECHNICAL PAPERS
- QUESTIONNAIRE
- CLIENTS AND PROJECTS
- F.A.Q.'s
- CONTACT US



Water Clarification

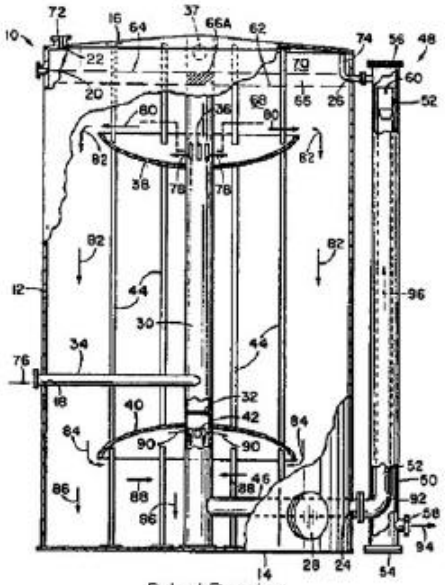
High-Tech Designs That Work For You

Water treating is often considered a "black art". That it is little understood in the oil production industry may be an understatement. The fact is that water treating is a very complex issue; too complex to be mixed with other operational issues. Few operators have the luxury of a staff with enough time to fully comprehend the subject. And so, the subject of water treating is rarely adequately addressed. This costs the industry hundreds of millions each year in plugged disposal and injection wells, pipelines, tanks, and in lost productivity.

Clean water can be injected or disposed of at almost no cost to the produce. However, water with just a few parts per million of oil and iron sulfide can cost millions.

HTC developed the HWSB™ design to produce high quality water without a pressure vessel, without filtration, and without moving parts. This High-Tech design is so innovative it was granted patents in the US and Canada.

The HWSB™ is over 70% hydraulically efficient. This compares to <3% for most other designs.



Patent Drawing

SMI 420F EVAPORATOR

OVERVIEW

The SMI® 420F Evaporator is a floating unit, designed for effective operation in small areas, especially sites containing large particles or highly corrosive water. The 420F Evaporator is durable, simple to use and easy to maintain – a reliable way to manage excess water.

BENEFITS

Low Buildup: the SMI® 420F Evaporator is designed with a minimal amount of top surface area to control the build-up of residue or ice, helping to reduce clean up and maintenance!

High Performance: High-speed fan blade rotation creates an optimum water droplet distribution for evaporation. Annual evaporation rates up to 70% have been achieved with the 420F, and averages are typically between 25% and 60%. Evaporation rates depend on many factors, including ambient temperature, relative humidity, water make-up and wind conditions.

Easy Maintenance: The machine is designed for easy cleaning and maintenance. It requires no weekly bearing lubrication, as it is lubricated for the life of the motor.

Minimal Clogging: The SMI® 420F Evaporator can pass particles up to 3/16 inch (4.7 mm) in diameter, which reduces the need for pre-filtering, filter cleaning and the hassles of clogged nozzles.

Extreme Duty: This design has evolved from 10 years of experience in industrial and extreme outdoor applications. Polyethylene pontoons are filled with closed-cell polyurethane foam, ensuring buoyancy even after any accidental puncturing of the plastic outer shell. Critical components are manufactured from stainless steel for extended life in harsh environments.

FEATURES

Floating unit supported by plastic pontoons containing closed-cell PU foam

Low plume height for shorter drift distance, allowing longer operation in swirling or changing winds

Heavy industrial construction, including stainless control panel, motor enclosure, manifold and fan blade, increasing durability and life span

Vibration sensor included to shut down motor before catastrophic failure due to residue or ice build-up

Stainless steel submersible pump attached to floating frame

SMI 420F EVAPORATOR

Fan

Frame

Pontoon

AUTOMATION ■ ENGINEERING ■ CONSTRUCTION ■ EQUIPMENT

SPECIFICATIONS

Fan and Head System

- 25 HP industrial grade world motor (for 3 phase / 480 volt / 60 cycle and 3 phase / 400 volt / 50 cycle power; motors for other voltages available upon request)
- Stainless steel casing protects motor and enhances cooling
- Patented stainless steel fan blades (optional scale-resistant coating)
- Vibration sensor for motor shut off

Floating Platform

- Galvanized steel construction with stainless steel fasteners
- Plastic pontoon composed of UV-stabilized polyethylene shell with closed-cell polyurethane foam
- 7.5 HP submersible stainless steel pump for 3 phase / 480 volt / 60 cycle power (specified for 80 gpm (303 lpm) at 100 psi (7 bar))

Water System

- Standard flow, stainless steel water manifold for average evaporation conditions. Designed for flow rate of 66 gpm (250 lpm) at 100 psi (7 bar) water pressure

Electrical

- 25 HP premium efficiency fan motor rotating at 3600 rpm (480 volt / 60 cycle) or 2900 rpm (400 volt / 50 cycle)
- Stainless Steel control panel with start and stop buttons
- 150 foot (45 m) electrical cord

Warranty

- Full one year warranty on all parts and workmanship

Options

- For acidic or high-alkaline water applications, stainless steel construction and acid-resistant coating
- Special scale-resistant coating on fan to reduce residue build-up on blades
- 10 HP submersible stainless steel pump for 3 phase / 400 volt / 50 cycle
- Optional high flow, stainless steel water manifold for above average evaporation. Designed for flow rate of 91 gpm (344 lpm) at 100 psi (7 bar) water pressure
- Y-line manual flush filter for dirtier water

SMI Evaporative Solutions
TECHNOLOGY :: LONGEVITY :: SERVICE

SMI Evaporative Solutions
1512 Rockwell Drive
Midland, MI 48642
Phone: 989-631-6091
Toll-Free: 1-800-248-6600
Fax: 989-631-3162
Website: www.evapor.com

APPLICATION FOR PERMIT
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ATTACHMENT II.1.C

WEEKLY INSPECTION FORM (TYPICAL)

ATTACHMENT II.1.C
Weekly Inspection Form (Typical)
DNCS Environmental Solutions

Date: _____ **Print Name:** _____

Signature: _____

Inspection will be in accordance with NMOCD operational conditions.

Item	Satisfactory	Action Required
Entrance Sign		
Berms and outside pond levees		
Tank Labels		
Sumps		
Pit & Pond levels one-foot free board		
Free oil on Pits-Ponds		
Pit and Pond condition		
Pit and Pond marker numbers		
Treatment Plant inspection		
Solid waste disposal area inspection		
Blowing trash		
Fences and Gates		
Leak detection sumps - Tank Farm - Liquid present?		(Monthly analysis required if yes)
Leak detection sumps - Evaporation Ponds - Liquid present?		(Monthly analysis required if yes)
Leak detection sumps - Jet Out Pit - Liquid present?		(Monthly analysis required if yes)
Leak detection sumps - SWD - Liquid present?		(Monthly analysis required if yes)

***Comments & Repairs:** _____

H_2S

READINGS ARE TO BE TAKEN 4 FT DOWNWIND FROM EVAPORATION PONDS

Evaporation Pond (readings in ppm):

POND	(A)	(B)	(C)	(D)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

*In the event that a reading of 10 ppm is registered at the Facility, personnel will evacuate the area and Sundance will monitor H_2S levels at the downwind boundary of the Facility. If H_2S levels reach 20 ppm, the Facility will be closed and notification will be given to the following:

DNCS Office	575-XXX-XXXX	NMOCD Hobbs	575-393-6161
New Mexico State Police	575-392-5580	NMOCD Santa Fe	505-476-3440
Lea County Sheriff	575-397-3611		

Receipt & Approval

Name: _____

Date: _____

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ATTACHMENT II.1.D

POND INTEGRITY/LEAK DETECTION INSPECTION FORM (TYPICAL)

ATTACHMENT II.1.D
Pond Integrity/Leak Detection Inspection Checklist (Typical)
DNCS Environmental Solutions

Date: _____ **Inspector(s):** _____

Time: _____ _____

_____

Weather:

Temperature _____ deg. F Precipitation (last 24 hours) _____ inches

Skies _____

Wind Speed _____ mph

Wind Direction _____ *(direction blowing from)*

NOTES:
"X" indicates that a Deficiency has been noted. "P" indicates that a Photograph has been taken. "S" indicates that a Sample has been collected. Complete descriptions of Deficiencies, Photographs, and Samples are provided on attached pages. Items are referenced by Location.

POND CONDITION

Location	Item			
	Erosion	Vegetation Established	Vectors	Sample

LEAK DETECTION SYSTEM

Riser #	Deficiency	
	Depth of H_2O	Structural Defect

NOTES: _____

_____

_____

APPLICATION FOR PERMIT
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ATTACHMENT II.1.E

POTENTIAL GEOMEMBRANE LINER LEAKAGE

Attachment II.1.E
Potential Geomembrane Liner Leakage
DNCS Environmental Solutions

Title: Leakage Through Liners Constructed with Geomembranes - Part 1. Geomembrane Liners

Written by: J.P. Giroud and R. Bonaparte
Published in: Geotextiles and Geomembranes **Volume:** 8 **Issue:** 2 **Pages:** 27 to 67
Phone: +31 20-485-3757 ~ **Web Site:** http://www.elsevier.com

How impermeable are 'impermeable liners'? All liners leak, including geomembranes, but how much? What are the mechanisms of leakage through liners constructed with geomembranes? To answer these questions, a detailed review of leakage mechanisms, published and unpublished data, and analytical studies has been carried out with the goal of providing practical design recommendations. In particular, it appears that a composite liner (i.e. geomembrane on low-permeability soil) is more effective in reducing the rate of leakage through the liner than either a geomembrane alone or a soil liner (low-permeability soil layer) alone. However, the paper shows that the effectiveness of composite liners depends on the quality of the contact between the geomembrane and the underlying low-permeability soil layer.

Table 1
Calculated Leakage Rates Due to Pinholes and Holes in a Geomembrane

Water depth on top of the geomembrane, h_w						
	Defect Diameter	0.003 m (0.01 ft)	0.03 m (0.1 ft)	0.3 m (1 ft)	3 m (10 ft)	30 m (100 ft)
Pinholes	0.1 mm (0.004 in)	0.006 (0.0015)	0.06 (0.015)	0.6 (0.15)	6 (1.5)	60 (15)
	0.3 mm (0.012 in)	0.5 (0.1)	5 (1)	50 (13)	500 (130)	5000 (1 300)
Holes [a]	2 mm (0.08 in)	40 (10)	130 (30)	400 (100)	1300 (300)	4000 (1 000)
	11.3 mm (0.445 in)	1 300 (300)	4 000 (1 000)	13 000 (3 000)	40 000 (10 000)	130 000 (30 000)
Values of leakage rate in liters/day (gallons/day)						

Table 2
Calculated Unitized Leakage Rates Due to Permeation of Water Through an HDPE Geomembrane

Water depth on top of the geomembrane, h_w						
	0 m (0 ft)	*0.003 m (0.01 ft)*	*0.03 m (0.1 ft)*	*0.3 m (1 ft)*	*3 m (10 ft)*	*>10 m (>30 ft)*
Coefficient of migration, m_g(m^2/s)	0	$9x10^{-20}$	$9x10^{-18}$	$9x10^{-16}$	$9x10^{-14}$	$3x10^{-13}$
Unitized leakage rate, q_q	0	$9x10^{-17}$	$9x10^{-15}$	$9x10^{-13}$	$9x10^{-11}$	$3x10^{-10}$
(m/s)	0	$8x10^{-5}$	0.008	0.8	80	260
(lphd)	0	$8x10^{-6}$	0.0008	0.08	8	28
(gpad)						

Notes: These values of utilized leakage rates were calculated using eqn (5) and assuming a geomembrane thickness of 1 mm (40 mils). The coefficients of migration used to calculate the unitized leakage rates in this table were obtained from eqns (19) and (20), with $C_1 = 1x10^{-22}$ m^4 $kg^{-2}s^3$, $n = 2$, and $m_{gmax} = 3x10^{-13}$ m^2/s.

The water depths used here correspond to the typical values defined in Section1.3.6. (To use eqn (19), it is necessary to know the pressure difference, Δp. According to eqn (1), water depths, h_w, are approximately equal to hydraulic head differences, Δh, which are related by eqn (12) to pressure differences, Δp.)

- data used in calculations

APPLICATION FOR PERMIT
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VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 2: OIL FIELD WASTE MANAGEMENT PLAN

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DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 2: OIL FIELD WASTE MANAGEMENT PLAN

1.0 INTRODUCTION

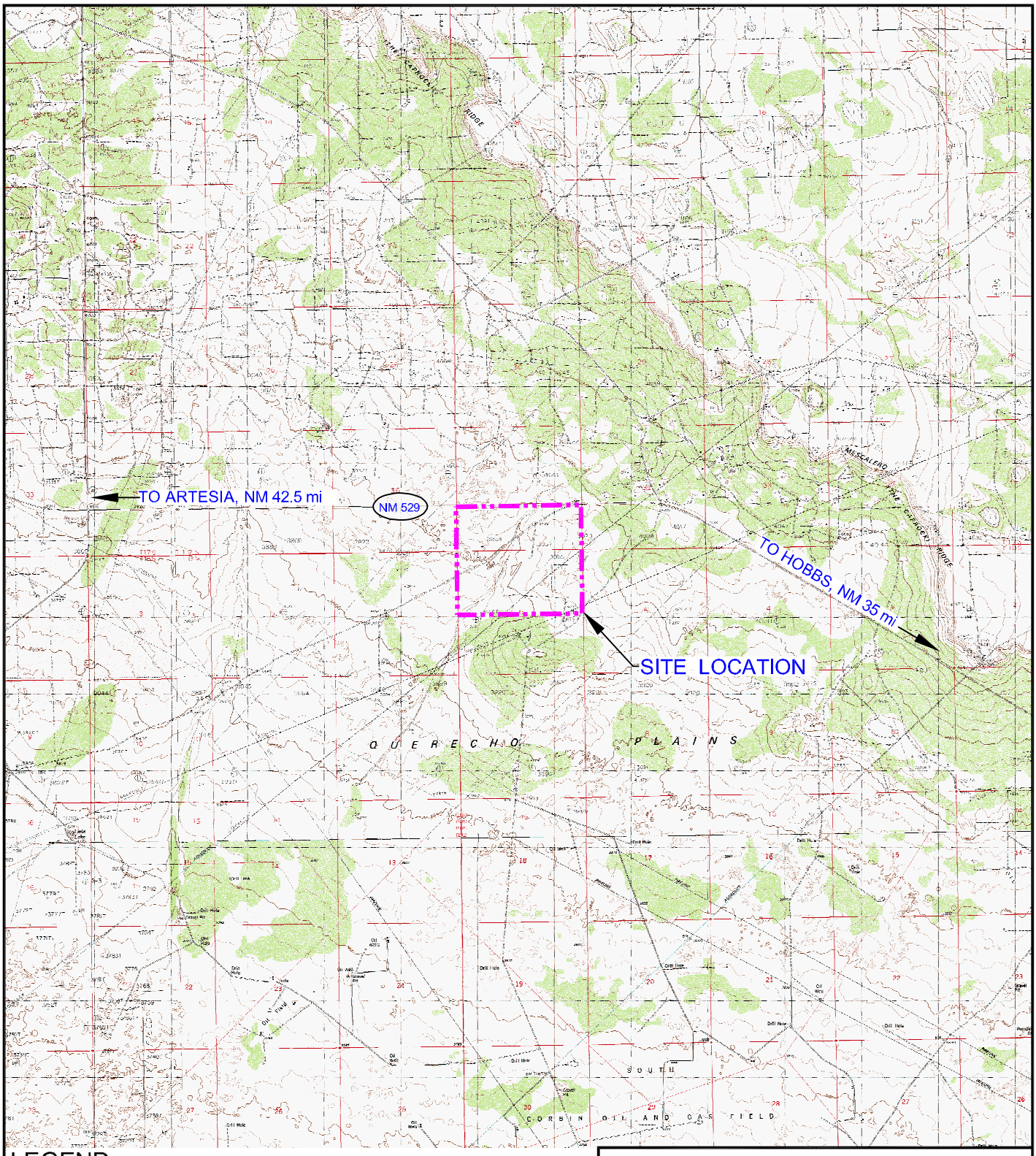
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oilfield waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation 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 II.2.1**). 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.



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. 23, 2013-13:31:42 ; 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 II.2.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

2.0 PURPOSE

This Oil Field Waste Management Plan (the Plan) addresses the requirements of 19.15.36.13, 14, 15, and 17 NMAC, and establishes an internal control program that will be followed by DNCS to ensure that oil field wastes receive attention commensurate with the associated risk. The purpose of this Plan is to provide waste identification, tracking and screening mechanism for OCD waste that may require special handling to meet regulatory requirements and/or to protect employee health and safety. This Plan also establishes a waste identification and exclusion program for regulated, non-exempt, hazardous waste and non-exempt naturally occurring radioactive materials (NORM) that prevents these materials from bring processed at the DNCS Facility. The oil field wastes discussed in this Plan will be limited to those materials that have met specific disposal requirements as described in Sections 13, 14, 15, and 17 of 19.15.36 NMAC; and 19.15.35.8 NMAC.

Specifically, this Plan is intended to address the management and disposal procedures for oil field waste types which include, but are not limited to:

1. Solid waste as described in 19.15.36.14 NMAC; and
2. Produced waters as described in 19.15.36.17 NMAC; and
3. Waste as described in 19.15.35.8.C(1), (2), and (3) NMAC.

The 19.15.35.8.C NMAC requirements apply to oil field waste generated at the Facility as a result of operational processes and normal maintenance activities. Upon approval from the OCD, this waste will be disposed of onsite in the DNCS Landfill, or transported to a New Mexico Environment Department Solid Waste Bureau permitted facility (e.g., Lea County Landfill) for disposal, if appropriate.

3.0 OIL FIELD WASTE ACCEPTANCE PROGRAM

A decision to approve or disapprove incoming oil field waste for management at the DNCS Facility will be clearly documented for each load received at the Facility, as delineated on **Table II.2.1**. At a minimum, the following Waste Acceptance Protocol (**Table II.2.1**) requirements must be met prior to managing oil field waste at DNCS:

TABLE II.2.1
Waste Acceptance Protocol
DNCS Environmental Solutions

1. **For Produced Water:**

   Commercial or industrial customers will be required to provide a valid *Authorization to Move Produced Water,* OCD Form C-133 (**Attachment II.1.A**). After producing the OCD Form C-133, DNCS will verify that the customer is an authorized hauler by checking it against the OCD quarterly updated list located at http://www.emnrd.state.nm.us/ocd/Statistics.htm. DNCS will pursue the following protocol in managing the OCD Form C-133:

   a) Quarterly, the General Manager will provide the Facility personnel an updated list.
   b) The OCD Form C-133 list will be maintained onsite in the DNCS administrative files.
   c) Prior to accepting any material, Facility personnel will ensure that the hauling company has a valid OCD Form C-133 approval.
   d) If a valid OCD Form C-133 is not on file, the hauler will not be allowed to unload the liquid waste.
   e) The General Manager or other appropriate DNCS personnel will be contacted if assistance is needed.

2. **For Solid Waste:**

   The customer must provide OCD Form C-138, *Request for Approval to Accept Solid Waste* (**Attachment II.2.B**) to the Facility certifying that the waste is exempt oil field waste. In addition, the generator, or their authorized representative, will be required to sign the Facility Disposal Ticket, (**Attachment II.2.C**) which documents the following certification:

   > *I do hereby certify that, according to the Resource Conservation and Recovery Act (RCRA) and Environmental Protection Agency's July, 1988, regulatory determination, any and all waste delivered to DNCS from the above locations is: EXEMPT oilfield waste. This waste is in compliance with Regulated Levels of Naturally Occurring Radioactive Material (NORM) pursuant to 20 NMAC 3.1 Subpart 1403.C and D.*

   Should the generator or their authorized representative fail to sign the Facility Disposal Ticket, the load of oil field waste will be rejected.

3. The Facility will notify the customer of necessary conditions/limitations that apply to managing the waste, and the customer will be required to comply with the conditions/limitations.

3.1 Prohibited Wastes

Regulated non-exempt hazardous waste and non-exempt Naturally Occurring Radioactive Material (NORM) wastes which are subject to other Federal or State regulations are prohibited at DNCS. Generators/haulers with these wastes will be referred to a United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) permitted facility (i.e., WCS, Andrews County, TX).

3.2 Oil Field Waste Inspection and Management

Once the required paperwork has been reviewed and verified, each load will be inspected to ensure compliance with 19.15.36.13.F NMAC. Inspections consist of:

1. **Examination of Fluid from Load**
   a) All loads will be checked prior to acceptance to check for the presence of non-permitted materials (e.g., compressor oil) and to determine the solid content of the load (i.e., is the load "clean" or "dirty") for the purposes of proper handling.
   b) Every truck will stop at an inspection landing (similar to the one shown in **Figure II.2.2**).
   c) Facility personnel will not step onto the truck until the driver has placed the truck in park with the brake applied, opened the door, and has his/her legs outside the cab. This is to ensure the truck does not move while Facility personnel are on the truck.
   d) Facility personnel will wear neoprene or other heavy duty non-permeable gloves.
   e) The cap on the tank will be opened and a metal rod will be inserted to the bottom of the tank.
   f) Care will be exercised because hydrogen sulfide (H_2S) may be present when the cap is opened. If there is any indication that H_2S may be present, the H_2S safety procedures will be followed (**Volume II.3**).
   g) Based on whether the rod contacts the metal bottom of the tank, or is slowed by sludge/solid material, Facility personnel will be able to gauge if the load may potentially be laden with sediment.
   h) The metal rod will be pulled out from the tank and the fluid on the rod examined for the presence of oils or other non-exempt materials.
   i) Odor can also be an indication if the load contains fluids that are non-exempt. Non-exempt waste with potential odors include:
      a. Septic conditions
      b. Caustic or acid cleaners
      c. Methanol, unused
      d. Pesticide and herbicide wastes
      e. Solvents, spent (including waste solvents)

INSPECTION LANDING EXAMPLE

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: 10/22/2013	CAD: INSPECTION.dwg	PROJECT #: 542.01.01
DRAWN BY: JFP	REVIEWED BY: DRT	FIGURE II.2.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\INSPECTION.dwg
Date/Time:Oct. 23, 2013-13:26:44

2. Presence of H_2S

DNCS will monitor for H_2S on a continual basis on each oil field delivery waste vehicle arriving at the site. Monitoring for H_2S will be completed as follows:

a) The battery and calibration date on the monitor will be checked to ensure both are current.

b) DNCS personnel will position themselves as far away from the cap opening on the tank as possible, in order to minimize the potential for exposure. Safety is the most important consideration when checking for H_2S.

c) DNCS personnel will use the H_2S monitor to determine the potential presence and concentration of H_2S (for specific operational instructions, refer to specific owner's manual for the monitoring instrument).

d) The tube wand will be used to acquire a sample, and the H_2S reading and related notes will be recorded on the DNCS Disposal Ticket (**Attachment II.3.B**).

In the event of an H_2S detection of 10 ppm or greater, the following procedures will also be implemented by DNCS personnel:

a) Notification of the presence of H_2S will be provided to both the driver (hauler) and the generator.

b) The generator will be provided the option of allowing DNCS to treat the load on-site. Should the generator decline treatment, the load will be rejected and directed to leave the DNCS Facility.

c) If the generator requests treatment, DNCS personnel will add calcium hypochlorite ($Ca(ClO)_2$) to the load at the levels corresponding to **Table II.3.6.**

d) Once the $Ca(ClO)_2$ has been added, the load will be "rolled" [i.e., trucks will use their air pumps to "roll" air through the tank to allow for mixing of the contents and the added $Ca(ClO)_2$] to assist the chemical reaction. After approximately 20 minutes, the load will be re-sampled for the presence of H_2S. Treatment will continue until the H_2S reading is below 1 ppm. Once the H_2S measurement reads below 1 ppm, the load will be directed to the receiving area for processing.

e) Treatment information and the final H_2S measurement will be recorded on the DNCS Disposal Ticket (**Attachment II.3.B**).

f) DNCS personnel will contact the Generator's Plant Manager or General Manager if assistance is needed.

3. Presence of Non-Exempt fluids

a) In the event compressor oil or other non-exempt fluids are detected, a sample of the fluid will be collected in a sample container.

b) The date, generating company, hauler, and location will be noted on the container.

c) The hauler will be prevented from unloading at the Facility.

d) The Facility will contact the generator's Plant Manager or General Manager if assistance is needed.

e) Samples will be maintained at the Facility for two weeks for inspection by the generator's personnel and OCD, as necessary.

4. Presence of High Solids Content

a) In the event high solid/sludge content is suspected, a sample of the material will be collected in a sample container.

b) The date, company, hauler, and location will be noted on the container.

c) If the load cannot be accepted through the Produced Water Receiving Tanks due to high solids content, the hauler will contact the generator for permission to be charged for the cost of discharging through the Jet Out Pit.

d) If the load cannot be accepted due to high solid content, the hauler will contact the production company to inform them that the load has been rejected, and the hauler will be prevented from unloading at the Facility.

e) The Facility will contact the Generator's Plant Manager or General Manager if assistance is needed.

f) Samples will be maintained at the Facility for two weeks for inspection by the generator's personnel.

5. Unloading

a) DNCS anticipates a maximum of 8 unloading stations for Produced Water Receiving, and a maximum of 6 Jet Out Pit Bays.

b) To minimize the chance for conflicts between trucks, only 14 trucks will be allowed past the inspection platform(s) at any one time once the Facility is fully operational. Prior to ultimate development, the number of trucks allowed past the inspection platform(s) will be limited to the total number of Produced Waters Receiving stations and Jet Out Pit Bays that are available for use.

c) Trucks will pull up to the load-out station or back into the Jet Out Pit Bays as instructed by Facility personnel.

d) Drivers will connect their grounding straps to the grounding stakes at their specific Load-Out Point.

e) Trucks will off-load materials to Jet Out Tanks as appropriate.

f) Trucks will exit the Facility as instructed.

g) Failure of drivers to follow these procedures will be brought to the attention of Facility management for proper resolution with the hauling company.

3.3 Recordkeeping

Upon receipt of oil field waste, Facility employees will record the following into the Facility Disposal Log Book or similar (**Attachment II.2.D**).

- Generator
- Origin
- Date received
- Quantity

- Transporter
- Disposal location

Logbooks will be maintained for a minimum of 5 years after operations at the Facility have ceased. At the end of each month, the DNCS General Manager will compile information to be submitted electronically to OCD on the OCD Form C-115, *Operator's Monthly Report* (**Attachment II.2.E)**.

3.4 Site Generated Waste

The DNCS Facility will generate waste as a result of routine operations and maintenance as defined in 19.15.35.8 NMAC. The anticipated list of waste that may be generated at DNCS, along with the testing requirements and final disposition, is presented in **Table II.2.2**.

TABLE II.2.2
Testing Requirements[1]
DNCS Environmental Solutions

Description	Testing Requirements	Disposal Location
C(1) Waste	None	Landfill Cell
C(2) Waste		
Junk pipe, valves, metal pipe	NORM[2]	Landfill Cell
Pipe scale and other deposits	TPH,TCLP metals, NORM[3,4]	Landfill Cell
Produced water filters	Corrosivity	Landfill Cell
C(3) Waste		
Other waste	As determined by Division	Landfill Cell
Petroleum contaminated soils (PCS)	Chloride, Paint filter, TPH, BTEX[5]	Landfill Cell
Sludges	Chloride, Paint filter, TPH, BTEX	Landfill Cell

Notes:

1. *While this list is not all inclusive, the Facility will coordinate with OCD regarding the proper management and disposal requirement for the 19.15.35.8 C(2) and C(3) NMAC waste and approved disposal facilities.*
2. *NORM = naturally occurring radioactive materials*
3. *TPH = total petroleum hydrocarbons*
4. *TCLP = toxicity characteristic leaching procedure*
5. *BTEX = benzene, toluene, ethylbenzene, and xylenes*

4.0 TRAINING

Facility employees will be trained and updated in the identification of oil field waste and excluded wastes on at least an annual basis. Spotters and/or equipment operators will be present at the Facility when oil field waste is unloaded in order to check for unauthorized waste. In addition to the routine customer screening process, new customer oil field waste deliveries will receive focused supervision and scrutiny.

At a minimum, inspection personnel will be trained to identify suspicious wastes based on visual (and olfactory) characteristics in addition to the waste screening procedures outlined in Section 2.2 of this Plan. Specific items that will be on the training agenda include:

- Hazardous placarding or markings
- Proper form identification and use
- H_2S screening
- Non-exempt liquids recognition
- "Chemical" odors
- Excessive solids recognition
- Employee safety and personal protective equipment (PPE) use
- Site-generated waste handling and disposal

Whenever a suspicious waste is identified, Facility inspection personnel will follow specific procedures that may include:

- Identifying the unacceptable waste by characteristic, estimated quantity, transport vehicle, and the names and addresses of those associated with the waste load
- Questioning the driver of the vehicle
- Reviewing existing generator paperwork
- Contacting the possible source (i.e., generator) and questioning the originator of waste pursuant to the regulations.
- Denying access to the vehicle
- Calling the Division and/or Hazardous Waste Bureau, as applicable
- Using protective equipment
- Calling an emergency response agency, if required
- Contacting laboratory support, if necessary

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 2: OIL FIELD WASTE MANAGEMENT PLAN

ATTACHMENT II.2.A

AUTHORIZATION TO MOVE PRODUCED WATER

OCD FORM C-133

Submit a single copy to
Santa Fe Office

State of New Mexico
Energy Minerals and Natural Resources

Form C-133
Revised August 1, 2013

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

AUTHORIZATION TO MOVE PRODUCED WATER

Transporter Name:_____

Business (Physical) Address in New Mexico:

_____

_____

Contact Mailing Address (If different):

_____

_____

Business Phone: _____
Business Fax: _____

Contact Phone: _____
Contact Fax: _____

1. Attach a copy of the applicant's New Mexico Public Regulation Commission (PRC) Warrant for Transportation Services.

2. Identify the form of the applicant's business entity: (Example: corporation, limited liability company [LLC], limited partnership, limited liability partnership, partnership, sole proprietor): _____

A. If the applicant is a corporation or LLC, provide the Secretary of State corporation number:
_____

B. If the applicant is a limited partnership or limited liability partnership, provide the Secretary of State file number: _____

C. If the applicant is any other form of partnership, identify all partners:
_____

D. If the applicant is a sole proprietor, provide the name of the sole proprietor:
_____

(Note: If the form of your business entity changes, the name of your business changes, or the business address changes, you must re-apply for authorization.)

It is the responsibility of each holder of an approved Form C-133 to comply with 19.15.34 NMAC and familiarize its personnel with that rule's requirements. Failure to move or dispose of produced water in accordance with 19.15.34 NMAC may be cause for cancellation of the Form C-133.

"I hereby certify that the information above is true and complete to the best of my knowledge and belief." (Application must be signed by person who is authorized to obligate the company applying for the permit)

Signature:_____ Date:_____

Printed Name:_____ Title:_____

E-mail Address:_____

(This space for State use)

Approved by:_____ Title:_____

Date:_____

APPLICATION FOR PERMIT
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ATTACHMENT II.2.B

GENERATOR CERTIFICATE OF WASTE STATUS,

OCD FORM C-138

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-138
Revised August 1, 2011

*Surface Waste Management Facility Operator and Generator shall maintain and make this documentation available for Division inspection.

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. Generator Name and Address:

2. Originating Site:

3. Location of Material (Street Address, City, State or ULSTR):

4. Source and Description of Waste:

Estimated Volume _____ yd^3 / bbls Known Volume (to be entered by the operator at the end of the haul) _____ yd^3 / bbls

5. GENERATOR CERTIFICATION STATEMENT OF WASTE STATUS

I, _____, representative or authorized agent for _____ do hereby certify that according to the Resource Conservation and Recovery Act (RCRA) and the US Environmental Protection Agency's July 1988 regulatory determination, the above described waste is: (Check the appropriate classification)

☐ RCRA Exempt: Oil field wastes generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. *Operator Use Only: Waste Acceptance Frequency* ☐ *Monthly* ☐ *Weekly* ☐ *Per Load*

☐ RCRA Non-Exempt: Oil field waste which is non-hazardous that does not exceed the minimum standards for waste hazardous by characteristics established in RCRA regulations, 40 CFR 261.21-261.24, or listed hazardous waste as defined in 40 CFR, part 261, subpart D, as amended. The following documentation is attached to demonstrate the above-described waste is non-hazardous. (Check the appropriate items)

☐ MSDS Information ☐ RCRA Hazardous Waste Analysis ☐ Process Knowledge ☐ Other (Provide description in Box 4)

GENERATOR 19.15.36.15 WASTE TESTING CERTIFICATION STATEMENT FOR LANDFARMS

I, _____, representative for _____ do hereby certify that representative samples of the oil field waste have been subjected to the paint filter test and tested for chloride content and that the samples have been found to conform to the specific requirements applicable to landfarms pursuant to Section 15 of 19.15.36 NMAC. The results of the representative samples are attached to demonstrate the above-described waste conform to the requirements of Section 15 of 19.15.36 NMAC.

5. Transporter:

OCD Permitted Surface Waste Management Facility

Name and Facility Permit #:

Address of Facility:

Method of Treatment and/or Disposal:

☐ Evaporation ☐ Injection ☐ Treating Plant ☐ Landfarm ☐ Landfill ☐ Other

Waste Acceptance Status:

☐ **APPROVED** ☐ **DENIED** (Must Be Maintained As Permanent Record)

PRINT NAME: _____ TITLE: _____ DATE: _____

SIGNATURE: _____ TELEPHONE NO.: _____

Surface Waste Management Facility Authorized Agent

APPLICATION FOR PERMIT
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ATTACHMENT II.2.C

FACILITY DISPOSAL TICKET (TYPICAL)

ATTACHMENT II.2.C
Disposal Ticket (Typical)
DNCS Environmental Solutions

Lea County, NM
NMOCD #_____

Date: _____ Time: _____ a.m./p.m.
Bill to: _____
Address: _____
State: _____ Zip: _____ Phone: _____
Company/Generator: _____
Lease Name: _____
Hauler: _____ Vehicle Number: _____ Driver (Print): _____

Type of Material

☐ Fluids ☐ Soils
☐ Tank Bottoms ☐ Other Material *(List Description Below)* Receiving Area: _____

Description: _____

Volume of Material

☐ Bbls ☐ Yard ☐ Gallons ☐ Wash Out
☐ Call Out ☐ After Hours ☐ Debris Charge

H2S Reading

H2S Reading (ppm): _____
Notes: _____

Generator Certification Statement of Waste Status

I do hereby certify that, according to the Resource Conservation and Recovery Act (RCRA) and Environmental Protection Agency's July, 1988, regulatory determination, any and all waste delivered to DNCS from the above locations is: EXEMPT oil field waste. This waste is in compliance with Regulated Levels of Naturally Occurring Radioactive Material (NORM) pursuant to 20 NMAC 3.1 Subpart 1403.C and D.

☐ DNCS Approval # _____ ☐ Denied

Agent/Representative of Generator/Hauler: _____

DNCS Representative: _____

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DNCS ENVIRONMENTAL SOLUTIONS

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ATTACHMENT II.2.D

DISPOSAL LOG BOOK (TYPICAL)

ATTACHMENT II.2.D
Disposal Log (Typical)
DNCS Environmental Solutions

Lea County, NM
NMOCD #_____

Date: _____ **Page _____ of _____**

Generator	Origin	Hauler	Soil (yards)	Mud (bbls)	Fluids (bbls)	Bottoms (bbls)	Cuttings (yards)	Washout	Sulfur (tons or bbls)	Trash (sales)	Disposal Location
		Totals:									

APPLICATION FOR PERMIT
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ATTACHMENT II.2.E

OPERATOR'S MONTHLY REPORT

OCD FORM C-115

District I
1625 North French, Hobbs, NM 88241

District II
1301 West Grand Avenue, Artesia, NM 88210

District III
1000 Rio Brazos, Aztec, NM 84710

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION

1220 South Saint Francis Drive
Santa Fe, NM 87505

OPERATOR'S MONTHLY REPORT

Form C-115 First Page
Revised January 22, 2004
Instruction on Reverse Side
1 ☐ Amended Report

2 Operator	3 OGRID:	4 Month/Year
5 Address:		6 Page 1 of 4

		INJECTION			PRODUCTION				DISPOSITION OF OIL, GAS, AND WATER						
7 . AND NAME No. and Name & U-L-S-T-R PI No.	8 CODE 1	9 Volume	10 Pressure	11 CODE 2	12 Barrels of Oil/conden-sate produced	13 Barrels of water produced	14 MCF Gas Produced	15 Days Prod-uced	16 CODE 3	17 Point of Disposition	18 Gas BTU or Oil API Gravity	19 Oil on hand at beginning of month	20 Volume (Bbls/mcf)	21 Transporter Ogrid	22 CODE 4	23 Oil on hand at end of month

I hereby certify that the information contained in this report is true and complete to the best of my knowledge.
24

Signature	Printed Name & Title	E-mail Address	Date	Phone Number

2 Operator	3 OGRID	4 Month/Year	6 Page 2 of 4

		INJECTION			PRODUCTION				DISPOSITION OF OIL, GAS, AND WATER							
7 . AND NAME No. and Name & U-L-S-T-R PI No.	8 C O D E 1	9 Volume	10 Pressure	11 C O D E 2	12 Barrels of Oil/conden-sate produced	13 Barrels of water produced	14 MCF Gas Produced	15 Days Prod-uced	16 C O D E 3	17 Point of Disposition	18 Gas BTU or Oil API Gravity	19 Oil on hand at beginning of month	20 Volume (Bbls/mcf)	21 Transporter Ogrid	22 C O D E 4	23 Oil on hand at end of month

2 Operator	3 OGRID	4 Month/Year	6 Page 3 of 4

		INJECTION			PRODUCTION				DISPOSITION OF OIL, GAS, AND WATER							
7 . AND NAME No. and Name & U-L-S-T-R PI No.	8 CODE 1	9 Volume	10 Pressure	11 CODE 2	12 Barrels of Oil/conden-sate produced	13 Barrels of water produced	14 MCF Gas Produced	15 Days Prod-uced	16 CODE 3	17 Point of Disposition	18 Gas BTU or Oil API Gravity	19 Oil on hand at beginning of month	20 Volume (Bbls/mcf)	21 Transporter Ogrid	22 CODE 4	23 Oil on hand at end of month

2 Operator	3 OGRID	4 Month/Year	6 Page 4 of 4

		INJECTION			PRODUCTION				DISPOSITION OF OIL, GAS, AND WATER							
7 . AND NAME No. and Name & U-L-S-T-R PI No.	8 CODE 1	9 Volume	10 Pressure	11 CODE 2	12 Barrels of Oil/conden-sate produced	13 Barrels of water produced	14 MCF Gas Produced	15 Days Prod-uced	16 CODE 3	17 Point of Disposition	18 Gas BTU or Oil API Gravity	19 Oil on hand at beginning of month	20 Volume (Bbls/mcf)	21 Transporter Ogrid	22 CODE 4	23 Oil on hand at end of month

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SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

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1.0 INTRODUCTION

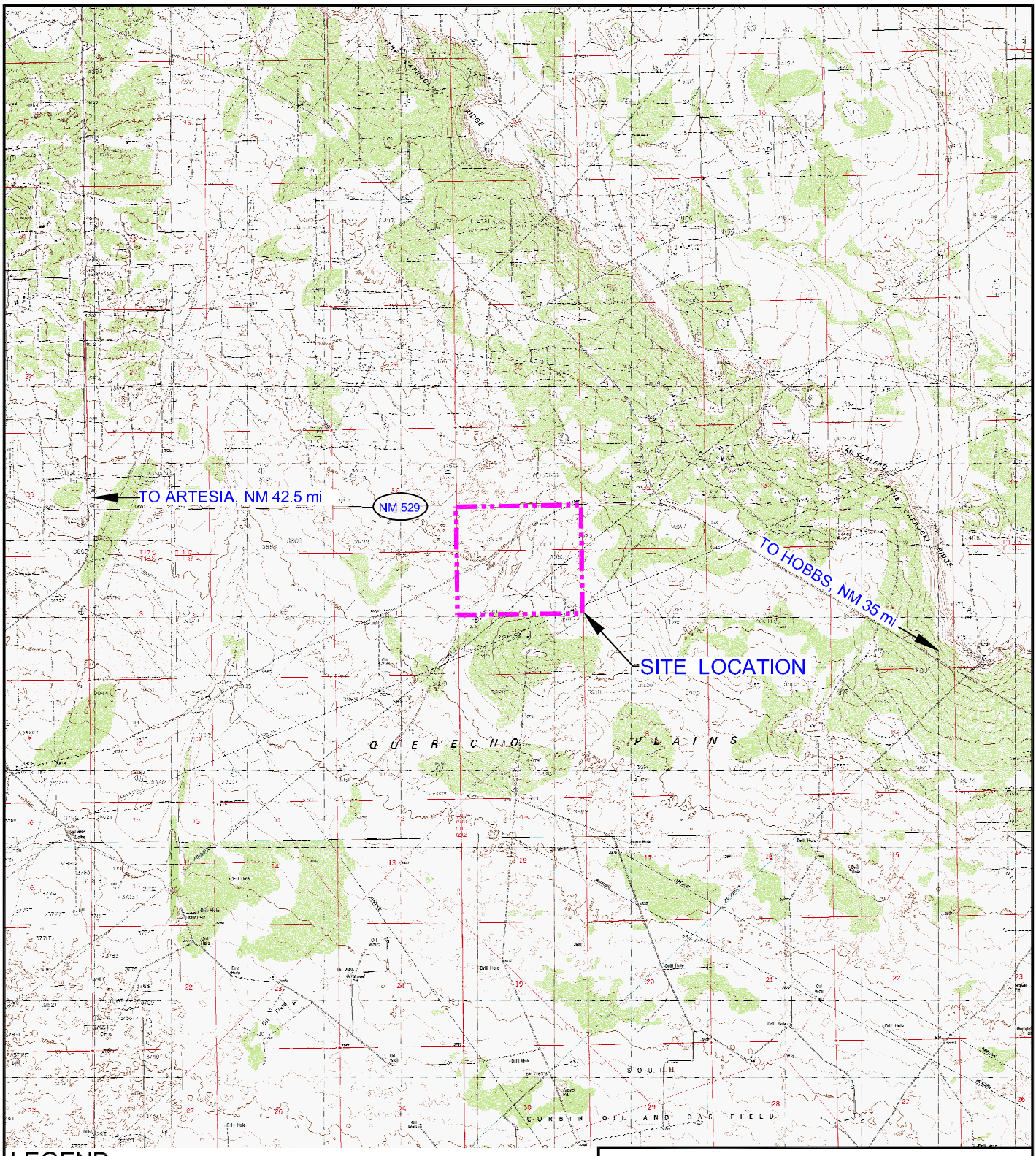
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 II.3.1**). 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 Plan provided as **Figure II.3.2** identifies the locations of the Processing Area and Landfill facilities. The proposed facilities are detailed in **Table II.3.1**, and are planned to be developed in four primary phases.



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

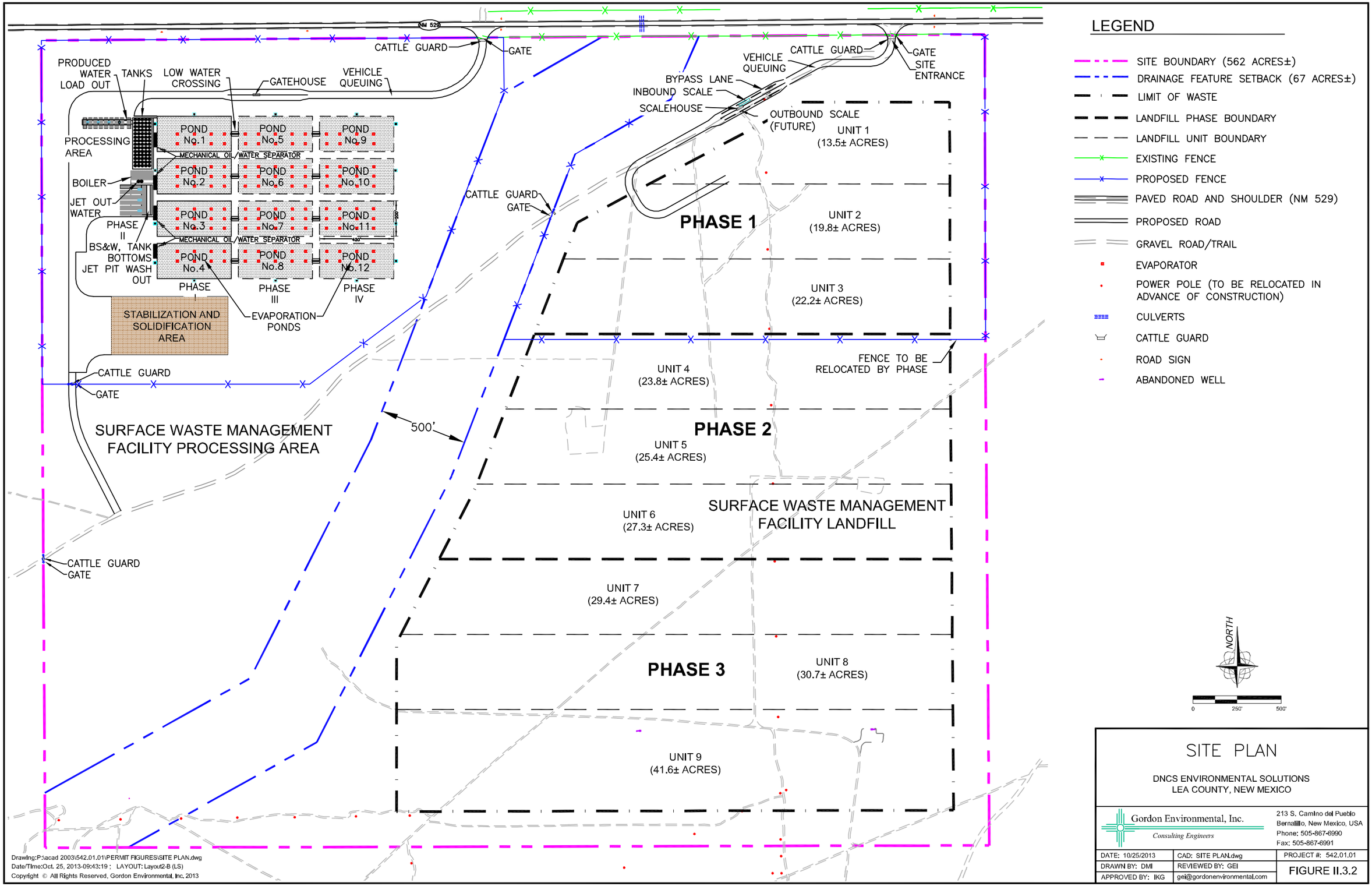
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SITE LOC MAP.dwg
Date/Time:Sep. 19, 2013-08:30:02 ; LAYOUT: A (P)

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: 09/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.1
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 II.3.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.3.1
Proposed Facilities[1]
DNCS Environmental Solutions

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	9
Produced water receiving tanks	12
Produced water settling tanks	48
Mechanical oil/water separation unit	4
Evaporation ponds	12
Stabilization and Solidification Area	1
Oil treatment plant	1
Crude oil receiving tanks	5
Oil sales tanks	5
Customer jet wash	1 (6 bays)

Note:
[1]Subject to change. The proposed facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, technology, etc.

1.3 Purpose

The purpose of this Hydrogen Sulfide (H_2S) Prevention and Contingency Plan (the Plan) is to enhance awareness and establish measures to protect employees from occupational exposure to H_2S while allowing them to perform their assigned duties. The Plan is also designed to protect customers and visitors to the DNCS Facility, as well as the general public and nearby land users.

This Plan prescribes measures for:

- Providing routine H_2S monitoring of incoming wastes.
- Installation of monitoring points at the Facility evaporation ponds.
- Routine perimeter monitoring, and the potential for permanent monitoring stations.
- Regular monitoring in and around incoming oil field waste transportation vehicles.
- Augmenting the monitoring procedures in the event that H_2S is detected in excess of 10 parts per million (ppm).

DNCS will invite the local emergency response authorities identified in **Table II.3.2** to the site for a briefing on this Plan. During this briefing, DNCS will discuss notification, emergency response procedures, and evacuation plans. The H_2S monitoring program will be implemented during the active life of the Facility.

TABLE II.3.2
Emergency Response Agencies and Contacts
DNCS Environmental Solutions

Agency/Organization	Emergency Number
1. Fire	
Maljamar Fire Department	911 or (575) 676-4700
2. Police	
Lea County Sheriff's Department	911 or (575) 396-3611
New Mexico State Police	911 or (575) 392-5580
3. Medical/Ambulance	
Lea County EMS	911
Lea Regional Medical Center 5419 N. Lovington Highway Hobbs, NM 88240	(575) 492-5000
4. Response Firm	
Phoenix Environmental, LLC. 2113 N French Drive Hobbs, NM 88240	(575) 391-9685
5. OCD Emergency Response Contacts	
Oil Conservation Division 1625 N. French Drive Hobbs, NM 88240	(575) 393-6161
Mobile Phone	(575) 370-3180
Oil Conservation Division 1220 South St. Francis Drive Santa Fe, NM 87505	(505) 476-3440
6. State Emergency Response Contacts	
Hazardous and Radioactive Materials Bureau, Santa Fe	(505) 827-1557
Spill Emergencies 24 hr. Hotline (NMED)	(505) 827-9329
New Mexico Environment Department Solid Waste Bureau, Santa Fe	(505) 827-0197
7. Local Emergency Response Contacts	
Lea County Emergency Management	(575) 396-8602
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI 24 hr. Emergency Response Hotline (USEPA)	(214) 665-2222

1.4 Hydrogen Sulfide Characteristics

H_2S is a colorless and flammable gas with a distinct odor. Being heavier than air, H_2S tends to accumulate at the floor of poorly ventilated spaces. It is found in petroleum and natural gas and is sometimes present in groundwater. The odor of hydrogen sulfide gas can be perceived at levels as low as 10 parts per billion (ppb). At levels of 50-100 ppm, it may cause the human sense of smell to fail. Limited exposure to low concentrations of H_2S can result in eye irritation, sore throat, coughing, shortness of breath, and fluid in the lungs. These symptoms usually recede in a few weeks in the absence of continued exposure. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Exposure to high concentrations of H_2S can lead to eye damage, loss of sense of smell, pulmonary edema (swelling and/or fluid accumulation in the lungs), loss of breathing and death. General risks associated with H_2S contact are summarized on **Table II.3.3**, and more detailed chemical hazard information for H_2S is provided on the material safety data sheet (MSDS) furnished in **Attachment II.3.A**.

The oil field waste types, and engineering design and operating procedures specific to the DNCS Facility, will mitigate against the potential release of H_2S in to the environment. The measures deployed by DNCS that minimize the potential generation of releases include:

- Screening of existing and new deliveries
- Load inspections for the presence of H_2S as outlined in the Oil Field Waste Management Plan (**Volume II.2**)
- Onsite H_2S treatment of incoming loads to ensure that the acceptance criteria of no measurable H_2S (< 1 ppm) is met
- Constant evaporation pond testing
- Employee training

TABLE II.3.3
H_2S Exposure Health Risk
DNCS Environmental Solutions

H_2S EXPOSURE LEVEL[1]	HEALTH RISK
Low (0-10 ppm)	Eye, nose, and throat irritation; coughing, shortness of breath, fluid in the lungs
Moderate (10-50 ppm)	Headache, dizziness, nausea and vomiting, coughing and breathing difficulty, loss of sense of smell
High (50-200 ppm)[2]	Severe respiratory tract irritation, loss of sense of smell, eye damage, shock, convulsions, coma, pulmonary edema (swelling and/or fluid accumulation in the lungs), death

[1]*General data obtained from www.safetydirectory.com*
[2]*NIOSH Immediate Danger to Life or Health (IDLH) is 100 ppm*

The cornerstone of this Plan consists of routine H_2S monitoring conducted for the Facility evaporation ponds and incoming waste streams to ensure that the regulatory limits for H_2S are not exceeded. The monitoring is intended to confirm that the H_2S concentration being accepted at the Facility is less than 1 ppm. This approach to monitoring and treatment has proven effective in reducing H_2S concentrations and successful in eliminating the need for H_2S Contingency Plan implementation as described in 19.15.11.9 NMAC (i.e., to address H_2S > 100 ppm). In addition, this Plan follows American Petroleum Institute (API) Recommended Practice 55 (RP-55), paragraph 7.6 to address H_2S >30 ppm (**Table II.3.4**).

1.5 Regulatory Requirements: 19.15.36 NMAC and 19.15.11 NMAC

The Rules for Surface Waste Management Facilities (19.15.36 NMAC) address the monitoring and management of H_2S in 19.15.36.8.C.(8) and 19.15.36.13.N NMAC:

19.15.36.8 SURFACE WASTE MANAGEMENT FACILITY PERMITS AND APPLICATION REQUIREMENTS

C. Application requirements for new facilities, major modifications and permit renewals. An applicant or operator shall file an application, form C-137, for a permit for a new surface waste management facility, to modify an existing surface waste management facility or for permit renewal with the environmental bureau in the division's Santa Fe office. The application shall include:

(8) a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.11 NMAC that apply to surface waste management facilities;

TABLE II.3.4
API Recommended Practice 55
DNCS Environmental Solutions

7.6 IMMEDIATE ACTION PLAN

Each contingency plan should contain a condensed "Immediate Action Plan" to be followed by designated personnel any time they receive notice of a potentially hazardous hydrogen sulfide or sulfur dioxide discharge. For the protection of personnel (including the general public) and abatement of the discharge, this "Immediate Action Plan" should include, but not be limited to, the following provisions:

a. Alert and account for facility personnel.
   1. Move away from the hydrogen sulfide or sulfur dioxide source and get out of the affected area.
   2. Don proper personal breathing equipment.
   3. Alert other affected personnel.
   4. Assist personnel in distress.
   5. Proceed to the designated emergency assembly area.
   6. Account for on-site personnel.

b. Take immediate measures to control the present or potential hydrogen sulfide or sulfur dioxide discharge and to eliminate possible ignition sources. Emergency shutdown procedures should be initiated as deemed necessary to correct or control the specific situation. When the required action cannot be accomplished in time to prevent exposing operating personnel or the public to hazardous concentrations of hydrogen sulfide or sulfur dioxide, proceed to the following steps, as appropriate for the site specific conditions.

c. Alert the public (directly or through appropriate government agencies) that may be subjected to an atmosphere exposure exceeding 30 ppm[21] of hydrogen sulfide or 10[21] ppm of sulfur dioxide.

d. Initiate evacuation operations.

e. Contact the first available designated supervisor on the call list (refer to Par. 7.4.a). Notify the supervisor of circumstances and whether or not immediate assistance is needed. The supervisor should notify (or arrange for notification of) other supervisors and other appropriate personnel (including public officials) on the call list.

f. Make recommendations to public officials regarding blocking unauthorized access to the unsafe area and assist as appropriate.

g. Make recommendations to public officials regarding evacuating the public and assist as appropriate.

h. Notify, as required, state and local officials and the National Response Center to comply with release reporting requirements (i.e., 40 *Code* of *Federal Regulations Parts 302* and 355) (refer to Par. 4.4).

i. Monitor the ambient air in the area of exposure (after following abatement measures) to determine when it is safe for re-entry.

[2l]Emergency Response Planning Guide Level 2 (ERPG-2), refer to Reference 27. ERPG-2 is defined as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

Note: This sequence (Par. 7.6) should be altered to fit the prevailing situation. Certain actions, especially those dealing with the public, should be coordinated with public officials.

This Table is extracted from the American Petroleum Institute (API) Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, Recommended Practice 55, Second Edition, February 15, 1995

19.15.36.13 SITING AND OPERATIONAL REQUIREMENTS APPLICABLE TO ALL PERMITTED SURFACE WASTE MANAGEMENT FACILITIES:

N. Contingency plan. Each operator shall have a contingency plan. The operator shall provide the division's environmental bureau with a copy of an amendment to the contingency plan, including amendments required by Paragraph (8) of Subsection N of 19.15.36.13 NMAC; and promptly notify the division's environmental bureau of changes in the emergency coordinator or in the emergency coordinator's contact information. The contingency plan shall be designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water. The operator shall carry out the plan's provisions immediately whenever there is a fire, explosion or release of contaminants or oil field waste constituents that could threaten fresh water, public health, safety or the environment; provided that the emergency coordinator may deviate from the plan as necessary in an emergency situation. The contingency plan for emergencies shall:

Additionally, this H_2S monitoring program is intended to demonstrate compliance with 19.15.36.8.C.(8) NMAC (Surface Waste Management), and the requirements of 19.15.11 NMAC (Hydrogen Sulfide Gas), as well as, other permit conditions that may apply to this Facility. Should monitoring results identify unexpected concentrations of H_2S in excess of 100 ppm (RP-55 limit = 30 ppm) in a public area, the requirements of 19.15.11.8.C NMAC will be implemented and this Plan, developed specifically to be responsive to 19.15.11.9 NMAC, will be implemented as required with proper notification.

2.0 EMERGENCY COORDINATORS

DNCS has designated individual specialists with the responsibility and authority to implement response measures in the event of an emergency which threatens freshwater, public health, safety or the environment per 19.15.36.13.N.(3) NMAC. The Primary, Alternate, and on-site Emergency Coordinators (ECs; **Table II.3.5**) will be thoroughly familiar with all aspects of this Plan; operations and activities at the Facility; location and characteristics of waste to be managed; the repository of all records within the Facility; and the Facility layout. **Table II.3.5** provides a list of names, designations, titles, and phone numbers for each EC, who will be formally identified to OCD prior to commencing Facility operations.

TABLE II.3.5
List of Emergency Coordinators*
DNCS Environmental Solutions

Primary Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Manager	Mobile Phone:	(575) TBD

Alternate Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Operator	Mobile Phone:	(575) TBD

Onsite Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Operator	Mobile Phone:	(575) TBD

**To be determined (TBD)*

The ECs are responsible for coordinating emergency response measures and have the authority to commit the resources required for implementation of this Plan. A designated EC will be available to respond to emergencies 24 hours a day, 7 days a week. The DNCS employee who identifies an emergency situation will contact an EC directly; or via phone or radio. Contact will be attempted with each EC (Primary, Alternate, and the On-site) until communication is achieved (**Table II.3.5**). Upon arrival at the scene of an emergency, the first EC to arrive will assume responsibility for initiating response measures. If more than one EC responds, authority is assigned to the highest-ranking EC.

In the rare case that an EC cannot be contacted in an emergency, the DNCS employee who identifies the emergency will make every effort to follow the emergency procedures outlined in this Plan until an EC or emergency authority (local, state, or federal; **Table II.3.2**) arrives to assist or take charge. The term "EC" as used throughout this Plan to references the responsible Emergency Coordinator at the scene of an emergency regardless of whether that EC is the Primary, Alternate, On-site EC, or EC designee. This Plan will be amended as described in Section 8.0 if the list of ECs changes, with updates submitted in a timely manner to OCD and filed on-site.

3.0 MONITORING

3.1 Incoming loads

DNCS will monitor for H_2S on a continual basis on every oil field delivery waste vehicle arriving at the site, as described in the Oil Field Waste Management Plan (**Volume II.2**). Monitoring results will be recorded on a Disposal Ticket (**Attachment II.3.B**) and retained as part of the Facility Operating Record. DNCS personnel will wear H_2S personal monitors under circumstances where H_2S may be present, including when they are testing or unloading materials that may contain H_2S. The monitors will issue a visual and audible signal at 10 ppm of H_2S in the ambient air that becomes more rapid at 20 ppm. In the event of an H_2S detection of 10 ppm or greater, the following procedures will be implemented:

- Notification of the presence of H_2S will be provided to both the driver (hauler) and the generator.
- The generator will be provided the option of allowing DNCS to treat the load on-site. Should the generator decline treatment, the load will be rejected and directed to leave the DNCS Facility.
- If the generator requests treatment, DNCS personnel will add calcium hypochlorite ($Ca(ClO)_2$) to the load at the levels corresponding to **Table II.3.6.**
- Once the $Ca(ClO)_2$ has been added, the load will be "rolled" (i.e., trucks will use their air pumps to "roll" air through the tank to allow for mixing of the contents and the added $Ca(ClO)_2$ to assist the chemical reaction. After approximately 20 minutes, the load will be re-sampled for the presence of H_2S. Treatment will continue until the H_2S reading is below 1 ppm. Once the H_2S measurement reads below 1 ppm, the load will be directed to the receiving area for processing.
- Treatment information and the final H_2S measurement will be recorded on the DNCS Disposal Ticket (**Attachment II.3.B**).
- DNCS personnel will contact the generator's Plant Manager or General Manager if assistance is needed.

3.2 Evaporation Pond Monitoring

3.2.1 Stationary Monitors

Evaporation ponds will be monitored for the presence of H_2S by recording at continuous monitors maintained along the outside perimeter of the pond area as shown on **Figure II.3.3**. These monitors will be wired directly to the office for remote observation. H_2S readings and wind speed/direction will be logged and recorded twice daily on the DNCS Daily Air and Water Inspection Form (**Attachment II.3.C**). The EC will be notified, and will implement

TABLE II.3.6
H_2S Treatment for Vehicles [1]
DNCS Environmental Solutions

H_2S PPM[2]	$Ca(ClO)_2$ "Coffee Cans" Required[3]
<50	1.0
50-100	1.5
100-150	2.0
150-200	2.5
200-250	3.0
250-300	3.5
300-350	4.0
350-400	4.5
400-450	5.0
450-500	5.5
500-550	6.0
550-600	6.5
600-650	7.0
650-700	7.5
700-750	8.0
750-800	8.5
800-850	9.0
850-900	9.5
900-950	10.0
950-1000	10.5

Notes:
[1]*Typical volume of truck is 80 bbl. One coffee can equals 34.5 oz of product.*
[2]*PPM = parts per million*
[3]*$Ca(ClO)_2$ = calcium hypochlorite*

GATE
CATTLE GUARD

GATEHOUSE

VEHICLE QUEUING

LOW WATER CROSSING

PRODUCED WATER LOAD OUT

TANKS

PROCESSING AREA

BOILER

JET OUT WATER

BS&W, TANK BOTTOMS
JET PIT WASH OUT

PHASE II

MECHANICAL OIL/WATER SEPARATOR

MECHANICAL OIL/WATER SEPARATOR

EVAPORATION POND
POND No.1

EVAPORATION POND
POND No.5

EVAPORATION POND
POND No.9

EVAPORATION POND
POND No.2

EVAPORATION POND
POND No.6

EVAPORATION POND
POND No.10

EVAPORATION POND
POND No.3

EVAPORATION POND
POND No.7

EVAPORATION POND
POND No.11

EVAPORATION POND
POND No.4

EVAPORATION POND
POND No.8

EVAPORATION POND
POND No.12

200'

420'

PHASE I

PHASE III

PHASE IV

STABILIZATION AND SOLIDIFICATION AREA

MATCH LINE

CATTLE GUARD

GATE

MATCH LINE

N 651300
N 651200
N 651100
N 651000
N 650900
N 650800
N 650700
N 650600
N 650500
N 650400
N 650300
N 650200
N 650100
N 650000
N 649900
N 649800
N 649700
N 649600

E 732600
E 732700
E 732800
E 732900
E 733000
E 733100
E 733200
E 733300
E 733400
E 733500
E 733600
E 733700
E 733800
E 733900
E 734000
E 734100
E 734200
E 734300
E 734400
E 734500
E 734600

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- EVAPORATOR
- M MONITORING LOCATION
- N 650,500 / E 734,500 100' SITE GRID

NORTH

0 100' 200'

EVAPORATION POND STATIONARY MONITORING

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: MONITORING.dwg	PROJECT #: 452.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.3.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\MONITORING.dwg
Date/Time:Nov. 04, 2013-10:08:12 ; LAYOUT: Layout1-B (LS)

the procedures outlines below if H_2S readings are ≥ 1 ppm. If H_2S readings are ≥ 10 ppm, the EC will implement the procedures listed in **Table II.3.7**.

- A second reading will be taken on the downwind berm within one hour
- The dissolved oxygen and dissolved sulfide levels of the pond will be tested immediately and the need for immediate treatment determined
- Tests for H_2S levels will be made at the fenceline downwind from the area of concern

If two (2) consecutive H_2S readings of 1 ppm or greater are recorded:

- The EC will notify the Hobbs office of the OCD immediately (**Table II.3.2**)
- DNCS will commence hourly monitoring on a 24-hour basis
- DNCS will lower the pond level so that the mechanical evaporation system will circulate the entire pond
- DNCS will obtain daily analysis of dissolved sulfides in the pond

TABLE II.3.7
Implementation, Assessment, and Notification Procedures for H_2S
DNCS Environmental Solutions

1. **EVACUATE AREA AND NOTIFY THE ECs:** The employee who first becomes aware of the H_2S alarm will immediately evacuate the area, don protective personal breathing equipment and notify the Primary EC, and the Alternate EC and On-site EC if necessary. Notification will be made in person, via telephone, or via radio. The responding EC will assume full authority over the situation. Properly protected responders will then assist any affected personnel or customers.
2. **REMAIN UPWIND OF RELEASE:** Persons evacuated from the release area should remain away and upwind from the area of the release until an assessment of the conditions has been made.
3. **ASSESS THE AMOUNT OF RELEASE:** The EC will assess the source, severity, and extent of the alarm. Monitoring equipment will be operated by trained personnel.
4. **MONITOR DOWNWIND IF H_2S ≥ 10 PPM**: In the event a reading of 10 ppm is registered, the area will be evacuated and Facility personnel will monitor the H_2S levels along the downwind boundary of the Facility.
5. **EVACUATE AND CLOSE THE FACILITY IF H_2S ≥ 20 PPM AT DOWNWIND BOUNDARY:** If levels reach 20 ppm at the downwind boundary, the Facility will be evacuated and closed. Evacuation procedures are enumerated the Site Evacuation Plan provided as **Figure II.3.4**. Additionally, DNCS will notify all persons within one-half mile of the fence line. (No residents are currently within one-half mile.)
6. **NOTIFICATION OF AUTHORITIES:** Notification will be provided to the New Mexico State Police, Lea County Sheriff, Lea County Emergency Management, and OCD (**Table II.3.1**). In addition, medical authorities will be contacted if needed. DNCS will also notify Phoenix Environmental (if necessary) in Hobbs (**Table II.3.1**) to provide

response personnel, equipment, and supplies to mitigate the source of an H_2S reading of ≥10 ppm.

7. **RECORDKEEPING:** DNCS will log and report to the OCD all incidences where an H_2S reading of ≥10 ppm is registered at the Facility boundary (also see Section 6.0). Records will be maintained for at least 5 years at the DNCS administrative offices.

3.2.2 Dissolved Oxygen and pH Monitoring

Dissolved oxygen and pH levels are key indicators of the efficacy of treatment and removal of H_2S during the aeration process in the evaporation ponds. The chemical reaction of H_2S and oxygen to produce sulfate as an end product is dependent upon the level of both dissolved oxygen and pH. Daily tests will be conducted and records made for each pond. If the pH falls below 8.0, remedial steps will be taken immediately to raise the pH. DNCS proposes to use sodium hydroxide (caustic agent) to raise the pH to the optimal level of 8.2-9.0. Dissolved oxygen levels will be tested on a daily basis to ensure a residual of 0.5 ppm is maintained. The dissolved oxygen level will be taken at the beginning of each day (or at least once per 24-hour period), one foot off the bottom of each pond at various locations and recorded. If any tests show a dissolved residual oxygen level of less than 0.5 ppm, immediate steps will be under taken to oxygenate the pond and create a residual oxygen level within the pond of at least 0.5 ppm. Remedial measures may include addition of chemicals or increased aeration. The pH readings will be recorded daily on the Daily Air and Water Inspection Form (**Attachment II.3.C**).

4.0 IMPLEMENTATION, ASSESSMENT, AND NOTIFICATION

The following subsections present a series of procedures for implementation, assessment, and notification of appropriate authorities in the unlikely event that a H_2S emergency develops (19.15.11.9 NMAC).

4.1 Implementation

This H_2S Contingency Plan will be implemented when an imminent or actual emergency situation develops that represents a potential impact to fresh water, public health, safety or the environment. The circumstances that could require implementation of this Plan includes the release of H_2S gas.

Table II.3.7 lists the implementation, assessment, and notification procedures that will be followed in the event of an emergency. Assessment and notification are discussed further in Sections 4.2 and 4.3.

4.2 Assessment

In the event of a release, the EC will immediately identify the character, source, amount and extent of released materials, if possible; as well as assess the potential impact to fresh water, public health, safety or the environment. During an emergency, the EC may amend this Plan, as necessary, to protect fresh water, public health, safety or the environment (19.15.11.9.F NMAC). The EC will also assess the circumstances of an emergency situation and determine the responses required to:

- provide notifications to appropriate agencies and the general public
- implement appropriate response and recordkeeping procedures

The assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities should be contacted, and whether DNCS should attempt to control the release with on-site personnel and equipment. **Table II.3.8** provides OCD descriptions of "major" and "minor" releases which are applicable for assessment purposes (19.15.29.7 – 11 NMAC). This section contains additional, detailed information regarding the Site Evacuation Plan, and Section 5.0 addresses control procedures.

4.2.1 Site Evacuation Plan

Based upon the type of waste materials and treatment received at DNCS, the potential for a Facility evacuation is unlikely (19.15.11.9.B.(2)(a) NMAC). However, various circumstances could arise warranting a Facility evacuation. In an emergency situation, the EC is the individual responsible for determining when evacuation of the Facility is required. Imminent or actual dangers that constitute a situation that could require evacuation include:

- Detection of H_2S levels at ≥10 ppm (evacuate the immediate area and monitor downwind levels)
- Detection of H_2S levels at ≥20 ppm (evacuate and close the Facility)

TABLE II.3.8
Part 29: Release Notification
DNCS Environmental Solutions

19.15.29.7 DEFINITIONS:

A. "Major release" means:

(1) an unauthorized release of a volume, excluding gases, in excess of 25 barrels;

(2) an unauthorized release of a volume that:

- **(a)** results in a fire;
- **(b)** will reach a watercourse;
- **(c)** may with reasonable probability endanger public health; or
- **(d)** results in substantial damage to property or the environment;

(3) an unauthorized release of gases in excess of 500 MCF; or

(4) a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

B. "Minor release" means an unauthorized release of a volume, greater than five barrels but not more than 25 barrels; or greater than 50 MCF but less than 500 MCF of gases.

19.15.29.8 RELEASE NOTIFICATION:

A. The person operating or controlling either the release or the location of the release shall notify the division of unauthorized release occurring during the drilling, producing, storing, disposing, injecting, transporting, servicing or processing of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixture of the chemicals or contaminants, in accordance with the requirements of 19.15.29 NMAC.

B. The person operating or controlling either the release or the location of the release shall notify the division in accordance with 19.15.29 NMAC with respect to a release from a facility of oil or other water contaminant, in such quantity as may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

19.15.29.9 REPORTING REQUIREMENTS: The person operating or controlling either the release or the location of the release shall provide notification of releases in 19.15.29.8 NMAC as follows.

A. The person shall report a major release by giving both immediate verbal notice and timely written notice pursuant to Subsections A and B of 19.15.29.10 NMAC.

B. The person shall report a minor release by giving timely written notice pursuant to Subsection B of 19.15.29.10 NMAC.

19.15.29.10 CONTENTS OF NOTIFICATION:

A. The person operating or controlling either the release or the location of the release shall provide immediate verbal notification within 24 hours of discovery to the division district office for the area within which the release takes place. In addition, the person shall provide immediate verbal notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief. The notification shall provide the information required on form C-141.

B. The person operating or controlling either the release or the location of the release shall provide timely written notification within 15 days to the division district office for the area within which the release occurs by completing and filing form C-141. In addition, the person shall provide timely written notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief within 15 days after the release is discovered. The written notification shall verify the prior verbal notification and provide appropriate additions or corrections to the information contained in the prior verbal notification.

19.15.29.11 CORRECTIVE ACTION: The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.

When conditions warrant immediate evacuation (e.g., $H_2S \geq 20$ ppm), on-site persons (e.g., Facility personnel, haulers, visitors, vendors, etc.) will be directed to proceed immediately to the Processing Area Gatehouse or the Landfill Scalehouse (as applicable) to evacuate through the main gates (**Figure II.3.4**), the primary evacuation route. DNCS Personnel will exercise good judgment and common sense in using the primary evacuation route to exit the Facility, or selecting the most appropriate alternative evacuation route, if necessary. Assembly points and primary/secondary evacuation routes are provided on **Figure II.3.4.** Driving directions to the nearest hospital are included as **Figure II.3.5**, and **Table II.3.9** provides detailed procedures for evacuating the Facility.

TABLE II.3.9
Evacuation Procedures
DNCS Environmental Solutions

When evacuation is required, the following procedures will be followed:

1. Facility personnel will be alerted directly or using the Facility telephone, cellular telephones, or radios.
2. Vehicles delivering waste will be diverted away from the location of the emergency and routed towards the Facility exit (**Figure II.3.2**).
3. All Facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Processing Area Gatehouse or the Landfill Scalehouse (as applicable), which will be the primary meeting locations (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the Gatehouse or Scalehouse or its immediate environs, the Facility secondary assembly point and evacuation routes will be utilized (as applicable).
6. Once assembled, personnel will stand by to afford assistance and coordinate further actions.

4.3 Notification of Authorities and General Public

This Section provides a series of procedures for implementation and notification of appropriate authorities in the event that a specific emergency develops (19.15.11.16 NMAC). Whenever there is an imminent or actual emergency, the EC will immediately contact on-site persons (Facility personnel, visitors, vendors, haulers, etc.) via on-site communication systems, as well as notify the appropriate state and local agencies (**Table II.3.2**), as necessary. OCD will be notified within 4 hours after the Contingency Plan has been activated.

NM 529

CATTLE GUARD
GATE

GATEHOUSE
A

PROCESSING AREA

PHASE I
PHASE III
PHASE IV

STABILIZATION AND SOLIDIFICATION AREA

B

CATTLE GUARD
GATE

CATTLE GUARD
GATE

SITE ENTRANCE
SCALEHOUSE
A

CATTLE GUARD
GATE

B

CATTLE GUARD
GATE

UNIT 1
(13.5± ACRES)

PHASE 1

UNIT 2
(19.8± ACRES)

UNIT 3
(22.2± ACRES)

UNIT 4
(23.8± ACRES)

PHASE 2

UNIT 5
(25.4± ACRES)

UNIT 6
(27.3± ACRES)

UNIT 7
(29.4± ACRES)

PHASE 3

UNIT 8
(30.7± ACRES)

UNIT 9
(41.6± ACRES)

CATTLE GUARD
GATE

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- PAVED ROAD AND SHOULDER (NM 529)
- PROPOSED ROAD
- GRAVEL ROAD/TRAIL
- POWER POLE
- CULVERTS
- CATTLE GUARD
- ROAD SIGN
- OBJECT
- ABANDONED WELL
- PRIMARY EVACUATION ROUTE
- SECONDARY EVACUATION ROUTE
- (A) PRIMARY MEETING LOCATION
- (B) SECONDARY MEETING LOCATION

NORTH

0 250' 500'

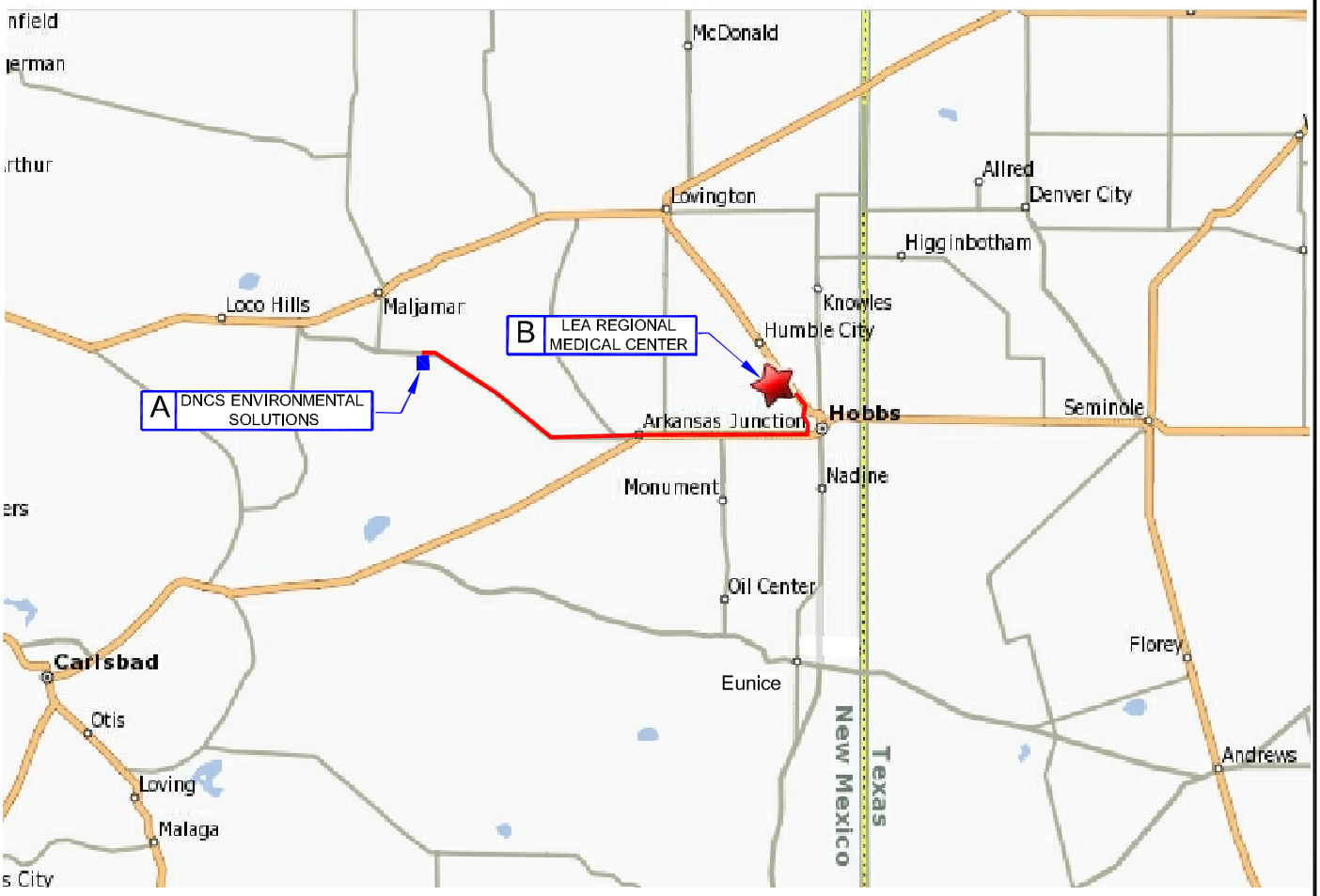
SITE EVACUATION MAP

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: EVACUATION.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\EVACUATION.dwg
Date/Time:Oct. 18, 2013-15:42:48 ; LAYOUT: B (LS)



A: DNCS ENVIRONMENTAL SOLUTIONS. NM 529

1. Head EAST on NM-529 toward DOG LAKE RD.	20.2 mi
2. Turn LEFT onto US-180 E / US-62/HOBBS Hwy.	11.9 mi
3. Turn LEFT onto Co Rd 66A / NW COUNTY ROAD.	3.5 mi
4. Turn LEFT onto NM-18 N / N LOVINGTON HWY.	1.8 mi
5. Arrive 5419 N LOVINGTON HWY	0.0 mi

B: Lea Regional Medical Center, 5419 N Lovington Hwy, Hobbs, NM 88240-9100

Note: A to B Travel Estimates: 42 minutes / 37.4 miles

HOSPITAL 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: 09/18/13	CAD: HOSPITAL LOCATION.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

NORTH
NOT TO SCALE

Map downloaded from MAPQUEST, September 15, 2009
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\HOSPITAL LOCATION.dwg
Date/Time:Sep. 19, 2013-08:40:17

Table II.3.2 provides a list of emergency response agencies and contacts that may need to be notified depending on the type and extent of an emergency situation. **Table II.3.2** will be posted as appropriate and near on-site telephones for easy access by DNCS personnel. Fire, police, and medical authorities will be contacted, as necessary, in an emergency situation (**Table II.3.2**).

In the case of an H_2S emergency where H_2S is ≥10 ppm, notification will be provided to the New Mexico State Police, Lea County Sheriff, and OCD (also listed on **Table II.3.2**):

- OCD
  Hobbs, NM (575) 393-6161
  Mobile Phone (575) 370-3180
  Santa Fe, NM (505) 476-3440
- New Mexico State Police 911 or (575) 392-5580
- Lea County Sherriff's Dept. 911 or (575) 396-3611
- Lea County Emergency Management (575) 396-8602

DNCS will also notify Phoenix Environmental (if necessary) in Hobbs (**Table II.3.2**) to provide response personnel, equipment, and supplies to mitigate the source of an H_2S reading ≥10 ppm.

Table II.3.8 provides specific information regarding notification of OCD in the case of a release, which by definition includes breaks, leaks, spills, releases, fires or blowouts. In addition, **Table II.3.8** also provides OCD definitions for "major" and "minor" releases.

Additional State, Federal, and other local emergency contact numbers are provided and should be used as deemed appropriate to the situation (**Table II.3.2**). If the EC determines that the incident could threaten fresh water, human health, public safety or the environment beyond the limits of the Facility, the EC will notify the National Response Center and USEPA at the following phone numbers (also included on **Table II.3.2**):

- National Response Center - 24 Hr. Hotline: (800) 424-8802
- Region VI 24 hr. Emergency Response Hotline (USEPA): (214) 665-2222

The EC's notification to authorities will include the following information, as listed on the Incident Report Form (**Attachment II.3.D**):

- name and telephone number of person reporting the incident
- name and address of Facility
- time and type of incident (e.g., hazardous material release, fire)
- name and quantity of material(s) involved, to the extent known
- extent of injuries, if any
- possible hazards to human health or the environment
- other information requested by the response entity

5.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment at DNCS that will be available for responding to emergency situations. An Emergency Response Equipment List describing the equipment, quantity, location, and uses is provided as **Table II.3.10**.

TABLE II.3.10
Emergency Response Equipment List[1]
DNCS Environmental Solutions

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher	2	Gatehouse/Scalehouse[2]	Firefighting
10 lb ABC rated fire extinguisher	2	Trucks	Firefighting
10 lb ABC rated fire extinguisher	1	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher	1	Oil Process Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Produced Water Receiving Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Diesel Storage Tank	Firefighting
Loader	1	Facility	Berm Repair
Oil Booms	4	NE Corner of Pond	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Gatehouse/Scalehouse[2]	Protective gear for employees
Pair leather gloves	1 per employee	Assigned to employee	Protective gear for employees
NOMEX Coveralls	7 per Employee	Assigned to Employee	Protective gear for employees
Pair safety glasses	1 per employee	All employee workstations	Protective gear for employees
Round-point wood handled shovels	2	Gatehouse/Scalehouse[2]	Contain spillage, putting out fires
First Aid Kit	1	Gatehouse/Scalehouse[2]	First Aid
First Aid Kit	1 per vehicle	Facility Vehicles	First Aid
Eye Wash Station	1	Produced Water Receiving Tanks	First Aid
Portable 2-way radio	1 per employee	Base unit at Gatehouse/Scalehouse[2]	Communications
Cell Phones	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Office Phone	2	Gatehouse/Scalehouse[2]	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment

Notes:
[1]Subject to change in response to waste receipts, regulatory requirements, technology, etc.
[2]The Gatehouse is associated with the Processing Area, and the Scalehouse is associated with the Landfill.

5.1 Internal Communications

Communications at DNCS will be accomplished via cellular telephones, land lines, and two-way radios. These systems provide Facility personnel with immediate emergency notification capabilities, and the opportunity to receive instructions in the event of an emergency incident. Any mechanical difficulties with the communications equipment will be promptly repaired. Internal communication devices are also listed on **Table II.3.10.**

5.2 External Communications

The land-line telephones and cell phones located at DNCS will have outside access in the event that notification of the local emergency response authorities is required (i.e., fire department, ambulance, etc.). Key Facility personnel including the ECs, Facility Manager, etc., will carry cellular telephones for contacting outside agencies. The cellular telephones also provide a backup means for contacting emergency authorities in the event they cannot be reached by conventional telephone lines. Emergency phone numbers will be posted in the Processing Area Gatehouse and the Landfill Scalehouse and provided to employees on laminated pocket cards. External communication devices are also listed on **Table II.3.10.**

5.3 Personnel Protection, First Aid, and Safety Equipment

Personal protective equipment (PPE) necessary for responding to a potential release of hazardous materials will be maintained in on-site buildings (Processing Area Gatehouse and the Landfill Scalehouse and the Produced Water Facility) and/or issued to each employee (**Table II.3.10**). These items include Tyvek suits, gloves, safety glasses, hearing protection, self-contained breathing apparatus (SCBA), etc.

First aid and safety equipment will be maintained at strategic locations at DNCS as shown on **Table II.3.10**. Safety equipment located at the Facility includes industrial first aid kits, fire extinguishers, an eye wash station, etc. An emergency shower will be located at the Produced Water Facility. First aid kits will be placed in the Processing Area Gatehouse and the Landfill Scalehouse and the Produced Water Facility. In addition, first aid kits will be maintained in all Facility vehicles, including heavy equipment. Prominent signs will be placed identifying the location of health and safety equipment, and emergency response items (e.g., fire extinguishers).

6.0 RECORDKEEPING

The EC will be responsible for ensuring that emergency response actions are fully documented. The Primary EC may complete the documentation requirements or delegate to another EC. The Incident Report Form (**Attachment II.3.D**) illustrates the information that will be recorded as a result of any emergency incident and related response action. This form will be signed by both the EC and the Facility Manager. Copies of the form filed for each incident will be retained for OCD review as part of the Facility Operating Record.

In addition, in the case of an unauthorized release at DNCS, the OCD will be notified pursuant to 19.15.29 NMAC. As defined by OCD a "release" is any "*breaks, leaks, spills, releases, fires or blowouts involving crude oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and natural gases to the environment"* (19.15.2.7.R(4) NMAC). A major release (19.15.29 NMAC; **Table II.3.8**) includes an unauthorized release of any volume which may, with reasonable probability, endanger public health; or an unauthorized release of natural gases in excess of 500 thousand cubic feet (mcf); or a release of any volume which may with reasonable probability endanger public health or results in substantial damage to property or to the environment, cause detriment to water, or exceed the standards in 19.15.30 NMAC. A major release requires both immediate verbal notification (within 24 hours), as well as timely written notification to OCD (within 15 days) using OCD Form C-141 (*Release Notification and Corrective Action*). A minor release (**Table II.3.8**) is an unauthorized release of greater than 50 mcf but less than 500 mcf of natural gases. A minor release requires timely written notice. A copy of OCD Form C-141 is provided as **Attachment II.3.E**. Copies of the Form filed for each incident will be retained on-site as part of the Facility Operating Record.

7.0 COORDINATION AGREEMENTS

A copy of this Plan will be made available to the organizations identified in **Table II.3.2**. This Plan serves to familiarize each of the identified organizations with the operations of the Facility and types of emergencies and responses that may be required. Each agency will be encouraged to visit the Facility for purposes of assessing site operations, and providing input regarding emergency response procedures (19.15.11.9.B.(2)(e) NMAC).

8.0 PLAN AMENDMENT

The EC will be responsible for assuring that updates to or amendments of this Plan are conducted and recorded in the event of any of the following (19.15.11.9.F NMAC):

1. The Facility Permit is revised or modified with potential impacts on this Plan.
2. The OCD mandates it, including responses to regulatory updates.
3. The Plan fails in an emergency.
4. Modification to the Facility design, construction, operation, maintenance or other circumstances that changes the potential circumstance or locations for fires, explosion, or releases of hazardous oil field waste constituents; or related changes in the appropriate emergency response.
5. The list of ECs changes.
6. The list of emergency equipment changes significantly.

The updated Plan will be distributed to OCD and made available to the organizations identified in **Table II.3.1** with a cover letter highlighting any substantive changes. Proposed changes will be in compliance with 19.15.36 NMAC.

9.0 TRAINING

The EC or Facility training representative will ensure all new and existing employees are trained on the H_2S Prevention and Contingency Plan at least annually; or when significant changes to the Plan have been made, whichever is more frequent. Prior to any new employee commencing work, a training session separate from the standard annual training will be conducted to provide specific proficiency in H_2S safety and procedures. Training will include both classroom drills and field exercises simulating H_2S monitoring, potential releases, and evacuation procedures. Included in this training are H_2S hazards identification and detection, personal protection, and contingency procedures.

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ATTACHMENT II.3.A

MATERIAL SAFETY DATA SHEET FOR H_2S

MATERIAL SAFETY DATA SHEET

Hydrogen Sulfide

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Hydrogen Sulfide
Synonyms:	H2S Sour Gas Sulfuretted Hydrogen Hepatic Gas Hydrosulfuric Acid Alliance - Hydrogen Sulfide - 1605 Ferndale - Hydrogen Sulfide - 1605 LAR - Acid Gas LAR - Sour Gas Santa Maria - Acid gas Santa Maria - Sour Gas Trainer - Hydrogen Sulfide - S173 Wood River - Hydrogen Sulfide - 100240
Intended Use:	Refinery by-product
Chemical Family:	Inorganic Gas

Responsible Party:	ConocoPhillips 600 N. Dairy Ashford Houston, Texas 77079-1175
MSDS Information:	800-762-0942 MSDS@conocophillips.com

Emergency Overview

24 Hour Emergency Telephone Numbers:
Spill, Leak, Fire or Accident Call CHEMTREC:
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3219

Health Hazards/Precautionary Measures: Poisonous hydrogen sulfide gas. Harmful if inhaled. Causes severe eye irritation. Use with ventilation adequate to keep exposure below recommended limits, if any. Do not breathe gas. Avoid contact with eyes. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Flammable gas. Can cause flash fire. Keep away from heat, sparks, flames, static electricity or other sources of ignition. Do not enter storage areas or confined space unless adequately ventilated.

Appearance:	Colorless
Physical Form:	Gas
Odor:	Rotten egg (odorless at high concentrations or after prolonged exposure at low concentrations)

NFPA 704 Hazard Class:

Health:	4 (Extreme)
Flammability:	4 (Extreme)
Instability:	0 (Least)

2. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS					
Component / CAS No:	**Percent (%)**	**ACGIH:**	**OSHA:**	**NIOSH:**	**Other:**
Hydrogen Sulfide 7783-06-4	100	10 ppm TWA 14 mg/m^3 TWA 15 ppm STEL 21 mg/m^3 STEL	20 ppm CEIL 50 ppm 10 min. peak	100 ppm IDLH	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.
NE=Not Established

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye: Severe eye irritant. Contact may cause stinging, watering, redness, swelling, and eye damage.

Skin: Skin contact is unlikely. No information available on skin absorption.

Inhalation (Breathing): Toxic. May be harmful if inhaled.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Signs and Symptoms: Effects of overexposure may include irritation of the eyes, nose, throat, and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats (arrhythmias), sudden collapse, respiratory failure, convulsions and death.

Cancer: There is no information available on the cancer hazard of this material.

Target Organs: No data available for this material.

Developmental: Inadequate data available for this material.

Other Comments: Hydrogen sulfide is a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include respiratory (asthma-like) disorders.

4. FIRST AID MEASURES

Eye: Immediately move victim away from exposure and into fresh air. If irritation or redness develops, flush eyes with clean water and seek immediate medical attention. For direct contact, immediately hold eyelids apart and flush the affected eye(s) with clean water for at least 20 minutes. Seek immediate medical attention.

Skin: First aid is not normally required. However, it is good practice to wash any chemical from the skin.

Inhalation (Breathing): Immediately move victim away from exposure and into fresh air. If respiratory symptoms or other symptoms of exposure develop, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Notes to Physician: In high doses hydrogen sulfide may produce pulmonary edema and respiratory depression or paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote; however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of H2S is confirmed and the patient does not respond rapidly to supportive care, the use of nitrites is an alternative treatment. For adults the dose is 10 ml of a 3% NaNO2 solution (0.5 gm NaNO2 in 15 mL water) I.V. over 2-4 minutes. Dosage should be adjusted in children or in presence of anemia. Follow blood pressure, methemoglobin levels, arterial blood gases, and electrolytes closely in serious cases.

5. FIRE-FIGHTING MEASURES

Flammable Properties:

Flash Point:	10°F / -12°C
Test Method:	Test Method Unknown
OSHA Flammability Class:	Flammable Gas
LEL%:	4.0
UEL%:	46.0
Autoignition Temperature:	500°F / 260°C

Unusual Fire & Explosion Hazards: This material is flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, or mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. Vapors are heavier than air and can accumulate in low areas. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire. Closed containers exposed to extreme heat can rupture due to pressure buildup.

Extinguishing Media: Dry chemical or carbon dioxide is recommended. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. If this cannot be done, allow fire to burn. Move undamaged containers from immediate hazard area if it can be done with minimal risk. Stay away from ends of container.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk.

6. ACCIDENTAL RELEASE MEASURES

Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate danger area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Water spray may be useful in minimizing or dispersing vapors (see Section 5).

Notify fire authorities and appropriate federal, state, and local agencies. If spill/release in excess of EPA reportable quantity (see Section 15) is made into the environment, immediately notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Use good personal hygiene practices.

Storage: Keep container(s) tightly closed. In a tank, barge, or other closed container, the vapor space above materials that contain hydrogen sulfide (H2S) may result in concentrations immediately dangerous to life or health (IDLH). Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

Personal Protective Equipment (PPE):

Respiratory: Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode in oxygen deficient environments (oxygen content <19.5%) or if exposure concentration is unknown or if conditions immediately dangerous to life or health (IDLH) exist.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: Not required based on the hazards of the material. However, it is considered good practice to wear gloves when handling chemicals.

Eye/Face: The use of a face shield and chemical goggles to safeguard against potential eye contact, irritation, or injury is recommended.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Appearance:	Colorless
Physical Form:	Gas
Odor:	Rotten egg (odorless at high concentrations or after prolonged exposure at low concentrations)
Odor Threshold:	0.0047 ppm
pH:	Not applicable
Vapor Pressure (mm Hg):	554.6 psia @ 100°F (38°C)
Vapor Density (air=1):	1.20
Boiling Point:	-60°F / -12°C
Melting/Freezing Point:	-86°F / -66°C
Solubility in Water:	Slight
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	1.2 (Gas)
Heat Value (BTU):	-6552 (BTU/lb)

Percent Volatile:	100%
Evaporation Rate (nBuAc=1):	>1
Molecular Weight:	34.08
Flash Point:	10°F / -12°C
Test Method:	Test Method Unknown
LEL%:	4.0
UEL%:	46.0
Autoignition Temperature:	500°F / 260°C

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Flammable gas.

Conditions to Avoid: Avoid high temperatures and all sources of ignition (see Sections 5 and 7). Toxic fumes can be released on heating.

Materials to Avoid (Incompatible Materials): Avoid contact with nitric acid, strong oxidizing agents.

Hazardous Decomposition Products: Combustion can yield sulfur oxides.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

No definitive information available on carcinogenicity, mutagenicity, target organ, or developmental toxicity.

Acute Data:

Hydrogen Sulfide - CAS: 7783-06-4
Dermal LD50 = Not Applicable
LC50 = 600 ppm, 30 min. (Human)
Oral LD50 = Not Applicable

12. ECOLOGICAL INFORMATION

Not evaluated at this time.

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced or spilled to soil or water, would be a RCRA "listed" hazardous waste, as would any soils or waters contaminated by spills of the material. This material is listed as hydrogen sulfide (U135). Further, this material, once it becomes a waste, is subject to the land disposal restrictions at 40 CFR 268.40 and must be treated prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent than the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT

Note: This material normally remains in plant and does not enter the public transportation system. i.e. rail, highway, air or water.

IMDG

ICAO/IATA

	LTD. QTY.	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

15. REGULATORY INFORMATION

U.S. Regulations:

EPA SARA 311/312 (Title III Hazard Categories)
Acute Health: Yes
Chronic Health: No
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

SARA - Section 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:
Hydrogen Sulfide.....7783-06-4.....100%

EPA (CERCLA) Reportable Quantity (in pounds):
Petroleum Exemption applies to this material.

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:
Hydrogen Sulfide.....7783-06-4.....500

California Proposition 65:
Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):
-- None Known --

Carcinogen Identification:
This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

TSCA:
All components are listed on the TSCA inventory.

International Regulations:

Canadian Regulations:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Domestic Substances List: Listed
WHMIS Hazard Class:
B1 - Flammable Gases
D1A - Materials Causing Immediate and Serious Toxic Effects - Very Toxic Material
D2B - Materials Causing Other Toxic Effects - Toxic Material

16. OTHER INFORMATION

Issue Date:	13-Oct-2005
Previous Issue Date:	28-Dec-2000
Revised Sections or Basis for Revision:	Responsible party (Section 1) Added facility synonyms - SEE SECTION 1.
MSDS Code:	001909

Disclaimer of Expressed and implied Warranties:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

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ATTACHMENT II.3.B

DISPOSAL TICKET (TYPICAL)

ATTACHMENT II.3.B
Disposal Ticket (Typical)
DNCS Environmental Solutions

Lea County, NM
NMOCD #_____

Date: _____ Time: _____ a.m./p.m.
Bill to: _____
Address: _____
State: _____ Zip: _____ Phone: _____
Company/Generator: _____
Lease Name: _____
Hauler: _____ Vehicle Number: _____ Driver (Print): _____

Type of Material

☐ Fluids ☐ Soils
☐ Tank Bottoms ☐ Other Material *(List Description Below)* Receiving Area: _____

Description: _____

Volume of Material

☐ Bbls ☐ Yard ☐ Gallons ☐ Wash Out
☐ Call Out ☐ After Hours ☐ Debris Charge

H2S Reading

H2S Reading (ppm): _____
Notes: _____

Generator Certification Statement of Waste Status

I do hereby certify that, according to the Resource Conservation and Recovery Act (RCRA) and Environmental Protection Agency's July, 1988, regulatory determination, any and all waste delivered to DNCS from the above locations is: EXEMPT oil field waste. This waste is in compliance with Regulated Levels of Naturally Occurring Radioactive Material (NORM) pursuant to 20 NMAC 3.1 Subpart 1403.C and D.

☐ DNCS Approval # _____ ☐ Denied

Agent/Representative of Generator/Hauler: _____

DNCS Representative: _____

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ATTACHMENT II.3.C

DAILY AIR AND WATER INSPECTION REPORT FORM H_2S MONITOR

(TYPICAL)

ATTACHMENT II.3.C
Daily Air and Water Inspection (Typical)
DNCS Environmental Solutions

YEAR_____ MONTH_____ WEEK BEGINNING_____

AMBIENT AIR WIND SPEED/DIRECTION
A.AM READINGS, NOTE INTIALS AND TIME
B.PM READINGS, NOTE INTIALS AND TIME
SUMP LEVELS
A. POND AND SLAB CHECKED DAILY,NOTE INTIALS AND TIME
B. PUMP SUMP CHECKED AM & PM,NOTE INTIALS AND TIME
C. LOADING AREA SUMP CHECKED AM & PM, NOTE INTIALS AND TIME

LOADING SUMP EMPTIED
A. LOADING AREA SUMP EMPTIED AT 4 PM, NOTE INTIALS AND TIME
CONCRETE SLAB EMPTIED
A.SLAB EMPTIED AT 4 PM, NOTE INTIALS AND TIME

Date	Sun	Mon	Tues	Wed	Thu	Fri	Sat
Ambient Air H2S (AM)							
H2S Reading (ppm)							
Wind Speed (mph)							
Wind Direction							
Initials and Time							
Ambient Air H2S (PM)							
H2S Reading (ppm)							
Wind Speed (mph)							
Wind Direction							
Initials and Time							
Sump Levels							
AM Pond Sump (ft)							
AM Cement Slab (ft)							
AM Loading Area (ft)							
AM Pump House Sump (ft)							
Intials and Time							
PM Loading Area (ft)							
PM Pump House(ft)							
Intials and Time							
Loading Sump Emptied							
Intials and Time							
Concrete Slab Emptied							
Intials and Time							
Pond Conditions							
Pond Level							
Overflow Color							
Pond Color							
Water Temperature							
pH							
Dissolved Oxygen							
Total Chlorine							
Dissolved H2S/Sulfides							
Bleach/Chemical							
Volume							
Time							
Initials							
Volume							
Time							
Initials							
Volume							
Time							
Initials							
Manager Verification							
Intials and Time							

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ATTACHMENT II.3.D

INCIDENT REPORT FORM (TYPICAL)

INCIDENT REPORT FORM
DNCS Environmental Solutions

Lea County, NM

Type of Incident and General Information

- ❑ Work Related Injury/Illness
- ❑ Property Damage
- ❑ Vehicular Accident
- ❑ Unsafe Act/Near Miss
- ❑ Vandalism/Criminal Activity
- ❑ Other _____ (i.e., spill, release, fire, explosion, hot load, etc.)

Employee Name: _____ Job Title: _____

Phone No: _____ Date of Incident: _____ Time of Incident: _____ AM/PM

Location of Incident: _____

Start of Shift:_____ Weather:_____

Date and Time Reported to Management: Date: _____ Time: _____ AM/PM

Reported to: _____ Title: _____ Reported by: _____

What was the injury category of incident at the time it was first reported to management?

[ ] N/A. Employee does not claim an injury associated with this incident
[ ] Notice Only of Injury, Declined Medical Treatment at this time
[ ] First Aid done on site, Declined Medical Treatment at this time
[ ] Medical Treatment. Transported by _____ to _____
[ ] Fatality, employee

THIS SECTION FILLED OUT BY EMPLOYEE

Employee's Description of Incident / Declaración del empleado de los hechos

Were you injured? *(Ud. se lastimó ?)* **Yes [ ] No [ ]**

Type of Injury: *(Tipo de lesión)* _____

Part of Body: _____ Left _____ Right _____
(Parte del cuerpo) *(Izq)* *(Der)*

Explain in your own words what happened. *(Explique en sus propias palabras lo que sucedió)*

_____

_____

_____

_____

_____

Employee Signature: (*Firma del empleado*) _____

Date: (*Fecha*) _____

INCIDENT REPORT FORM
DNCS Environmental Solutions

TO BE FILLED OUT BY EMERGENCY COORDINATOR

Describe in order of occurrence the events leading to the incident and/or injury. Reconstruct the sequence of events that led to the incident. _____

_____

_____

_____

_____

Identify possible hazards to human health or the environment: _____

_____

_____

_____

_____

Identify name and quantity of material(s) involved: _____

_____

_____

_____

_____

CORRECTIVE ACTIONS. (Equipment, Practices, Environment, Retraining) Steps that have been, or will be taken to prevent recurrence: _____

_____

_____

_____

_____

Date Corrective Action Completed: _____

- I have been briefed on the corrective actions outlined above
- *Estoy consciente de las acciones correctivas mencionadas anteriormente en esta hoja*

_____
Employee's Signature

_____
Date

Report Reviewed and Concluded By:

_____
Emergency Coordinator's Signature

_____
Date

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.E

RELEASE NOTIFICATION AND CORRECTIVE ACTION

OCD FORM C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☐ Final Report

Name of Company	Contact
Address	Telephone No.
Facility Name	Facility Type

Surface Owner	Mineral Owner	API No.

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County

Latitude_____ Longitude_____

NATURE OF RELEASE

Type of Release	Volume of Release	Volume Recovered
Source of Release	Date and Hour of Occurrence	Date and Hour of Discovery
Was Immediate Notice Given? ☐ Yes ☐ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☐ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Describe Area Affected and Cleanup Action Taken.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:	OIL CONSERVATION DIVISION	
Printed Name:	Approved by Environmental Specialist:	
Title:	Approval Date:	Expiration Date:
E-mail Address:	Conditions of Approval:	Attached ☐
Date: Phone:		

* Attach Additional Sheets If Necessary

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 4: CLOSURE/POST-CLOSURE PLAN

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DNCS ENVIRONMENTAL SOLUTIONS

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APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 4: CLOSURE/POST-CLOSURE PLAN

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 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 Purpose

The purpose of this Closure/Post-Closure (C/PC) Plan (the Plan) is to comply with the requirements of 19.15.36.8.C.(9) and 19.15.36.18 NMAC. This Plan describes the proposed procedures for closure and post-closure of the DNCS Facility, including a C/PC Cost Estimate sufficient to close the Facility in a manner that will protect fresh water, public health, safety and the environment.

The oil field waste processing and disposal infrastructure is anticipated to be developed and operated in four phases (Phases I-IV) over a projected multi-year time period to allow for the development of services in response to the needs of the oil and gas industry. **Table II.4.1**, DNCS Development Sequence, provides an outline of the projected phased development, including an implementation schedule for the installation of waste processing and disposal activities at the DNCS Facility. However, different combinations of these improvements may be constructed at any time dependent on market conditions and logistical considerations. This C/PC Plan may be modified by DNCS to address changes in site or operating conditions; and submitted and approved by OCD 30 days prior to implementation of proposed change. This Plan may also be amended at the request of OCD per 19.15.36.18.A.(5) NMAC.

TABLE II.4.1
DNCS Development Sequence[1]
DNCS Environmental Solutions

Description	Summary	Year No.[2]
Phase I - Initial Landfill & Produced Water Processing Operation.		
• Initial Landfill Cell (13.5-acres) • Produced water load-out points (4) • Tank farm berm (complete) • Boiler (75 HP) running a heat transfer fluid tank farm • Produced Water Receiving Tanks (4), 1,000 bbl capacity[3] • Settling Tanks (16), 1,000 bbl capacity • Crude Oil Recovery Tank (1), 1,000 bbl capacity • Oil Sale Tank (1), 1,000 bbl capacity • Mechanical Oil/Water Separation Unit • Ponds (4) capable of evaporating 3,000 bbl of liquid per day	The oil recovered from the Produced Water Processing Operations process is anticipated to be 6 bbl per day. This material will be pumped to the heated crude oil recovery tank for further processing before being pumped to the oil sale tank.	1
Phase II - Jet-Out Pit Operation.		
• Jet-Out Pit (six-station) for handling basic sediment and water (BS&W), tank bottoms, oily drilling muds and tank wash-outs • Additional crude oil recovery tank (1), 1,000 bbl capacity • Install 5-acre Stabilization and Solidification area	The oil recovered from the top of the Jet-Out Pit will be pumped to a heated Crude Oil Recovery Tank installed in the Tank Farm. Oil recovery from the Produced Water Tanks will also be plumed to this tank. Water recovered from the Pit will be pumped to the Produced Water Receiving Tanks. Sediments from the Pit will be bucket-loaded out of the pit and transferred to the Stabilization and Solidification Area for processing prior to landfilling.	2
Phase III - Expanded Produced Water Processing Operation.		
• Produced water load-out points (4) • Additional Produced Water Receiving Tanks (4), 1,000 bbl capacity • Additional Settling Tanks (16), 1,000 bbl capacity • Additional Crude Oil Recovery Tanks (3), 1,000 bbl capacity • Additional Oil Sales Tanks (2), 1,000 bbl capacity • Additional (2) Mechanical Oil/Water Separation Units • Additional ponds (4) capable of evaporating an additional 5,000 bbl per day of liquid	The additional oil recovered from the expanded Produced Water Processing Operation process, anticipated to be 6 bbl per day, will pumped to the Crude Oil Recovery tanks for further processing.	3
Phase VI - Ultimate Produced Water Processing Facility.		
• Additional Produced Water Receiving Tank (4), 1,000 bbl capacity • Additional Settling Tanks (16), 1,000 bbl capacity • Additional Oil Sales Tanks (1), 1,000 bbl capacity • Additional Mechanical Oil/Water Separation Unit • Additional ponds (4) capable of evaporating an additional 4,000 bbl per day of liquid	The additional oil recovered from the ultimate Produced Water Processing Facility will be pumped to the Crude Oil Recovery Tank for further processing.	4

Notes:

[1] The DNCS site development sequence is subject to change. Different combination of these improvements may be constructed at any time.

[2] Estimated number of years after OCD Surface Waste Management Facility Permit issued

[3] bbl = barrels of oil

1.2 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 II.4.1**). Site access will be provided via the south side of NM 529.

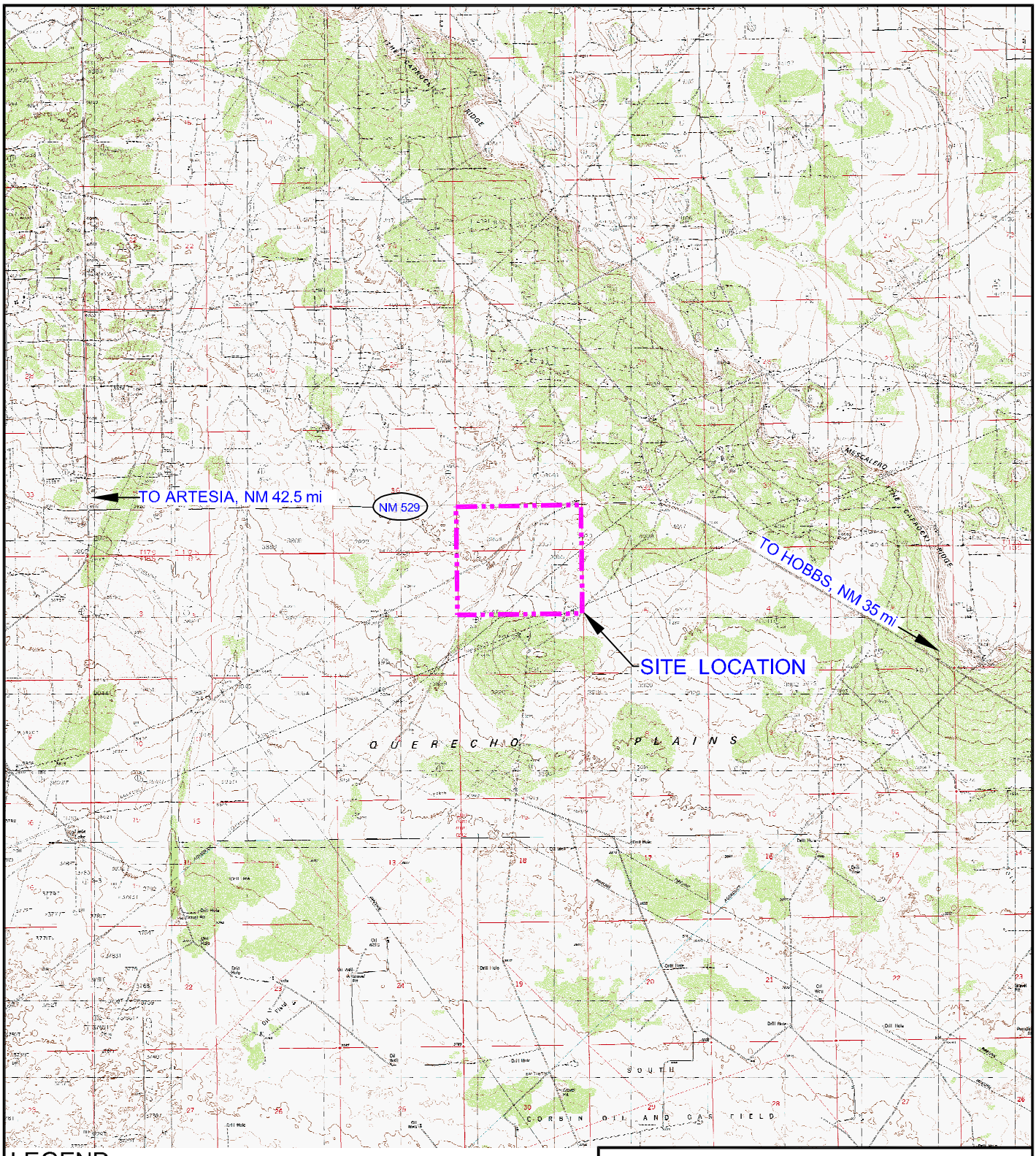
1.3 Facility Description

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 **Permit Plans**, **Sheet 3** identifies the locations of the Processing Area and Landfill facilities.

2.0 CLOSURE PLAN

2.1 Construction Schedule

DNCS will notify OCD's Environmental Bureau at least 60 days prior to cessation of permanent operations at the DNCS Facility. Included in this notification will be a proposed schedule for closure and monitoring activities. During the 60 day period after notification, it is anticipated that DNCS will coordinate the required site inspection by OCD. During this period, DNCS and OCD will additionally review and modify part of this C/PC Plan and proposed schedule that may be required for the protection of fresh water, public health, safety, or the environment that may result from the required OCD review or site inspection(s). Should OCD not notify DNCS of modification or additions to the C/PC Plan, DNCS will commence the following closure activities at the Facility provided the Director has not extended, in good cause, the OCD's response to the closure notification, as summarized on **Table II.4.2**.



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:Sep. 19, 2013-08:28:03 ; 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: 09/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.4.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.4.2
Closure Procedures
DNCS Environmental Solutions

- Processing Area:
  - Liquids Removal
  - Evaporation Pond Liner Removal
  - Tank Removal
  - Jet Wash Facility Closure
  - Treatment Plant Disassembly
  - Site Sampling
  - Final Site Closure
- Solid Waste Disposal Area:
  - Landfill closure construction
  - Final cover
  - Vegetation
  - Landfill closure documentation
- Miscellaneous Building and Structure Removal
- Final Land Use

2.2 Liquids Removal

Produced water remaining in receiving tanks will be pumped or transported to the evaporation ponds. Once all produced water is placed into the ponds, and free floating crude oil is removed and taken to the treating plant, evaporation will be conducted with or without the aid of a mechanical evaporation system. DNCS may introduce soils when sufficient evaporation has taken place to expedite solidification. Once solidification has been completed and the waste has been tested, the material will be encapsulated at the solid waste disposal area (DNCS Landfill). Although highly unlikely, should the DNCS Landfill not be in operation at the time of closure, all remaining liquids or solids will be removed from the ponds and disposed of in an OCD-approved surface waste management facility.

2.3 Evaporation Pond Liner Removal

Upon successful liquids removal, the remaining sludge, if any, will be allowed to dry to a consistency that lends itself to management and removal (i.e., paint filter test). Testing of the sludge will be performed prior to removal and disposal of the material in the DNCS Landfill. Although highly unlikely, should the DNCS Landfill not be in operation at the time of closure, remaining solids will be removed from the ponds and disposed of in an OCD-approved surface waste management facility in conformance with current operating standards. Testing of the sludge will include the following parameters:

- Total petroleum hydrocarbons (TPH)
- Benzene, toluene, ethylbenze, xylenes (BTEX)
- Resource Conservation and Recovery Act (RCRA) metals
- Paint Filter Test
- Chlorides
- Other parameters required by the disposal facility or OCD at the time of closure

The sample results will be provided to the OCD's Environmental Bureau (Santa Fe). Once the sludge has been removed, the high-density polyethylene (HDPE) liner system components will be thoroughly cleaned in accordance with 19.15.35.8 NMAC. DNCS proposes to cut the HDPE liner material and geocomposite into manageable pieces and disposal of the material in the DNCS Landfill; or to transport the material to a New Mexico Environment Department Solid Waste Bureau approved recycling or disposal facility.

2.4 Tank Removal

Upon closure, all tanks and equipment will be emptied and cleaned. DNCS will test accordingly and dispose of the residual oil field waste removed from the tanks and deposit it in the solid waste disposal area. If the DNCS Landfill is not in operation at time of closure, remaining solids will be removed from the ponds and disposed of in an OCD-approved surface waste management facility. DNCS will reuse, recycle or remove the tanks, infrastructure, and equipment from the site within 90 days of closure and notify OCD accordingly.

2.5 Jet Wash Facility

Closure of the Jet Wash Facility will consist of dismantling the above-grade installations for recycling (of clean elements) or on-site disposal. The tanks will be cleaned for re-use or recycled as scrap metal. The leak detection zone will be examined for contamination. If evidence of contamination is present, the gravel from the leak detection zone will be exhumed and disposed of on-site. If the DNCS Landfill is not in operation at time of closure, all remaining solids will be removed from the Facility and disposed of in an OCD-approved surface waste management facility. If no contamination is present, the lined units will be backfilled with clean soil, and crowned to promote drainage.

2.6 Treatment Plant

Once crude oil recovery processes have been completed, the treatment plant will be disassembled. Associated piping leading to or from the treatment plant will be removed, cleaned and recycled for reuse. Once equipment, tanks, piping, and buildings have been dismantled (if applicable) the treatment plant will be inspected for contamination. If contamination is discovered, the affected zone will be excavated and disposed of in the solid waste disposal area, and the area will be tested until confirmed to meet applicable regulatory standards. If the DNCS Landfill is not in operation at time of closure, remaining solids will be removed from the Facility and disposed of in an OCD-approved surface waste management facility.

2.7 Site Sampling

Once Processing Area tanks, equipment, and liners have been removed, but prior to backfilling ponds and site leveling, the site will be sampled in accordance with chapter nine of United States Environmental Protection Agency (EPA) publication SW-846; *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. A typical sampling grid is provided as **Figure II.4.2** (@ 5 tests/acres), which illustrates the proposed sampling locations for the DNCS Processing Area to document proper closure. Soil samples will be taken at select locations in the areas used for shipping and receiving, treatment and storage areas, and the

GATE
CATTLE GUARD

GATEHOUSE

VEHICLE QUEUING

LOW WATER CROSSING

PRODUCED WATER LOAD OUT

TANKS

PROCESSING AREA

BOILER

JET OUT WATER

BS&W, TANK BOTTOMS
JET PIT WASH OUT

MECHANICAL OIL/WATER SEPARATOR

MECHANICAL OIL/WATER SEPARATOR

EVAPORATION POND
POND No.1

EVAPORATION POND
POND No.5

EVAPORATION POND
POND No.9

EVAPORATION POND
POND No.2

EVAPORATION POND
POND No.6

EVAPORATION POND
POND No.10

EVAPORATION POND
POND No.3

EVAPORATION POND
POND No.7

EVAPORATION POND
POND No.11

EVAPORATION POND
POND No.4

EVAPORATION POND
POND No.8

EVAPORATION POND
POND No.12

PHASE I

PHASE II

PHASE III

PHASE IV

200'

420'

STABILIZATION AND SOLIDIFICATION AREA

MATCH LINE

CATTLE GUARD

GATE

MATCH LINE

N 651300
N 651200
N 651100
N 651000
N 650900
N 650800
N 650700
N 650600
N 650500
N 650400
N 650300
N 650200
N 650100
N 650000
N 649900
N 649800
N 649700
N 649600

E 732600
E 732700
E 732800
E 732900
E 733000
E 733100
E 733200
E 733300
E 733400
E 733500
E 733600
E 733700
E 733800
E 733900
E 734000
E 734100
E 734200
E 734300
E 734400
E 734500
E 734600

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- EVAPORATOR
- M MONITORING LOCATION
- SAMPLING POINT
- N 650,500 / E 734,500 100' SITE GRID

NORTH

0 100' 200'

TYPICAL SAMPLING GRID

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: 10/30/2013	CAD: SAMPLING GRID.dwg	PROJECT #: 452.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.4.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SAMPLING GRID.dwg
Date/Time:Oct. 31, 2013-14:09:13 ; LAYOUT: Layout1-B (LS)

evaporation ponds area. The soil samples will be taken at select depths within the in-situ soil, including at least one from the first foot of soil; and one within 36 to 42 inches below the surface. Samples will be evaluated for the following constituents:

- TPH
- BTEX
- Metals and organics listed in Water Quality Control Commission (WQCC) 20.6.2.3103.A&B

Samples will be submitted to the OCD's Environmental Bureau (Santa Fe). Provided the sample results indicate no contamination persists at the Facility in excess of allowable levels, DNCS will proceed with final site closure and post-closure activities.

2.8 Final Site Closure – Processing Area

Upon OCD determination that no contamination is present at DNCS at regulatory thresholds, the Processing Area will be re-graded to the intended final use. Activities to be conducted during this period include:

- Submittal of Notice of Intent (NOI) to the EPA for a Construction General Permit (CGP) and Stormwater Pollution Prevention Plan (SWPPP) implementation
- Evaporation and sedimentation pond berm removal and backfilling
- Site grading and re-contouring
- Site revegetation

Re-vegetation of the DNCS site will be conducted during the optimum planting period, whenever possible. Examples of seed types identified and recommended by the NRCS as acceptable cover for the local and are described in **Table II.4.3.** The Closure Documentation Record (**Attachment II.4.C**), or a similar template, will be used to record the field activities specific to final site closure. A licensed New Mexico Professional Engineer, experienced in landfill engineering, will supervise closure construction and certify completion of closure activities.

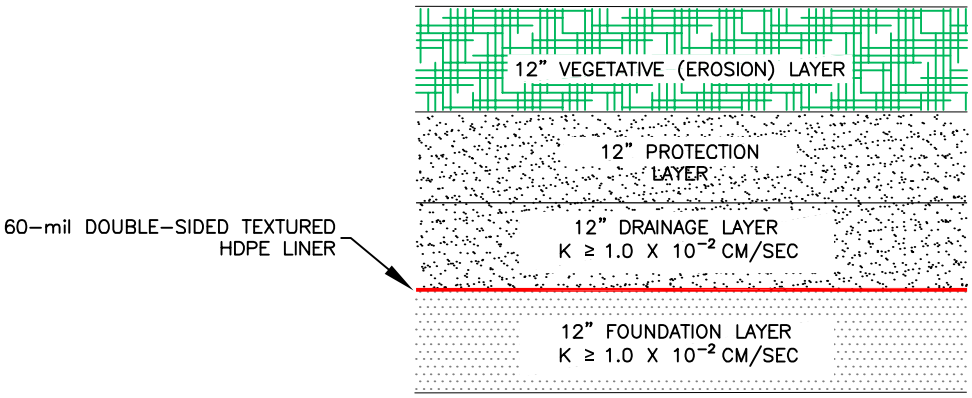
2.9 Solid Waste Disposal Area

It is anticipated that the DNCS Landfill will be the final area closed at the DNCS Facility due to the need for disposal of wastes from other on-site process units under premature closure conditions. The overall final grading contours for the Landfill are provided in the **Permit Plans, Sheet 5**. The final cover proposed for the DNCS Landfill includes a prescriptive crown, and an alternative sideslope cover configuration. The prescriptive cover (crown) was designed in compliance with 19.15.36.14.C(8) NMAC, and consists of:

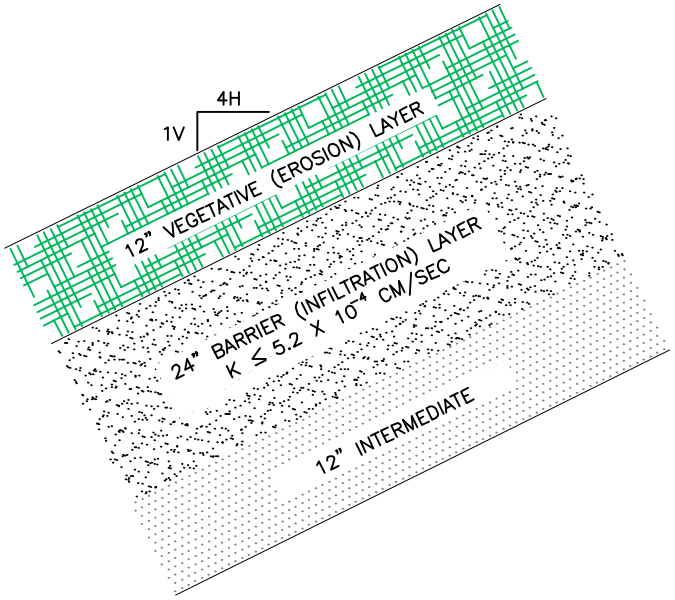
- a 12-inch erosion layer
- a 12-inch protection layer
- a 12-inch drainage layer ($k \geq 1 \times 10^{-2}$ cm/sec)
- 60-mil double-sided, textured, HDPE liner
- a 12-inch foundation layer

The alternative (evapotranspiration) cover for the sideslopes will consist of a 12-inch erosion layer; a 24-inch infiltration layer ($k \leq 5 \times 10^{-5}$ cm/sec); and a 12-inch intermediate cover layer as shown on **Figure II.4.3**. Based on the results provided in **Volume III.4** (HELP Model), the proposed alternative final cover for the sideslopes is proven to provide superior performance in preventing liquid migration through the cover when compared to the prescriptive cap outlined in the regulations; and the prescriptive design is not stable on sideslopes.

Final slopes will be constructed in accordance with the Final Grading Plan (**Permit Plans, Sheet 5**). The side slopes will be no greater that 25% (4 horizontal to 1 vertical) and the top crown will be constructed at a design grade of 5%. Details for the final cover design are shown on the **Permit Plans, Sheet 8**. The final cover, as well as other disturbed areas of the site, will be seeded with native vegetation. Vegetation on the site will be planted during the optimum planting period, whenever possible. Examples of seed types identified and recommended by the Natural Resource Conservation Service (NRCS) as acceptable cover for the local climate and precipitation include, but are not limited to:



FINAL COVER DETAIL CROWN
PRESCRIPTIVE DESIGN



FINAL COVER DETAIL SIDESLOPE
EVAPOTRANSPORATION DESIGN

FINAL COVER PROFILE

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: 10/22/2013	CAD: FINAL COVER.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.4.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\FINAL COVER.dwg
Date/Time:Oct. 31, 2013-14:06:23

TABLE II.4.3
NRCS Recommended Seed Mix
DNCS Environmental Solutions[1,2,3,4]

Grass Species	% of Mix	RATE (PLS/Acre)[5]	Lbs. PLS/Acre[6]
Bluegrama (Native)	40	1.5	1.2
Buffalograss (burs)	10	16	3.2
Green Sprangletop	10	1.7	0.34
Sand Dropseed	10	0.5	0.1
Sideoats (Vaughn)	20	4.5	1.8
Western Wheatgrass (Native)	10	8	1.6
Totals	**100%**	**32.2**	**8.24**

Notes:

1. *Lea County NRCS recommends doubling the seeding rate on critical area plantings.*
2. *These grasses are fairly shallow rooted; well adapted to Lea County; are available from area growers; and will aid in erosion control once established.*
3. *NRCS recommends that seeding a cover crop of sorghum in the spring at 8 lbs/acre will stabilize the site initially.*
4. *Subject to change based on changes in NRCS requirements, new technology, etc.*
5. *PLS = pure live seed per acre*
6. *Lbs. = pounds of PLS per acre*

The Closure Documentation Record (**Attachment II.4.C**) or a similar template will be used to record the field activities specific to final site closure. Documentation of closure activities including, but not limited to, monitoring results, site inspection data, soil sampling and maintenance procedures will be submitted to OCD in the Final Closure Report. Closure construction activities will be supervised by a licensed New Mexico Professional Engineer experienced in waste facility technology, who will certify the closure.

2.10 Miscellaneous Building and Structure Removal

At this time, it is anticipated that the DNCS Facility site following closure will revert to open space or livestock grazing, Should an alternate land use be identified that could utilize the remaining structures and buildings, they will be cleaned and left in place with the exception of below-grade sumps. If not, all buildings and miscellaneous structures will be dismantled, and where practical, recycled or reused. Non-recyclable material will be disposed of in the DNCS Landfill, or other OCD-approved landfill. Once building, structures and sumps are removed, the areas will be inspected for contamination. Should contamination be discovered, the zone will be excavated and disposed of in the solid waste disposal unit, and the area will be tested until confirmed to meet regulatory standards. If the DNCS Landfill is not in operation at time

of closure, remaining materials will be removed from the Facility and disposed of in an OCD-approved surface waste management facility.

2.11 Final Land Use

At this time DNCS has not established a use for the Facility after closure beyond open pasture. Should a specific use be determined, DNCS will notify OCD and request approval to be released from the following post-closure activities provided there has not been a release to the vadose zone or ground water pursuant to 19.15.30 and 19.15.29 NMAC.

3.0 POST-CLOSURE PLAN

3.1 Post-Closure Maintenance

DNCS will monitor and provide post-closure maintenance for the Landfill Facility for a period of not less than 30 years, or as otherwise approved by OCD. During the post-closure care period, DNCS proposes to inspect and maintain the site at least quarterly, and immediately after a documented 24 hour, 25-year storm event, whichever is more frequent as defined on the Site Inspection Checklist (**Attachment II.4.D**). Upon successful re-vegetation efforts resulting in at least 70% coverage or other approved erosion control methods (gravel mulches, etc.), DNCS plans to reduce the inspection frequency subject to OCD approval. Post-closure care inspections will typically include:

- Vegetative growth observation
- Erosion
- Differential settlement
- Vegetative stress (i.e., gas migration)

DNCS will conduct post-closure monitoring of the Processing Area for a period of no less than 3 years. Should deficiencies or discrepancies be discovered during the site inspections in these or other areas of the landfill, DNCS will conduct corrective measures. If there has been a release to the vadose zone or groundwater, DNCS will comply with the requirements of 19.15.30 and 19.15.29 NMAC.

3.2 Reporting

Reports of post-closure activities including, but not limited to site inspection data and maintenance procedures will be submitted to OCD within 45 days from the end of each calendar year or as otherwise required.

4.0 FINANCIAL ASSURANCE

4.1 Closure/Post Closure Cost Estimate

The Cost Estimate (**Attachment II.4.A**) for the closure and post-closure activities described in this C/PC Plan is presented in current dollars and conservatively assumes that third party contractors will perform closure and post closure activities at the site, as required by 19.15.36.8.C.(9) NMAC. Preparation of the C/PC Cost Estimate also assumes that no contamination or remedial activities are required due to releases into the environment. The current estimate for Phase 1 (**Table II.4.1**) of DNCS closure construction and post-closure operations and is provided as **Attachment II.4.A**.

This estimate will be revised accordingly as additional Phases (**Table II.4.1**) of DNCS construction and operations are implemented, or should unforeseen conditions arise, as well as annually once Phase Development is complete. Upon Division approval of the requested permit, DNCS will elect a financial assurance mechanism pursuant to 19.15.36.11.E NMAC and submit the appropriate documentation to OCD based on the estimates provided in this Plan.

4.2 Release of Financial Assurance

Upon successful completion of closure activities for the entire Facility, or portions of the operation (i.e., sections of the Landfill that have reached final grade; components of the process that have ceased operation); and after OCD concurrence; DNCS will request the release of the financial assurance mechanism in-place for that component of closure of the Facility. After the post-closure periods have expired (i.e., 3 years for waste processing pits/ponds, and 30 years for the Landfill), provided there is no contamination evident and the site has established re-vegetation in accordance with the regulations, DNCS will request release from the remaining financial assurance requirements for the Facility or portions that have been successfully closed.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 4: CLOSURE/POST-CLOSURE PLAN

ATTACHMENT II.4.A

CLOSURE/POST-CLOSURE COST ESTIMATES

ATTACHMENT II.4.A.1
CLOSURE/POST-CLOSURE
COST ESTIMATE SUMMARY
DNCS Environmental Solutions

TASK	COST ESTIMATE
1.0 LANDFILL CLOSURE CONSTRUCTION	**$282,648**
2.0 LANDFILL MAINTENANCE	**$330,000**
3.0 ENVIRONMENTAL MONITORING	**$125,400**
4.0 POND AND PROCESSING AREA CLOSURE (see Att. II.4.A.5)	**$350,304**
TOTAL COST ESTIMATE	**$1,088,352**

ATTACHMENT II.4.A.2
LANDFILL CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
DNCS Environmental Solutions Landfill (Unit 1 - 13.5 acres ±)

TASK 1.0	Unit Quantity	Unit	Unit Cost	**Total Cost**
1.1 Final Cover Installation				
1.1.1 Install and compact 24" Infiltration (Barrier) Layer	43,516	CY	$3.50	$152,308
1.1.2 Install 12" Erosion (Vegetative) Layer	21,758	CY	$2.50	$54,396
1.1.3 Vegetative Layer Seeding (Class A)	13.5	AC	$1,500.00	$20,250
			Task Subtotal	**$226,953**
1.2 Final Cover CQA				
1.2.1 Inspection and Testing	1	LS	$25,000	$25,000
1.2.2 Certification	1	LS	$5,000	$5,000
			Task Subtotal	**$30,000**
			TASK TOTALS	**$256,953**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$25,695
			TOTAL COST	**$282,648**

Notes:

1. Closure costs are based on contracting with a qualified third party to complete and certify closure. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
2. Final cover installation costs assume that:
   - ▸ The greatest area requiring final cover is 13.5 acres ± (Unit 1).
   - ▸ 12" of intermediate cover is already installed.
   - ▸ All soils necessary for closure are available on-site.
3. CY = Cubic Yard
   AC = Acre
   LS = Lump Sum

ATTACHMENT II.4.A.3
LANDFILL MAINTENANCE
POST-CLOSURE COST ESTIMATE
DNCS Environmental Solutions

TASK 2.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost For 30 Years
2.1 Final Cover Inspection and Reporting					
2.1.1 Inspection	2	events/yr	$400	$800	$24,000
2.1.2 Recordkeeping and Reporting	2	events/yr	$400	$800	$24,000
			Task Subtotals	**$1,600**	**$48,000**
2.2 Final Cover Maintenance					
2.2.1 Cover Maintenance	1	AC/yr	$1,000	$1,000	$30,000
2.2.2 Vegetation	2	AC/yr	$1,500	$3,000	$90,000
			Task Subtotals	**$4,000**	**$120,000**
2.3 Leachate System					
2.3.1 Inspection/Repair	1	LS	$400	$400	$12,000
2.3.2 Disposal	4	events/yr	$400	$1,600	$48,000
			Task Subtotals	**$2,000**	**$60,000**
2.4 Surface Water Management Systems					
2.4.1 Inspection/Repairs	2	events/yr	$600	$1,200	$36,000
			Task Subtotals	**$1,200**	**$36,000**
2.5 Fencing					
2.5.1 Inspection/Repairs	2	events/yr	$600	$1,200	$36,000
			Task Subtotals	**$1,200**	**$36,000**
			TASK TOTALS	**$10,000**	**$300,000**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$1,000	$30,000
			TOTAL COST	**$10,000**	**$330,000**

Notes:

1. Post-closure maintenance costs are based on contracting with a qualified third party to conduct post-closure care maintenance for the landfill. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
2. AC = Acre
   LS = Lump Sum

ATTACHMENT II.4.A.4
ENVIRONMENTAL MONITORING
POST-CLOSURE COST ESTIMATE
DNCS Environmental Solutions

TASK 3.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost
3.1 Landfill Gas Monitoring[3]					
3.1.1 Field Services/Reporting (30 years)	0	events/yr	$0	$0	$0
			Task Subtotal	**$0**	**$0**
3.2 Vadose Zone Monitoring					
3.2.1 Field Services/Lab Analysis/Reporting (30 years)	1	events/yr	$2,300	$2,300	$69,000
			Task Subtotal	**$2,300**	**$69,000**
3.3 NPDES Monitoring					
3.3.1 Field Services/Reporting (30 years)	1	LS	$1,500	$1,500	$45,000
			Task Subtotal	**$1,500**	**$45,000**
			TASK TOTALS	**$3,800**	**$114,000**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$380	$11,400
			TOTAL COST	**$4,180**	**$125,400**

Notes:

1. Closure costs are based on contracting with a qualified third party to conduct post-closure monitoring for the landfill. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
2. Assume no water in vadose wells (i.e., sampling and analysis costs not included).
3. Included with Task 3.2.
4. LS = Lump Sum

ATTACHMENT II.4.A.5
POND AND PROCESSING AREA CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
DNCS Environmental Solutions

Task 4.0	Units	Unit Cost	Total (28 acres)	
			Quantity	Cost
4.1 Evaporation Pond				
4.1.1 Liquids Transport/Disposal				
4.1.1.1 Transport Liquid	bbl	$1.75	240	$ 420
4.1.1.2 Disposal Liquids	bbl	$0.95	240	$ 228
4.1.1.3 Remove/Transport Sludge	ton	$6.50	4,840	$ 31,460
4.1.1.4 Disposal Sludge	ton	$15.00	4,840	$ 72,600
4.1.1.5 Liner Removal/Transport	yd^3	$4.00	200	$ 800
4.1.1.6 Disposal Liner	yd^3	$4.25	200	$ 850
			Task Subtotal	**$ 106,358**
4.1.2 Pond Backfill and Contouring				
4.1.2.1 Soil On-site	yd^3	$1.00	0	$ -
4.1.2.2 Place and Compact Soil	yd^3	$1.90	15,000	$ 28,500
			Task Subtotal	**$ 28,500**
4.1.3 Seeding	acres	$1,200	28	$ 33,600
			Task Subtotal	**$ 33,600**
Pond Closure Subtotal:			**$**	**168,458**
4.2 Site Work				
4.2.1 Tank Removal		Lump Sum	$	25,000
4.2.2 Jet-Out Pit Removal		Lump Sum	$	25,000
4.2.3 Building Removal		Lump Sum	$	25,000
4.2.4 Process Equipment Removal		Lump Sum	$	25,000
4.2.5 Earthwork		Lump Sum	$	10,000
Site Work Subtotal:			**$**	**110,000**
4.3 Engineering				
4.3.1 CQA/Certification		Lump Sum	$	40,000
Engineering Subtotal:		Lump Sum	**$**	**40,000**
4.4 Totals				
4.4.1 Subtotal			$	318,458
4.4.2 Adminstration Cost (10%)			$	31,846
Total:			**$**	**350,304**

Notes:

1. Closure costs are based on contracting with a qualified third party to complete and certify closure.
2. Assume 1,000 gallons of residual water in each pond.
3. Assume 6" of sludge remaining in each pond at closure.
4. Site Sampling is conducted during the CQA phase.

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ATTACHMENT II.4.B

FINANICAL ASSURANCE DOCUMENTATION

TO BE PROVIDED UPON PERMIT APPROVAL

APPLICATION FOR PERMIT
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ATTACHMENT II.4.C

CLOSURE DOCUMENTATION RECORD (TYPICAL)

ATTACHMENT II.4.C
Closure Documentation Record (Typical)
DNCS Environmental Solutions

Pond or Tank	Location		Location Closure				Revegetation			
			Liner		Tank					
Number	Lat. (Northing)	Lon. (Easting)	Removed	Tested	Cleaned	Removed	Installed	Date	Certified	Date

Date: _____ **Recorded By:** _____

Inspected By: _____ **Certified By:** _____

Comments: _____

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ATTACHMENT II.4.D

SITE INSPECTION CHECKLIST (TYPICAL)

ATTACHMENT II.4.D
Post-Closure Site Inspection Checklist (Typical)
DNCS Environmental Solutions

Date: _____ **Inspector(s):** _____

Time: _____ _____

Weather:

Temperature _____ deg. F Precipitation (last 24 hours) _____ inches

Skies _____

Wind Speed _____ mph

Wind Direction _____ *(direction blowing from)*

NOTES:
"X" indicates that a Deficiency has been noted. "P" indicates that a Photograph has been taken. "S" indicates that a Sample has been collected. Complete descriptions of Deficiencies, Photographs, and Samples are provided on attached pages. Items are referenced by Location.

Vegetation Condition

Location	Item			
	Vegetation Stress	Vegetation Dieback	Vectors	Sample

Surface Water Management System

Location	Deficiency			Sample
	Erosion/ Siltation	Structural Defect	Flow Obstruction	

NOTES: _____

_____

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1.0 INTRODUCTION

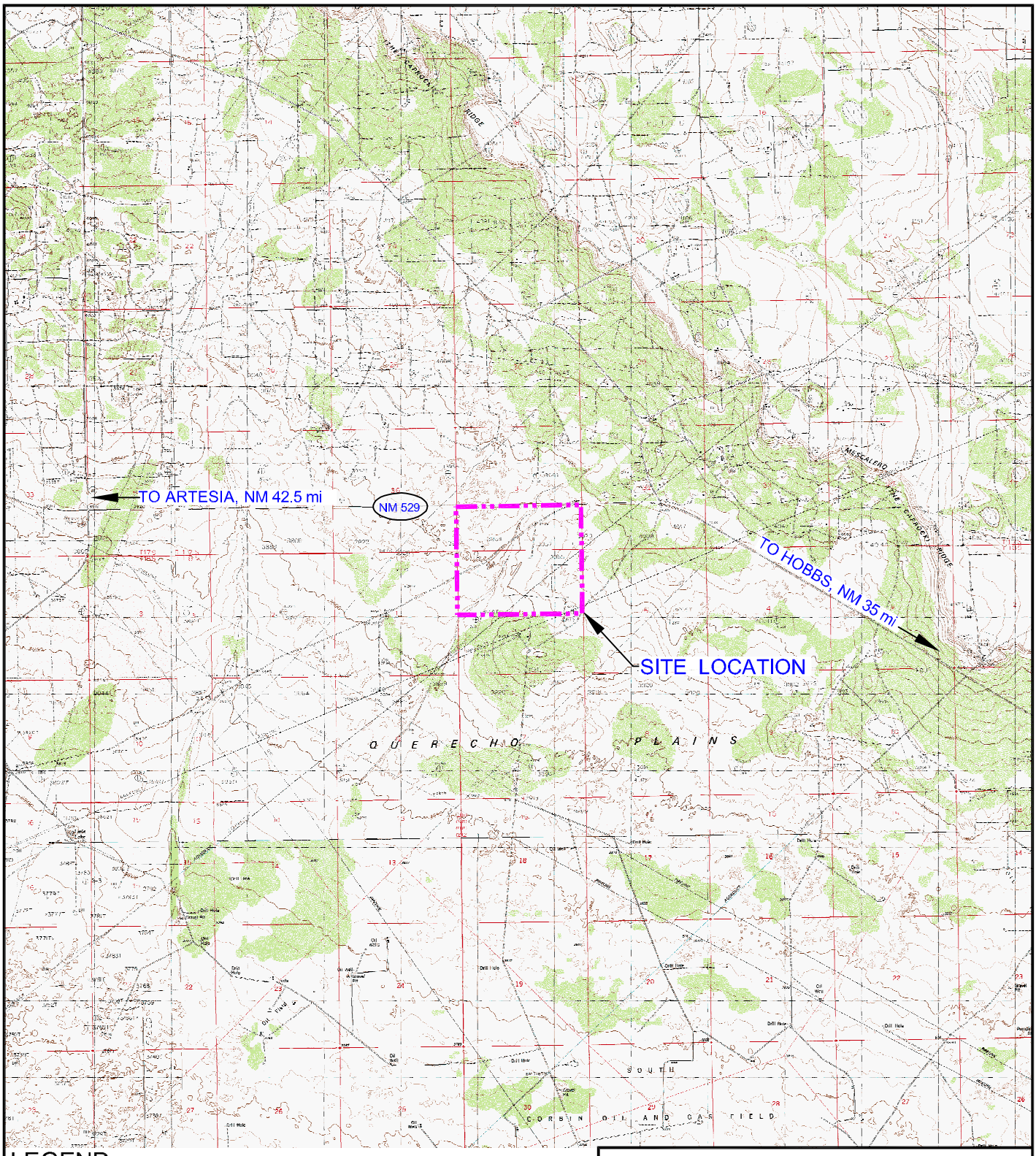
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 II.5.1**). 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 Plan provided as **Figure II.5.2** identifies the locations of the Processing Area and Landfill facilities. The proposed facilities are detailed in **Table II.5.1**, and are anticipated to be developed in four primary phases.



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

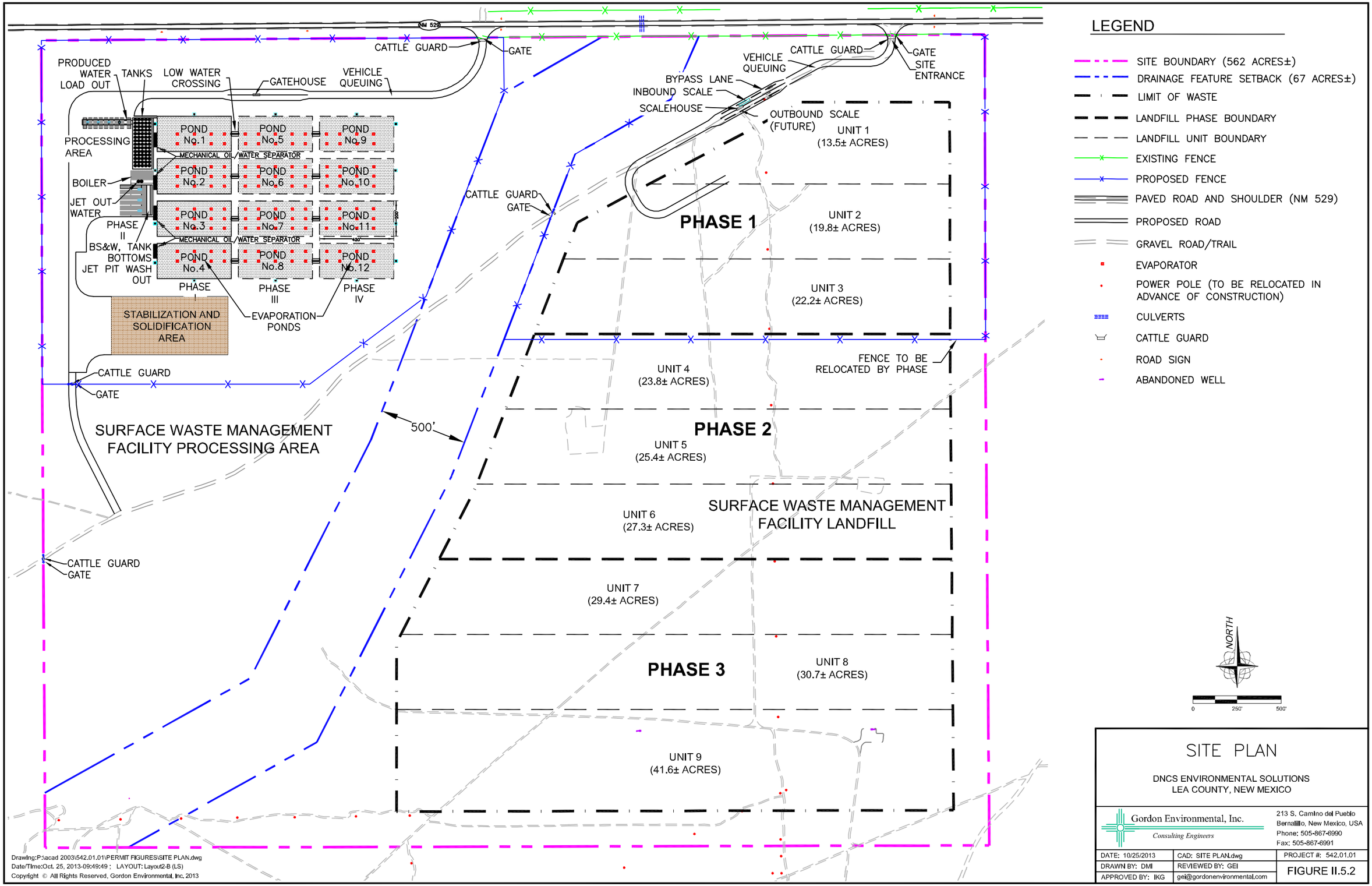
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\SITE LOC MAP.dwg
Date/Time:Sep. 19, 2013-08:26:52 ; LAYOUT: A (P)

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: 09/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.1
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 II.5.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.5.1
Proposed Facilities[1]
DNCS Environmental Solutions

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	9
Produced water receiving tanks	12
Produced water settling tanks	48
Mechanical oil/water separator unit	4
Evaporation ponds	12
Stabilization and Solidification Area	1
Oil treatment plant	1
Crude oil receiving tanks	5
Oil sales tanks	5
Customer jet wash	1 (6 bays)

Note:
[1]Subject to change. The proposed facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, technology, etc.

1.3 Purpose

This document has been prepared to address the requirements of 19.15.36.13.N NMAC which specify that each operator of a surface waste management facility must prepare and have available a Contingency Plan (the Plan). This Plan is designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water. Applicable provisions of this Plan will be implemented immediately whenever there is a fire, explosion or release of contaminants or oil field waste constituents that could threaten fresh water, public health, safety or the environment. This Plan is supplemented by the H_2S Prevention and Contingency Plan (**Volume II.3**), as a cross-reference.

This Plan is organized for easy reference by Facility personnel, whom will be required to read it. Copies of this Plan will be maintained in a readily accessible location at the Landfill Scalehouse and the Processing Area Gatehouse. In addition, copies of the Plan will be made available to the emergency agencies identified in **Table II.5.2**. Agencies listed on **Table II.5.2** will be invited to the site for the purposes of familiarizing themselves with the Facility and reviewing the Plan's contents with DNCS (19.15.36.13.N.(2) NMAC). As detailed in Section 10 of this Plan, whenever significant changes to the Plan are made, revised copies of the Plan will replace existing copies, and the agencies listed in **Table II.5.2** will be provided with the most recent Plan updates. Definitions specific to this Plan are provided in **Table II.5.3** as specified in 19.15.2.7 NMAC, and a more comprehensive list of definitions is included as **Table I.5** (**Volume I**).

2.0 EMERGENCY COORDINATORS

DNCS has designated specific individuals with the responsibility and authority to implement response measures in the event of an emergency which may threaten freshwater, public health, safety or the environment per 19.15.36.13.N.(3) NMAC. The Primary, Alternate, and On-site Emergency Coordinators (ECs; **Table II.5.4**) will be thoroughly familiar with aspects of this Plan; operations and activities at the DNCS Facility; location and characteristics of waste to be managed; the location of records within the Facility; and the Facility layout. **Table II.5.4** lists the names, designations, titles, and phone numbers for each EC, each of whom will be designated prior to Facility operations, as notified and updated to OCD.

The ECs are responsible for coordinating emergency response measures and have the authority to commit the resources required for implementation of this Plan. A designated EC is available to respond to emergencies 24 hours a day, 7 days a week. The DNCS employee who identifies an emergency situation will contact an EC directly or via phone. Contact will be attempted with each EC (Primary, Alternate, and the On-site) until communication is achieved (**Table II.5.4**). Upon arrival at the scene of an emergency, the first EC to arrive will assume responsibility for initiating response measures. If more than one EC responds, authority is assigned to the highest-ranking EC.

TABLE II.5.2
Emergency Response Agencies and Contacts
DNCS Environmental Solutions

Agency/Organization	Emergency Number
1. Fire	
Maljamar Fire Department	911 or (575) 676-4700
2. Police	
Lea County Sheriff's Department	911 or (575) 396-3611
New Mexico State Police	911 or (575) 392-5580
3. Medical/Ambulance	
Lea County EMS	911
Lea Regional Medical Center 5419 N. Lovington Highway Hobbs, NM 88240	(575) 492-5000
4. Response Firm	
Phoenix Environmental, LLC. 2113 N French Drive Hobbs, NM 88240	(575) 391-9685
5. OCD Emergency Response Contacts	
Oil Conservation Division 1625 N. French Drive Hobbs, NM 88240	(575) 393-6161
Mobile Phone	(575) 370-3180
Oil Conservation Division 1220 South St. Francis Drive Santa Fe, NM 87505	(505) 476-3440
6. State Emergency Response Contacts	
Hazardous and Radioactive Materials Bureau, Santa Fe	(505) 827-1557
Spill Emergencies 24 hr. Hotline (NMED)	(505) 827-9329
New Mexico Environment Department Solid Waste Bureau, Santa Fe	(505) 827-0197
7. Local Emergency Response Contacts	
Lea County Emergency Management	(575) 396-8602
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI 24 hr. Emergency Response Hotline (USEPA)	(214) 665-2222

TABLE II.5.3
Definitions
DNCS Environmental Solutions

Barrel: *shall mean 42 United States gallons measured at 60 degrees Fahrenheit and atmospheric pressure at the sea level*. [19.15.2.7.B.(3) NMAC]

Division: *shall mean the New Mexico energy, minerals and natural resources department, oil conservation division.* [19.15.2.7.D.(4) NMAC]

Fresh water: *(to be protected) includes the water in lakes and playas (regardless of quality, unless the water exceeds 10,000 mg/l TDS and it can be shown that degradation of the particular water body will not adversely affect hydrologically connected fresh ground water), the surface waters of streams regardless of the water quality within a given reach, and underground waters containing 10,000 mg/l or less of TDS except for which, after notice and hearing, it is found there is no present or reasonably foreseeable beneficial use that contamination of such waters would impair.* [19.15.2.7.F.(3) NMAC]

Hazard to public health:

exists when water that is used or is reasonably expected to be used in the future as a human drinking water supply exceeds at the time and place of the use, one or more of the numerical standards of Subsection A of 20.6.2.3103 NMAC, or the naturally occurring concentrations, whichever is higher, or if a toxic pollutant as defined at Subsection WW of 20.6.2.7 NMAC affecting human health is present in the water. In determining whether a release would cause a hazard to public health to exist, the director investigates and considers the purification and dilution reasonably expected to occur from the time and place of release to the time and place of withdrawal for use as human drinking water. [19.15.2.7.H.(2) NMAC]

Oil field waste:

shall mean waste generated in conjunction with the exploration for, drilling for, production of, refining of, processing of, gathering of or transportation of oil, gas or carbon dioxide;-waste generated from oil field service company operations; and waste generated from oil field remediation or abatement activity regardless of the date of release. Oil field waste does not include waste not generally associated with oil and gas industry operations such as tires, appliances or ordinary garbage or refuse unless generated at a division-regulated facility, and does not include sewage, regardless of the source. [19.15.2.7.O.(3) NMAC]

Release: *shall mean all breaks, leaks, spills, releases, fires or blowouts involving oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and gases to the environment.* [19.15.2.7.R.(4) NMAC]

Waste (non-hazardous):

Non-hazardous waste shall mean non-exempt oil field waste that is not hazardous waste. [19.15.2.7.W.(1) NMAC]

TABLE II.5.4
List of Emergency Coordinators
DNCS Environmental Solutions

Primary Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Manager	Mobile Phone:	(575) TBD

Alternate Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Operator	Mobile Phone:	(575) TBD

Onsite Emergency Coordinator

Name:	TBD	Work Phone:	(575) TBD
Title:	Facility Operator	Mobile Phone:	(575) TBD

**To be determined (TBD)*

In the rare case that an EC cannot be contacted in an emergency, the DNCS employee who identifies the situation should make every effort to follow the emergency procedures outlined in this Plan until an EC or emergency authority (local, state, or federal; **Table II.5.2**) arrives to assist or take control. The term "EC" as used throughout this Plan, references the responsible Emergency Coordinator at the scene of an emergency regardless of whether that EC is the Primary, Alternate, On-site EC, or EC designee. This Plan will be amended as described in Section 10.0, if the list of ECs changes.

3.0 PREVENTION MEASURES

3.1 Waste Inspection and Screening

Non-hazardous and RCRA-exempt oil field wastes will be accepted at the DNCS Facility. It is unlikely that defined hazardous wastes will be delivered to this Facility, and DNCS will implement a waste inspection and screening program at the Processing Area Gatehouse and Landfill Scalehouse to preclude acceptance of unauthorized wastes as described in the Oil Field Waste Management Plan (**Volume II.2**). A Disposal Ticket is provided as **Attachment II.5.A**, which identifies the documentation required for each generator to certify the waste characteristics. It is possible that hazardous materials could become a concern if they arrive with other typical waste materials (19.15.36.13.N.(6) NMAC). If this occurs, the generator will be notified and the entire load will be rejected and returned for proper management. The waste inspection and screening program has been established in order to identify hazardous materials before they become a health and safety liability.

3.2 Fire Prevention and Preparedness

DNCS will implement a program of fire preventative and preparedness measures, as well as employee training. Preventive measures taken to avoid fires will include regular inspections of incoming vehicles to identify incompatible or problematic wastes, and indication of suspect loads.

A list of available emergency response equipment is provided in **Table II.5.5** in accordance with the requirements of 19.15.36.13.N.(4) NMAC. Control preparation procedures for potential fire emergencies include:

- Placement and maintenance of ABC-type fire extinguishers in structures and equipment.
- Implementation of a site-wide communication network to optimize mobilization of appropriate response personnel and equipment.
- Well established emergency response procedures, documented and posted at the Gate House and provided to each employee on a laminated pocket cards.

Employee fire prevention and preparedness training will include the following:

- Training of equipment operators to identify suspect incompatible problematic wastes loads and measures for mitigation.
- Training of site personnel in waste screening (see Section 3.1), flammables identification, etc.
- Training on fire response technique, notification procedures, fire response equipment, etc.

4.0 IMPLEMENTATION, ASSESSMENT, AND NOTIFICATION

The following subsections present a series of procedures for implementation, assessment, and notification of appropriate authorities in the unlikely event that a specific emergency develops (19.15.36.13.N.(1) NMAC).

4.1 Implementation

This Contingency Plan will be implemented when an imminent or actual emergency situation develops that represents a potential impact to freshwater, public health, safety or the environment. Situations that could require implementation of this Plan include:

TABLE II.5.5
Emergency Response Equipment List[1]
DNCS Environmental Solutions

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher	2	Gatehouse/Scalehouse[2]	Firefighting
10 lb ABC rated fire extinguisher	2	Trucks	Firefighting
10 lb ABC rated fire extinguisher	1	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher	1	Oil Process Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Produced Water Receiving Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Diesel Storage Tank	Firefighting
Loader	1	Facility	Berm Repair
Oil Booms	4	NE Corner of Pond	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Gatehouse/Scalehouse[2]	Protective gear for employees
Pair leather gloves	1 per employee	Assigned to employee	Protective gear for employees
NOMEX Coveralls	7 per Employee	Assigned to Employee	Protective gear for employees
Pair safety glasses	1 per employee	All employee workstations	Protective gear for employees
Round-point wood handle shovels	2	Gatehouse/Scalehouse[2]	Contain spillage, putting out fires
First Aid Kit	1	Gatehouse/Scalehouse[2]	First Aid
First Aid Kit	1 per vehicle	Facility Vehicles	First Aid
Eye Wash Station	1	Produced Water Receiving Tanks	First Aid
Portable 2-way radio	1 per employee	Base unit at the Gatehouse/Scalehouse[2]	Communications
Cell Phones	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Office Phone	2	Gatehouse/Scalehouse[2]	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment

Notes:

[1]Subject to change in response to waste receipts, regulatory requirements, technology, etc.

[2]The Gatehouse is associated with the Processing Area, and the Scalehouse is associated with the Landfill.

- fire/explosions
- release of contaminants or oil field waste constituents

Table II.5.6 lists the implementation, assessment, and notification procedures that will be followed in the case of an emergency. Assessment and notification are discussed further in subsections 4.2 and 4.3.

TABLE II.5.6
Implementation, Assessment, and Notification Procedures for Releases
(Breaks, Leaks, Spills, Releases, Fires or Blowouts)
DNCS Environmental Solutions

1. **NOTIFY THE ECs:** The employee who first becomes aware of the emergency will immediately notify the Primary EC, and the Alternate EC and On-site EC if necessary. Notification will be made in person, via telephone, or via radio. The responding EC will assume full authority over the situation.
2. **ASSESS SOURCE, AMOUNT, AND EXTENT OF RELEASE:** The EC will assess the source, amount, and extent of spill or release, or released material resulting from a fire or explosion and determine possible hazards to fresh water, public health, safety or the environment.
3. **CONTROL MEASURES OR EVACUATION:** The EC's assessment of the emergency situation will be the basis for attempting to control the release or for implementing an evacuation, as well as for notifying the appropriate state and local authorities if their assistance is needed. **Table II.5.8** provides Evacuation Procedures and a Site Evacuation Plan is provided as **Figure II.5.3** (also refer to control measures in Section 5.0).
4. **CONTAIN AND PREVENT SPREAD OF RELEASE:** If deemed safe by the EC, the appropriate DNCS response equipment and personnel will be dispatched to the scene of the release. Personnel will initiate actions within their scope of training to contain the release and prevent the spread and/or windblown dispersion of the release. Depending on the type of release, appropriate equipment may include deployment of absorbents for spills, fire extinguishers, and/or earthmoving equipment.
5. **NOTIFICATION OF EMERGENCY AUTHORITIES:** If the EC's assessment indicates a need to notify appropriate state and local emergency authorities, notification will be initiated immediately. A list of state and local response agencies with phone numbers is provided as **Table II.5.2**. OCD will be notified as necessary in accordance with **Table II.5.7** (Release Notification and Corrective Action).
6. **DIVERT TRAFFIC AND RESTRICT PERSONS FROM AREA:** DNCS personnel not actively involved in release control operations will be restricted from the area until the area is determined to be safe by the EC and, if appropriate, the on-scene senior emergency authority (i.e., fire, police, hazard or other official). Vehicular traffic will be diverted away from release response activities until the situation is abated.

4.1.1 Fires/Explosions

Potential scenarios for fires include ignition of mobile equipment while operating or during servicing, or the ignition of oil-contaminated wastes. It is also possible that a chemically incompatible material may be transported to the Facility. Personnel are trained in the identification, prevention and control of fires or explosions.

4.1.2 Spills/Releases

The spill or release of a hazardous material at DNCS is most likely to involve fuel or various vehicle maintenance materials (i.e., engine oil, hydraulic oil, antifreeze, etc.). Routine releases will be managed according to the protocol outlined in the Operations, Inspection, and Maintenance Plan (**Volume II.1**). Other materials most likely to present a concern as a result of normal operations include petroleum products and petroleum wastes delivered to the Facility for processing or disposal. Spills involving these types of materials could potentially occur during fueling, routine maintenance operations or during unloading or processing of waste. In addition, the possibility exists for a spill of a hazardous material that may be inadvertently transported to the Facility. Although highly unlikely, spill/releases from pond and tanks on-site are addressed in Section 5.2.

4.2 Assessment

In the event of a spill, release, fire, or explosion the EC will immediately identify the character, source, amount and extent of released materials, if possible; as well as assessing the potential impact to fresh water, public health, safety or the environment (19.15.36.13.N.(10) NMAC). During an emergency, the EC may amend this Plan as necessary to protect fresh water, public health, safety or the environment (19.15.36.13.N.(14) NMAC). The EC will also assess the circumstances of an emergency situation and determine the responses required to:

- provide notifications to appropriate agencies
- implement appropriate recordkeeping procedures

This assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities are needed, and whether DNCS will attempt to control the release with on-site personnel and equipment. **Table II.5.7** provides OCD descriptions of "major" and "minor" releases which are applicable for assessment purposes (19.15.29.7 – 11 NMAC). This section prescribes additional detailed information regarding the Site Evacuation Plan, and Section 5.0 addresses control restrictions.

4.2.1 Site Evacuation Plan

Based upon operational safeguards and the type of waste materials proposed for receipt at DNCS, the potential for a Facility evacuation is unlikely (19.15.36.13.N.(5) NMAC). In an emergency situation, the EC is the individual responsible for determining when evacuation of the DNCS Facility is required. Imminent or actual dangers that constitute a situation that could require evacuation include:

- A generalized fire or threat of fire that cannot be avoided.
- An explosion or the threat of explosion that cannot be averted.
- A major spill or leak that cannot be contained and constitutes a potential threat to human health or the environment.

When conditions warrant immediate evacuation of on-site persons (e.g., Facility personnel, transporters, visitors, vendors, etc.) everyone will be directed to proceed immediately to the Landfill Scalehouse or the Processing Area Gatehouse (as applicable), DNCS's primary evacuation route. DNCS Personnel will exercise good judgment and common sense in using the primary evacuation route to exit the Facility, or selecting the most appropriate alternative evacuation route, if necessary. Assembly points, primary and secondary evacuation routes are provided on **Figure II.5.3**. Driving directions to the nearest hospital are included as **Figure II.5.4**, and **Table II.5.8** provides detailed procedures for evacuating the Facility.

TABLE II.5.7
Part 29: Release Notification
DNCS Environmental Solutions

19.15.29.7 DEFINITIONS:

A. "Major release" means:

(1) an unauthorized release of a volume, excluding gases, in excess of 25 barrels;

(2) an unauthorized release of a volume that:

- **(a)** results in a fire;
- **(b)** will reach a watercourse;
- **(c)** may with reasonable probability endanger public health; or
- **(d)** results in substantial damage to property or the environment;

(3) an unauthorized release of gases in excess of 500 MCF; or

(4) a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

B. "Minor release" means an unauthorized release of a volume, greater than five barrels but not more than 25 barrels; or greater than 50 MCF but less than 500 MCF of gases.

19.15.29.8 RELEASE NOTIFICATION:

A. The person operating or controlling either the release or the location of the release shall notify the division of unauthorized release occurring during the drilling, producing, storing, disposing, injecting, transporting, servicing or processing of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixture of the chemicals or contaminants, in accordance with the requirements of 19.15.29 NMAC.

B. The person operating or controlling either the release or the location of the release shall notify the division in accordance with 19.15.29 NMAC with respect to a release from a facility of oil or other water contaminant, in such quantity as may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

19.15.29.9 REPORTING REQUIREMENTS: The person operating or controlling either the release or the location of the release shall provide notification of releases in 19.15.29.8 NMAC as follows.

A. The person shall report a major release by giving both immediate verbal notice and timely written notice pursuant to Subsections A and B of 19.15.29.10 NMAC.

B. The person shall report a minor release by giving timely written notice pursuant to Subsection B of 19.15.29.10 NMAC.

19.15.29.10 CONTENTS OF NOTIFICATION:

A. The person operating or controlling either the release or the location of the release shall provide immediate verbal notification within 24 hours of discovery to the division district office for the area within which the release takes place. In addition, the person shall provide immediate verbal notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief. The notification shall provide the information required on form C-141.

B. The person operating or controlling either the release or the location of the release shall provide timely written notification within 15 days to the division district office for the area within which the release occurs by completing and filing form C-141. In addition, the person shall provide timely written notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief within 15 days after the release is discovered. The written notification shall verify the prior verbal notification and provide appropriate additions or corrections to the information contained in the prior verbal notification.

19.15.29.11 CORRECTIVE ACTION: The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.

NM 529

CATTLE GUARD
GATE

GATEHOUSE
A

PROCESSING AREA

PHASE I
PHASE III
PHASE IV

STABILIZATION AND SOLIDIFICATION AREA

B

CATTLE GUARD
GATE

CATTLE GUARD
GATE

SITE ENTRANCE
SCALEHOUSE
A

CATTLE GUARD
GATE

B

CATTLE GUARD
GATE

UNIT 1
(13.5± ACRES)

PHASE 1

UNIT 2
(19.8± ACRES)

UNIT 3
(22.2± ACRES)

UNIT 4
(23.8± ACRES)

PHASE 2

UNIT 5
(25.4± ACRES)

UNIT 6
(27.3± ACRES)

UNIT 7
(29.4± ACRES)

PHASE 3

UNIT 8
(30.7± ACRES)

UNIT 9
(41.6± ACRES)

LEGEND

- SITE BOUNDARY (562 ACRES±)
- DRAINAGE FEATURE SETBACK (67 ACRES±)
- LIMIT OF WASTE
- LANDFILL PHASE BOUNDARY
- LANDFILL UNIT BOUNDARY
- EXISTING FENCE
- PROPOSED FENCE
- PAVED ROAD AND SHOULDER (NM 529)
- PROPOSED ROAD
- GRAVEL ROAD/TRAIL
- POWER POLE
- CULVERTS
- CATTLE GUARD
- ROAD SIGN
- OBJECT
- ABANDONED WELL
- PRIMARY EVACUATION ROUTE
- SECONDARY EVACUATION ROUTE
- A — PRIMARY MEETING LOCATION
- B — SECONDARY MEETING LOCATION

NORTH

0 250' 500'

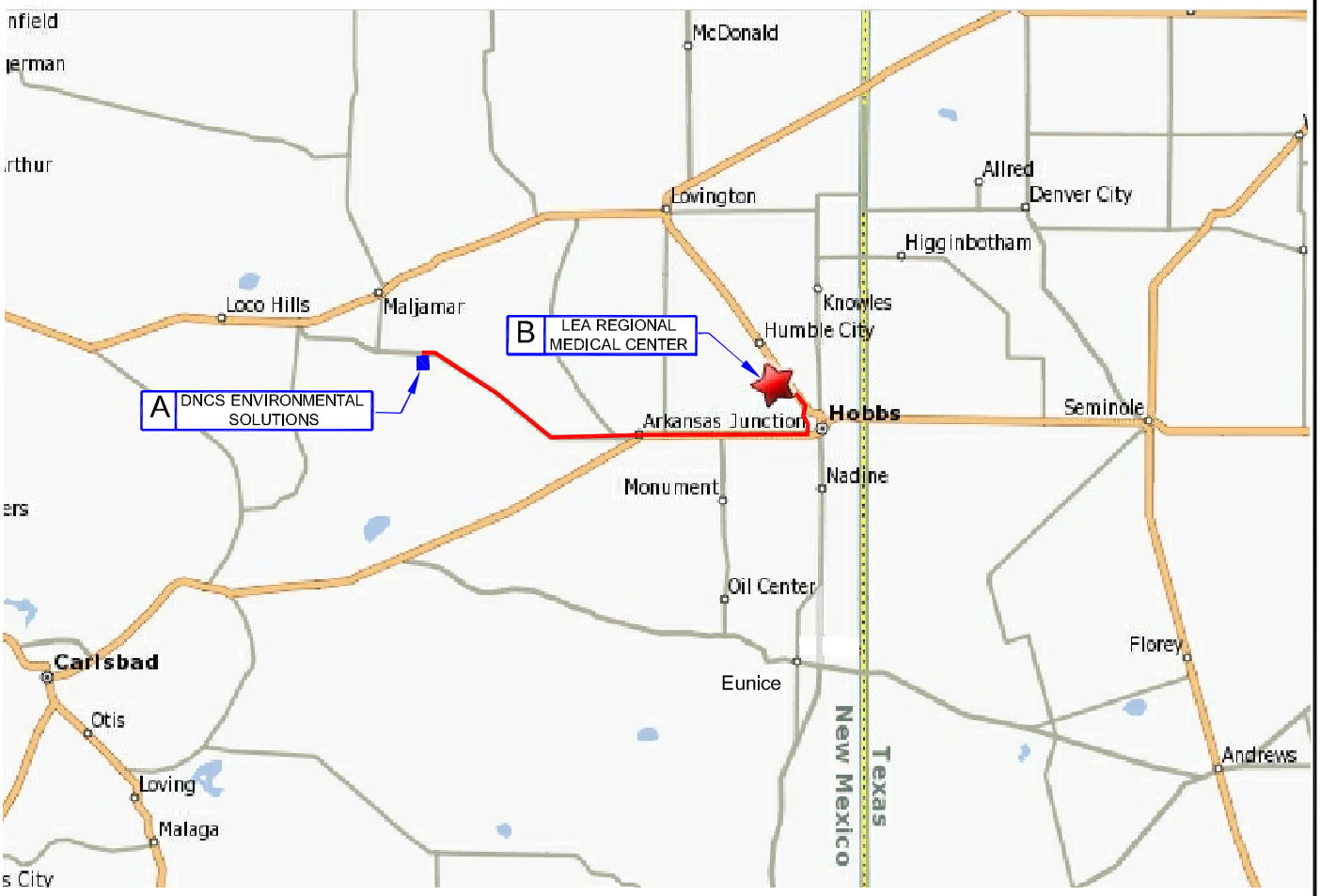
SITE EVACUATION MAP

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: EVACUATION.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\EVACUATION.dwg
Date/Time:Oct. 18, 2013-15:38:58 ; LAYOUT: B (LS)



A: DNCS ENVIRONMENTAL SOLUTIONS. NM 529

1. Head EAST on NM-529 toward DOG LAKE RD.	20.2 mi
2. Turn LEFT onto US-180 E / US-62/HOBBS Hwy.	11.9 mi
3. Turn LEFT onto Co Rd 66A / NW COUNTY ROAD.	3.5 mi
4. Turn LEFT onto NM-18 N / N LOVINGTON HWY.	1.8 mi
5. Arrive 5419 N LOVINGTON HWY	0.0 mi

B: Lea Regional Medical Center, 5419 N Lovington Hwy, Hobbs, NM 88240-9100

Note: A to B Travel Estimates: 42 minutes / 37.4 miles

HOSPITAL 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: 09/18/13	CAD: HOSPITAL LOCATION.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

NORTH
NOT TO SCALE

Map downloaded from MAPQUEST, September 15, 2009
Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\HOSPITAL LOCATION.dwg
Date/Time:Sep. 19, 2013-08:39:11

TABLE II.5.8
Evacuation Procedures
DNCS Environmental Solutions

When evacuation is required, the following procedures will be followed:

1. Facility personnel will be alerted directly or using the Facility telephone, cellular telephones, or radios.
2. Vehicles delivering waste will be diverted away from the location of the emergency and routed towards the Facility exit (**Figure II.3.2**).
3. Facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Processing Area Gatehouse or the Landfill Scalehouse (as applicable), which will be the primary meeting locations (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the Gatehouse or Scalehouse or its immediate environs, the Facility secondary assembly point and evacuation routes will be utilized (as applicable).
6. Once assembled, personnel will stand by to afford assistance, if and as needed, or to evacuate the Site.

4.3 Notification of Authorities

The following discussion presents a series of procedures for implementation and notification of appropriate authorities in the event that a specific emergency develops (19.15.36.13.N.(1) NMAC). Whenever there is an imminent or actual emergency, the EC will immediately notify on-site persons (Facility personnel, visitors, vendors, transporters, etc.) via on-site communication systems, as well as notify the appropriate state and local agencies as necessary (19.15.36.13.N.(9) NMAC).

Table II.5.1 provides a list of emergency response agencies and contacts that may need to be notified depending on the type and extent of an emergency situation. **Table II.5.1** will be posted as appropriate and near on-site telephones for easy access by DNCS personnel. Fire, police, and medical authorities should be contacted as necessary in an emergency situation (**Table II.5.1**). The adjacent property users should be notified if there is an immediate threat to human health and the environment in the area, such as fire, explosions or H_2S release (land currently vacant).

In the case of an H_2S emergency where $H_2S \geq 20$ ppm site personnel will follow the H_2S plan in **Volume II.3**. However**,** notification will be provided to the New Mexico State Police, Lea County Sheriff, and OCD (also listed on **Table II.5.1**):

- OCD
  Hobbs, NM (575) 393-6161
  Mobile Phone (575) 370-3180
  Santa Fe, NM (505) 476-3440
- New Mexico State Police 911 or (575) 392-5580
- Lea County Sherriff's Dept. 911 or (575) 396-3611
- Lea County Emergency Management (575) 396-8602

DNCS will also notify Phoenix Environmental if necessary (**Table II.5.2**) to provide response personnel, equipment, and supplies to mitigate the source of an H_2S reading of ≥ 10 ppm at the property boundary.

Table II.5.7 provides specific information regarding notification of OCD in the case of a release, which by definition includes breaks, leaks, spills, releases, fires or blowouts (**Table II.5.3**). In addition, **Table II.5.7** also provides OCD definitions for "major" and "minor" releases.

Additional State, Federal, and other local emergency contact numbers are provided and should be used as deemed appropriate to the situation. If the EC determines that the incident could threaten fresh water, human health, public safety or the environment beyond the limits of the DNCS Facility, the EC will notify the National Response Center and New Mexico Environment Department (NMED) spill emergencies at the following phone numbers (also included on **Table II.5.1**):

- National Response Center - 24 Hr. Hotline: (800) 424-8802
- NMED Spill Emergencies - 24 Hr. Hotline: (505) 827-9329

The EC's notification to authorities must include the following information, as listed on the Emergency Response Record Keeping Form:

- name and telephone number of person reporting the incident
- name and address of Facility
- time and type of incident (e.g., hazardous material release, fire)
- name and quantity of material(s) involved, to the extent known

- extent of injuries, if any
- possible hazards to human health or the environment

5.0 CONTROL PROCEDURES

This section provides information for the EC and DNCS personnel regarding control procedures for different types of releases including fires, explosions, spills, and releases. The focus of the EC's initial efforts will be the protection of Facility personnel and those using the Facility. Control procedures should only be implemented by the EC and DNCS personnel once an assessment of the situation and possible hazards to fresh water, public health, safety or the environment has been completed. Persons should not attempt to contain or control fires, explosions, spills, leaks, breaks, or blowouts that are beyond the scope of their safety, training, and available response equipment. Once the appropriate state and local agencies arrive on scene, these authorities will take control of the situation, as appropriate.

The following subsections provide the EC and DNCS personnel with specific control procedures for emergency situations. Note that in the case of an H_2S emergency situation, the procedures outlined in **Volume II.3** (Hydrogen Sulfide (H_2S) Prevention and Contingency Plan) should be followed.

5.1 Fire Control Guidelines

Fire response equipment available at DNCS is identified on **Table II.5.5**. Fire control efforts will not be initiated until untrained personnel or customers are at a safe distance. The following general guidelines for fire control will be followed in the event of a fire or explosion at DNCS:

TABLE II.5.9
Fire/Explosion: Control Guidelines
DNCS Environmental Solutions

1. **INITIATE FIRE CONTROL:** The EC and DNCS personnel will initiate response actions within the scope of their training to control the spread of the fire.
2. **P.A.S.S. METHOD:** Fires will generally be controlled with ABC-type fire extinguishers using the P.A.S.S. method (Pull pin, Aim nozzle, Squeeze trigger, Sweep from side to side to extinguish).
3. **SMOTHER METHOD:** Fires may also be smothered with cover materials (i.e., soil, caliche) when possible to extinguish.

4. **AVAILABLE WATER SOURCES:** Fires may be doused or hosed with available equipment, water truck, etc.
5. **EVACUATE AND NOTIFY EMERGENCY AUTHORITIES:** If at any time the scope of the fire is beyond the capabilities of DNCS personnel to contain and/or extinguish it, the EC will contact the local Fire Department or the Lea County Emergency Management (**Table II.5.2**) for assistance. Personnel and visitors will be instructed to evacuate the area.
6. **MONITOR SITUATION:** The EC will monitor for leaks, pressure buildup, gas generation or rupture in valves, pipes or equipment as appropriate (19.15.36.13.N.(11) NMAC).
7. **RECORDKEEPING/REPORTING:** The EC will complete an Incident Report Form (**Attachment II.5.B**) and maintain a copy in the Facility Operating Record, readily accessible for OCD inspection.

After responding to the incident, the EC will meet with involved personnel and response agencies, if appropriate, to assess the cause of the emergency and document the incident. The Incident Report Form (**Attachment II.5.B**) will reflect the details of emergency and the resulting actions. The identified causative agent will be removed from the vicinity of the Facility if the possibility of re-ignition exists. Appropriate actions to prevent recurrence of fire will be developed and implemented. Personnel involved with the handling, transport, and placement of materials at the Facility will be informed of the resultant actions. Significant changes in operating protocol or procedures resulting from this meeting will be documented and added as an amendment to the Plan (see Section 10.0).

5.2 Spills/Release Control Guidelines

The waste inspection and screening program (see Section 3.0) has been implemented in order to intercept potential unauthorized wastes inadvertently delivered to DNCS before they are unloaded at the Facility. Emergency equipment for response to such releases includes, but is not limited to, the items provided in the Emergency Response Equipment List (**Table II.5.5**). Containment/control and characterization of potential releases will be conducted only after untrained personnel are at a safe distance. At that point, the EC will then implement the following procedures for managing existing or potential release (19.15.36.13.N.(6) NMAC):

TABLE II.5.10
Spill/Release: Control Guidelines
DNCS Environmental Solutions

1. **INITIATE CONTROL:** The EC and DNCS personnel will initiate response actions within the scope of their training to control the spill/release.
2. **REMOVAL OR SEGREGATION:** Determine if the material can be safely removed to a designated waste inspection/segregation area for further evaluation. If the materials cannot be safely relocated, contain them for investigation and sampling using the spill control list. If necessary, shut down operations until safe conditions are restored.
3. **CONTAIN RELEASE:** Attempt to contain the release to the smallest area possible. Examples of equipment available for spill containment are non-reactive sorbent materials, oil booms, sand, shovels and heavy equipment. A third-party contractor is also available for emergency response to augment efforts by on-site personnel.
4. **SAMPLING:** After isolating the contaminants and contaminated media, inspect them to determine if sampling is appropriate. If appropriate, isolate contaminants in the waste inspection or segregation area, or in designated leak-proof containers, until characterization is complete.
5. **CLEANUP:** After the release has been contained and necessary samples have been obtained, cleanup will be initiated by removing the spilled materials, sorbent materials, soils used for containment, etc.
6. **EQUIPMENT MONITORING:** Pertinent liners and equipment, including valves and pipes, will be monitored for leaks, pressure buildup, gas generation or rupture as appropriate (19.15.36.13.N.(11) NMAC).
7. **VERIFICATION SAMPLING:** Dependent on the type of material spilled, the EC will assess requirements for cleanup verification including the collection of samples for appropriate analytical testing.
8. **DISPOSAL OR PROCESSING:** When visual and/or laboratory characterization is complete, determine appropriate processing or disposal procedures for that waste type. Send residuals for disposal to a Facility that is approved for managing that type of waste.
9. **EVACUATE AND NOTIFY EMERGENCY AUTHORITIES:** If at any time the scope of the spill/release is beyond the capabilities of the on-site personnel to contain and/or extinguish it, the EC will contact the local Fire Department or Lea County Emergency Management (**Table II.5.1**) for assistance. Personnel and visitors will be instructed to evacuate the area.
10. **RECORDKEEPING/REPORTING:** The EC will complete an Incident Report Form (**Attachment II.5.B**) and maintain a copy in the Facility Operating Record, readily accessible for OCD inspection.

Immediately after an emergency situation, the EC will make arrangements for the segregation, storage, or disposal of recovered wastes, water, or contaminated materials resulting from the incident. An evaluation of the contamination will be carried out as soon as time permits to prevent future accidents. The Incident Report Form (**Attachment II.5.B**) will reflect the details of emergency and the resulting actions.

Although operating procedures, roadways, unloading areas, and general areas surrounding the DNCS Facility will be maintained in an effort to minimize the potential for a release or spill of hazardous materials, provisions have been developed to improve procedures if an event warrants review and modification. After responding to the incident, the EC will meet with involved personnel to determine the cause of the spill. Appropriate actions to prevent its recurrence will be developed and implemented. Personnel involved with the handling and transport of hazardous materials will be informed of the procedures/protocol that is developed in response to knowledge gained from past response procedures. Significant changes in operating protocol or procedures resulting from this meeting will be documented and added as an amendment to this Plan. Plan amendments will be documented and disseminated as outlined in Section 10.0, including OCD.

5.3 Clean, Replace, and Inspect Equipment

Following an emergency incident, emergency response equipment used will be inspected, decontaminated/cleaned and made fit for re-use, or replaced as necessary, so that the equipment will be available when Facility operations resume. The inspection of equipment will take place before operations resume ensuring that each item is in proper working condition. This inspection will include a review of the Facility infrastructure to ensure that a potential hazard has not been created as a result of responding to the emergency. Prescribed procedures may include lock-out/tag-out on processing equipment until inspection and repairs can be completed. Remedial activities, as a result of this inspection, may include recharging of fire extinguishers, replacement of personal protective gear, restocking of disposable items, etc. The EC will verify that response equipment has been properly decontaminated and returned to its original location and is fit for future use.

6.0 STORAGE AND TREATMENT OF RELEASED MATERIALS

Spilled or otherwise contaminated material approved for disposal at the DNCS Landfill will be managed in accordance with standard operating practices. Other hazardous spilled materials will be containerized, stored and disposed of in accordance with applicable local, state and federal regulatory requirements; potentially including third-party services (i.e., Phoenix Environmental, Hobbs, NM). No oil field waste, which may be incompatible with the released material, will be treated, stored, or disposed of until cleanup procedures are complete (19.15.36.13.N.(12), (13) NMAC).

7.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment that is available at DNCS for responding to emergency situations. An Emergency Response Equipment List describing the equipment, quantity, location, and uses is provided as **Table II.5.5**.

7.1 Internal Communications

Communications at the DNCS Facility will be accomplished via cellular telephones, land lines, and two-way radios. These systems provide Facility personnel with immediate and redundant emergency notification capabilities, and the opportunity to receive instructions in the event of an emergency incident. Mechanical difficulties with the communications equipment will be promptly repaired. Internal communication devices are also listed on **Table II.5.5**.

7.2 External Communications

The telephones located at DNCS will have outside access in the event that notification of the local emergency response authorities is required (i.e., EMS, fire department, ambulance, etc.). In addition, key Facility personnel including the ECs, General Manager, etc., will carry cellular telephones for contacting each other and outside agencies. The cellular telephones will also provide a backup means for contacting emergency authorities in the event they cannot be reached by conventional telephone lines. Emergency phone numbers will be posted in the Landfill Scalehouse and the Processing Area Gatehouse and provided to employees. External communication devices are also included on **Table II.5.5**.

7.3 Fire Prevention

Portable ABC-type fire extinguishers will be located in Facility vehicles and mobile equipment, as well as within the Landfill Scalehouse and the Processing Area Gatehouse, and tanks areas. Fire extinguishers will be maintained in accordance with state and local fire codes and regulations and routinely serviced. On-site earthmoving equipment will be available to move and apply cover material for control of smoldering loads. Cover material will be readily available throughout the site.

7.4 Personnel Protection, First Aid, and Safety Equipment

Personal protective equipment (PPE) necessary for preliminary response to a release of hazardous materials will be maintained in on-site buildings (Landfill Scalehouse/Processing Area Gatehouse, etc.) and/or issued to each employee (**Table II.5.5**). These items may include Tyvek suits, gloves, safety glasses, hearing protection, etc.

First aid and safety equipment will be maintained at various locations at the DNCS Facility (**Table II.5.4**). Safety equipment located at the Facility will include industrial first aid kits, emergency shower/eye wash station, etc. First aid kits will be placed in the Landfill Scalehouse/Processing Area Gatehouse and the Produced Water Facility. An emergency shower and eye wash station will be located at the Produced Water Facility. In addition, first aid kits will be maintained in Facility vehicles, including heavy equipment. Prominent signs will be placed identifying the location of health and safety equipment, and emergency response items (e.g., fire extinguishers).

7.5 Spill Response Equipment

Spill response equipment, including heavy equipment and hand-gear, will be stored at specific locations around the Facility (**Table II.5.5**).

8.0 RECORDKEEPING

The EC will be responsible for ensuring that emergency response actions are fully documented. The Incident Report Form (**Attachment II.5.B**) illustrates the information that will be recorded as a result of emergency incident and related response action. This form will be signed by both the EC and the Facility Manager. Copies of the form filed for each incident will be retained as part of the DNCS Facility Operating Record.

In addition, in the case of an unauthorized release at the DNCS Facility, the OCD will be notified pursuant to 19.15.29 NMAC. As defined by OCD in **Table II.5.2**, a "*release*" is "*breaks, leaks, spills, releases, fires or blowouts involving crude oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and natural gases to the environment*" (19.15.2.7.R.(4) NMAC). A major release (19.15.29 NMAC; **Table II.5.6**) includes *an unauthorized release of a volume in excess of 25 barrels; or of any volume which results in a fire, will reach a water course, may with reasonable probability endanger public health or results in substantial damage to property or to the environment, cause detriment to water or exceed the standards in 19.15.30 NMAC*. A major release requires both immediate verbal notification (within 24 hours) as well as timely written notification to OCD (within 15 days) using OCD Form C-141 (**Attachment II.5.C**) relating to *Release Notification and Corrective Action*. A minor release (**Table II.5.6**) is an unauthorized release of greater than 5 barrels but less than 25 barrels. A minor release requires timely written notice only. A copy of OCD Form C-141 is provided as **Attachment II.5.C**. Copies of the form filed for each incident will be retained as part of the DNCS Facility Operating Record.

9.0 COORDINATION AGREEMENTS

A copy of the Contingency Plan will be made available to the organizations identified in **Table II.5.1**. The Contingency Plan serves to familiarize each of the identified organizations with the operations of the Facility and types of emergencies and responses that may be required. Each agency will be encouraged to visit the Facility for purposes of assessing site operations and providing input regarding emergency response procedures (19.15.36.13.N.(2), (7) NMAC).

10.0 PLAN AMENDMENT

The EC will be responsible for assuring updates to or amendments of the Contingency Plan in the event of the following (19.15.36.13.N.(8) NMAC):

1. The Facility Permit is revised or modified.
2. The Plan fails in an emergency.
3. Modification to the Facility design, construction, operation, maintenance or other circumstances that changes the potential for fires, explosion, or releases of hazardous oil field waste constituents; or related changes in the appropriate emergency response.
4. The list of EC's changes.
5. The list of emergency equipment changes significantly.

The Contingency Plan amendments will be distributed to OCD and made available to each of the organizations identified in **Table II.5.1** with a cover letter highlighting substantive changes. Proposed changes will be in compliance with 19.15.36.13.N NMAC.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

ATTACHMENT II.5.A

DISPOSAL TICKET (TYPICAL)

ATTACHMENT II.5.A
Disposal Ticket (Typical)
DNCS Environmental Solutions

Lea County, NM
NMOCD #_____

Date: _____ Time: _____ a.m./p.m.
Bill to: _____
Address: _____
State: _____ Zip: _____ Phone: _____
Company/Generator: _____
Lease Name: _____
Hauler: _____ Vehicle Number: _____ Driver (Print): _____

Type of Material

☐ Fluids ☐ Soils
☐ Tank Bottoms ☐ Other Material *(List Description Below)* Receiving Area: _____

Description: _____

Volume of Material

☐ Bbls ☐ Yard ☐ Gallons ☐ Wash Out
☐ Call Out ☐ After Hours ☐ Debris Charge

H2S Reading

H2S Reading (ppm): _____
Notes: _____

Generator Certification Statement of Waste Status

I do hereby certify that, according to the Resource Conservation and Recovery Act (RCRA) and Environmental Protection Agency's July, 1988, regulatory determination, any and all waste delivered to DNCS from the above locations is: EXEMPT oil field waste. This waste is in compliance with Regulated Levels of Naturally Occurring Radioactive Material (NORM) pursuant to 20 NMAC 3.1 Subpart 1403.C and D.

☐ DNCS Approval # _____ ☐ Denied

Agent/Representative of Generator/Hauler: _____

DNCS Representative: _____

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ATTACHMENT II.5.B

INCIDENT REPORT FORM (TYPICAL)

INCIDENT REPORT FORM
DNCS Environmental Solutions

Lea County, NM

Type of Incident and General Information

- ❑ Work Related Injury/Illness
- ❑ Property Damage
- ❑ Vehicular Accident
- ❑ Unsafe Act/Near Miss
- ❑ Vandalism/Criminal Activity
- ❑ Other _____ (i.e., spill, release, fire, explosion, hot load, etc.)

Employee Name: _____ Job Title: _____

Phone No: _____ Date of Incident: _____ Time of Incident: _____ AM/PM

Location of Incident: _____

Start of Shift:_____ Weather:_____

Date and Time Reported to Management: Date: _____ Time: _____ AM/PM

Reported to: _____ Title: _____ Reported by: _____

What was the injury category of incident at the time it was first reported to management?

[ ] N/A. Employee does not claim an injury associated with this incident
[ ] Notice Only of Injury, Declined Medical Treatment at this time
[ ] First Aid done on site, Declined Medical Treatment at this time
[ ] Medical Treatment. Transported by _____ to _____
[ ] Fatality, employee

THIS SECTION FILLED OUT BY EMPLOYEE

Employee's Description of Incident / Declaración del empleado de los hechos

Were you injured? *(Ud. se lastimó ?)* **Yes [ ] No [ ]**

Type of Injury: *(Tipo de lesión)* _____

Part of Body: _____ Left _____ Right _____
(Parte del cuerpo) *(Izq)* *(Der)*

Explain in your own words what happened. *(Explique en sus propias palabras lo que sucedió)*

_____

_____

_____

_____

_____

Employee Signature: (*Firma del empleado*) _____

Date: (*Fecha*) _____

INCIDENT REPORT FORM
DNCS Environmental Solutions

TO BE FILLED OUT BY EMERGENCY COORDINATOR

Describe in order of occurrence the events leading to the incident and/or injury. Reconstruct the sequence of events that led to the incident. _____

_____

_____

_____

_____

Identify possible hazards to human health or the environment: _____

_____

_____

_____

_____

Identify name and quantity of material(s) involved: _____

_____

_____

_____

_____

CORRECTIVE ACTIONS. (Equipment, Practices, Environment, Retraining) Steps that have been, or will be taken to prevent recurrence: _____

_____

_____

_____

_____

Date Corrective Action Completed: _____

- I have been briefed on the corrective actions outlined above
- *Estoy consciente de las acciones correctivas mencionadas anteriormente en esta hoja*

_____
Employee's Signature

_____
Date

Report Reviewed and Concluded By:

_____
Emergency Coordinator's Signature

_____
Date

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ATTACHMENT II.5.C

RELEASE NOTIFICATION AND CORRECTIVE ACTION

OCD FORM C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☐ Final Report

Name of Company	Contact
Address	Telephone No.
Facility Name	Facility Type

Surface Owner	Mineral Owner	API No.

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County

Latitude_____ Longitude_____

NATURE OF RELEASE

Type of Release	Volume of Release	Volume Recovered
Source of Release	Date and Hour of Occurrence	Date and Hour of Discovery
Was Immediate Notice Given? ☐ Yes ☐ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☐ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Describe Area Affected and Cleanup Action Taken.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:	OIL CONSERVATION DIVISION	
Printed Name:	Approved by Environmental Specialist:	
Title:	Approval Date:	Expiration Date:
E-mail Address:	Conditions of Approval:	Attached ☐
Date: Phone:		

* Attach Additional Sheets If Necessary

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SECTION 6: MIGRATORY BIRD PROTECTON PLAN

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1.0 INTRODUCTION

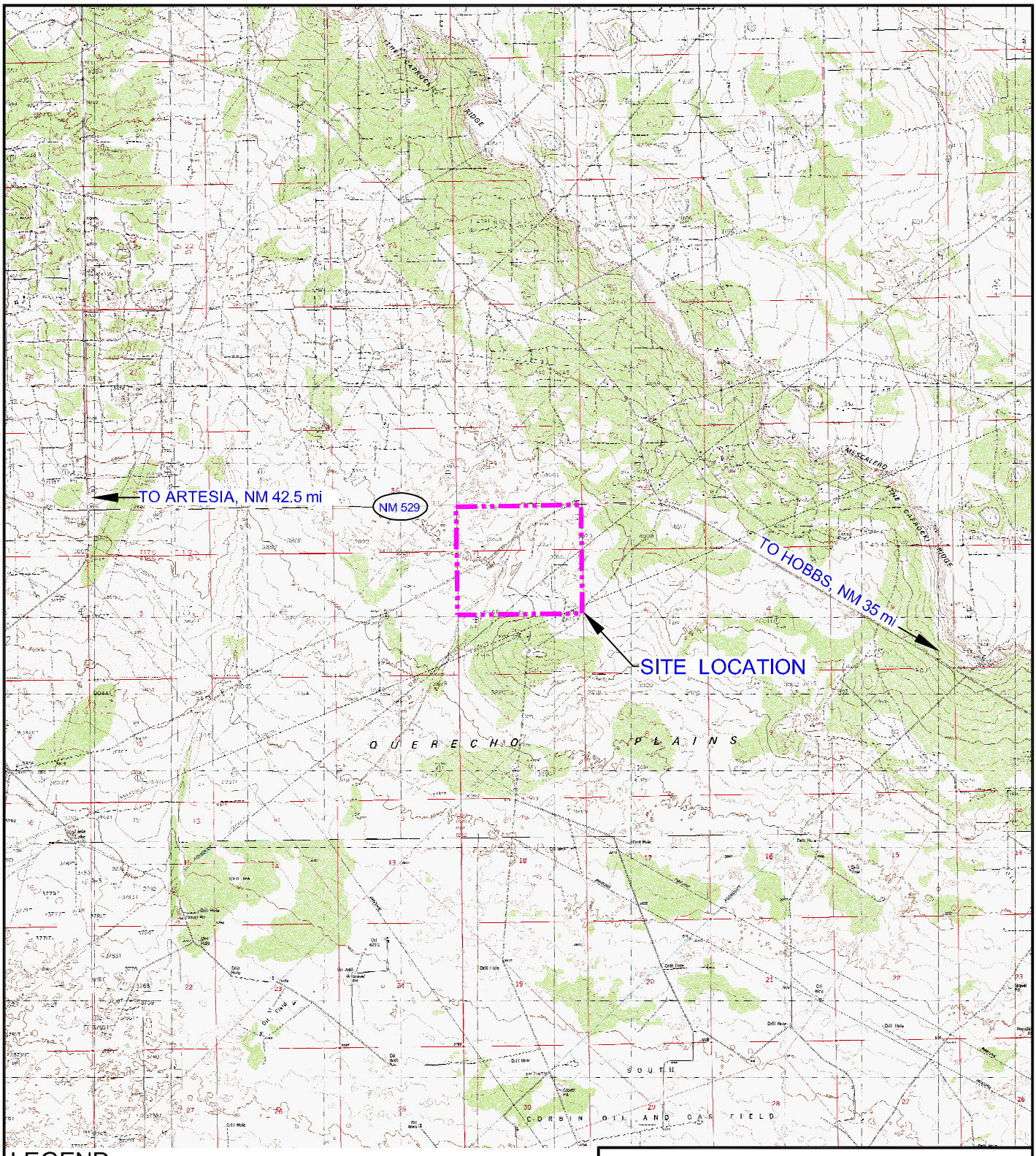
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 II.6.1**). Site access will be provided via the south side of NM 529.

1.2 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.



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:Sep. 19, 2013-08:29:00 ; 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: 09/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.6.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

1.3 Purpose

This Migratory Bird Protection Plan (the Plan) for the DNCS Facility has been prepared in accordance with requirements of 19.15.36.13.I and 19.15.36.17.C.(3) NMAC. This Plan describes the procedures for migratory bird protection at DNCS. DNCS is not proposing to install screening, netting or covering over the evaporation ponds. Instead, DNCS is proposing alternate procedures that have proven historically effective in discouraging bird propagation; and which fulfill the requirements of 19.15.36.13.I and 19.15.36.17.C.(3) NMAC for equal protection of migratory birds.

This Plan may be modified by DNCS to address changes in site conditions following OCD review and approval of the proposed change. This Plan may also be amended at the request of OCD should conditions warrant.

2.0 MIGRATORY BIRD PREVENTION

2.1 Siting Perspective

DNCS proposes an exception to the screening/netting requirements of 19.15.36.17.C.(3) NMAC, although DNCS plans to meet the requirements of this Rule through an alternative monitoring method described herein. Additionally, DNCS does not anticipate that the ponds will be potentially hazardous to migrating birds as oil will be removed from the water prior to discharge into ponds. There is a significant absence of habitat for aquatic migratory birds congregating around, or landing in, the vicinity of the DNCS Facility. This is due primarily to the lack of a food source at the Facility that limits avian sustainability, and the lack of other nearby suitable habitat. In addition, as documented in Volume IV.1 (Siting Criteria), no evidence of wetlands are documented at the site.

2.2 Human and Mechanical Intervention

DNCS Processing Area operations, as proposed in this Application, have been designed to eliminate oil from accumulation on the evaporation ponds. This will be accomplished utilizing tanks and equipment that separate the oil from the water prior to discharge into the evaporation ponds. The anticipated absence of oil in the evaporation ponds eliminates the concerns typically associated with migratory birds being endangered if they land on the evaporation ponds. In the

unlikely event that oil is found on an evaporation pond, the following actions will be implemented. Operations at the Processing Area Facility will be manned by at least two employees 24 hours per day. During the occurrence the Facility Manager, operators and employees will conduct periodic (every fifteen minutes) inspection rounds making note of any migratory bird activity in or surrounding the evaporation ponds. Should migratory bird activity be discovered at the Facility, inspection and scare tactic frequency will be increased to alleviate the roosting of the birds.

In order to prevent oil sheen accumulation on the surface of the ponds (19.15.36.17.C.(1) NMAC), Facility personnel will work continually throughout each day to ensure the Produced Water Settling Tanks are functioning properly, removing the oil from the water prior to discharging to the evaporation ponds. If oil is observed on the evaporation ponds, effort will be made to remove the visible oil layer from the evaporation ponds immediately. This will be accomplished by using booms to bring the oil sheen to the banks of the ponds where the oil will be removed by vacuum trucks and returned to the Produced Water Receiving Tanks.

Operations will not lend the Facility to migratory bird congregation, with proposed operations 24 hours per day, 7 days per week, and 365 days per year. During this time, the mechanical evaporation systems will be in full operation, truck traffic will be consistently entering and leaving the Facility, and pumps will be transferring waters to and from the evaporation ponds. General activities at the site will involve human and truck motion, a natural deterrent to wildlife.

3.0 MIGRATORY BIRD LANDING CONTINGENCY

3.1 Migratory Bird Rescue

In the unlikely event that a bird lands on a pond and becomes contaminated, Facility employees will immediately utilize a boat and side ropes to retrieve the bird. Upon retrieval, Facility employees will transport the bird to a local veterinary clinic for treatment. Bird rescue procedures adapted from those of the International Bird Rescue Research Center are provided in **Table II.6.1**.

TABLE II.6.1
Bird Rescue Protocol
DNCS Environmental Solutions

a. The bird's entire body is immersed in a one percent solution of Dawn and warm water (warm enough to approximate the bird's internal body temperature. Once wet, the bird is unable to thermo regulate) by one person while a second vigorously agitates the water into the bird's feathers.
b. A WaterPik® filled with the same solution is used to clean the head.
c. A soft toothbrush and cotton swabs are used to loosen dried oil around the head and eye area.
d. When the water becomes dirty, the bird is moved to a second pan. The washing process is repeated as often as necessary.
e. The bird is considered clean when the tub of water is clear and free of oil.
f. The bird is moved to another pan of clean warm water for rinsing.
g. A WaterPik filled with the warm water is used to clean the head.
h. When the water becomes soapy, the bird is moved to a second pan. The rinsing process is repeated as often as necessary to remove the remaining soap.
i. The bird is considered rinsed when no soap is visible in a fresh pan of water.
j. After wash and rinse, the cleaned bird is placed in a protective net-bottomed pen. As it rests, the bird will begin to preen its own feathers back into place. The complete realignment of feathers in a tight overlapping pattern creates a waterproof seal.
k. The bird is fed a nutritious food mixture to assure proper nourishment, plenty of fluids, as well as vitamins and medications, and is allowed free access to food.
l. The bird is released when it is stable, healthy, and completed preening. The bird shall be taken to a local veterinary clinic for examination prior to release.

3.2 Screening and Netting

Although it is highly unlikely the DNCS Facility will have a migratory bird issue based on the described preventative methodology and lack of suitable habitat and food, DNCS is committed to the protection of migratory birds. Should migratory bird landings become an ongoing concern, DNCS will implement more aggressive techniques, such as netting or screening, after review and discussion with OCD and wildlife experts.

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1.0 PROJECT OBJECTIVES

The Construction Quality Assurance (CQA) Plan has been developed to document the measures that will be used to ensure that the environmental control systems will be constructed in compliance with:

- 19.15.36.14.D NMAC
- 19.15.36.14.E NMAC
- 19.15.36.17.B NMAC
- The approved Permit Plans
- The permit and any permit conditions
- This CQA Plan
- Industry standards and other applicable technical criteria

This CQA Plan establishes the quantitative criteria that will be used in the field and laboratory to measure the quality of the installed infrastructure. Specific construction elements that are addressed in this Plan includes:

- Inspection and compaction of the subgrade and liner foundation
- Installation of the geosynthetic clay liner
- Installation of the primary geomembrane
- Installation of the geonet leak detection layer
- Installation of the secondary geomembrane
- Installation of the leachate drainage layer and collection system
- Installation of the protective soil layer
- Ancillary installations as needed to complete the above

This CQA Plan is a quality control plan meeting the specifications of 19.15.36.14.D NMAC, 19.15.36.14.E NMAC, and 19.15.36.17.B NMAC. No revisions to the technical specifications should be allowed without the express approval of the Engineer. The Engineer is a registered professional engineer in New Mexico with applicable experience in geosynthetics design and construction. This Plan may be updated to address changes in materials, technologies, test methods, etc. in consultation with the New Mexico Energy, Minerals and Natural Resources Department, Oil Conservation Division; and more specifically revisions will be made to the applicable geosynthetics testing standards as implemented.

Table II.7.1 lists the applicable testing required for each construction element. The Table identifies:

- Key property being evaluated
- The appropriate type of test procedure and method
- The sampling strategy and frequency

TABLE II.7.1 (SHEET 1 of 2)
Summary of Required COA Standards

Element	Key Property	CQA/CQC Test	Sampling Plan	Sampling Frequency	Standard Test Method
Excavation Required: Subgrade Layer Material Evaluation	Maximum Density	Proctor Test	Judgmental	1 per 5000 cy	ASTM D698
Fill Required: Subgrade Layer Material Evaluation	Maximum Density	Proctor Test	Judgmental	1 per 5000 cy	ASTM D698
Subgrade Layer Construction Quality Evaluation	In-Place Density	Nuclear Density Test	Random within grid	4 per acre per lift	ASTM D2922
	No angular stones	Visual	Judgmental	100%	NA
Geosynthetic Clay Liner	Conformance	Mass per unit area, Free Swell, Fluid Loss	Systematic	1 per 100,000 sf	ASTM D5993, D5890, D5891
	Surface Defects	Visual	100%	100%	NA
Primary and Secondary Liner Geomembrane	Conformance	Thickness, Density,Tensile properties, Tear reistance, Carbon black content, Carbon black dispersion, Puncture resistance	Systematic	1 per 100,000 sf	ASTM D5199/D5994, D1505, D6693, D1004, D1603, D5996, D4833
	Surface Defects	Visual	100%	100%	NA
Primary and Secondary Liner Geomembrane Seaming Procedures	Subgrade	Visual	100%	100%	NA
	Anchor Trench	Visual	100%	100%	NA
	Temporary Anchor	Visual	100%	100%	NA
	Sheet Placement	Visual	100%	100%	NA
	Overlap of Sheets	Measurement	100%	100%	NA
	Cleanliness of Seam	Visual	100%	100%	NA
	Extent of Grinding	Measurement	100%	100%	NA
Liner Geomembrane Seams	Test Seams	Tensiometer	Systematic	in accordance with specifications	NA
	Field Hot Wedge Seams	Non-Destructive Tests (Pressure Dual Seam)	100%	100%	NA
		Destructive Tests (peel & shear strength)	Random within a grid and Judgmental	1 per 500 feet	ASTM D413 and D6392
	Field Extrusion Fillet Seams	Non-Destructive Tests (Vacuum Box Testing)	100%	100%	ASTM D4437
		Destructive Tests (peel & shear strength)	Random within a grid and Judgmental	1 per 500 feet	ASTM D413 and D6392

TABLE II.7.1 (SHEET 2 of 2)
Summary of Required CQA Standards

Element	Key Property	CQA/CQC Test	Sampling Plan	Sampling Frequency	Standard Test Method
Geonet	Conformance	Thickness, Density, Wide width tensil properties, Mass per unit area, Carbon black, Melt index	Systematic	1 per 100,000 sf	ASTM D4354, D1777, D1505, D1682, D3776, D1603, D1238
	Anchor Trench	Visual	100%	100%	NA
	Temporary Anchor	Visual	100%	100%	NA
	Sheet Placement	Visual	100%	100%	NA
	Overlap and Tying of Sheets	Measurement	100%	100%	NA
Protective Soil Layer	Permeability	Lab Permeability	Random	1 per Source	ASTM D2434 or Falling Head
	Particle Size	Gradation of Soil	Random	1 per 1,500 cy	ASTM C136
	Thickness of Protective Soil Layer	Surveying or Direct Test	Within a grid	5 per acre	NA
Geotextile	Conformance	Thickness, Weight, Tensile strength, Mullen burst strength, Puncture strength, Trapezoidal tear strength, AOS	Systematic	1 per 100,000 sf	ASTM D5199, D5261, D4632, D3786, D4833, D4533, D4751
	Overlap	Measurement	100%	100%	NA
	Seams	Visual Observation	100%	100%	NA
Leachate Collection System	Grade	Surveying	NA	1 per 50 lf	NA
	Product specs, placement and	Visual Observation	100%	100%	NA
Leachate Pipe Envelope	Minimize clogging	Gradation of Gravel	Random	1 per Source	ASTM C136
	Placement and workmanship	Visual Observation	100%	100%	NA

2.0 PROJECT ORGANIZATION

2.1 Project Organization

The Project Team shall be identified in advance of construction, and each Team member will be assigned specific responsibilities as discussed in this section.

2.2 Authority and Responsibilities

2.2.1 Owner

The Owner has the responsibility for scheduling and administration, which may include, but not be limited to:

- Contractor procurement.
- Some or all of the construction tasks.
- Assignments of duties of Project Team and orientation of the Project Staff to the needs and requirements of the project.
- Approval of project-specific procedures and internally prepared plans, drawings, and reports.
- Serving as the "Collection point" for Project Staff reporting project documents and activities.
- Point of collection for archived destruction test (DT) samples.

2.2.2 Site CQA Engineer

The Site CQA Engineer shares responsibilities with the Owner/Operator for addressing technical and administrative issues. The Site CQA Engineer must be present at the outset of major undertakings and at critical times during the construction. The Site CQA Engineer's staff shall be on-site continually for construction activities. The Site CQA Engineer will also be on-site, as necessary, to perform the following:

- Periodic review of submittals from the Site CQA Manager.
- Approval of any CQA Plan revisions.
- Administrative functions as necessary to staff and maintain personnel for the CQA activities.
- Periodic review and assessment of the CQA Plan as implemented to determine completeness and compliance.
- Spot-checking of field and laboratory methods and results for accuracy.
- Acceptance and approval of materials and workmanship.
- Compilation and submission to NMED of Certification Reports and other project deliverables.
- Design and certification responsibilities mandate that this site CQA Engineer must be a Professional Engineer properly registered in the State of New Mexico; who possesses demonstrated competence and experience in waste containment engineering.

2.2.3 Site CQA Manager

- Review moisture-density curves correlated to compaction specifications for the borrow source or in-situ subgrade.
- Review Field Grain Size Analysis of materials to confirm suitability.
- Perform nuclear density testing as necessary for in-place compaction confirmations.
- Conduct verification testing for thickness and placement of materials.
- Perform inspection and documentation of synthetic materials installation.
- Review of documentation from contractors as enumerated in this CQA Plan.
- Review CQA activities.
- Notification to appropriate personnel of nonconformance, or changes in CQA procedures.
- Completion of Project CQA audits.
- Scheduling, at regular intervals, CQA meetings with project staff and Subcontractors.
- Reporting, on a regular basis, to the Site CQA Engineer the results of reviews, inspections, and audits.
- Identifying for the Site CQA Engineer project issues, which require his direct involvement.
- Maintaining records of reviews, inspections, audits, and their results.
- Collection of Daily Field Reports from Contractor, which are to be provided no later than 24 hours after each shift has ended.
- Maintenance of calibration records of the instrumentation used on-site in the implementation of this plan.
- Other duties as directed by the Site CQA Engineer.

2.2.4 Contractor

Responsibilities of the Contractor may include:

A) Management of daily field operations (labor and equipment allocation).
B) Submission of Daily Field Progress Reports to the Site CQA Manager.
C) Implementation of tasks relative to this CQA Plan specific to his assigned construction activities per contract.
D) Submittal of required as-built drawings and certificates to the Site CQA Manager.
E) Submittal of required work plans to the Site CQA Engineer.

Work and materials installed by the Contractor shall be guaranteed for at least two (2) years from date of completion.

The Contractor/Installer must construct this project in a workmanlike manner, in conformance with the plans and specifications. The purpose of the CQA program is to provide independent confirmation of compliance with the plans and specifications for the Owner's benefit. The CQA is also required by NMED as means of demonstrating compliance with performance standards, permit conditions, and applicable regulations.

2.3 Documentation

1. Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data and will be of significant or greater quality to stand up to scientific and regulatory scrutiny.
2. Data will be of known or acceptable precision, accuracy, representatives, completeness, and comparability within the limits of the project.

The quality of the measurement data can be defined in terms of the following elements:

1. Completeness - the adequacy in quantity of valid measurements to reduce the potential for misinterpretation.
2. Representativeness - the extent to which discrete measurements accurately describe the greater picture of which they are intended to represent. Good representativeness is achieved through careful, informed selection of sampling site.
3. Accuracy and Precision - the agreement between a measurement and the true value and the degree of variability in this agreement, respectively. Accuracy and precision of data collected in the investigation will depend upon the measurement standards used and the competent use of them by qualified personnel.
4. Comparability - the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. Comparability among measurements will be achieved through the use of standard procedures and standard field data sheets.
5. Traceability - the extent to which data can be substantiated by hard-copy documentation. Traceability documentation exists in two essential forms: that which links quantitation to authoritative standards, and that which explicitly describes the history of each sample from collection to analysis.

The fundamental mechanisms that will be employed to achieve these quality goals can be categorized as prevention, assessment and correction, as follows:

1. Prevention of defects in the quality through planning and design, documented instructions and procedures, and careful selection and training of skilled, qualified personnel;
2. Quality assessment through a program of regular audits and inspections to supplement continual informal review;
3. Permanent correction of conditions adverse to quality through a closed-loop corrective action system.

The Site CQA Manager shall maintain current records, on appropriate CQA forms, of quality control operations, inspections and tests performed relative to the work of suppliers and contractors. **Table II.7.2** is an index of CQA Forms which are typically used for the Liner CQA program.

TABLE II.7.2
CQA Forms Index

Form No.	Title
1.	Liner Quality Control Project Specifications **(Attachment II.7.A)**
2.	Approval/Authorization to Proceed Form **(Attachment II.7.B)**
3.	Daily Summary Report **(Attachment II.7.C)**
4.	Field Compaction Testing Form **(Attachment II.7.D)**
5.	GCL Inventory Control Log **(Attachment II.7.E)**
6.	FML Inventory Control Log **(Attachment II.7.F)**
7.	Geonet Inventory Control Log (**Attachment II.7.G)**
8.	Geotextile Inventory Control Log (**Attachment II.7.H**)
9.	Leachate Collection and Extraction Pipe Inventory Control Log (**Attachment II.7.I**)
10.	GCL Deployment Log **(Attachment II.7.J)**
11.	FML Deployment Log **(Attachment II.7.K)**
12.	FML Trial Seaming Test Log **(Attachment II.7.L)**
13.	FML Seaming Log **(Attachment II.7.M)**
14.	FML Seam Pressure Test Log **(Attachment II.7.N)**
15.	FML Destructive Field Test Record **(Attachment II.7.O)**
16.	FML Seam Vacuum Test/Repair Log **(Attachment II.7.P)**
17.	Geonet Deployment Log **(Attachment II.7.Q)**
18.	Geotextile Deployment Log **(Attachment II.7.R)**

Photographs may also be used to document the progress and acceptability of the work and may be incorporated into the Daily Summary Report; if photographic documentation is used, each photo shall be identified with the following information:

- Date
- Time of Day
- Location

Originals of the photographs will be retained at the offices of the Site CQA Engineer, and select photocopies will be submitted with Engineering Certification Reports as applicable.

3.0 CONSTRUCTION QUALITY ASSURANCE OBJECTIVES

3.1 Allowable Variations

It is the objective of this CQA Plan that test results must meet the applicable specified values. Should a test result not achieve the specified value for a material, it must be replaced or repaired; or for operation, the operation must be repeated until it is acceptable. However, as stated by Daniel and Koerner, *"it is unrealistic to think that 100 percent of all CQA tests will be in compliance with specifications."* Variations due to isolated anomalies in material, sample disturbance, human testing errors, or other factors may result in failing tests, yet these tests are not indicative of the general quality of the construction. For this reason, the Site CQA Engineer

may accept a small percentage of outliers. The total number of outliers will not exceed the maximum allowable number as defined in Waste Containment Facilities – Guidance for Construction Quality Assurance and Construction Quality Control of Liner and Cover Systems 2nd Edition (Daniel, D.E. and Koerner, R.M.), 2007.

4.0 SITE PREPARATION

4.1. General

The following is a list of the work to be included in site preparation by the Contractor:

A) Field check utilities and groundwater monitoring well locations, as appropriate.
B) Mark survey hub markers and permanent benchmarks.
C) Strip topsoil and any other material deemed unsuitable by the Engineer, or his representative, and stockpile at designated location.
D) Strip or remove brush, and non-mowable vegetation, surface debris and similar materials from existing surface and relocate to a designated area on the site. Stumps, logs, roots, etc. will be completely removed.
E) Excavate to design grade at the direction of the Site CQA Manager.
F) The existing surfaces will be proof rolled to check stability conditions of existing surface and to provide a trafficable, reasonably smooth, working surface for construction equipment.
G) Contractor will be responsible for costs associated with repairing and/or replacement of the ground surface utilities, and appurtenant facilities damaged by the Contractor, to the satisfaction of the Owner. Any damage resulting from unauthorized intrusion upon or use of off-site areas will be completely and immediately repaired, solely at the expense of the Contractor.

The following is a list of requirements related to site grading:

A) Relocate exposed debris outside the limits of the construction area to locations as directed by Owner.
B) Remove and dispose of coarse vegetation. Vegetation removal will be accomplished in such a manner as to minimize the amount of bare soil exposed at any given time.
    1) Stripped vegetation may be stockpiled temporarily at the site, provided that it is stockpiled in a manner, which prevents movement of the material off-site due to wind, water, or other factors.
    2) Residual vegetative matter, such as stumps, will be transported to the designated on-site area or removed off-site by the Contractor under authorization by the Owner.

4.2. Survey Coordinate System

The site will be surveyed and integrated into a grid system so that locations of sample and testing points made during construction can be readily discernible by the CQA personnel. This grid system should consist of equidistant spaced parallel lines, l00-foot on center, projecting north to south and east to west within the limits of the site. In addition, permanent project benchmarks will be placed by the Owner or his representative in the vicinity of the site for correlation of lift

thickness, site liner construction, etc. This grid system will be coincident with the existing and former site coordinate system for future reference. The project limits will be staked out by the Owner or his representative based on record drawings

4.3. Subgrade Development

Subgrade development will be required prior to landfill cell or pond construction. The existing topography will be contoured to the subgrade elevations shown on the drawings identified by the Site CQA Manager. The subgrade will be constructed, prepared and protected in accordance with the procedures stated below.

4.3.1 Subgrade Preparation

A) Establish required lines, levels and contours. Place grade stakes as required by Contractor's methods a minimum 100' on center.
B) Before grading commences, adjust monitoring wells and piezometer heights in the area to be graded in accordance with details shown on the drawings if applicable. Such adjustments will be made under direct surveillance of the Site CQA Manager. Any wells adjusted without the Site CQA Manager being present will be re-established at the Contractor's expense.
C) No subgrading will begin in a given area prior to approval of the area by the Site CQA Manager.

4.3.2 Excavating to Subgrade Elevation

A) Excavated material will be placed on-site as directed by Owner.
B) Adequate grade control during subgrade preparation/construction is imperative. Should insufficient grade control during this phase occur, the Site CQA Manager may stop work until the situation has been rectified.

4.3.3 Filling to Subgrade Elevation and Berm Construction

A) Engineer will collect samples of proposed in-situ or borrow fill material in advance of construction for determination of soil characteristics (e.g. Standard Proctor)
B) Materials will be obtained from designated in-situ areas, borrow sources, or stockpiles.
C) No fill will be used for subgrade or berm construction without approval of the Site CQA Manager.
D) Place fill material to the required elevations as shown on the drawings.
E) Place suitable fine grained subgrade soils in 6-inch finshed lifts and compact to 90-percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D698).
F) Place berm material in maximum 12-inch finished horizontal lifts over the prepared surface. Compact to not less than 90-percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D698).
G) The surface of each lift will be scarified prior to placing the next lift, if applicable.
H) The moisture content of fill material will be adjusted in the stockpile, borrow area, and/or other approved areas to maintain uniform moisture content of fill. Uniform moisture

distribution will be obtained by mixing with disc, harrow, and pulverizers or by otherwise manipulating the soil prior to compaction.

I) The final surface of subgrade and berms will be rolled smooth, free of protrusions and will contain no lumps, angular materials or large rocks. Roll the exposed surface transverse to slopes.

4.4. Final Subgrade Inspection and Protection

The final subgrade lift will conform to the following specifications:

A) The upper 6-inches shall be comprised of suitable fine grained soils and compacted to a minimum 90-percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D698)

B) The surface of the final lift of subgrade will be free of angular material or stones greater than one-half inch in diameter.

C) The final lift will be wetted and smooth rolled. Abrupt changes of grade will be regraded.

D) Completed subgrade will be protected from traffic, erosion and damage of any kind.

E) Completed subgrade will be kept free of trash and debris.

F) Prior to placement of liner system, any areas of subgrade damaged by traffic, erosion, settlement, or another cause, will be repaired and the grades shown on the drawings will be re-established. Exposed subgrade, which has significantly dried or exhibits desiccation will be wetted and compacted prior to fill placement. Disturbed areas will be reshaped, scarified, recompacted and rolled prior to further work.

G) The condition of the subgrade will be approved by the Site CQA Manager prior to placement of any additional layers or liner system materials immediately in advance of installation.

4.5. Subgrade and Berm Testing

The following tests will be performed on the subgrade soils prior to compaction:

A) One particle size distribution per 1,000-cubic yards of borrow using ASTM D422.

B) One Standard Proctor moisture density relationship per 5,000 cubic yards of borrow using ASTM D698.

C) One Atterberg Limits per 5,000 cubic yards of borrow using ASTM D423 and D424.

The following tests will be performed during construction:

A) One field compaction test will be performed at a frequency of a minimum 4 tests per acre per 6-in lift for confirmation of density of the subgrade soils and 12-in for confirmation of density of soils used in berm construction.

B) The subgrade will be required to meet an elevation tolerance of 0.2’±; and the sidewalls a vertical tolerance of 0.50’± based on a regular grid established by site survey.

5.0 ANCHOR TRENCH

1. The anchor trench shall be constructed as shown on the construction drawings and as specified in the CQA Plan. The anchor trench shall be backfilled and compacted by the Contractor as approved by the Site CQA Manager. Trench backfill material shall be placed and compacted by rolling with a rubber-tired wheel or mechanical tampers. Approval of compaction equipment shall be obtained from the Site CQA Manager before any compaction begins.
2. Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. At no time shall construction equipment make direct contact with geosynthetic materials.
3. Anchor trench backfill shall be compacted to 90% Standard Proctor Dry Density.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 GCL Properties

1. The GCL installed directly in contact with the subgrade material under the leak detection sumps in the ponds shall be a reinforced GCL, and as defined by compliance with the requirements listed in **Table II.7.3** or approved by Engineer as equivalent.

TABLE II.7.3
Technical Specifications
Geosynthetic Clay Liner (GCL)

MATERIAL	PROPERTY	UNIT	CERTIFIED VALUE	TEST METHOD[1]
Nonwoven Cover Geotextile	Grab Strength	lbs	170	ASTM D4632
	Grab Elongation	%	50	ASTM D4632
	Mass/Unit Area	$^{oz}/_{yd^2}$	6.0	ASTM D5261
Bentonite	Free Swell	ml	24/2g min	ASTM D5890
	Fluid Loss	ml	18 max	ASTM D5891
	Bentonite Mass/Unit Area	lbs/ft^2	0.75	ASTM D5993
	Grab Strength[2]	lbs	90	ASTM D4632
	Permeability	cm/sec	$5x10^{-9}$	ASTM D5887
Woven Base Fabric	Mass/Unit Area	$^{oz}/_{yd^2}$	3.2	ASTM D5261
GCL Hydrated Internal	Shear Strength	lbs/ft^2	500	ASTM D5321 ASTM D6243

Notes:

1. *Standard test methods will be updated to reflect the most current industry standards.*
2. *Grab tensile tests in machine direction.*

2. The primary component in the GCL is high-quality sodium bentonite (montmorillonite). The bentonite used in the manufacture of the GCL must be demonstrated to meet the testing and acceptance criteria listed in **Table II.7.3**. The testing shall be performed on the bentonite obtained from the finished GCL product.
3. Bentonite Sealing Compound (BSC) and Granular Bentonite (GB) shall be applied to ensure tightness at penetrations and structures. The BSC and GB shall be supplied by the manufacturer and shall be comprised of the same bentonite used in the manufacturing of the GCL. The BSC shall be a mixture of non-aqueous liquid suspension agent, which creates a paste-like texture. The suspension agents used in the manufacture of the BSC shall be non-toxic, water- soluble and shall not restrict the bentonite's ability to swell and absorb water upon hydration.
4. Longitudinal seams can also be sealed using the Winning Edge^{TM} which eliminates the need for free bentonite on those seams.

6.2 Delivery, Storage and Handling

1. The GCL rolls shall be packaged and shipped by appropriate means to prevent damage of the geomembrane rolls. Off-loading and storage of the GCL is the responsibility of the Contractor/Installer. The Contractor shall be responsible for replacing any damaged or unacceptable material discovered upon arrival at no cost to the Owner.
2. The GCL storage area will be designated by the Site CQA Manager/Owner. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Any damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Site CQA Manager.
3. A steel support pipe shall be inserted through the roll core. Slings or lifting chains shall be attached at the ends of the support pipe to the bucket of a front-end loader or lifting device. A spreader bar, which is used to support the pipe, must be long enough to prevent damage to the edges of the GCL during hoisting.
4. The rolls of GCL shall be stored in their original, unopened, wrapped cover in a clean, dry area, stacked no higher than three rolls high. The material shall be stored off the ground on pallets and shall be covered with a heavy, protective tarpaulin or enclosed within a storage facility. Care shall be used to keep the bentonite clean and free from debris prior to installation.
5. The installer shall be responsible for the transportation of each roll of GCL from the storage area to its proposed panel location. The contractor shall not drive upon the GCL panels with equipment exceeding 6 psi and shall be responsible for replacing any material damaged during installation until the GCL is accepted by the Site CQA Manager/Owner.

6.3 Manufacturer Quality Control Documentation

Prior to installation commencement of any GCL material, the Contractor shall provide the following information to the Site CQA Manager, certified by the manufacturer for the delivered GCL.

1. Manufacturer's certification verifying that the quality of the raw materials used to manufacture the GCL meets the Manufacturer specifications.
2. Each roll delivered to the project site shall have the following identification information:
    - Manufacturer's name
    - Product identification
    - Roll number
    - Roll dimensions
3. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum, the following results shall be provided in accordance with test requirements specified in **Table II.7.3:**
    - Free swell (ASTM D5890)
    - Fluid loss (ASTM D5891)
    - Bentonite mass/unit area (ASTM D5993)
    - Grab strength (ASTM D4632)
    - Permeability (ASTM D5887)

6.4 Conformance Testing

1. The Site CQA Manager will group the documentation of the delivered rolls into the manufacturer's listed lot numbers. The Site CQA Manager may, at his/her discretion, subdivide the manufacturer's listed lots into smaller lots for purposes of conformance testing.
2. Based on the requirements outlined in ASTM D4354, the Site CQA Manager will determine the number of sampling units within each lot or at a minimum, 1 test per 100,000 ft^2 of delivered GCL.
3. The Site CQA Manager shall cut or observe the sampling (i.e. if contractor is responsible for conformance samples) from randomly selected rolls which have been delivered to the site, one foot wide by roll width Sampling Units, which shall be used for field and laboratory testing as described below. A measuring device and straight edge shall be used to ensure uniformity of length and width. Moisture content, bentonite content, and unit weight testing shall be performed on delivered rolls by an approved independent laboratory. The method used for determining specification conformance shall be in accordance with ASTM D4759.
    a) The entire sample unit will be loosely rolled and the width of each sample shall also be measured and recorded.
    b) The sample shall then be unrolled and spread out on a clean, dry area at the site. The Site CQA Manager (or Contractor) shall randomly cut five 12 inch by 6 inch specimens from varying places across the sample. Each specimen will be immediately packaged up in a "zip-lock" bag marked with the project name, roll number, lot number, and specimen number.
    c) The five specimens shall be sent to an independent laboratory for fluid loss, bentonite content and mass per unit area testing (ASTM D5891, ASTM D5890 and ASTM D5993, respectively).

i. The average of the fluid loss, bentonite content, and mass per unit area of the five specimens will be provided by the independent laboratory in accordance with ASTM D5891, ASTM D5890, and ASTM D5993.
ii. If any two samples from a given lot being tested for bentonite content falls below the specified values, the entire lot shall be rejected.
iii. If any one of the samples from a given lot being tested for bentonite content falls below the specified values, an additional set of samples shall be taken from the lot (the number of samples taken for the second set shall be equal to that taken from the first set). If any one of the samples from the second set fails to meet the specified criteria, the entire lot shall be rejected.

4. Conformance test results shall be reviewed by the Site CQA Officer and lots shall be accepted or rejected, prior to the placement of the GCL. Test results shall meet, or exceed, the property values listed in **Table II.7.3**. In case of failing test results for any given lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer. If the test values from the resamples pass the acceptable specification values listed in **Table II.7.3**, then the lot shall be accepted.

6.5 GCL Placement

1. As each roll is moved from the storage area by the Installer, the labels shall be removed by the installer and submitted to the Site CQA Manager. The rolls of GCL shall be brought to the area to be lined with a front-end loader and support pipes set up such that the GCL roll is fully supported across its length. A spreader bar or similar device shall be used to prevent the lifting chains or slings from damaging the edges. Dragging of the GCL panels over the surface shall be minimized. Travel on the GCL is permissible if low-ground pressure equipment (6 psi or less) is used. The Site CQA Manager shall be informed as to the equipment to be used and shall approve same.
2. The flexible membrane liner shall be placed over the GCL during the same day as the placement of the GCL. Only those GCL panels which can be anchored and covered the same day shall be placed in position.
3. The GCL shall not be installed in standing water or during rain. The GCL must be dry when installed and must be dry when covered.
4. In areas where wind is prevalent, GCL installation should be started at the upwind side of the project and proceed downwind. The leading edge of the GCL shall be secured at times with sandbags or other means sufficient, and approved by the Site CQA Manager, to secure it down during high winds.
5. The GCL shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. Stretching of the GCL to fit will not be allowed. The GCL shall be straightened to smooth out creases or irregularities in the runs.

6.6 Field Seams

1. Longitudinal seams shall be a minimum of 9 inches on the cell floor (up to 10% slope); and 12 inches for sideslopes (>10%).
2. Soil, gravel, or other debris shall be removed from the overlap area.

3. Seam overlap shall be placed such that the direction of flow is from the top sheet to the bottom sheet to form a shingle effect.
4. On slopes, runs shall be from crest to toe with the GCL machine direction running perpendicular to the base. On slopes greater than or equal to 20%, the number of seams will be minimized, and end seam overlap will be increased to a minimum of 36 inches.
5. If the temperatures are higher than 85°F and humidity is low, contraction may occur soon after placement when no confining stress or soil cover is placed. In order to account for the possibility of contraction under these conditions, the seam overlap shall be increased to a minimum of twelve inches on longitudinal seams and 36 inches on end seams, or 4% of the distance to the next parallel seam, whichever is greater. Free bentonite shall be used to seal seam. Free bentonite is not necessary on longitudinal seams if the Winning Edge™ seam is used.
6. Once the first run has been laid, adjoining runs shall be laid with 9-inch minimum overlap or use of the Winning Edge™, on the longitudinal seams and 12 inches on end seams.

6.7 Field Quality Control

1. The Installer shall provide the Site CQA Manager with daily reports addressing the following:
    - subgrade approval for areas expected to be covered by GCL
    - the total amount and location of panels placed
    - total amount and location of seams completed
    - location of repairs
    - weather conditions
2. The Installer's Superintendent and the Site CQA Manager shall provide 100% inspection of the installation to ensure compliance with the construction drawings, technical specifications, and manufacturer recommended procedures.
    a) The surface of the GCL shall be clean and free of debris at the time of inspection.
    b) The Installer and the Site CQA Manager shall record each roll number and lot number as panels are deployed and a general description of the location of each panel.
    c) The Installer and the Site CQA Manager shall inspect the overlap for each panel.
    d) The Installer and the Site CQA Manager shall inspect the anchoring and sealing around penetrations and structures.
    e) The Installer and the Site CQA Manager shall inspect the geotextile quality, bentonite uniformity, and degree of hydration on the GCL. Areas requiring repair shall be marked and subsequently repaired in accordance with the Repair Procedures listed in this CQA Plan.
    f) The Installer and the Site CQA Manager shall re-inspect areas previously marked as requiring repair.

6.8 Repair Procedures

1. Seam and non-seam areas of the GCL shall be inspected for identification of defects, holes, and any sign of contamination by foreign matter in accordance with the Field Quality Control procedures listed in this CQA Plan.

2. Any defects shall be repaired by the Installer, by placing a GCL patch with a minimum 12 inch overlap in all directions.
3. Horizontal patch seams shall be secured with adhesive glue as approved by the Site CQA Manager and manufacturer's recommendations.
4. Patches and repairs shall not be allowed on slopes greater than 5H:1V, unless they are securely anchored with an adhesive or other approved method. Alternatively, the patches can be placed under the defective liner in order to prevent slippage of the patch.
5. For any repair method, surfaces shall be clean and dry at the time of the repair.
6. Each completed repair shall be inspected in accordance with the Field Quality Control procedures listed in this CQA Plan.

6.9 GCL Acceptance

1. The GCL shall be accepted by the Site CQA Manager when the installation is complete, and documentation of installation is completed and verification of the adequacy of field seams and repairs, are complete.
2. Approval of any subsequent post-liner construction, as well as payment requests of the same, will not be granted until required documentation is provided by the Installer and approved by the Site CQA Officer.

7.0 FLEXIBLE GEOMEMBRANE LINER (FML)

1. The flexible membrane (FML) used for liner installation shall be textured 60-mil thick HDPE for landfill sideslopes and smooth 60-mil thick HDPE for the landfill floor and ponds. Reinforced polyester 30-mil geomembrane will be used for the tank farm and jet out pit.
2. The geomembrane shall be manufactured of new, prime first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures and chemically resistant to leachate.
3. The geomembrane material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.
4. The sheets shall have NSF label of approval and shall be manufactured in a minimum 15 foot seamless width. Labels on the roll shall identify the thickness, length, width and manufacturer's lot number.
5. The geomembrane rolls shall meet the minimum properties listed in **Table II.7.4** for textured HDPE liner, **Table II.7.5** for smooth HDPE liner**,** and **Table II.7.6** for reinforced polyester liner.
6. Extrudate welding rods shall be of the same compound as the geomembrane and supplied by the manufacturer and shall be delivered in the original sealed containers. Each container shall have a label bearing the brand name, manufacturer's lot number and complete directions as to proper storage.

7.1 Manufacturer Quality Control Documentation

Prior to installation commencement of any geomembrane material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geomembrane.

1. Origin, identification and production of the resin (supplier's name, brand name and production plant).
2. Copies of quality control certificates issued by the resin supplier.
3. Manufacturer's certification verifying that the quality of the resin used to manufacture the geomembrane meets the resin specifications fingerprint properties shown in **Table II.7.4** for 60-mil textured HDPE liner, **Table II.7.5** for smooth HDPE liner, and **Table II.7.6** for the reinforced polyester liner.
4. Each roll delivered to the project site shall have the following identification information:
    - Manufacturer's name
    - Product identification
    - Thickness
    - Roll number
    - Roll dimensions
5. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Tables II.7.4** and **II.7.5** for the HDPE liner:
    - Thickness (smooth, ASTM D 5199; textured, ASTM D5994)
    - Density (ASTM D1505)
    - Tensile properties (ASTM D638, as modified by annex A)
    - Tear properties (ASTM D6693)
    - Carbon black content (ASTM D 1603 or ASTM D 4218)
    - Carbon black dispersion (ASTM D5596)
    - Puncture Resistance (ASTM D4833)
    - Notched constant tensile load (ASTM D 5397, Appendix)
    - Interface Friction Angle (Textured Geomembrane) [GRI - GS -7]
6. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Table II.7.6** for the reinforced polyester liner:
    - Thickness (ASTM D751, Optical Method)
    - Weight (ASTM D751)
    - Break strength (ASTM D751 Grab Tensile Method, Procedure A)
    - Break elongation (ASTM D751)
    - Tear strength (ASTM D751)
    - Puncture Resistance (ASTM D4833)
    - Hydrostatic resistance (ASTM D751, Procedure A)
    - Bursting strength (ASTM D751, Ball Tip)

7.2 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft^2. As stated in the contract documents, the Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory for the HDPE liner material:
    - Thickness (ASTM D5199, or ASTM D5994)
    - Density (ASTM D1505)
    - Tensile properties (ASTM D6693)
    - Tear resistance (ASTM D1004)
    - Carbon black content (ASTM D1603, or ASTM D4218)
    - Carbon black dispersion (ASTM D5996)
2. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft^2. As stated in the contract documents, the Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory for the reinforced polyester liner material:
    - Thickness (ASTM D751, Optical Method)
    - Weight (ASTM D751)
    - Break strength (ASTM D751, Grab Test Method, Procedure A)
    - Break elongation (ASTM D751)
    - Tear strength (ASTM D751)
    - Puncture resistance (ASTM D4833)
3. These conformance tests shall be performed in accordance with **Tables II.7.4, II.7.5**, and **II.7.6**.
4. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geomembrane. Test results shall meet, or exceed, the property values listed in **Tables II.7.4** and **II.7.5.** If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If the test values from the resamples pass the acceptable specification values listed in **Tables II.7.4**, **II.7.5**, and **II.7.6,** the lot shall be accepted.

TABLE II.7.4
Technical Specifications
60-mil HDPE Textured Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[3]**
Thickness	Minimum Average	mils	57	ASTM D5994
	Lowest individual for 8 out of 10 values	mils	54	
	Lowest individual for any of the 10 values	mils	51	
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	≤1.0	ASTM D1238
Tensile Properties (each direction):				ASTM D6693, Type IV Dumbell,
Break Strength	Minimum Average	lb/in	90	2 ipm
Yield Strength	Minimum Average	lb/in	126	
Elongation at Break	Minimum Average	%	100	G.L. = 2.0 in
Elongation at Yield	Minimum Average	%	12	G.L. = 1.3 in
Tear Resistance	Minimum	lb	42	ASTM D1004
Puncture Resistance	Minimum	lb	90	ASTM D4833
Carbon Black Content	Minimum	%	2.0	ASTM D1603
Carbon Black Dispersion	Rating	N/A	Note 1	ASTM D5596
Asperity Height	Minimum Average	N/A	Note 2	GRI GM 12
Notched Constant Tensile Load	Minimum	hours	300	ASTM D5397, Appendix
SEAM PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[3]**
Thickness	Minimum	mils	60	ASTM D5199/ D5994
Bonded Seam Strength	Minimum	lb/in	120	ASTM D6392
Tensile Properties:				
Fusion Weld	Minimum	lb/in	90	ASTM D 6392
Extrusion Weld	Minimum	lb/in	78	ASTM D6392

Notes:

(1) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.

(2) 10 mil average. 8 of 10 readings ≥ 7 mils. Lowest individual reading ≥ 5 mils.

(3) Standard test methods will be updated to reflect the most current industry standards.

TABLE II.7.5
Technical Specifications
60-mil HDPE Smooth Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[2]**
Thickness	Minimum Average Minimum	mils mils	60 54	ASTM D5199
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	≤1.0	ASTM D1238
Tensile Properties (each direction): Break Strength Yield Strength Elongation at Break Elongation at Yield	 Minimum Average Minimum Average Minimum Average Minimum Average	 lb/in lb/in % %	 228 126 700 12	ASTM D6693, Type IV Dumbell, 2 ipm G.L. = 2.0 in G.L. = 1.3 in
Tear Resistance	Minimum	lb	42	ASTM D1004
Puncture Resistance	Minimum	lb	108	ASTM D4833
Carbon Black Content	Minimum	%	2.0	ASTM D1603
Carbon Black Dispersion	Rating	N/A	Note 1	ASTM D5596
Notched Constant Tensile Load	Minimum	hours	300	ASTM D5397, Appendix
SEAM PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[2]**
Thickness	Minimum	mils	60	ASTM D5199/ D5994
Bonded Seam Strength	Minimum	lb/in	120	ASTM D6392
Tensile Properties: Fusion Weld Extrusion Weld	 Minimum Minimum	 lb/in lb/in	 90 78	 ASTM D6392 ASTM D6392

Notes:

(1) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.

(2) Standard test methods will be updated to reflect the most current industry standards.

TABLE II.7.6
Technical Specifications
30-mil Reinforced Polyester Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[1]**
Thickness	Minimum Average	mils	30	ASTM D751 (Optical Method)
Weight	Minimum	oz/yd^2	30 ± 2	ASTM D751
Break Strength	Minimum	lb	550	ASTM D751 Grab Test Method Procedure A
Break Elongation	Minimum	%	20	ASTM D751
Tear Strength	Minimum	lb	40	ASTM D751
Puncture Resistance	Minimum	lb	275	ASTM D4833
Hydrostatic Resistance	Minimum	psi	800	ASTM D751, Procedure A
Bursting Strength	Minimum	lb	750	ASTM D751, Ball Tip
SEAM PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD[1]**
Bonded Seam Strength	Minimum	lb	575	ASTM D751 Grab Test Method Procedure A
Peel Adhesion	Minimum	lb/2 in	40	ASTM D413

Notes:
(1) Standard test methods will be updated to reflect the most current industry standards.

7.3 Delivery, Storage and Handling

1. The geomembrane rolls shall be packaged and shipped by appropriate means to prevent damage of the geomembrane rolls. Off-loading and storage of the geomembrane is the responsibility of the Installer. The Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.
2. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined collectively by the installer and Site CQA Manager.
3. The geomembrane rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the geomembrane material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than two rolls high.

7.4 Guarantee

1. The Contractor shall guarantee the HDPE and reinforced polyester geomembrane against defects in installation and workmanship for the period of two years commencing with the date of final acceptance by the Owner. The guarantee shall include the services of qualified service technicians and materials required for the repairs at no expense to the Owner.

7.5 Quality Assurance

1. In addition to manufacturer and installer requirements for qualifications and certification specified in submittals, the Quality Assurance consists of conformance testing of the material delivered to the site and field quality control during installation.
2. Conformance testing requirements are listed in this CQA Plan. The purpose of conformance testing is to assure that the supplied material conforms to the specifications and to the manufacturer's quality control certificates.
3. Field quality control requirements are specified in this CQA Plan. The purpose of field quality control procedures is to assure that the geomembrane has been installed in accordance with the specifications and manufacturer's recommendations.
4. Quality control forms for geomembrane installation documentation are used for field installation documentation. Sample project forms are listed on **Table II.7.7**.

TABLE II.7.7
FML Project CQA Forms

Form No.	Title
1.	Liner Quality Control Project Specifications **(Attachment II.7.A)**
2.	Approval/Authorization to Proceed Form **(Attachment II.7.B)**
3.	Daily Summary Report **(Attachment II.7.C)**
4.	FML Inventory Control Log **(Attachment II.7.F)**
5.	FML Deployment Log **(Attachment II.7.K)**
6.	FML Trial Seaming Test Log **(Attachment II.7.L)**
7	FML Seaming Log **(Attachment II.7.M)**
8.	FML Seam Pressure Test Log **(Attachment II.7.N)**
9.	FML Destructive Field Test Record **(Attachment II.7.O)**
10.	FML Seam Vacuum Test/Repair Log **(Attachment II.7.P)**

Photo-documentation will be also used to record the cell construction. Select photographs shall include date, time, location, and Site CQA Manager; and shall be included in the Liner Certification Report submitted to OCD.

7.6 Geomembrane Placement

1. Weather Conditions
   Geomembrane placement shall not proceed at an ambient temperature below 40 degrees F or above 104 degrees F unless otherwise authorized, in writing, by the Site CQA Manager. Geomembrane placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds. Observation of temperature, humidity, precipitation, and wind shall be noted on CQA forms to ensure that weather conditions are acceptable prior to geomembrane placement.
2. Method of Placement
   a) No more material than can be seamed on that same day shall be deployed.
   b) Each panel of the geomembrane shall be rolled out and installed in accordance with the approved construction drawings. The layout shall be designed to keep field joining of the HDPE geomembrane to a minimum and consistent with proper methods of HDPE geomembrane installation, seaming, etc.
   c) Geomembrane rolls shall be placed using proper spreader and rolling bars with cloth slings.
   d) The Site CQA Manager shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the Site CQA Manager.
   e) The installer shall avoid dragging the geomembrane sheets on rough soil subgrades.
   f) Geomembranes shall be anchored as shown on the construction drawings and consistent with manufacturer's recommendations.
   g) Personnel working on the geomembrane shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the geomembrane.

h) Vehicular traffic across the geomembrane shall not be allowed on the liner material.
i) Damage shall be recorded and located on the as-built drawings.
j) When tying into existing geomembrane, final excavation to previously installed liner segments shall be performed by hand to prevent damage. Damaged sections of previously installed liner at the boundary zone shall be removed and replaced. New liner segments shall be seamed only to competent segments of previously installed liner as approved by the Site CQA Manager.
k) The geomembrane shall be kept free of debris, unnecessary tools and materials. In general, the geomembrane area shall remain neat in appearance.
l) Installed liner will not be left exposed for more than fourteen (14) days to sunlight and/or adverse weather conditions.
m) The method used to unroll the panels shall neither score, scratch or crimp the geomembrane, nor damage the underlying liner system components or subgrade.
n) Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind. In cases of high wind, continuous loading is recommended along edges of panels to minimize wind flow under the panels.
o) Direct contact with the geomembrane shall be minimized; i.e., the geomembrane under traffic areas shall be protected by geotextile, extra geomembrane, or other suitable materials.
p) Sufficient slack shall be placed in the geomembrane to compensate for the coldest temperatures envisioned so that no tensile stresses are generated in the geomembrane or in its seams either during installation or subsequently after the geomembrane is covered.
q) The geomembrane shall have adequate slack such that it does not lift up off of the subgrade or substrate material at any location within the facility, i.e., no "trampolining" of the geomembrane shall be allowed to occur at any time.
r) The geomembrane shall not have excessive slack to the point where creases fold over upon themselves either during placement and seaming, or when the protective soil or drainage materials are placed on the geomembrane.
s) Permanent (fold over type) creases in the covered geomembrane shall not be permitted. Creases shall be repaired in accordance with this CQA Plan and manufacturer's recommendations.
t) The amount of slack to be added to the deployed and seamed geomembrane should be carefully considered and calculated, taking into account the type of geomembrane and the geomembrane's temperature during installation versus its final temperature in the completed facility.

3. Field Seams
   a) Individual panels of geomembrane shall be laid out and overlapped by a minimum of 4 inches (or three inches for extrusion fillet welding) but no more than 6 inches prior to welding. The area to be welded shall be cleaned and prepared in accordance with the quality control welding procedures.
   b) If the overlap is too wide to contain the hot wedge welding machine, "float" the liner into better position by lifting it high enough to draw air beneath it, guiding it upon the

air to an improved position. Avoid dragging the liner, particularly across rough soil subgrades.

c) If overlap between the placed liners is excessive, the excess must be trimmed away. This should be done by trimming the lower sheet. If this is not possible and the upper sheet must be trimmed, use a knife with a shielded or hook blade.
d) Cutting and preparation of odd-shaped sections or small fitted pieces should be completed at least 50 feet ahead of the seaming operation, so that seaming may be conducted with the fewest interruptions.
e) Liner panel overlaps shall be shingled so the upper panel is hydraulically upgradient of lower panel.
f) Sheets which are overlapped and ready for seaming must be clean. If dirty, they must be wiped clean with dry rags.
g) The seam area must be completely free of moisture before the overlapping sheets can be properly seamed. Dry rags should be used to wipe any such moisture up from the seam surface. Air blowers may also be used.
h) Seaming is not to be performed when the soil surface beneath the liners is saturated, because the hot seaming apparatus will draw moisture into the ongoing seam. Seaming activity on frozen soil is unacceptable for the same reason.
i) Double track hot wedge fusion welder shall be used for straight welds.
j) Extrusion welder shall be used for cross seam tees, patches and repairs and penetration boots.
k) The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the geomembrane material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.
l) No “fish mouths” will be allowed within the seam area. Where “fish mouths” occur, the material shall be cut, overlapped and a patch fusion weld shall be applied. Welds upon completion of the work shall be tightly bonded. Any geomembrane area showing damage due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of geomembrane. The number of patches per 100 foot length shall not exceed five. If more than five patches per 100 foot length are necessary, then the entire 100 foot length of seam shall be removed. Further welding will cease at this time and the Site CQA Manager shall be notified.
m) Seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the as-built drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be welded together.
n) Fusion welded “T” seams (i.e., the result of the geomembrane panels placed perpendicular to each other) shall be double welded where possible. Extrusion welding shall be used for the second weld.
o) Extrudate shall be free of debris, dry and protected from damage.
p) If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. Purged extrudate shall be placed on a sacrificial sheet and disposed of.

q) No horizontal seams shall be constructed on slopes greater than or equal to 5H:1V. If seams are constructed on such slopes, their number must be minimized, and they must be at a minimum angle of 45° with the toe of slope.
r) Vertical panels placed on sloped surfaces shall extend 10 feet inward from the toe of slope and 3 feet from the edge of the trench.
s) In the anchor trench, seams shall extend a minimum 12 inches.
t) Factory seams, field seams and repair welds shall meet seam strength requirements specified in **Tables II.7.4, II.7.5,** and **II.7.6.**
u) For geomembrane installation in geometrically unique areas, the number of field seams shall be minimized.
v) No solvent or adhesive may be used unless the product is approved by the Site CQA Officer.

7.7 Hot Wedge Fusion Welding

The objective of hot wedge seaming is to heat two facing liner surfaces to their melting point before forcing them together and creating a permanent bond. The wedge is situated between the overlap of the two liners; it reduces the surface tension of the viscous polymer sheets and acts as a scraper and mixer, so that the nip rollers can pressure the two liners together. The result is that the two facing surfaces are bonded into one continuous molecular structure. Types of thermoplastic liners can be seamed by the hot wedge method, but temperature settings will vary according to their specific polymer components:

TABLE II.7.8
Typical Wedge Temperature Ranges for
Hot Wedge Seaming of Thermoplastic Liners

LINER TYPE	FAHRENHEIT (°F)	CELSIUS (°C)
HDPE		
Minimum[1] Temperature	600	320
Maximum[2] Temperature	750	400

[1] For dry, warm weather seaming conditions
[2] For damp, cold weather seaming conditions

a) The hot wedge system should be properly positioned for completing the desired single or dual (split) seam.
b) Ambient variables such as temperature, cloud cover, and wind speed may make it necessary to vary the temperatures used successfully in a variety of ambient conditions, so that the hot wedge can be more accurately adjusted if new conditions are met, or if personnel changes are necessary.
c) The drive motor should be off when positioning the welding machine to seam. Place the machine where the sheets overlap. Guide the overlapped material between the idlers and the wedge, and into the drive/nip rollers. When continuing a weld that has been abandoned mid-seam, the liners must be spread where the seam leaves off and loaded into the respective sides of the machine. Raise the machine a few inches, load the bottom

sheet first, and then load the top sheet. When the nip rollers engage and the wedge is in position, turn on the drive motor. Immediately engage the sheets when they are between the nip rollers to prevent an imminent melt-through. Move the hot wedge into position and lock it.

d) The Operator must constantly monitor the temperature controls, as well as the completed seam passing out of the machine. Occasional adjustments in temperature or speed will be necessary to maintain a consistent weld. Visual inspection and constant hand testing by the peel method (or other) is also recommended.

e) On some soils, the device tends to "bulldoze" into the ground as it travels, causing soil to enter the weld. A seam with soil trapped in its weld is unacceptable. To keep this from happening, the operator should lift the front of the machine slightly. Alternatively, a moveable base for the machine to travel on can be used. Scrap strips of geotextile or geomembrane have proven to be effective materials upon which the welder can maintain traction. It may also be necessary to change the size of the rollers in loose soils.

f) A small amount of "squeeze-out" or "flashing" is a reliable indication that proper temperatures have been achieved. The melted polymer will laterally extrude, or squeeze-out of the seam zone in properly welded seams, but not to excess. An excessive amount of extruded hot melt indicates that excessive heat or pressure, or both, was applied. Reduce the temperature and/or pressure to correct the situation.

g) The hot wedge device has just a few adjustable parts, but it is critical that they be checked after a day of seaming. The machine should be cleaned daily.

7.8 Extrusion Welding

a) The upper sheet's leading edge must be ground to a 45º bevel. It is imperative that the sheet be lifted up and away from the lower sheet during the beveling so that no deep gouges are cut in the lower sheet. Grinding should therefore be done before tack welding.

b) After beveling, the upper sheet is lowered and laid flat against the lower sheet. The horizontal surface grinding across the interface of both sheets is completed. Surface sheen in the area to be seamed must be removed. Material dust generated by grinding the liner sheets must be wiped or blown away from the seaming zone.

c) Grinding marks should run perpendicular to the seam. Though this process is slower than grinding parallel to the seam, it does not create the deep parallel grooves that significantly decrease the thickness of the parent material that can lead to seam failure. Parallel grinding marks can also initiate stress cracking.

d) Grind marks should never be deeper than 10% of the sheet thickness. Optimally, they should be about 5% of the sheet thickness. The only purpose of grinding is the removal of oxide layers and dirt from the liner surfaces, and the roughening of their interface for extrudate.

e) Grinding marks should not extend beyond 1/4 inch of either side of the extrudate after its placement. For example, if the final extrudate bead width is 1-1/2 inches, the width of the grinding trail should not exceed 2 inches.

f) Seaming must take place no more than 10 minutes after grinding, so that surface oxide layers do not reappear where the extrudate must be placed.

g) The hand grinder should never be left running when it is not in use. If it makes contact with the liner while running it will cause serious damage.

h) A hot air gun may be used to "tack" the two sheets together, ahead of the extrusion welder. The hot air gun prepares the seam for the extrusion welder by heating the ground surface and by creating a light bond between the two sheets, securing their position. The hot air gun is not meant to create a primary seam. No heat distortion should be evident on the surface of the upper sheet.

i) The extrusion welder's barrel shall be purged of heat-degraded extrudate before starting a seam. This must be done every time the extruder is restarted after two or more minutes of inactivity. The purged extrude shall not be discharged onto the surface of previously placed liner, or onto prepared subgrade, where it would eventually form a hard lump under the liner and cause stress concentrations and possibly premature failure.

j) Molten, highly viscous extrudate is deposited along the overlapped seam. The center of the extrudate pass directly along the edge of the upper liner, at sufficient width to completely cover the edge and most of the outlying grind marks, at least to within 1/4 inch of their extremity.

k) The extrudate should be approximately twice the specified sheet thickness, measured from the top of the bottom sheet to the top or "crown" of the extrudate. Excessive "squeeze out" is acceptable, if it is equal on both sides and will not interfere with subsequent vacuum box testing. If however, the extrudate can be pulled by its squeeze-out off the seam, the extrudate is unacceptable. The presence of squeeze-out may indicate that the extrusion die was not riding directly against the liner, that the extrudate temperature was improper for adequate flow, or that the seaming rate was too slow.

l) Where possible, inspect the underside of the lower for heat distortion. This can be done at the end of seams, and wherever samples are cut out of the seam. A slight amount of thermal "puckering" on relatively thin liners (less than 50 mil) is acceptable. It indicates that heat penetrated entirely through the sheet. However, if the underside is greatly distorted, either lower the temperature or increase the rate of seaming.

m) If the seaming process must be interrupted at mid-seam, the extrudate should trail off gradually, not terminate in a large mass of solidified extrudate. Where such welds are abandoned long enough to cool, they must be ground prior to continuing with new extrudate over the remainder of the seam. Grind where the extrudate trail-off begins. This restart procedure must be followed for patches, pipes, fittings, appurtenances and "T" and "Y" shaped items.

n) The extrudate bead should be visually inspected. Look to see that its alignment is straight, its height is appropriate, and its surface texture is uniform. No bubbles or pock marks should appear in the extrudate, which indicate the undesirable presence of air, water or debris within the extrudate rod or palletized polymer.

o) Grind marks should not be visible more than 1/4 inch beyond the extrudate. These should be very light and not contain heavy gouges. As stated previously, grinding is considered excessive when it is deeper than 10% of the liner thickness. It is unacceptable to apply additional extrudate over the original extrusion fillet seam in an area of excessive grinding. A cap strip shall be placed over the entire portion of the seam where excessive grinding is seen.

7.9 Field Quality Control

1. Start-up Testing
   A trial weld, 10 feet long for hot wedge welding and 3 feet long for extrusion welding, from each welder/welding machine shall be run upon the beginning of each shift, every four hours thereafter and at the discretion of the Site CQA Manager, under the same conditions that exist for the geomembrane welding. The trial weld shall be marked with date, ambient temperature, welder's name, and welding machine number. A tensiometer provided by the Installer shall be required to be on-site before and during geomembrane installation for the purpose of testing samples. Specimens of weld l inch wide shall be cut from the trial weld and tested on site for shear and peel strength in accordance with **Tables II.7.4, II.7.5,** and **II.7.6**. No welder may start work until the trial weld has been approved by the Site CQA Manager.
2. Nondestructive Seam Testing
   a) The installer shall perform nondestructive tests on field seams over their full length. The purpose of this test is to assure continuity and integrity of the seams. Vacuum and air pressure tests shall be used for nondestructive testing. The vacuum test shall be used for extrusion welds and single-track hot wedge welds. The air pressure test shall be used for double track hot wedge welds.
   b) Vacuum Testing
      Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:
      (l) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, porthole or valve assembly and a vacuum gauge.
      (2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
      (3) A rubber pressure/vacuum hose with fittings and connections.
      (4) A plastic bucket and wide paintbrush.
      (5) A soapy solution.

The following procedures shall be followed by the installer:

(1) Excess sheet overlap shall be trimmed away.
(2) Clean the window, gasket surfaces and check for leaks.
(3) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
(4) Wet a strip of geomembrane approximately 12 inch by 48 inch (length of box) with the soapy solution.
(5) Place the box over the wetted area and compress.
(6) Close the bleed valve and open the vacuum valve.
(7) Ensure that a leak-tight seal is created.
(8) For a minimum period of ten seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
(9) If no bubbles appear after ten seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3 inch overlap and repeat the process.

(10) Areas where soap bubbles appear shall be marked and repaired in accordance with the Repair Procedures contained in this CQA Plan.

If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Site CQA Manager for uniformity and completeness.

3. Air Pressure Testing (for double track fusion seams only)

   The following procedures are applicable to those processes which produce a double seam with an enclosed space. Equipment for testing double fusion seams shall be comprised of the following:

   (1) An air pump equipped with pressure gauge capable of generating and sustaining a pressure of 35 psi and mounted on a cushion to protect the geomembrane.
   (2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed by the installer:

(1) Seal one end of the seam to be tested.
(2) Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.
(3) Energize the air pump to verify the unobstructed passage of air through the channel.
(4) Seal the other end of the channel.
(5) Energize the air pump to a pressure of 35 psi, close valve, and sustain pressure for approximately 5 minutes.
(6) If loss of pressure exceeds 2 psi, or pressure does not stabilize, locate faulty area, repair and retest.
(7) Remove needle or other approved pressure feed device and seal.

7.10 Destructive Seam Testing

The purpose of the destructive testing is to evaluate seam strength properties. An average minimum of one test sample shall be obtained per 500 feet of performed seam length. The location of samples shall be determined by the Site CQA Manager. Selection of such locations may be prompted by suspicion of overheating, contamination, or other potential cause that may adversely impact the welds. This may result in more than one sample per 500 feet of seam length. Sampling shall be performed by the installer. Testing of field samples shall be performed by the installer in the presence of the Site CQA Manager as described below.

1. Sampling Procedures
   a) Samples shall be cut by the installer at locations chosen by the Site CQA Manager as the seaming progresses.
   b) The seams shall not be covered by another material before they have been tested and accepted by the Site CQA Manager.
   c) Upon obtaining each sample, assign a number to the sample and mark it accordingly.
   d) Record sample location on layout drawing.
   e) Record purpose of the sample, statistical routine or suspicious weld area.
   f) Record date, time, location, roll, seam number, master seamer, welding apparatus, and ambient temperature.

g) Holes in the geomembrane resulting from destructive seam testing shall be immediately repaired in accordance with the Repair Procedures contained in this CQA Manual.

2. Size and Disposition of Samples
   a) The samples shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three pieces of equal length and distributed as follows:
      (1) One portion to the Installer for field testing; 12 inch by 12 inch.
      (2) One portion for the independent geosynthetic laboratory quality assurance testing; 12 inch by 12 inch.
      (3) One portion to the Landfill Manager for archive storage in the Site Operating Record; 12 inch by 12 inch.
   b) The portion of the seam samples for geosynthetic laboratory quality assurance testing will be packed and shipped to an independent lab for testing by the Installer.
3. Field Testing
   a) The following shall be performed by the Installer in the presence of the Site CQA Manager for samples designated for field sampling.
      (1) The Installer shall cut ten 1-inch wide replicate specimens from the sample to be tested for shear and peel strength, in accordance with the criteria set in **Tables II.7.4, II.7.5,** and **II.7.6**.
      (2) Any specimen that fails through the weld or by fusion at the weld sheet interface is a non-FTB (Film Tearing Bond) break and shall be considered a failure.
      (3) The Installer shall test five specimens for shear seam strength and five for peel strength. Four out of the five replicate test specimens shall pass for the seam to be acceptable. A specimen must pass both Sections 1 and 2 above to be acceptable.
4. Quality Assurance Laboratory Test
   a) The Installer shall package and ship destructive test samples designated for laboratory testing to the independent Quality Assurance Laboratory. The laboratory must be approved by the Site CQA Officer.
   b) Laboratory tests shall include shear and peel strength tests. The minimum acceptable values obtained in these tests shall be in accordance with **Tables II.7.4, II.7.5,** and **II.7.6**.
   c) At least five specimens shall be tested each for shear and peel strength. A passing test shall meet the minimum required values in at least four of the five specimens tested for each method.
   d) Any specimen that fails through the weld or by fusion at the weld sheet interface is a non-FTB (Film Tearing Bond) break and shall be considered a failure.
   e) The Independent Laboratory shall provide verbal test results to the Site CQA Manager no more than 24-hours after they receive the samples. The Site CQA Manager shall review the laboratory results as soon as they become available.
5. Procedures for Destructive Test Failure
   a) The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted in the field or by the laboratory. The Installer has two options:
      (1) The installer can repair the seam between any two passing test locations.

(2) The installer can retrace the welding path to an intermediate location 10 feet (on both sides) from the location of the failed test and take a sample for an additional field test. If these tests pass, then the seam shall be repaired. If the test fails, then the process is repeated to establish the zone in which the seam should be repaired. This process may only be repeated twice. After the third failed test, the entire seam must be repaired.

b) Acceptable repaired seams shall be bound by two locations from which sample passing destructive tests have been taken. In cases where repaired seam exceeds 150 feet, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with this CQA Plan.

c) The Installer shall document actions taken in conjunction with destructive test failures.

7.11 Repair Procedures

1. Any portion of the geomembrane exhibiting signs of defect, failing a destructive or a nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the Site CQA Manager.
2. The repair procedures available include:
   a. Defective seams shall be restarted/reseamed as described in this CQA Plan.
   b. Small holes shall be repaired by extrusion cap welding. If the hole is larger than 1/4 inch, it shall be patched with a piece of material extending six inches out from the damaged area.
   c. Tears shall be repaired by patching. The sharp end of a tear on a slope, or in an area of particular stress, must be rounded prior to patching.
   d. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
   e. HDPE surfaces to be patched shall be abraded and cleaned no more than one hour prior to the repair. No more than 10% of the thickness shall be removed.
   f. Patches shall be round or oval in shape, made of the same geomembrane, and extend to a minimum of six inches beyond the edge of defects. Patches shall be of the same compound and thickness as the geomembrane specified. Patches shall have their top edge beveled prior to placement on the geomembrane in accordance with this CQA Plan. Patches shall be applied and the repair made using methods discussed in the CQA Plan.
3. Restart/Reseaming Procedures - Fillet Extrusion Welds
   The Fillet Extrusion Welds process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least two inches. Reseaming over an existing seam without regrinding shall not be permitted.
4. Restart/Reseaming Procedures - Hot Wedge Welds
   Over the length of the seam failure, the Installer shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Site CQA Manager.
5. For any repair method, the following provisions shall be satisfied:

a) Surfaces of the geomembrane which are to be repaired using extrusion methods shall be abraded no more than one hour prior to the repair.
b) Surfaces shall be clean and dry at the time of the repair.

6. Repair Verification
   a) Each repair shall be numbered and logged by the installer and the Site CQA Manager. Each repair shall be nondestructively tested using the methods described in Section 5.10, Subsection 2 “Non-Destructive Testing” as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150 feet long may be of sufficient length to require destructive test sampling, at the discretion of the Site CQA Manager. Failed tests indicate that the repair shall be redone and retested until passing test results are achieved. The Site CQA Manager shall observe nondestructive testing of repairs. The installer shall record the number of each repair, date and test outcome.
7. Disposal of Waste Material
   Upon completion of installation, the Installer shall dispose of trash, waste material, etc., and shall leave the premises in a neat and acceptable condition.

7.12 Geomembrane Acceptance

The Installer shall retain ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane liner shall be accepted by the Owner when the following conditions are met:

1. Installation is finished.
2. Verification in the form of a certificate of acceptance of the adequacy of field seams and repairs, including associated testing, is complete.
3. Certification by the Site CQA Manager that the geomembrane was installed in accordance with the Construction Drawings, this CQA Plan and manufacturers recommendations.
4. Certification, including "as built" drawing(s) and installation documentation, is provided by the Installer to the Site CQA Manager.

8.0 GEONET

8.1. Geonet Properties

Geonet is proposed as the leak detection layer for the evaporation ponds and landfill.

1. The geonet shall be manufactured of new, prime first-quality materials designed and manufactured specifically for the purpose of planar drainage of liquid and chemically resistant to leachate.
2. Geonets are unitized sets of parallel ribs positioned in layers to form a three-dimensional structure such that liquid can be transmitted within their open spaces.
3. The geonet material shall meet the minimum properties listed in **Table II.7.9.**

8.2 Manufacturer Quality Control Documentation

Prior to installation commencement of any geonet material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geomembrane.

1. Origin, identification and production of the resin (supplier's name, brand name and production plant).
2. Copies of quality control certificates issued by the resin supplier.
3. Manufacturer's certification verifying that the quality of the resin used to manufacture the geonet meets the resin specifications fingerprint properties shown in **Table II.7.9**.
4. Each roll delivered to the project site shall have the following identification information:
    - Manufacturer's name
    - Product identification
    - Thickness
    - Roll number
    - Roll dimensions
5. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Tables II.7.9.**

TABLE II.7.9
Technical Specifications
HDPE Geonet

PHYSICAL PROPERTIES				
PROPERTY	**QUALIFIER**	**UNIT**	**VALUE**	**TEST METHOD**
Thickness	Minimum	mils	200	ASTM D1777
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	0.1 - 1.1	ASTM D1238
Carbon Black Content	Range	%	2.0 - 3.0	ASTM D1603
Tensile Strength	Minimum	lb/in	42	ASTM D1682
Mass Per Unit Area	Minimum	lb/ft^2	0.16	ASTM D3776
Transmissivity (loaded)	Minimum	m^2/sec	$1x10^{-3}$	ASTM D4716

Notes:
1. Values representative of GSE 200-mil geonet or equivalent.
2. Standard test methods will be updated to reflect the most current industry standards.

8.3 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft^2. The Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory:
    - Thickness (ASTM D 1777)
    - Density (ASTM D 1505)
    - Wide width tensile properties (ASTM D 1682)
    - Mass per unit area (ASTM D 3776)
    - Carbon black (ASTM D 1603)

- Melt Index (ASTM D 1238)

2. These conformance tests shall be performed in accordance with **Tables II.7.9.**
3. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geomembrane. Test results shall meet, or exceed, the property values listed in **Tables II.7.9.** If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If of the test values from the resamples pass the acceptable specification values listed in **Tables II.7.9,** the lot shall be accepted.

8.4 Delivery, Storage and Handling

1. The geonet rolls shall be packaged and shipped by appropriate means to prevent damage of the geonet rolls. Off-loading and storage of the geomembrane is the responsibility of the Installer. The Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.
2. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined collectively by the installer and Site CQA Manager.
3. The geonet rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the geonet material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall elevated from the ground (a minimum of 3 inches) to protect the geonet from standing water.

8.5 Guarantee

1. The Contractor shall guarantee the HDPE geonet against defects in installation and workmanship for the period of two years commencing with the date of final acceptance by the Owner. The guarantee shall include the services of qualified service technicians and materials required for the repairs at no expense to the Owner.

8.6 Geonet Installation

8.6.1 Geonet Placement

a. As each roll is moved from the storage area by the Installer, the labels shall be removed by the Installer and submitted to the Site CQA Manager. The rolls of geonet shall be brought to the area to be lined with a front-end loader and support pipes set up such that the geonet roll is fully supported across its length. A spreader bar or similar device shall be used to prevent the lifting chains or slings from damaging the edges.
b. Care shall be taken to keep the geonet clean and free from debris prior to installation. If the geonet is not clean, it should be washed using a high-pressured hose prior to installation.

c. Each panel of the geonet shall be rolled out and installed in accordance with the approved shop drawings prepared by the Installer. The layout shall be designed to keep field joining of the geonet to a minimum and consistent with proper methods of geonet installation.
d. On slopes, the geonet shall be secured and rolled down the slope in such a manner as to continually keep the geonet panel in tension. If necessary, the geonet shall be positioned by hand after being unrolled to minimize wrinkles.
e. In areas where wind is prevalent, geonet installation should be started at the upwind side of the project and proceed downwind. The leading edge of the geonet shall be secured at times with sandbags or other means sufficient to hold it down during windy conditions.
f. The geonet shall not be welded to the geomembrane.
g. The geonet shall only be cut using scissors or other cutting tools approved by the Manufacturer that will not damage the underlying geosynthetics. Care shall be taken not to leave tools on the geonet.
h. Necessary precautions shall be taken to prevent damage to underlying layers during placement of the geonet.
i. During placement of geonet, care shall be taken not to entrap dirt or excessive dust within the geonet that could cause clogging of the drainage system and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geonet, it should be hosed clean prior to placement of the next material on top of it. In this regard, care shall be taken in handling the sandbags to prevent rupture or damage of the sandbag.
j. Once the geonet is removed from the storage area by the Installer, it becomes the responsibility of the Installer.

8.6.2 Field Seams

The following requirements shall be met during installation of the geonet:

a. Adjacent rolls shall be overlapped by a minimum of 4 inches.
b. Overlaps shall be secured by tying. Tying can be achieved by HDPE fasteners or polymer braids. Tying devices shall be white or yellow for easy inspection. Metallic devices will not be permitted.
c. Tying shall be every 5 feet along the slope and base, every 6 inches in the anchor trench, and every 6 inches along end-to-end seams on the floor of the landfill and pond.
d. No horizontal seams shall be allowed on side slopes.
e. In the corners of the side slopes where overlaps between perpendicular geonet panels are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonet from top to bottom of the slope.
f. When more than one layer of geonet is installed, joints shall be staggered.

8.7 Field Quality Control

1. The Installer shall provide the Site CQA Manager with Daily Summary Reports addressing the following:
    - Underlying geomembrane approval for areas anticipated to be covered by geonet
    - The total number and location of panels placed
    - Location of repairs
2. The Field Installation Team Manager and the Site CQA Manager shall provide 100% inspection of the installation to ensure compliance with these technical specifications and Manufacturer recommended procedures.
    a. The surface of the geonet shall be clean and free of debris at the time of inspection.
    b. The Field Installation Manager shall record each roll number and lot number as panels are deployed, and a general description of the location of each panel.
    c. The Field Installation Manager and the Site CQA Manager shall inspect the overlap for each panel.
    d. The Field Installation Manager and the Site CQA Manager shall inspect the anchoring of the geonet.
    e. The Field Installation Manager and the Site CQA Manager shall inspect the geonet for any signs of defects or holes. Any areas requiring repair shall be marked and subsequently repaired in accordance with the Repair Procedures listed in these specifications.
    f. The Field Installation Manager and the Site CQA Manager shall reinspect, verify, and approve repairs and patches.
3. Repair Procedures
    a. Seams and non-seam areas of the geonet shall be inspected for defects, holes, and any sign of contamination by foreign matter in accordance with the Field Quality Control procedures listed in these specifications.
    b. Any defects shall be repaired by the Installer by placing a geonet patch with a minimum 12-inch overlap in all directions.
    c. The patch shall be secured to the original geonet panel by placing HDPE fasteners or polymer braids every 6 inches along the perimeter of the patch.
    d. For any repair method, surfaces shall be clean and dry at the time of the repair.
    e. Each completed repair shall be inspected and approved in accordance with the Field Quality Control procedures listed in this CQA Plan.

9.0 PROTECTIVE SOIL LAYER AND SELECT AGGREGATE

9.1 Protective Soil Layer

1. Protective soil layer material shall be comprised of readily available on-site materials free from organic substance and other deleterious matter typically comprised of materials from the unconsolidated formation at the surface of the site (sometimes referred to as “OAG”).
2. Protective soil layer material will be in direct contact with the geocomposite and shall have rounded particle shapes to avoid potential for damage.

9.2 Select Aggregate

Leachate Collection System Bedding Layer and Sumps

1. Washed select aggregate, shall be used for bedding material around the leachate collection pipes. The select aggregate shall be durable, resistant to weathering and shall be free organic material, and fines < 2% by dry weight.
2. The bedding aggregate shall have particle sizes that range from ¾ inch minimum diameter to 2.0 inch maximum diameter in accordance with ASTM C136.
3 The select aggregate shall have particle shapes that will not damage the HDPE liner with the use of a 10 oz/yd^2 non-woven geotextile cushion layer. The select aggregate shall be approved by the Engineer.

9.3 Conformance Testing

Protective Soil Layer

1. Conformance testing shall be performed on samples from each source of protective soil layer to assure compliance with the specifications. The following tests shall be performed on the samples:
   a. Permeability (ASTM D2434 or Falling Head) [min. 1 test per 2 acres]
   b. Total Thickness Test (survey or direct test) [min. 5 per acre]

Select Aggregate.

1. Gradation analysis shall be performed on samples from each source of the select aggregate to assure compliance with the project specifications (Section 10.2).

9.4 Delivery, Storage and Handling

If protective soil/select aggregate materials are delivered to the site prior to approval, materials shall be stockpiled on-site in areas as dictated by the Owner to facilite approval by the Engineer. Provision shall be implemented to minimize surface water or dust impacts on the stockpile. Removal and placement of the materials shall be conducted in a manner to minimize intrusion of soils adjacent to and beneath the stockpile.

9.5 Protective Soil Layer Placement

1. After the completion of installation and acceptance of the liner system and related work activities, placement of the minimum 24 inch thick protective soil layer will be initiated following approval by the Engineer.
2. During the placement of the protective soil layer material, no construction equipment shall be allowed directly on the geocomposite and any damage shall be repaired immediately by the Contractor in accordance with this CQA Plan.
3. Care shall be taken to protect the liner system. Ramps shall be provided at down slopes and in other heavily traveled areas. Heavily traveled areas shall have a minimum of 3 feet of select material above the liner system.
4. Protective soil layer shall not be placed over folds in the geocompsoite.

5. Protective soil material shall be placed on the side slopes starting at the toe of the slope and working toward the top of the slope/berm.
6. The protective soil layer should be spread when the geocomposite is taut or stretched evenly over the base of the landfill. The protective soil layer material shall not be spread when the geocomposite is elongated due to higher daytime temperatures and/or exposure to sun.
7. Protective soil layer shall not be placed while the soil is frozen or thawing, or during unfavorable weather conditions.

9.6 Select Aggregate Placement

Leachate Collection System Bedding Layer and Sump Select Aggregate

After geosynthetic placement has been approved, placement of non-woven geotextile in the floor of the leachate collection system trench, leachate collection sump and leak detection sump will ensure protection of the geosynthetics from the overlying select aggregate layer.

A. Leachate Collection System Bedding Layer
   1. Placement of a 3 inch bedding layer in the bottom of the trench and on top of the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry wright).
   2. Backfilling of the leachate pipe will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
   3. Backfilling around the leachate pipe will be with the select aggregate to the depth and width shown on the construction drawings.
   4. Haunching of the select aggregate will provide stability to the pipe from the sides and from underneath.
   5. Placement of the select aggregate should be in gradual 4 inch to 6 inch lifts and tamped simultaneously with a blunt tamping tool to ensure the material is well consolidated under and around the pipe.
   6. Backfilling, with the select aggregate, should be brought up to a height of a minimum of 12 inches above the top of the pipe.

B. Leachate Collection Sump and Leachate Detection Sump Select Aggregate Placement
   1. Placement of a 2 foot layer in the sumps and on top of the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry weight).
   2. Backfilling of the leachate collection and riser pipes will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
   3. Backfill around the leachate collection and riser pipes will be with the select aggregate to the depth and width shown on the construction drawings.
   4. Placement of the select aggregate should be in gradual 4 inch to 6 inch lifts and teamped simultaneously with a blunt tamping tool to ensure the aggregrate is well consolidated under the sides of the pipes as well as around it.
   5. Care shall be taken during backfilling such that damage to the leachate collection and riser pipes is avoided.

9.7 Field Quality Control

A. The protective soil layer thickness shall be verified by survey on a minimum frequency of 5 survey points per acre.
B. The protective soil layer thickness may be measured periodically throughout the day during construction to confirm that the thickness of the installed material is in accordance with the Engineering Drawings.
    1. Protective Soil Layer Thickness (i.e., Survey 5/acre, Test Probe, Calibrated cones).

9.8 Protective Soil Layer - Thickness Confirmation Procedure

Due to the effects of wind and stormwater, the protective soil may not maintain a full 24 inch thickness at locations over time. The following procedure (**Table II.7.10**) has proven effective at confirming protective layer thickness at the most important point in time when the protective soil layer is being covered with waste.

TABLE II.7.10
Protective Soil Layer – Supplemental Thickness Confirmation Procedure

1. Prior to advancing the fill face over new sections of the liner, the protective soil cover in these areas may be tested to confirm a thickness not less than 24 inches.
2. The area that may be tested will include the footprint where the next lift of waste will be placed over the protective cover; plus a buffer zone at least 50 feet ahead of the advancing fill face.
3. Add select protective soil material from the designated stockpile in the area to be tested if additional thickness is required.
4. Perform protective cover depth probe by field survey, with a blunt instrument or construction cones (i.e., no shovels) on a spacing not to exceed 100 feet. The instrument shall have a smooth rounded or flat tip, and it shall be advanced carefully until contact with the geosynthetic surface is confirmed. Care must be taken not to damage the geosynthetic surface.
5. The probes or traffic cones shall be calibrated such that the 24 inch length is visible and prominently marked. Record probe test results (both passing and failing) in the Site Log Book and/or on forms provided specifically for this purpose.
6. In sections where the protective cover is less than 24 inches thick, add additional protective soil to the area and retest. Continue this procedure until test locations meet the 24 inch thickness criterion, and the intervening protective cover layer surface appears level and smooth.
7. Record any retest data results in the Site Log Book and/or on forms provided specifically for that purpose (example included in appendix). The information recorded shall include, at a minimum;
    - Testing Date
    - Testing Personnel
    - Probe Identification
    - Approximate Probe Locations
    - Probe Test Results
    - Probe Retest Results
8. Maintain records regarding the protective soil layer on-site at all times for review by OCD inspectors, and by landfill management and engineering personnel.

10.0 GEOTEXTILE

10.1 Geotextile Properties

1. The 10 oz/yd^2 non-woven geotextile shall meet the specifications provided in **Table II.7.11**.
2. The minimum roll width shall be 15 feet, and the maximum roll length shall be 300 feet.

10.2 Manufacturer's Quality Control Documentation

Prior to installation commencement of any geonet composite material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geotextile.

1. Each roll delivered to the project site shall have the following identification information:
    - Manufacturer's name
    - Product identification
    - Thickness
    - Roll number
    - Roll dimensions
2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Table II.7.11**:
    - Thickness (ASTM D5199)
    - Weight (ASTM D5261)
    - Tensile strength (ASTM D4632)
    - Elongation (ASTM D4632)
    - Puncture strength (ASTM D4833)
    - Mullen burst strength (ASTM D3786)
    - Trapezoidal tear strength (ASTM D4533)
    - Coefficient of permeability (ASTM D4491)
    - Permittivity (ASTM D4491)
    - Flow rate (ASTM D4491)
    - UV resistance (ASTM D4355)
    - Apparent opening size (ASTM D4751)

10.3 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory approved by the Engineer at a minimum of one (1) per 100,000 ft^2. The Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory:
    - Weight (ASTM D5261)
    - Tensile strength (ASTM D4632)
    - Puncture strength (ASTM D4833)
    - Mullen burst strength (ASTM D3786)
    - Trapezoidal tear strength (ASTM D4533)
    - Apparent opening size (ASTM D4751)

TABLE II.7.11
Technical Specifications
Non-Woven Geotextile[1]

PHYSICAL PROPERTIES (MARV[2])				
PROPERTY	**QUALIFIER**	**10 oz/yd² UNIT**	**VALUE**	**TEST METHOD[4]**
Weight	MARV	10.0	oz/yd²	ASTM D5261
Thickness	MARV	105	Mils	ASTM D5199
Tensile Strength	MARV	270	Lbs	ASTM D4632
Elongation	MARV	50	%	ASTM D4632
Puncture Strength	MARV	180	Lbs	ASTM D4833
Mullen Burst Strength	MARV	520	psi	ASTM D3786
Tapezoidal Tear Strength	MARV	105	lbs	ASTM D4533
Apparent Opening Size (AOS)	Max ARV[3]	100	US Sieve	ASTM D4751
Coefficient of Permeability	MARV	0.30	cm/sec	ASTM D4491
Permittivity	MARV	1.20	sec^{-1}	ASTM D4491
Flow Rate	MARV	85	gpm/ft²	ASTM D4491
UV Resistance	MARV	70	% Retained @ 500 hrs	ASTM D4355
Roll Width (Nominal)	Measured	15	feet	n/a
Roll Length (Nominal)	Measured	300	feet	n/a

Notes:

1. *Values reported represent Propex Geosynthetics (formerly Synthetic Industries) 1071 Nonwoven.*
2. *Values shown are in weaker principal direction. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, this yields a 97.7% degree of confidence that any samples from quality assurance testing will be in compliance with the target values.*
3. *Maximum Average Roll Values (Max ARV) represent typical plus two standard deriations.*
4. *Geotextiles with greater or equivalent properties may be used for select application.*
5. *Standard test methods will be updated to reflect the most current industry standards.*

2. These conformance tests shall be performed in accordance with **Table II.7.11.**
3. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geotextile. Test results shall meet, or exceed, the property values listed in **Tables II.7.11.** If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If the test values from the resamples pass the acceptable specification values listed in **Table II.7.11,** the lot shall be accepted.

10.4 Installation

1. Leachate Trench/Sump Preparation
   a. Before the geotextile is placed into position in the leachate collection pipe trench, leachate collection sumps, and leak detection sumps, the following procedures will be completed.
      (1) The subgrade at the bottom and sides of the trench and sumps shall be carefully prepared in accordance with this CQA Plan.
      (2) Underlying geosynthetics have been installed in accordance with this CQA Plan.
2. Geotextile Installation
   a. After geosynthetic placement has been approved by the Site CQA Manager, the Geotextile Installer shall place the non-woven geotextile in the bottom of the trench, leachate collection and leachate detection sumps to ensure protection of the underlying geosynthetics from the overlying select aggregate layer.
      (1) Exposure of the geotextiles to the elements between lay down and cover shall be a maximum of 14 days.
      (2) The 10 oz/yd^2 non-woven geotextile shall be placed atop the underlying geosynthetics in the trenches, leak detection sump and leachate collection sump. The geotextile shall be placed such that the centerline of the geotextile lines up with the centerline of the trench. The geotextile shall be joined by overlapping and sewing. Overlapped seams shall have a minimum overlap of 6 inches.
      (3) The Installer shall take care not to damage the underlying geosynthetic materials. The Installer is responsible for any damage to the geotextile and underlying geosynthetics caused during geotextile installation.
3. Field Quality Control
   a. The Site CQA Manager shall inspect the installation for proper placement, sufficient overlap and damaged material. Damaged areas will be repaired in accordance with the Repair Procedures of this CQA Plan.
4. Repair Procedures
   a. A geotextile patch shall be placed over the damaged area and extend three feet beyond the perimeter of the tear or damage.
   b. The Site CQA Manager shall verify repairs.
5. Select Aggregrate Installation
   a. Placement of a 3 inch bedding layer in the bottom of the leachate collection pipe trench and on top of the geotextile will be performed by the Contractor.

b. Placeement of the 2 feet of select aggregrate in the leachate collection and leak detection sumps shall be performed by the Contractor.

6. Leachate Pipe Installation
   a. Installation of the slotted or perforated Sch 80 PVC or SDR 11 HDPE leachate collection pipe onto the bedding layer will be performed in accordance with the Leachate Pipe Specifications.
   b. Installation of the Sch 80 PVC or SDR 11 HDPE sump riser pipes will be performed in accordance with the Geopipe Specifications.
7. Select Aggregate Backfill
   a. Backfill of completed sections of the leachate trench shall be completed only after placement and workmanship have been approved by the Site CQA Manager and the top of leachate pipe has been surveyed to verify grade.
   b. Backfill of the leachate collection and leak detection sumps shall be completed only after placement and workmanship of the riser pipes has been approved by the Site CQA Manager.

11.0 GEOPIPE

11.1 General

The design of the evaporation ponds and landfill cells employ a leak detection system with sumps atop of the secondary liner that are monitored with piping to allow for the removal of liquids that may collect in the detection sump.

The landfill design employs a leachate collection system atop the primary composite liner that includes leachate collection piping and leachate extraction piping. The leachate collection system is comprised of slotted or perforated geopipes which collect leachate seepage through the drainage layer directing it to the permanent or temporary leachate collection sumps where leachate extraction piping is installed. These geopipes are placed within select aggregate and wrapped with a non-woven geotextile material and covered by the granular drainage layer. At the end of each slotted or perforated permanent leachate collection geopipe, a solid geopipe is attached which rises up along the landfill sideslope to allow cleanout of the pipe. The sump extraction geopipes rise along the landfill and pond sideslope to allow extraction of liquid from the leachate collection and leak detection sumps. Leachate collection and leak detection piping design is shown on Engineering Drawings.

11.2 HDPE Geopipe Material Properties

1. High Density Polyethylene (HDPE) Pipe utilized for the leachate collection pipe and leachate extraction pipe will be manufactured in accordance with ASTM D714 and have the following physical characteristics:
   a) Perforated 6-inch diameter HDPE Driscopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.

b) Solid wall 12-inch diameter HDPE Driscopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.
c) Solid wall 4-inch diameter HDPE Discopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.
d) HDPE pipe shall meet the requirements of cell classification PE 345464C or higher cell classification in accordance with ASTM D3350.
e) The slots or perforations must conform with the Engineering Drawings.
f) The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
g) Apart from structural voids and hollows associated with some profile wall designs, the pipe fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other defects.

2. HDPE Pipe Fittings
   a) HDPE fittings shall be manufactured in accordance with the requirements of ASTM E714.
   b) End caps for the clean-out risers will be of low pressure type HDPE, or similar.

11.3 Polyvinyl Chloride (PVC) Geopipe Material Properties

If Polyvinyl Chloride (PVC) Pipe is utilized for the leak extraction or leachate collection pipe, the material will be manufactured in accordance with ASTM D1784 and have the following physical characteristics:

a) PVC pipe will be Schedule 80 or as indicated on the Drawings. The pipes will conform to the requirements of ASTM D1785 and will have the nominal dimensions shown on the Engineering Drawings.
b) Pipe and fitting will be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1, Polyvinyl chloride (PVC) as outlined in ASTM D1784. A Type1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
c) Pipe will be furnished in standard laying lengths not exceeding twenty (20) feet.
d) Fittings will conform to the requirements of ASTM D2467 for socket type joints.
e) Slotted or perforated 6- inch diameter PVC leachate collection pipe as shown on the Engineering Drawings.
f) Solid wall 12-inch diameter PVC leachate extraction pipe as shown on the Engineering Drawings.
g) Solid wall 4-inch diameter PVC leak detection pipe as shown on the Engineering Drawings.
h) The pipe will be solvent welded according to manufacture specifications

11.4 Manufacturer's Quality Control Documentation

Prior to installation of the geopipe, the Contractor shall provide the following information certified by the manufacturer for the delivered geopipe:

1. Manufacturer's certification verifying that the quality of the raw materials used to manufacture the geopipe meets the Manufacturer specifications.
2. Each geopipe length delivered to the project site shall have the following identification information:
   - Manufacturer's name
   - Pipe size
   - Ring stiffness constant classification or SDR number
   - Production code designating plant location, machine, and date of manufacture.

11.5 Delivery, Storage and Handling

1. Off-loading and storage of the geopipe shall be performed by the Contractor.
2. Storage of the geopipe shall not exceed 17 rows high, as per Manufacturer's recommendation.
3. The Contractor shall be responsible for moving the pipes and fittings from the storage area to the area of pipe installation. The Contractor shall be responsible for replacing any material damaged during transport or installation.

11.6 Quality Assurance

1. Finished Product Evaluation
   A. Each length of pipe produced shall be checked by production staff for the items listed below. The results of measurements shall be recorded on production sheets which become part of the Manufacturer's permanent records.
      1) Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.).
      2) Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM D1785.
      3) Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with the Manufacturer's specifications.
      4) Pipe length shall be measured.
      5) Pipe marking shall be examined and checked for accuracy.
      6) Pipe ends shall be checked to ensure they are cut square and clean.

11.7 Installation

11.7.1 Leachate Collection Pipe

1. Leachate Collection Trench Preparation
   A. Before the geopipe is placed into position in the trench, the following procedures will be completed:

1) The subgrade at the bottom and sides of the trench shall be carefully prepared as shown on the Engineering Drawings by the Contractor.
2) The subgrade will be covered by a composite liner by the Liner Installer according to the Engineering Drawings.

2. Geotextile Installation
   A. After composite liner placement has been approved, the Liner Installer shall place the non-woven geotextile in the bottom of the leachate trench to ensure protection of the composite liner from the overlying select aggregate layer in accordance with the Geotextile Cushioning Fabric specifications.
3. Bedding Layer Installation
   A. Placement of a three 3-inch bedding layer in the V-notch trench and above the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry weight) will be performed.
      1) "Spading" with shovels or any other activities which could jeopardize the underlying liner's integrity will not be allowed.
      2) The three (3) inch bedding layer is discussed in more detail under Protective Soil Layer and Select Aggregate (Section 9.0).
4. Leachate Collection Pipe Installation
   A. Polyvinyl Chloride (PVC) Leachate Collection Pipe Installation.
      1) Installation of the 6-inch diameter perforated SCH 80 PVC pipe onto the bedding layer will be performed in such a manner as not to jeopardize the integrity of the pipe.
      2) Each pipe section shall be accurately placed to the line and grade called for on the Engineering Drawings.
      3) Pipe and fittings shall be inspected before being placed and no defective pipe shall be laid. Installation practices shall conform with ASTM D2321 and specific Manufacturer's recommendations.
      4) Trenches shall be kept free from water during pipe laying, jointing or before sufficient backfill has been placed to prevent flotation of the pipe. The Pipe Contractor shall provide ample means and devices to remove and dispose of water promptly from any source entering the construction area of pipe laying.
      5) No connection shall be made where joint surfaces and joint materials have been soiled by earth handling until such surfaces are thoroughly cleaned.
      6) As the work progresses, the interior of pipes shall be kept clean by the Contractor. After each line of pipe has been laid, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
      7) Slots/perforations on adjoining sections of pipe shall remain in alignment after fusion welding.
      8) Two sets of pipe slots/perforations shall be facing vertically down after pipe placement in the trench.
   B. High Density Polyethylene (HDPE) Leachate Collection Pipe Installation
      1) Installation of the 6-inch diameter perforated SDR 11 HDPE pipe onto the bedding layer will be performed in such a manner as not to jeopardize the integrity of the pipe.

2) Trenches shall be kept free from any deleterious material, water or backfill to prevent damage to the pipe. The Contractor shall provide means and devices to remove promptly and dispose of any deleterious material, or water entering the area of pipe laying.
3) Installation practices shall conform with ASTM D2321 and any specific manufacturer's recommendations.
4) HDPE pipe joints shall be butt fused in the field in accordance with the manufacturer's instructions. Fused joints, when tested for tension and pressure, shall be stronger than the pipe itself.
5) As many sections of pipe as practical shall be fused together outside of the lined landfill cell to minimize damage to the liner system during pipe fusion.
6) No connection shall be made where joint surfaces and joint materials have been soiled until such surfaces are thoroughly cleaned.
7) As the work progresses, the interior of pipes shall be kept clean. After each line of pipe has been laid, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
8) Slots/perforations on adjoining sections of pipe shall remain in alignment after fusion welding.
9) Two sets of pipe slots/perforations shall be facing vertically down after pipe placement in the trench.

5. Field Quality Control
   a) After completion of any section of geopipe; the grades, joints, and alignment shall be true to line and grade.
   b) The leachate collection pipe grade shall be surveyed on maximum 50 foot centers for compliance with the approved design.
   c) The Site CQA Manager shall inspect the installation. The pipe shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, dirt, debris or other materials on the inside.
6. Leachate Trench Backfill
   1) The Contractor shall backfill completed sections of pipe trench with additional select aggregate (0.75 inch to 2.0 inch diameter) around and above the pipe to a minimum thickness of 12 inches above the pipe as shown on the Engineering Drawings. Backfilling over the pipe trench will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
   2) Placement of a geotextile layer will be completed as shown on the Engineering Drawings.

11.7.2 Leachate Collection and Leak Detection Sumps

1. Leachate Collection and Leak Detection Sump Preparation
   A. Before the leachate collection and leak detection riser geopipe is placed into position in the sumps, the following procedures will be completed:
      1) The subgrade at the bottom and sides of the sumps shall be carefully prepared as shown on the Engineering Drawings by the Contractor.
      2) The subgrade will be covered by a composite liner by the Liner Installer according to the Engineering Drawings.

2. Geotextile Installation
   A. After composite liner placement has been approved, the Installer shall place the non-woven geotextile in the bottom of the leachate collection and leak detection sumps to ensure protection of the composite liner from the overlying select aggregate layer in accordance with the Geotextile Cushioning Fabric specifications.
3. Select Aggregate Installation
   A. Placement of 2 feet of select aggregate in the sumps and above the geotextile consisting of 0.75 inch minimum diameter to 2.0 inch maximum diameter (min 2% fines by dry weight) will be performed."Spading" with shovels or any other activities which could jeopardize the underlying composite liner's integrity will not be allowed.
4. Leachate Extraction and Leak Detection Pipe Installation
   A. Polyvinyl Chloride (PVC) Leachate Extraction and Leak Detection Pipe Installation.
      1) Installation of the 12-inch or 4-inch diameter SCH 80 PVC pipe in the leachate collection and leak detection sumps will be performed in such a manner as not to jeopardize the integrity of the pipe.
      2) Each pipe section shall be accurately placed to the line and alignment called for on the Engineering Drawings.
      3) Pipe and fittings shall be inspected before being placed and no defective pipe shall be laid. Installation practices shall conform with ASTM D2321 and specific Manufacturer's recommendations.
      4) Sumps shall be kept free from water during extraction pipe installation, jointing or before sufficient select aggregate backfill has been placed to prevent flotation of the pipe. The Pipe Contractor shall provide ample means and devices to remove and dispose of water promptly from any source entering the construction area of pipe laying.
      5) No connection shall be made where joint surfaces and joint materials have been soiled by earth handling until such surfaces are thoroughly cleaned.
      6) As the work progresses, the interior of pipes shall be kept clean by the Contractor. After each extraction pipe has been laid along the side slope, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
      7) Slots/perforations on the bottom 6 feet of the leachate extraction and leak detection riser pipes shall be as shown on the Engineering Drawings.
   B. High Density Polyethylene (HDPE) Leachate Collection and Leak Detection Pipe Installation
      1) Installation of the 12-inch or 4-inch diameter SDR 11 HDPE pipe in the leachate collection and leak detection sumps will be performed in such a manner as not to jeopardize the integrity of the pipe.
      2) Each pipe section shall be accurately placed to the line and alignment called for on the Engineering Drawings.
      3) The leachate collection and leak detection sumps shall be kept free from any deleterious material, water or backfill to prevent damage to the pipe. The Contractor shall provide means and devices to remove promptly and dispose of any deleterious material, or water entering the area of pipe laying.

4) Installation practices shall conform with ASTM D2321 and any specific manufacturer's recommendations.
5) HDPE pipe joints shall be butt fused in the field in accordance with the manufacturer's instructions. Fused joints, when tested for tension and pressure, shall be stronger than the pipe itself.
6) As many sections of pipe as practical shall be fused together outside of the composite lined area to minimize damage to the composite liner during pipe fusion.
7) No connection shall be made where joint surfaces and joint materials have been soiled until such surfaces are thoroughly cleaned.
8) As the work progresses, the interior of pipes shall be kept clean. After each line of pipe has been laid along the side slope, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
9) Slots/perforations on the bottom 6 feet of the leachate extraction and leak detection riser pipes shall be as shown on the Engineering Drawings.

5. Field Quality Control
   a) After completion of any section of the leachate collection and leak detection geopipe; the joints and alignment along the side slopes shall be true to line and alignment.
   b) The Site CQA Manager shall inspect the installation. The pipe shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, dirt, debris or other materials on the inside.
   c) Placement of a geotextile layer will be completed as shown on the Engineering Drawings.

12.0 ENGINEERING CERTIFICATION

An Engineering Certification Report, incorporating the laboratory and field data, shall be submitted by Engineer to the New Mexico Energy, Minerals and Natural Resources Department, Oil Conservation Division confirming that the subgrade, liner, leak detection system and leachate collection system have been installed in compliance with the project specifications and the CQA Plan. The Engineering Certification Report shall be sealed by a Professional Engineer registered in good standing with New Mexico; and who has applicable expertise in landfill liner engineering.

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ATTACHMENT II.7.A

LINER QUALITY CONTROL PROJECT SPECIFICATIONS

Liner Quality Control Project Specifications
DNCS Environmental Solutions

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1. Project Data

Site Name: _____ Date Prepared _____

Project/Cell: _____

Project Number _____ Project Start Date _____

Project Size _____ Acres or ft^2

Location _____

_____

Client Contact: _____

Phone: _____

Site Phone: _____

		Initials
I Project Manager	_____	_____
CQA Officer	_____	_____
CQA Technicians	_____	_____
	_____	_____
	_____	_____

Project Documentation Available

CQA Plan _____ Construction Drawings _____ Health and Safety Plan _____

Other: _____

Comments: _____

_____

_____

2. Subgrade/Soil Liner

2.1 Grade Control (Survey) Area: _____ Acres or ft^2

Performed By: _____ Date Performed: _____

Tolerance (vert) _____ feet or inches As-Built Drawing(s) Available? Y or N

_____

Thickness _____ feet or inches **NMED Standard = 1 per acre**

2.2 Compaction

		Sample ID	Maximum Density	Optimum Moisture
Reference Proctor(s)	_____ lb/ft^3	_____		
Standard (ASTM D698)	_____ lb/ft^3	_____		
Modified (ASTM D1557)	_____ lb/ft^3	_____		

Specifications

Density _____ % of Optimum Moisture _____ lb/ft^3

_____ lb/ft^3

Number of Lifts: _____ Lift Thickness (inches):

Loose: _____ Compacted: _____

Field Test Frequency: _____ per: acre/lift yd^3 other units: _____

Compaction Test Method: Nuclear Density Meter or Other: _____

Total Number of Density Tests Required _____ **NMED Standard = 4/acre/lift**

Field Permeability Tests required? Y or N Perm Test Method _____

2.3 Soil Classification Standards

Acceptable USCS: (circle or box)

GW	SW	ML	MH
GP	SP	CL	CH
GM	SM	OL	OH
GC	SC		

Subgrade/Liner Material Testing:

in situ _____ borrow source: _____

Testing Frequency		Quality Requirements	
Project	NMED	Project	NMED

Grain Size:

#200 Sieve _____ (percent passing)

C_u (D_{60}/D_{10}) _____

Other _____

Atterberg Limits: P.I.

Liquid Limit _____

Plastic Limit _____

Other _____

Laboratory Permeability: _____

2.4 Surface Preparation Y or N

_____ smooth surface

_____ remove angular material

_____ remove organic material

_____ remove rocks greater than _____ inches

3.0 Geosynthetics **Conformance Tests**

3.1 GCL

Area: _____ Acres or ft^2

Specifications:

collected by _____
performed by _____
frequency _____
total number _____

3.2 FML

Specifications: _____ 60 mil
_____ other

collected by _____
performed by _____
frequency _____
total number _____

HDPE Smooth Area: _____ Acres or ft^2

HDPE Textured Area: _____ Acres or ft^2

Other _____ Area: _____ Acres or ft^2

3.3 Geotextile (not including leachate system)

Specifications: oz
Woven or Nonwoven

Area: _____ Acres or ft^2

collected by _____
performed by _____
frequency _____
total number _____

3.4 Geonet

Area: _____ Acres or ft^2

Specifications: _____ thickness

collected by _____
performed by _____
frequency _____
total number _____

with Geotextile:
upper _____ lower _____

4.0 Leachate Collection System

Conformance Tests

4.1 Piping

Collection System — Specifications: _____
Linear Quantity — Material _____
Diameter _____
_____

Risers — Specifications: _____
Linear Quantity — Material _____
Diameter _____

4.2 Aggregate

Specifications:
greater than
smaller than

collected by _____
performed by _____
frequency _____
total number _____

4.3 Geotextile

Specifications: oz
Woven or Nonwoven

Area: _____ Acres or ft^2

collected by _____
performed by _____
frequency _____
total number _____

4.4 Sump

Design volume _____ yd^3 or gallons
Double Lined? Y or N
Area of double liner _____ ft^2

5.0 Protective Soil Layer

Conformance Tests

Area: _____ Acres or ft^2

Thickness (inches): _____

Volume _____ yd^3

performed by _____
frequency _____
total number _____

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ATTACHMENT II.7.B

APPROVAL/AUTHORIZATION TO PROCEED FORM

APPROVAL/AUTHORIZATION TO PROCEED FORM

THE FOLLOWING LINER SYSTEM SURFACE IS DEEMED ACCEPTABLE ON A VISUAL INSPECTION BY LINER CONTRACT REPRESENTATIVE:

PROJECT: _____

LAYER:
1. SUBGRADE _____
2. GEOSYNTHETIC CLAY LINER (GCL) _____
3. HDPE GEOMEMBRANE (FML) _____
4. GEONET _____

LOCATION: _____ TO _____

_____ TO _____

REMARKS: _____

_____

_____

_____

_____

_____

THE ABOVE NOTED LAYER IS NOW ACCEPTABLE FOR COVERING BY THE NEXT LAYER.

AUTHORIZATION BY:

LINER CONTRACTOR REPRESENTATIVE

_____ _____
SIGNATURE DATE

_____
PRINT NAME

SUBMITTED TO:

CQA REPRESENTATIVE

_____ _____
SIGNATURE DATE

_____
PRINT NAME

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ATTACHMENT II.7.C

DAILY SUMMARY REPORT

DAILY SUMMARY REPORT

Project:		**Project No.:**	
Owner:		**Date:**	
Project Location:		**Report No.:**	
Weather:	A.M: ˚F,		
	P.M.: ˚F,		

Contractor(s)

Summary of Daily Construction Progress and Inspections:

Summary of Problems and Resolutions:

Equipment:

Summary of Meeting Held and Attendees:

Site CQA Technician	GEI CQA Officer
_____	_____
Signture	Signture
_____	_____
Print Name	Print Name

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ATTACHMENT II.7.D

FIELD COMPACTION TESTING FORM

FIELD COMPACTION TESTING FORM

PROJECT INFORMATION	
PROJECT NAME:	PROJECT NO.:
OWNER:	DATE:
PROJECT LOCATION:	PAGE NO.:
TESTING INSTRUMENT	TECHNICIAN:
REFERENCE STANDARD PROCTOR (RSP):	REFERENCE MOISTURE (%):

TEST NUMBER	DRY DENSITY (PCF)	% RSP	% MOISTURE

TEST NUMBER	DRY DENSITY (PCF)	% RSP	% MOISTURE

REVIEWED BY: ______________________ **DATE:** ______________________

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ATTACHMENT II.7.E

GCL INVENTORY CONTROL LOG

GCL INVENTORY CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION _____ **SHEET NUMBER:** _____

MATERIAL TYPE: _____ **DATE OF INVENTORY:** _____
MATERIAL IDENTIFICATION: _____ **INVENTORY MONITOR:** _____
MATERIAL MANUFACTURER: _____ **UNLOADING METHOD:** _____

	ROLL NUMBER	BATCH OR LOT NO.	MATERIAL DIMENSIONS			MANUF. QC CERT. (Y/N)	CONFORMANCE SAMPLE (Y/N)	REMARKS
			LENGTH (FT)	WIDTH (FT)	AREA (FT^2)			
1								
2								
3								
4								
5								
6								
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

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ATTACHMENT II.7.F

FML INVENTORY CONTROL LOG

FML INVENTORY CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION _____ **SHEET NUMBER:** _____

MATERIAL TYPE: _____ **DATE OF INVENTORY:** _____
MATERIAL IDENTIFICATION: _____ **INVENTORY MONITOR:** _____
MATERIAL MANUFACTURER: _____ **UNLOADING METHOD:** _____

	ROLL NUMBER	BATCH OR LOT NO.	MATERIAL DIMENSIONS			MANUF. QC CERT. (Y/N)	CONFORMANCE SAMPLE (Y/N)	REMARKS
			LENGTH (FT)	WIDTH (FT)	THICKNESS OR WEIGHT			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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REVIEWED BY: _____ **DATE:** _____

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ATTACHMENT II.7.G

GEONET INVENTORY CONTROL LOG

GEONET INVENTORY CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION _____ **SHEET NUMBER:** _____

MATERIAL TYPE: _____ **DATE OF INVENTORY:** _____
MATERIAL IDENTIFICATION: _____ **INVENTORY MONITOR:** _____
MATERIAL MANUFACTURER: _____ **UNLOADING METHOD:** _____

	ROLL NUMBER	BATCH OR LOT NO.	MATERIAL DIMENSIONS			MANUF. QC CERT. (Y/N)	CONFORMANCE SAMPLE (Y/N)	REMARKS
			LENGTH (FT)	WIDTH (FT)	THICKNESS OR WEIGHT			
1								
2								
3								
4								
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REVIEWED BY: _____ **DATE:** _____

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ATTACHMENT II.7.H

GEOTEXTILE INVENTORY CONTROL LOG

GEOTEXTILE INVENTORY CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION _____ **SHEET NUMBER:** _____

MATERIAL TYPE: _____ **DATE OF INVENTORY:** _____
MATERIAL IDENTIFICATION: _____ **INVENTORY MONITOR:** _____
MATERIAL MANUFACTURER: _____ **UNLOADING METHOD:** _____

	ROLL NUMBER	BATCH OR LOT NO.	MATERIAL DIMENSIONS			MANUF. QC CERT. (Y/N)	CONFORMANCE SAMPLE (Y/N)	REMARKS
			LENGTH (FT)	WIDTH (FT)	THICKNESS OR WEIGHT			
1								
2								
3								
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REVIEWED BY: _____ **DATE:** _____

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ATTACHMENT II.7.I

LEACHATE COLLECTION AND EXTRACTION PIPE INVENTORY CONTROL LOG

LEACHATE COLLECTION AND EXTRACTION PIPE INVENTORY CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION: _____ **SHEET NUMBER:** _____

MATERIAL TYPE: _____ **DATE OF INVENTORY:** _____
MATERIAL IDENTIFICATION: _____ **INVENTORY MONITOR:** _____
MATERIAL MANUFACTURER: _____ **UNLOADING METHOD:** _____

	TYPE	QUANTITY	MATERIAL DIMENSIONS			MANUF. QC CERT. (Y/N)	TOTAL LENGTH (FT)	DATE INVENTORIED
			LENGTH (FT)	DIA. (IN)	PIPE SDR			
1								
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REVIEWED BY: _____ **DATE:** _____

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ATTACHMENT II.7.J

GCL DEPLOYMENT LOG

GCL DEPLOYMENT LOG

PROJECT NAME: ______________________ **PROJECT NUMBER:** ____________
OWNER: ______________________ **CONTRACTOR:** ____________
PROJECT LOCATION: ______________________ **SHEET NUMBER:** ____________

PANEL NUMBER	ROLL NUMBER	APPROXIMATE LENGTH (FT)	APPROXIMATE WIDTH (FT)	APPROXIMATE AREA (FT^2)	DATE INSTALLED
			TOTAL LINER PLACED (FT^2):		

REVIEWED BY: ____________________ **DATE:** ________________

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ATTACHMENT II.7.K

FML DEPLOYMENT LOG

FML DEPLOYMENT LOG

PROJECT NAME: ______________________ **PROJECT NUMBER:** ____________
OWNER: ______________________ **CONTRACTOR:** ____________
PROJECT LOCATION: ______________________ **SHEET NUMBER:** ____________

PANEL NUMBER	ROLL NUMBER	APPROXIMATE LENGTH (FT)	APPROXIMATE WIDTH (FT)	APPROXIMATE AREA (FT^2)	DATE INSTALLED
TOTAL LINER PLACED (FT^2):					

REVIEWED BY: ________________ **DATE:** ____________

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ATTACHMENT II.7.L

FML TRIAL SEAMING TEST LOG

FML TRIAL SEAMING TEST LOG

PROJECT INFORMATION		PROJECT SPECIFICATIONS					
PROJECT NAME:	PROJECT NUMBER:	FUSION	TEXTURED:	PEEL	98 lbs/in	SHEAR	121 lbs/in
OWNER:	CONTRACTOR:		SMOOTH:	PEEL	98 lbs/in	SHEAR	121 lbs/in
PROJECT LOCATION:	SHEET NUMBER:	EXTRUSION	TEXTURED:	PEEL	78 lbs/in	SHEAR	121 lbs/in
			SMOOTH:	PEEL	78 lbs/in	SHEAR	121 lbs/in

DATE	TIME	QC INITIALS	WELDER'S INITIALS	MACHINE NUMBER	WEDGE WELDS		EXTRUSION WELDS		PULL	FIELD TEST RESULTS				
					Temperature	Speed	Barrel Temp	Pre-Heat Temp		Test #1	Test #2	Test #3	Test #4	Test #5
									P					
									P					
									S					
									P					
									P					
									S					
									P					
									P					
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REVIEWED BY: ______________________ **DATE:** ______________________

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ATTACHMENT II.7.M

FML SEAMING LOG

FML SEAMING LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION: _____ **SHEET NUMBER:** _____

	DATE	PANEL #/PANEL #	APPROX. LENGTH WELDED	START TIME	SEAMER INITIALS	MACHINE #	TEMP SETTING	SPEED SETTING	DESTRUCTIVE TEST	MONITORED BY
1										
2										
3										
4										
5										
6										
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24										
25										

REVIEWED BY: _____ **DATE:** _____

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ATTACHMENT II.7.N

FML SEAM PRESSURE TEST LOG

FML SEAM PRESSURE TEST LOG

PROJECT INFORMATION			PROJECT SPECIFICATIONS
PROJECT NAME:	PROJECT NUMBER:		MIN START PSI:
OWNER:	CONTRACTOR:		TEST DURATION:
PROJECT LOCATION	SHEET NUMBER:		MAX PSI DROP:

	DATE	PANEL #/PANEL #	TESTER	TIME		PRESSURE		MONITORED BY	PASS/FAIL
				START	FINISH	INITIAL	FINAL		
1									
2									
3									
4									
5									
6									
7									
8									
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10									
11									
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55									

REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

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ATTACHMENT II.7.O

FML DESTRUCTIVE FIELD TEST RECORD

FML DESTRUCTIVE FIELD TEST RECORD

PROJECT INFORMATION	
PROJECT NAME:	**PROJECT NUMBER:**
OWNER:	**CONTRACTOR:**
PROJECT LOCATION:	**SHEET NUMBER:**

PROJECT SPECIFICATIONS					
FUSION	TEXTURED:	PEEL	98 lbs/in	SHEAR	121 lbs/in
	SMOOTH:	PEEL	98 lbs/in	SHEAR	121 lbs/in
EXTRUSION	TEXTURED:	PEEL	78 lbs/in	SHEAR	121 lbs/in
	SMOOTH:	PEEL	78 lbs/in	SHEAR	121 lbs/in

DATE	DT #	QC INITIALS	WELDER'S INITIALS	MACHINE NUMBER	WEDGE WELDS		EXTRUSION		PULL	FIELD TEST RESULTS					COMMENTS
					Temperature	Speed	Barrel Temp	Pre-Heat Temp		Test #1	Test #2	Test #3	Test #4	Test #5	
									P						
									P						
									S						
									P						
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REVIEWED BY: ______________________ **DATE:** __________________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

ATTACHMENT II.7.P

FML SEAM VACUUM TEST/REPAIR LOG

FML SEAM VACUUM TEST/REPAIR LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____
OWNER: _____ **CONTRACTOR:** _____
PROJECT LOCATION: _____ **SHEET NUMBER:** _____

	REPAIR DATE	PANEL	TYPE OF REPAIR	REPAIR TECH	NUMBER OF LEAKS	TESTING TECH ID	DATE ACCEPTED	COMMENTS
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

ATTACHMENT II.7.Q

GEONET DEPLOYMENT LOG

GEONET DEPLOYMENT LOG

PROJECT NAME: ______________________ **PROJECT NUMBER:** ____________
OWNER: ______________________ **CONTRACTOR:** ____________
PROJECT LOCATION: ______________________ **SHEET NUMBER:** ____________

PANEL NUMBER	ROLL NUMBER	APPROXIMATE LENGTH (FT)	APPROXIMATE WIDTH (FT)	APPROXIMATE AREA (FT^2)	DATE INSTALLED
TOTAL LINER PLACED (FT^2):					

REVIEWED BY: ______________________ **DATE:** ____________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

ATTACHMENT II.7.R

GEOTEXTILE DEPLOYMENT LOG

GEOTEXTILE DEPLOYMENT LOG

PROJECT NAME: ____________________ **PROJECT NUMBER:** ____________
OWNER: ____________________ **CONTRACTOR:** ____________
PROJECT LOCATION: ____________________ **SHEET NUMBER:** ____________

PANEL NUMBER	ROLL NUMBER	APPROXIMATE LENGTH (FT)	APPROXIMATE WIDTH (FT)	APPROXIMATE AREA (FT^2)	DATE INSTALLED
TOTAL LINER PLACED (FT^2):					

REVIEWED BY: ____________________ **DATE:** ____________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 8: VADOSE ZONE MONITORING PLAN

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APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 8: VADOSE ZONE MONITORING PLAN

1.0 INTRODUCTION

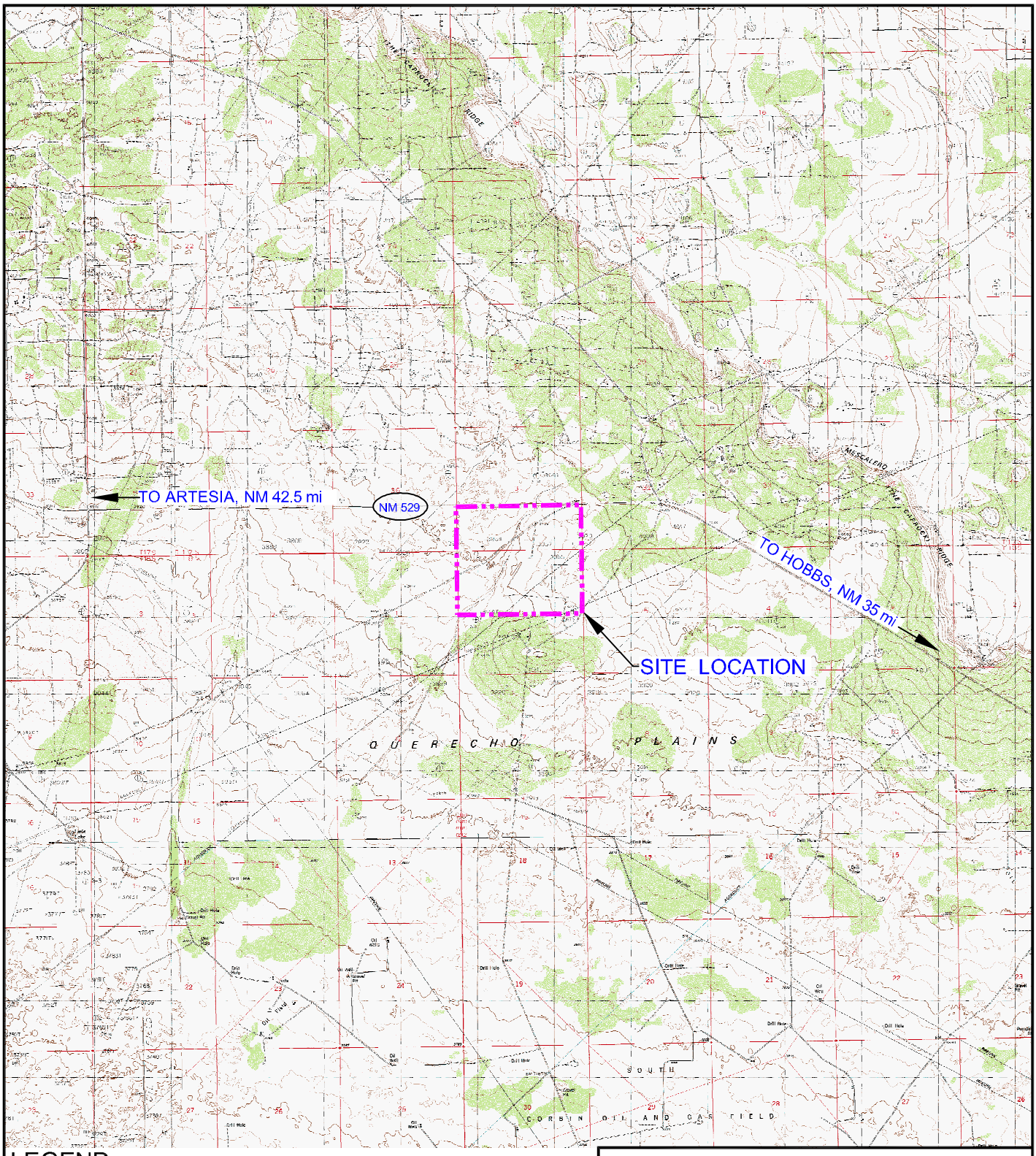
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 Purpose

The purpose of this Vadose Zone Monitoring Plan (the Plan) is to provide DNCS plans for the monitoring, recordkeeping, and reporting procedures for the site's vadose zone monitoring system. The Plan, as presented herein, is based, in part, on the OCD-approved "Proposal for Vadose Zone Monitoring" provided as **Attachment II.8.A**. The Plan identifies the locations of up to ten vadose zone monitoring points that are positioned appropriately to provide for early detection of potential fluid releases at the site; and provides additional guidance for monitoring point installation.

1.2 Site Location

The DNCS site is located approximately 10.5 miles east of the US 82/NM 529 intersection 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 II.1.1**). Site access will be provided via the south side of NM 529.



LEGEND

SITE BOUNDARY

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, 2013-15:20:04 ; 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 II.8.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

1.3 Facility Description

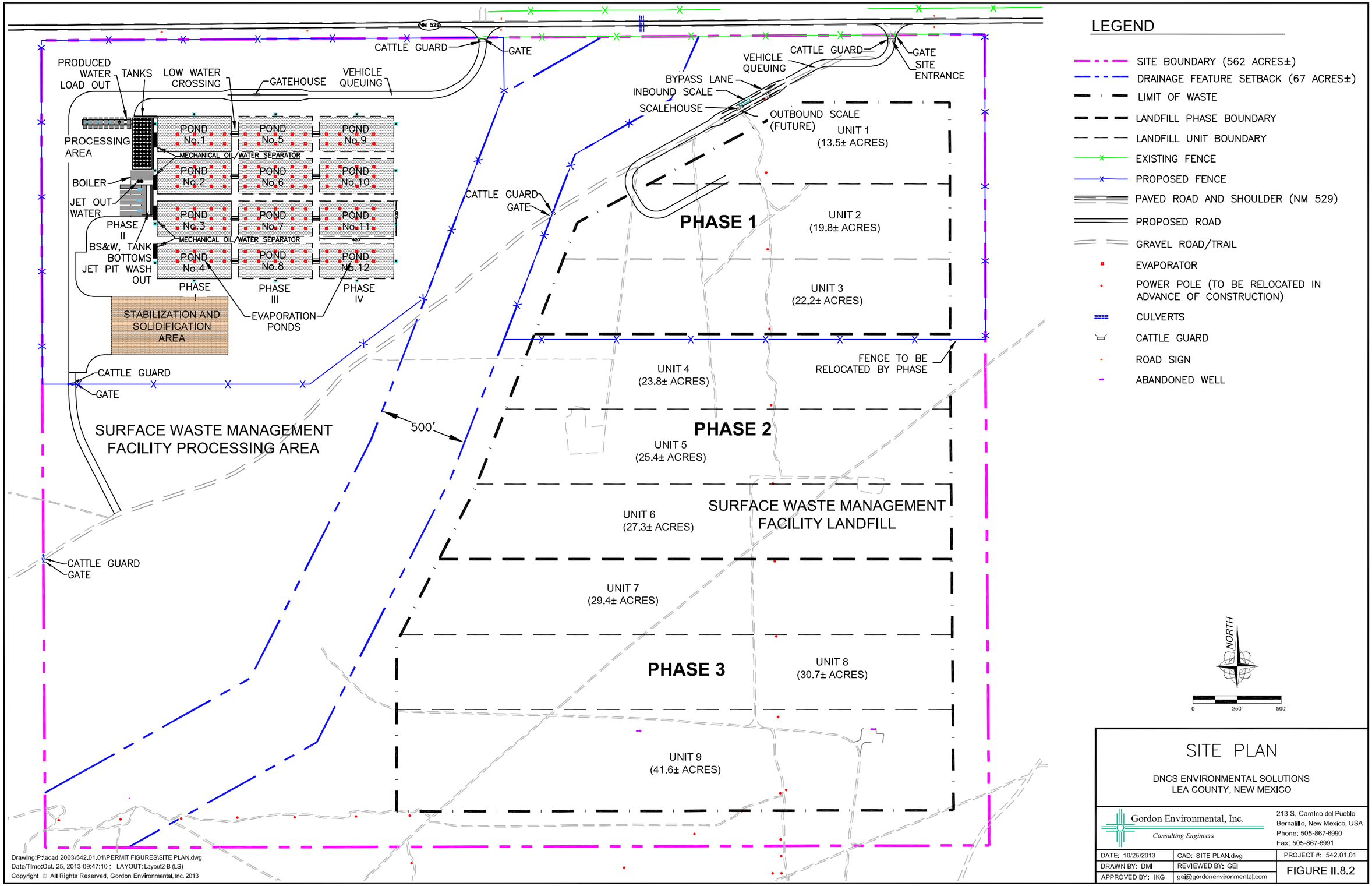
The 562-acre tract is intersected by a drainage feature that will be excluded from development, which includes minimum 250 foot (ft) from the centerline setbacks and totals 67 acres ±. The DNCS Facility will include two main components; a liquid oil field waste Processing Area (177 acres ±), and an oil field waste Landfill (318 acres ±); totaling 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 II.8.2** identifies the locations of the Processing Area and Landfill facilities. The proposed facilities will be developed in four primary phases; which are described in the Operations, Inspection, and Maintenance Plan (**Volume II.1**).

2.0 VADOSE ZONE MONITORING NETWORK

The proposed vadose zone monitoring system for the DNCS Facility is designed to provide for earliest possible detection of potential fluid releases from the Landfill. The hydrogeologic setting described in **Attachment II.8.A** provides the detailed rationale for establishing the vadose zone monitoring network for the site. In summary, the vadose zone monitoring wells (VWs) will be positioned such that downgradient wells are located downslope on the mapped upper redbed surface (i.e., Triassic Chinle) to the west of the Facility, and upgradient wells will be placed upslope on the redbed surface near the southeast corner and along the east boundary of the Facility (**Figure II.8.2**). The redbed structure map provided as **Figure II.8.3** presents a detailed depiction of the terrain on the redbed surface at the Facility; as well as a high confidence level that the proposed downgradient VWs are positioned directly downslope from the proposed waste disposal area in the zone most appropriate for detection of a potential release.

2.1 Monitoring Well Locations

Figure II.8.4 depicts the location of the proposed vadose zone monitoring network designed specifically to address both the known slope of the redbed surface, and the locations of the planned leachate collection sumps for the Landfill. The leachate collection sumps represent the most downgradient termini of the leachate collection system; are the deepest penetrations of the surface deposits; and are vertically most proximate to the redbed surface (e.g., 15 – 30 ft). In addition, the individual disposal cell sumps are the locations with the greatest potential for leachate head development due to their downgradient positions.

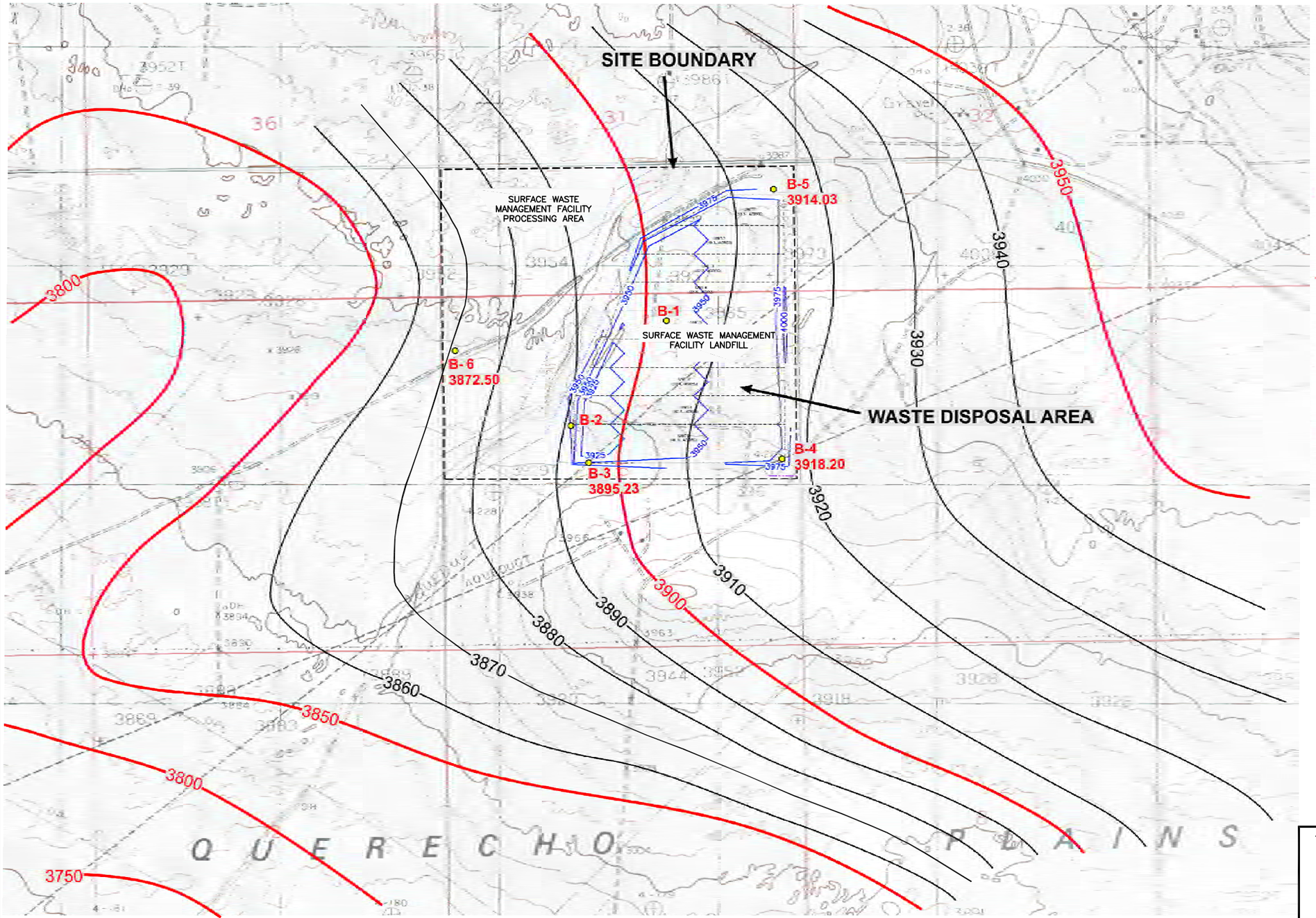


SITE PLAN

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 II.8.2
APPROVED BY: IKG	gei@gordonenvironmental.com	



B-5 3914.03 — Location of site geotechnical boring showing designation and elevation of top of redbeds (feet above MSL)

3950 — Isopleth on top of redbeds by Nicholson and Clebsch (1961)

3910 — Interpolated Isopleth on upper redbed surface using site boring data and 10-ft contour interval (feet above MSL)

3950 — Landfill Base Grades

NORTH

NOMINAL SCALE 1'=1500'

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: 10/18/2013	CAD: REDBED.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.8.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\REDBED.dwg
Date/Time:Oct. 18, 2013-14:00:08 ; LAYOUT: B (LS)

SURFACE WASTE MANAGEMENT FACILITY PROCESSING AREA (±177 ACRES) WEST TRACT

VW-1
VW-2
VW-3
VW-4
VW-5
VW-6
VW-7
VW-8
VW-9
VW-10

SUMP 1
SUMP 2
SUMP 3
SUMP 4
SUMP 5
SUMP 6
SUMP 7

PHASE 1
UNIT 1 (13.5± ACRES)
UNIT 2 (19.8± ACRES)
UNIT 3 (22.2± ACRES)

PHASE 2
UNIT 4 (23.8± ACRES)
UNIT 5 (25.4± ACRES)
UNIT 6 (27.3± ACRES)
UNIT 7 (29.4± ACRES)

SURFACE WASTE MANAGEMENT FACILITY LANDFILL (318± ACRES) EAST TRACT

PHASE 3
UNIT 8 (30.7± ACRES)
UNIT 9 (41.6± ACRES)

500'

LEGEND

- EXISTING 5' CONTOUR
- 3975 EXISTING 25' CONTOUR
- 3975 25' DESIGN CONTOUR
- TOE OF SLOPE
- SUMP 1 RISER/SUMP AND ID
- SITE BOUNDARY
- WASTE BOUNDARY
- UNIT BOUNDARY
- PHASE 1–3 BOUNDARY
- PROPOSED UPGRADIENT VADOSE MONITORING WELL
- PROPOSED DOWNGRADIENT VADOSE MONITORING WELL
- PROPOSED SUPPLEMENTAL DOWNGRADIENT VADOSE MONITORING WELL
- REDBED SURFACE GRADIENT
- 28 3971.91 CONTROL POINT
- N 650,000 E 738,000 SITE GRID

NORTH

0 250 500

VADOSE ZONE MONITORING NETWORK

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: VADOSE WELL LOC.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE II.8.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

The monitoring network strategy consists of the following elements, which are designed to correlate with the Landfill site development sequence shown in **Figure II.8.4**:

1. Following permitting, and prior to Landfill development, wells VW-1, VW-2, and VW-3 will be installed to evaluate ambient conditions; and will be constructed in accordance with the specifications listed in Section 2.2. Well VW-1 will serve as the upgradient monitoring point for Phase 1 operations; and the northern portion of Phase 2 operations. Wells VW-2 and VW-3 will be positioned as "sentinel" downgradient wells for Phase 1 (i.e., Units 1-3), and are specifically located adjacent to Sumps 1 and 3 based on the logic discussed above.
2. Downgradient well VW-4 will be installed prior to the development of Phase 2 (i.e., Units 4-6) in order to evaluate pre-construction conditions; and is deliberately positioned adjacent to Sump 5 for central Unit 5. Well VW-5 will be installed prior to the development of Phase 3, and will serve as the general upgradient monitoring point for all future Landfill development. Well VW-6 is the downgradient sentinel well for Phase 3, and will be installed prior to development of disposal Units 7-9.
3. Shown on **Figure II.8.4** are four additional downgradient monitoring points (i.e., wells VW-7 through VW-10) that may be added incrementally dependent upon monitoring results from the primary network (i.e., wells VW-1 through VW-6). These future wells will be installed to the same specifications prescribed in Section 2.2; and the well locations may be adjusted in consultation with OCD.

2.2 Well Drilling and Completion

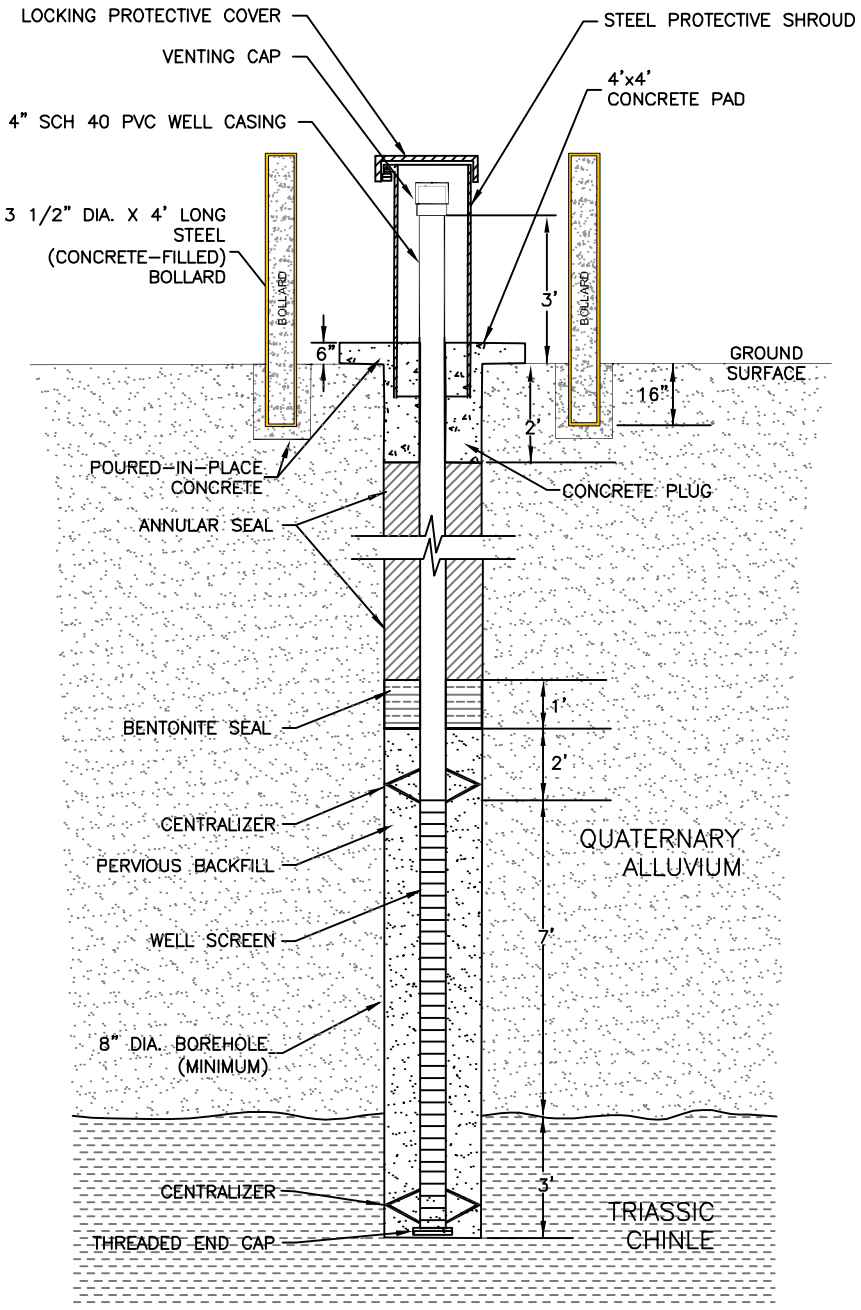
Prior to installation of the vadose zone monitoring wells, drilling permits will be obtained from the New Mexico Office of the State Engineer (NMOSE). The vadose zone monitoring wells will be installed using hollow-stem auger drilling methods; and no fluids will be introduced into the borings during drilling. Undisturbed, depth-referenced samples of penetrated sediments will be collected on at least 5-ft intervals using split-spoon sampling equipment. Drive blow counts will be logged during each sampling interval to allow precise determination of the upper redbed surface in each boring; which has typically been well-defined during other subsurface investigations. A qualified hydrogeologist will be present on-site during drilling activities; and will prepare detailed descriptions of the lithology, texture, sorting, rounding, color, and degree of lithification and moisture content of each sample and stratigraphic unit that is penetrated.

Although split-spoon sampling offers ample opportunity to identify saturated sediments with a high degree of confidence, each boring will be further evaluated for the presence of free water. Upon reaching total depth, the drilling rig will be placed on standby for a minimum of two hours, during which time the inside of the augers will be sounded to check for the potential for accumulating fluid.

The vadose zone monitoring wells will be constructed in accordance with the specifications set forth in **Table II.8.1**, and the well detail sheet provided as **Figure II.8.5**:

TABLE II.8.1
Vadose Zone Monitoring Well Installation Specifications
DNCS Environmental Solutions

- The well borehole will be drilled a minimum of 4 inches (in) larger than the casing diameter to allow for the emplacement of the well casing and annular space materials.
- Each boring will be advanced approximately 3 ft into the indurated Triassic redbed.
- Care will be taken not to introduce contamination to the well, i.e., all tools will be decontaminated prior to drilling the borehole.
- Each well will be constructed with 4-in inside diameter (ID) Schedule 40 (SCH 40) polyvinylchloride (PVC) flush-joint casing equipped with a threaded end cap.
- The well casing will extend from the bottom of the borehole to at least 3 ft above ground surface.
- The well casing will be constructed with a 10-ft length of 0.010-in slotted well screen. The well screen will be positioned with the lowermost portion extending approximately 3 ft below the detected upper redbed surface and the upper portion extending approximately 7 ft into the overlying alluvium. Casing centralizers will be placed at the top and bottom of the screened interval as shown on **Figure II.8.5**.
- The remaining well casing will be constructed with solid 4-in ID SCH 40 PVC flush-joint casing equipped with a venting cap.
- The annular space from the bottom of the borehole to 2 ft above the top of the well screen will be packed with 10-20 grade silica sand.
- A minimum of 1 ft of the annular space above the upper surface of the silica sand will be sealed with hydrated granular bentonite or bentonite chips.
- The annular space above the bentonite seal to 3 ft below ground surface will be sealed with bentonite-cement grout (minimum 2% - 5% bentonite).
- The upper 3 ft of the annular space will be filled with concrete to anchor a steel protective shroud.
- The steel protective shroud shall be minimum 6-inch ID, and will be equipped with a 2-piece cast locking protective cover. The locking protective cover shall be positioned a minimum of 6 in from the top of the PVC well casing to allow for easy access for removal of the PVC vent cap.
- A 4-ft x 4-ft x 6-in-thick concrete pad will be poured around the steel protective shroud. The pad will be radially sloped away from the well to promote stormwater drainage away from the well; and will be protected on each corner by a steel, concrete-filled bollard.
- The top of PVC casing, top of steel shroud, and top of concrete pad of the new monitoring well will be surveyed, referenced to a standard horizontal grid and elevations relative to the site control; and will be subsequently mapped by a licensed surveyor. The location of the well will be determined to within one-tenth of a foot, and the height above sea level at the top of the casing will be determined to within one-hundredth of a foot.
- Well completion data; NMOSE drilling permits and well records; and survey location information will be submitted to OCD in a "Well Completion Report".



TYPICAL VADOSE ZONE MONITORING WELL

NOT TO SCALE

LEGEND

CASING: 4" DIA. SCH 40 PVC

SCREEN: 4" DIA. 0.010" MACHINE SLOT SCH 40 PVC

PERVIOUS BACKFILL: 10-20 COLORADO® SILICA SAND OR EQUIVALENT

ANNULAR SEAL: NEAT CEMENT WITH 2% TO 5% BENTONITE

NOTE:

SPECIFIC VERTICAL DIMENSIONS FOR EACH NEW WELL WILL BE INCLUDED IN OSE AND OCD SUBMITTALS.

VADOSE ZONE MONITORING WELL CONSTRUCTION DETAIL

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: VADOSE MW .dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: MJC	FIGURE II.8.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

3.0 VADOSE ZONE MONITORING PROGRAM

Evidence of fluids in the VWs should not necessarily be attributed to impacts from the Landfill; and the fluid's origin must be interpreted correctly. For example, reconfiguration of Facility stormwater controls may alter surface water recharge to the subsurface, and it is possible that some liquids may accumulate in a monitoring well from condensation within the well casing. The following sections describe the planned monitoring protocol for the DNCS Facility vadose zone monitoring network.

3.1 Monitoring Schedule

The proposed vadose zone monitoring program will initially include inspection of each well for the presence of fluid in advance of the applicable disposal area construction. After the initial inspection, each VW will be monitored for the presence of free liquids on a monthly basis for a period of 12 months. If the monthly monitoring results continually indicate the absence of fluid, the subject wells will be transitioned to quarterly monitoring. The continued lack of fluids in the VWs may be the subject of future specific approvals by OCD for a reduced monitoring frequency (i.e., semi-annual).

3.2 Monitoring Assessment

Monitoring for the presence of liquid will be performed by lowering a calibrated electronic tape (i.e., water level indicator) that emits an audible signal when a water surface is penetrated. Total well depth measurements will also be recorded with the same electronic tape. **Attachment II.8.B** to this Plan is a typical field information form that may be used for routine vadose zone monitoring purposes.

If the water level indicator shows that free liquids are present in the well casing, an attempt will be made to evacuate the liquid to investigate its origin by lowering a 2-in PVC or Teflon bailer to remove the liquid from the well for sampling/testing purposes. If a liquid sample cannot be retrieved, then the quantity of liquid in the well will be considered *de minimus*; and likely the result of condensation. The same procedures will be used to check for liquid and evacuate (as necessary or if possible) for each subsequent monitoring event.

If a sufficient quantity of liquid is available to allow sample collection, the liquid will be field-screened for specific conductance (SC), pH, and temperature (i.e., field parameters). In addition, initial sampling will include independent qualified commercial laboratory analysis for the parameters identified in **Table II.8.2**. The initial field and laboratory data will be evaluated to determine if the water encountered is the result of surface water infiltration; or potential impacts from the Landfill.

If the initial analyses indicate that no impact from the Landfill is evident, then routine monitoring of field parameters will continue on either a monthly or quarterly basis, as applicable for wells with a measureable water column. If subsequent monitoring indicates elevated measurements of the field parameters relative to the initial measurements (i.e., greater than 5 times background values), additional samples will be collected for laboratory analyses, and the data will be evaluated in accordance with the following Section to determine if a release from the Landfill is possible.

3.3 Monitoring Data Evaluation

If the field parameter measurements indicate that a well shows evidence of non-natural constituents, OCD will be notified within 48 hours and verification re-sampling (VRS) for the parameters listed in **Table II.8.2** will be conducted within 2-weeks. If the VRS analytical results indicate that a potential Landfill release may have occurred, within 90 days of the finding, fluid samples from each active Landfill sump will collected and analyzed for the parameters listed in **Table II.8.2** for comparative evaluation with the VRS results. This data evaluation process is fundamental in determining if the potential source of an identified change is from the monitored Facility, an alternative on-site or off-site source, natural variability, an error in the sampling and analysis process, etc. The DNCS Facility will work with OCD to devise an appropriate scope of work for assessing water quality changes.

If the comparative evaluation indicates that the well may contain non-naturally occuring fluids, the DNCS Facility will submit an Action Plan to OCD within 30-days of the finding detailing the course of action to investigate further the potential release; and/or complete any mitigation measures as appropriate. If the comparative evaluation results indicate that no impacts have occurred, the monitoring data will be maintained as part of the Facility Operating Record, and submitted with annual vadose zone monitoring data for the Facility.

TABLE II.8.2
Vadose Zone Monitoring Parameters
DNCS Environmental Solutions

Field Parameters

- Specific Conductance
- pH
- Total Well Depth
- Temperature
- Depth to Water

Major Cations

- Calcium
- Magnesium
- Sodium
- Iron
- Potassium

Major Anions

- Fluoride
- Nitrate as N
- Sulfate
- Chloride
- Phosphorous

RCRA Metals

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury
- Selenium
- Silver

Organic Compounds

- Benzene
- Toluene
- Ethylbenzene
- Xylenes

Additional Parameters

- Total Dissolved Solids (TDS)
- Total Petroleum Hydrocarbons (TPH)

Concurrent with each vadose zone monitoring event, methane monitoring will be performed in each active well using an electronic, intrinsically safe portable gas analyzer, or equivalent instrument. Methane concentrations will be expressed either as percent by volume in air or as a percent of the lower explosive limit (LEL) for methane; and will be recorded on the form provided as **Attachment II.8.B**. In the event that methane concentrations exceed regulatory limits, the DNCS Facility will work with OCD to devise an appropriate scope of work for assessing the methane monitoring results.

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 8: VADOSE ZONE MONITORING PLAN

ATTACHMENT II.8.A

PROPOSAL FOR VADOSE ZONE MONITORING

ATTACHMENT II.8.A

Proposal for Vadose Zone Monitoring

DNCS Environmental Solutions

Lea County, New Mexico

August 2013

Updated November 2013

Prepared By:

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E-mails: brad.a.jones@state.nm.us
Glenn.vongonten@state.nm.us

ATTACHMENT II.8.A
Proposal for Vadose Zone Monitoring
DNCS Environmental Solutions
Lea County, New Mexico

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Proposal for Vadose Zone Monitoring
DNCS Environmental Solutions
Lea County, New Mexico

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 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 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. Site access will be provided via the south side of NM 529. A portion of the 562-acre tract is a drainage feature that will be excluded from development. The drainage feature includes a 500-ft buffer zone which totals 67 acres ±. The DNCS Facility will include two main components; an oil field waste Processing Area (177 acres ±), and an oil field waste Landfill (318 acres ±); totaling 495 acres ±.

1.2 Purpose

Siting criteria for Surface Waste Management Facilities per 19.15.36.13.A(1) NMAC require that the minimum depth to groundwater below the lower limit of waste is ≥ 100 feet (ft).

The Oil and Gas Rules include requirements for groundwater monitoring at facilities where "fresh groundwater" exists, unless "otherwise approved by the division" (19.15.36.14.B NMAC). Fresh groundwater is defined as groundwater that contains less than 10,000 milligrams per liter (mg/L) of total dissolved solids (TDS).

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 on the tract provide adequate demonstration that the minimum depth to the shallowest groundwater bearing zone on the property exceeds 150 ft below land surface; and is more than 100 ft below projected Landfill base grade levels. The northwest portion of the 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. Based upon projected data from wells in the vicinity, it is anticipated that the shallowest water bearing zones on the DNCS tract are on the order of six hundred ft below projected waste cell base grades, and are vertically separated from the proposed Facility by more than five hundred ft of dense non water-bearing shale.

The proposed Facility design includes double HDPE lining of Landfill waste cells with an intervening protective geonet leak detection layer, as well as installation of equipment and operational provisions for leachate monitoring and collection. Based upon the well documented shallow stratigraphy in the vicinity of the proposed Facility, it is anticipated that if leakage were to occur at the Facility, the leachate would migrate vertically through unconsolidated alluvium and would potentially pool on the upper surface of laterally extensive dense shale redbeds (i.e., Triassic Chinle) that are demonstrated to be present at approximately 50 ft below grade at the site. Available subsurface stratigraphic information for the site and surrounding area indicates that any potential leakage would migrate downslope above the alluvium-shale interface to the west or northwest.

As the proposed Facility design includes double HDPE lined waste cells and provisions for leak detection and leachate extraction, and since the Facility is underlain by laterally extensive dense shale and projected depth to groundwater is great, vadose zone monitoring at the shale-alluvium interface is proposed as the most effective mechanism for detection monitoring for the site. Due to the exceptional anticipated depth to groundwater at the site, as well as the low hydraulic conductance of the shale bedrock, it is anticipated that properly positioned and

completed vadose zone monitoring wells (VWs) at the site would detect leakage from the Facility long before groundwater monitoring wells at great depth (i.e., > 500 ft) could; and thus, would provide a greater level of protection to any groundwater resources present at the Facility. **Table 1** 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.

Similar strategies have been deployed nationally where groundwater exists at great depth, and there are intervening zones of dense and impermeable soils. In New Mexico, this technology, which consists of a two-phase vadose zone monitoring approach (i.e., double-liner with leak detection coupled with sentinel (wells) has been effectively implemented at a minimum of three Subtitle D Municipal Solid Waste Landfills approved by the New Mexico Environment Department, including one in Lea County.

The following sections of this submittal provide specific descriptions of the subsurface stratigraphy and water-bearing zones in the vicinity of the proposed Facility, as well as proposed design, installation methods and operational strategy for vadose zone monitoring at the site.

2.0 HYDROGEOLOGIC SETTING

Details regarding the hydrogeology of the DNCS site and region will be included as Volume IV.2 of the DNCS Application for Permit. The DNCS site is located in western Lea County, and is situated in the Upper Pecos-Black watershed (United States Geological Survey [USGS] cataloging Unit 1306001), near the western boundary of the Monument-Seminole Draws watershed (USGS cataloging unit 12080003). The physiography and hydrogeology of the area are described by Nicholson and Clebsch (1961) and the physiography of southern Lea County and eastern Eddy County are shown in **Figure 1** (Nicholson and Clebsch, 1961 and Kelly, 1979). The boundary between the Upper Pecos-Black and Monument-Seminole

TABLE 1
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 1
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)

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. The Mescalero Ridge is also the boundary between the High Plains province to the east and the Querecho Plains province to the west.

The 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. The Ogallala has been removed by erosion west of Mescalero Ridge and a veneer (generally less than 100 ft) of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle the Triassic Chinle in this area. Well-cemented sections (i.e., caliche) of the Ogallala Formation are the ledge-forming units of the Caprock bluffs.

The DNCS site is located approximately 1.75 miles west of Mescalero Ridge in the eastern portion of the Querecho Plains. The location of the DNCS site, as well as the Mescalero Ridge and the Querecho Plains, are shown in the vicinity map provided as **Figure 2**. Shallow subsurface geologic units at the DNCS site include approximately 50 ft of unconsolidated Quaternary sand, silt, gravel and cacliche above Triassic shale bedrock of the Chinle Formation (redbeds), as demonstrated by the site-specific drilling and testing results.

2.1 Groundwater Occurrence and Site Conditions

Water-bearing geologic units in the vicinity of the DNCS site include the Tertiary Ogallala Aquifer, shallow Quaternary alluvial aquifers, and the Santa Rosa Sandstone in the lower portion of the Triassic Chinle shale. The Ogallala Aquifer can be 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 and laterally discontinuous groundwater saturations are occasionally present in the basal alluvium overlying the Triassic Chinle. The Santa Rosa Sandstone is present at depth throughout much of southern Lea County, and this unit can locally produce modest quantities of groundwater.

Configuration of the top of the Chinle shale (redbeds) is an important control on water availability in the Ogallala Aquifer, as well as in the alluvial aquifers in the area. The Chinle shale redbeds were exposed and dissected by erosion throughout the region prior to deposition of the Ogallala. The most prolific Ogallala production occurs in areas where stream channels were cut into the Chinle shale and subsequently filled with coarse fluvial Ogallala detritus. The resulting buried paleochannels are areas where saturated aquifer thickness is greatest, and the best water-bearing properties are present.

In the Querecho Plains area, the Ogallala was removed by erosion and the Chinle shale section was reexposed and dissected by drainages associated with the Pecos River catchment to the southwest. 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 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 2** (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 3**. 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, 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.

Table 2 provides a summary of information from water wells and other oil wells and/or borings within two miles of the DNCS site. A more extensive table of the wells and borings in the vicinity of the site is included in **Attachment A-3**. Data included in these **Tables** were obtained from the following sources:

TABLE 2
Records of Wells within 2 miles 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.	Comments or Source
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
Continental Oil Pearsall BX #2		17.32.34.241111			OCD	3952	casing to 3515, redbeds to 792								64	3888	OCD 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
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
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

- Logs from geotechnical borings at the DNCS tract (**Attachment A-1**)
- Well and water level data from Geohydrology Associates Inc. (1978) (**Attachment A-2**)
- Water well data from Nicholson and Clebsch (1961)
- New Mexico Office of the State Engineer (NMOSE) Well Records (**Attachment A-3**)
- Summary oil well data on shallow stratigraphy and water-bearing units derived from New Mexico OCD records and recorded in NMOSE Well Record files (**Attachment A-3**)

Copies of information from these sources are included with this submittal in the above-referenced sections of **Attachment A**.

Wells and borings in the vicinity of the DNCS site that yielded data of significance with regard to groundwater occurrence or potential are plotted on the map provided as **Figure 2**. Few water wells are present in the Querecho Plains area in the vicinity of the DNCS site. Soil borings advanced on the DNCS tract found dry alluvium on top of the redbeds and no saturation in approximately the upper 100 ft of the redbeds at the site (copies of the logs from these borings are included in **Attachment A-1)**.

A few shallow alluvial wells are present in close proximity to Mescalero Ridge, including the Williams stock well, which is located approximately 7,600 ft north of the DNCS site (Nicholson and Clebsch, 1961). Based upon water levels reported by Geohydrology Associates (1978; **Attachment A-2**), an oil test well located approximately 4,400 ft northeast of the DNCS site, and open cased holes located 10,200 ft and 12,400 ft east of the DNCS site, apparently penetrated thin saturations in the alluvium. Based upon information from NMOSE Well Records (Well RA 10175 and Well L 3454; **Attachment A-3**), a well located approximately four miles west of the DNCS site, and another well located 3.5 miles south of the DNCS site, produce limited quantities of water from the alluvium.

Based upon notes taken from OCD records and posted on NMOSE Well Records, thirteen oil wells in the vicinity of the DNCS site penetrated water-bearing zones, or significant sandstones in the Triassic redbeds. Locations of these wells are shown on **Figure 2** and

details of the zone descriptions, as well as summary information are included on the well logs provided in **Attachment A-3**. One of these wells (Conoco, B-4-197), located approximately 5,800 ft north of the DNCS site, penetrated sandstone between 628 ft and 650 ft below land surface; another well (B-4-189), located about 9,000 ft northwest of the DNCS site penetrated a "water sand" between 710 ft and 810 ft below land surface.

Several wells to the south and "downgradient" of the DNCS site appear to produce from water-bearing zones in the Triassic bedrock unit. One of these wells (NMOSE Well Record, CP-677, **Attachment A-3**), located approximately 5.7 miles southwest of the DNCS site, is completed in a sandstone that is between 498 and 510 ft below grade; and the water level in this well was measured at 460 ft below grade, indicating artesian conditions. Another well drilled under the same permit a short distance away found similar conditions. Geohydrology Associates, Inc., (1978, **Appendix A-2**) reported a water level of 434.41 ft below land surface in an oil test well located approximately four miles southwest of the DNCS site. No water-bearing zone interval was identified in this record; however another well located approximately one mile southeast of this well penetrated several sandstones below a depth of 500 ft. The projected geometry of sandstones and associated potentiometric surface of these wells is depicted in the hydrogeologic cross section in **Figure 3**.

3.0 PROPOSED VADOSE ZONE MONITORING PROGRAM

Due to the anticipated great depth to the shallowest water-bearing units, as well as high impedance to vertical water flow posed by the Triassic redbeds at the DNCS site, vadose zone monitoring is proposed as the preferred alternative for the site. The proposed vadose zone monitoring wells would be positioned such that downgradient wells would be located downslope on the mapped upper redbed surface to the west of the Facility, and upgradient wells would be placed upslope on the redbed surface near the southeast corner and along the east boundary of the Facility. Equally important is the planned installation of a double HDPE-lined leak detection system that underlies the entire waste disposal footprint, which will provide for potential fluid capture beneath the primary liner.

3.1 Proposed Monitoring Well Locations

The location of the proposed Facility, as well as the site geotechnical borings and interpreted terrain on the top of the redbed surface are shown on the map provided as **Figure 4.** This diagram projects the isopleths on the upper redbed surface prepared by Nicholson and Clebsch (1961), as well as interpolated isopleths that comport with new redbed surface elevation data obtained from site-specific geotechnical borings on the DNCS site. It should be noted that no adjustment of the Nicholson and Clebsch isopleths was necessary to honor the new data points, confirming both datasets. The resulting structure map presents a detailed depiction of the terrain on the redbed surface at the proposed Facility, and a high confidence level that the proposed VWs are positioned directly downslope from the proposed waste disposal area in the zone most appropriate for detection of a potential release.

Figure 5 depicts the proposed location of the proposed vadose zone monitoring network designed specifically to address both the known slope of the redbed surface, and the locations of the planned leachate collection sumps. The leachate collection sumps represent the most downgradient termini of the leachate collection system; are the deepest penetrations of the surface deposits; and are vertically most proximate to the redbed surface (e.g., 15 – 30 ft). In addition, the individual cell sumps are designed as the locations with the greatest potential for leachate head development.

The planned strategy consists of the following elements, designed to correlate with the Landfill site development sequence (**Figure 5**):

1. Following permitting, and prior to Landfill development; VW-1, VW-2, and VW-3 will be installed to evaluate ambient conditions. These wells will be constructed in accordance with the specifications listed in Section 3.2; and will be sounded for the potential presence of water on the redbed surface. VW-1 will serve as an upgradient monitoring point for Phase 1 operations; and the northern portion of Phase 2 operations. VW-2 and VW-3 will be positioned as "sentinel" downgradient wells for Phase 1 (i.e., Units 1-3), and are specifically located adjacent to Sumps 1 and 3 based on the logic discussed above.
2. Downgradient Well VW-4 will be installed prior to the development of Phase 2 (i.e., Units 4-6) before cell construction in order to evaluate pre-construction conditions. It is deliberately positioned adjacent to the sump for central Unit 5. Well VW-5 will be installed prior to the development of Phase 3, and will serve as the general upgradient monitoring point for all of the Landfill development. Well VW-6 is the downgradient sentinel well for Phase 3, and will be installed prior to development of disposal Units 7-9.

3. Shown on **Figure 5** are four additional potential downgradient monitoring points (i.e., VW-7 through VW-10) that may be added incrementally dependent upon monitoring results from the primary network (i.e., VW-1 through VW-6). These future VWs would be installed to the same specifications prescribed in Section 3.2; and well locations may be adjusted in consultation with OCD.

Evidence of groundwater in the VWs should not necessarily be attributed to Landfill impacts, as reconfiguration of surface stormwater controls may alter recharge. Testing of water samples from the VWs will confirm if any water encountered is the result of surface water infiltration; or potential impacts from the disposal Facility. Details regarding sampling and analysis will be included in the Vadose Zone Monitoring Plan (**Volume II.8** of the Application for Permit).

3.2 Proposed Well Drilling and Completion

Prior to installation, drilling permits will be obtained from the NMOSE. Proposed VWs will be installed using hollow-stem auger drilling methods; and no fluids would be introduced into the borings during drilling. Undisturbed, depth-referenced samples of penetrated sediments will be collected on 5-ft intervals using split-spoon sampling equipment. Drive blow counts will be logged during each sampling event to allow precise determination of the upper redbed surface in each boring. A qualified hydrogeologist will be present on location during drilling, and will prepare detailed descriptions of the lithology, texture, sorting, rounding, color, degree of lithification and moisture content of each sample and stratigraphic unit that is penetrated.

Each boring will be advanced approximately 3 ft into indurated Triassic redbeds. Although split spoon sampling offers ample opportunity to identify saturated sediments with a high degree of confidence, each boring will be further evaluated for the presence of free water. Upon reaching total depth, the rig would be placed on standby for at least two hours, during which time soundings will be made inside the augers to check the potential of accumulating fluid.

VWs will be completed in accordance with specifications set forth on the well detail sheet provided as **Figure 6**. Each well will be completed using 4-inch schedule 40 flush joint casing to allow for sample extraction. Each well will be completed with a 10-ft length of 0.010-inch slotted well screen, positioned with the lowermost end extending approximately 3 ft below the detected upper redbed surface and the upper end extending approximately 7 ft into the overlying alluvium. The well annulus will be backfilled with a 10/20 grade silica sand pack

extending 2 ft above the screen, a bentonite seal extending 1 ft above the sand pack, and an annular seal consisting of bentonite grout or equivalent extending to land surface. Each well will be equipped with a radially sloped concrete surface pad with locking steel shroud extending approximately 3 ft above grade and marked.

3.3 Proposed Monitoring Program

The proposed vadose zone monitoring program will initially include inspection of each well for the presence of fluid in advance of disposal area construction. Results of fluid detection measurements will be submitted with related leachate monitoring results in routine Facility operations reporting to OCD. If fluids are noted in any of the VMs or leak detection system, the fluid will be sampled and tested in accordance with the Vadose Zone Monitoring Plan, which will be provided as **Volume II.8** in the Application for Permit. The continued lack of fluids in the leak detection system and vadose monitoring wells may be the subject of specific approvals by OCD for a reduced monitoring frequency and/or analyte list.

4.0 LIST OF REFERENCES

Geohydrology Associates, Inc., 1978, Collection of hydrologic data, eastside Roswell Range EIS area: Open-File Consultant Report to Bureau of Land Management, Denver, Colorado, Contract No. YA-512-CT-7-217, Table 4.

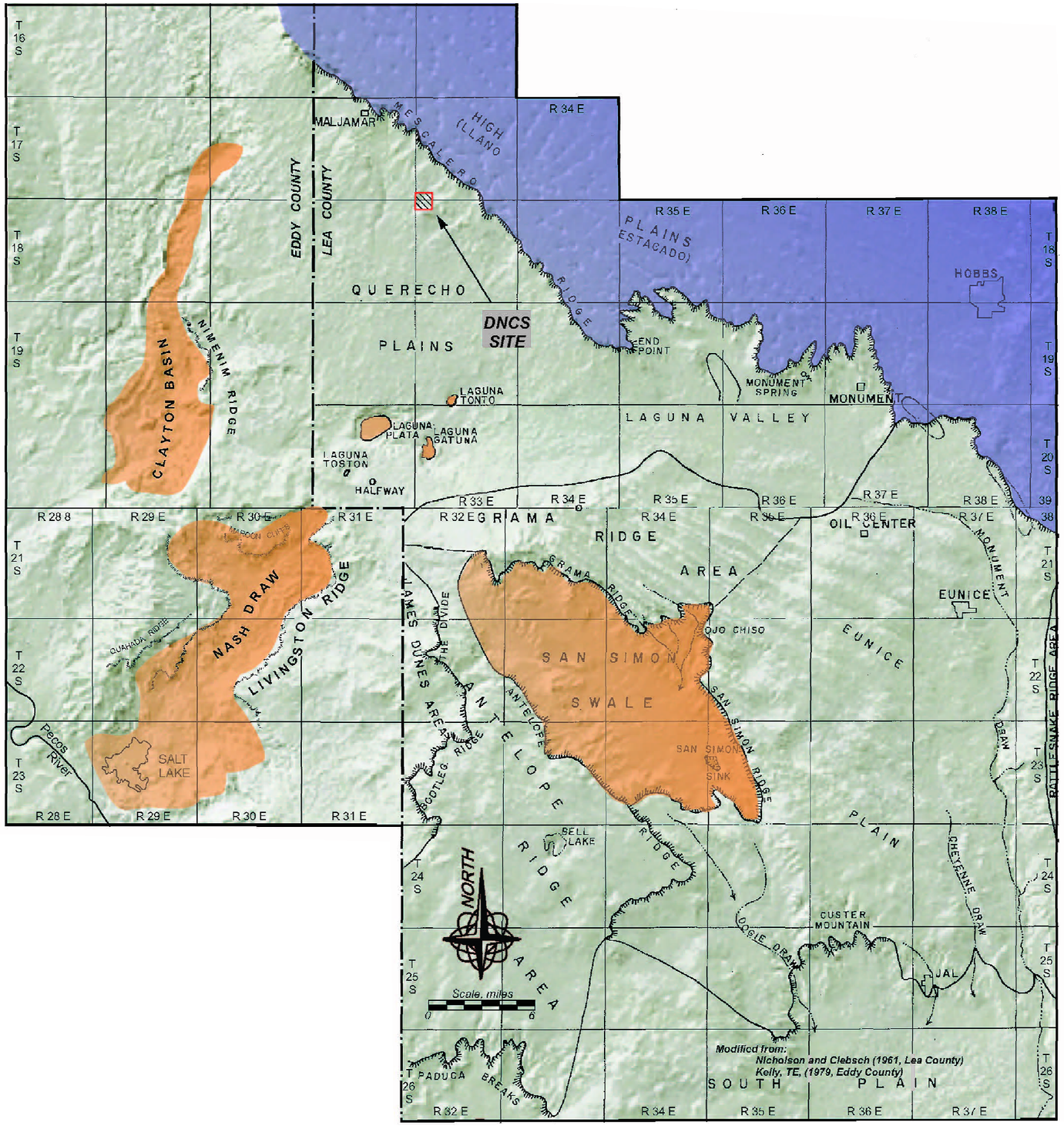
Golder Associates Inc. and Gordon Environmental, Inc., 2013, Hydrogeology (Volume IV.2), Application for Permit, DNCS Environmental Solutions, Surface Waste Management Facility

Golder Associates Inc. and Gordon Environmental, Inc., 2013, Vadose Zone Monitoring Plan (Volume II.8), Application for Permit, DNCS Environmental Solutions, Surface Waste Management Facility

Kelly, T.E., Geohydrology Associates, Inc., 1984, Hydrologic assessment of the Salt Lakes area, western Lea County, New Mexico, Consultant report to Pollution Control, Inc., Lovington, New Mexico, Figure 1.

Nicholson, A., and Clebsch, A., 1961, Geology and ground-water conditions in southern Lea County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Groundwater Report 6.

Office of the New Mexico State Engineer, 2013, Electronic image well log files for Lea County, http://www.ose.state.nm.us/water_info_rights_dist2_LeaCountyWellLogs.html



PHYSIOGRAPHY OF SOUTHERN LEA COUNTY AND EASTERN EDDY COUNTY

DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

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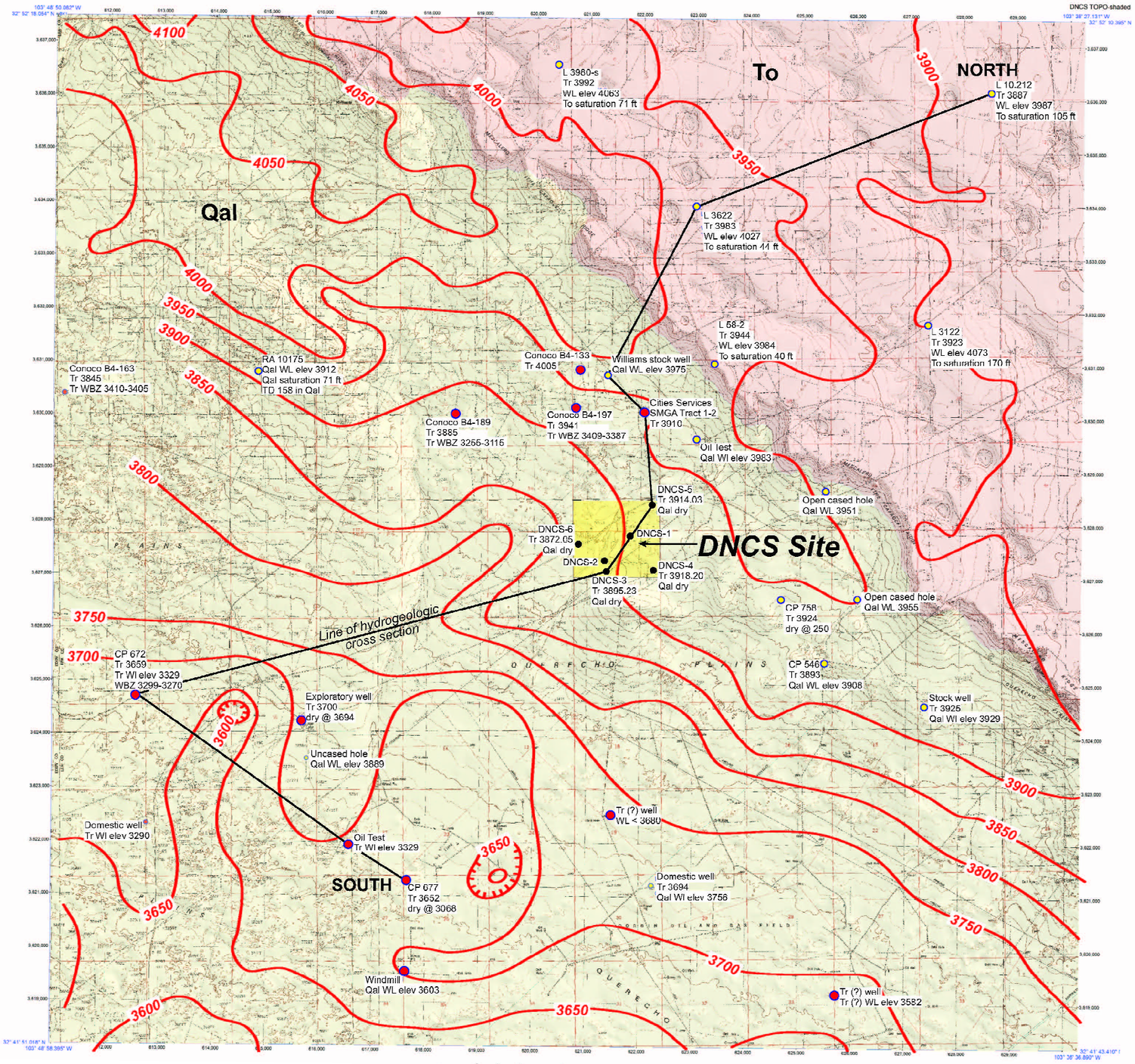
DATE: 11/04/2013	CAD: UPDATED FIGURE 1.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE 1
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\UPDATED FIGURE 1.dwg
Date/Time:Nov. 04, 2013-08:39:01 ; LAYOUT: B (LS)



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

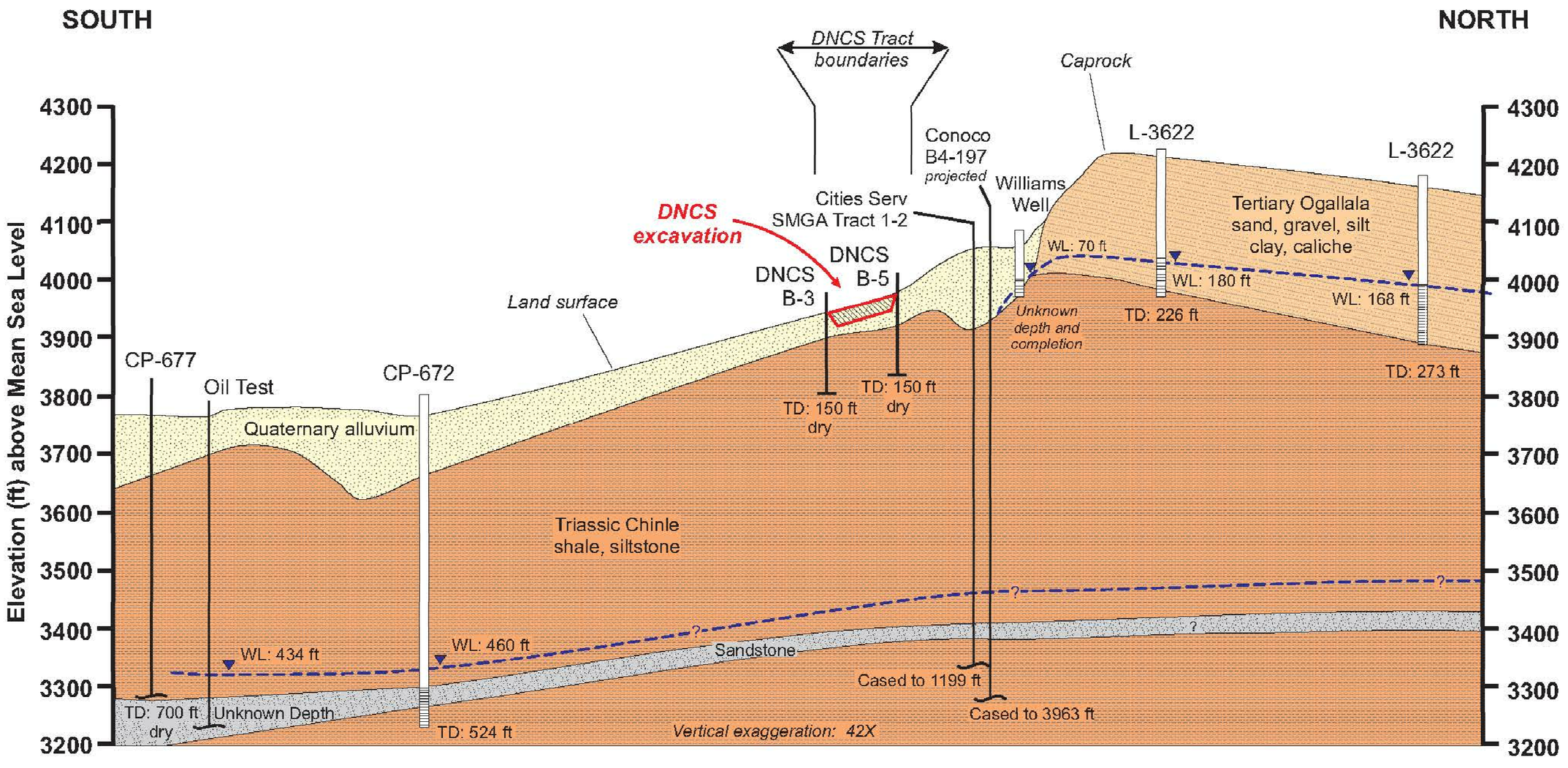
DNCS ENVIRONMENTAL SOLUTIONS
LEA COUNTY, NEW MEXICO

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 2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\UPDATED FIGURE 2.dwg
Date/Time:Nov. 04, 2013-11:25:45 ; LAYOUT: B (LS)

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.
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213 S. Camino del Pueblo
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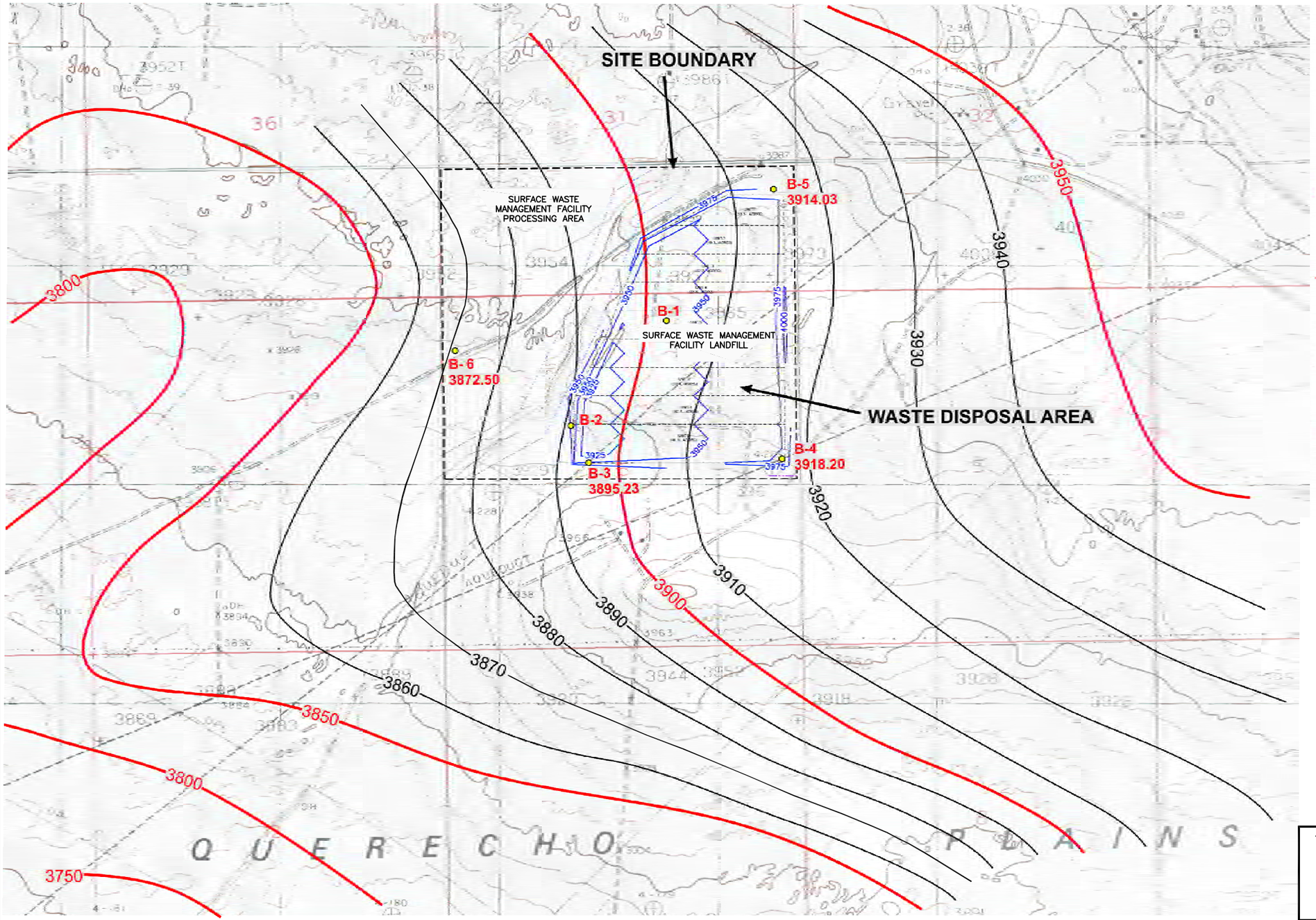
DATE: 11/04/2013	CAD: UPDATED FIGURE 3.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE 3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\UPDATED FIGURE3.dwg
Date/Time:Nov. 04, 2013-11:34:20 ; LAYOUT: B (LS)



B-5 3914.03 — Location of site geotechnical boring showing designation and elevation of top of redbeds (feet above MSL)

3950 — Isopleth on top of redbeds by Nicholson and Clebsch (1961)

3910 — Interpolated Isopleth on upper redbed surface using site boring data and 10-ft contour interval (feet above MSL)

3950 — Landfill Base Grades

NORTH

NOMINAL SCALE 1'=1500'

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: 10/18/2013	CAD: REDBED.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE 4
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\542.01.01\PERMIT FIGURES\REDBED.dwg
Date/Time:Oct. 18, 2013-13:28:42 ; LAYOUT: B (LS)

SURFACE WASTE MANAGEMENT FACILITY PROCESSING AREA (±177 ACRES) WEST TRACT

VW-1
VW-2
VW-3
VW-4
VW-5
VW-6
VW-7
VW-8
VW-9
VW-10

SUMP 1
SUMP 2
SUMP 3
SUMP 4
SUMP 5
SUMP 6
SUMP 7

PHASE 1
UNIT 1 (13.5± ACRES)
UNIT 2 (19.8± ACRES)
UNIT 3 (22.2± ACRES)

PHASE 2
UNIT 4 (23.8± ACRES)
UNIT 5 (25.4± ACRES)
UNIT 6 (27.3± ACRES)
UNIT 7 (29.4± ACRES)

PHASE 3
UNIT 8 (30.7± ACRES)
UNIT 9 (41.6± ACRES)

SURFACE WASTE MANAGEMENT FACILITY LANDFILL (318± ACRES) EAST TRACT

500'

LEGEND

- EXISTING 5' CONTOUR
- 3975 EXISTING 25' CONTOUR
- 3975 25' DESIGN CONTOUR
- TOE OF SLOPE
- SUMP 1 RISER/SUMP AND ID
- SITE BOUNDARY
- WASTE BOUNDARY
- UNIT BOUNDARY
- PHASE 1–3 BOUNDARY
- PROPOSED UPGRADIENT VADOSE MONITORING WELL
- PROPOSED DOWNGRADIENT VADOSE MONITORING WELL
- PROPOSED SUPPLEMENTAL DOWNGRADIENT VADOSE MONITORING WELL
- REDBED SURFACE GRADIENT
- CONTROL POINT
- N 650,000 SITE GRID

NORTH

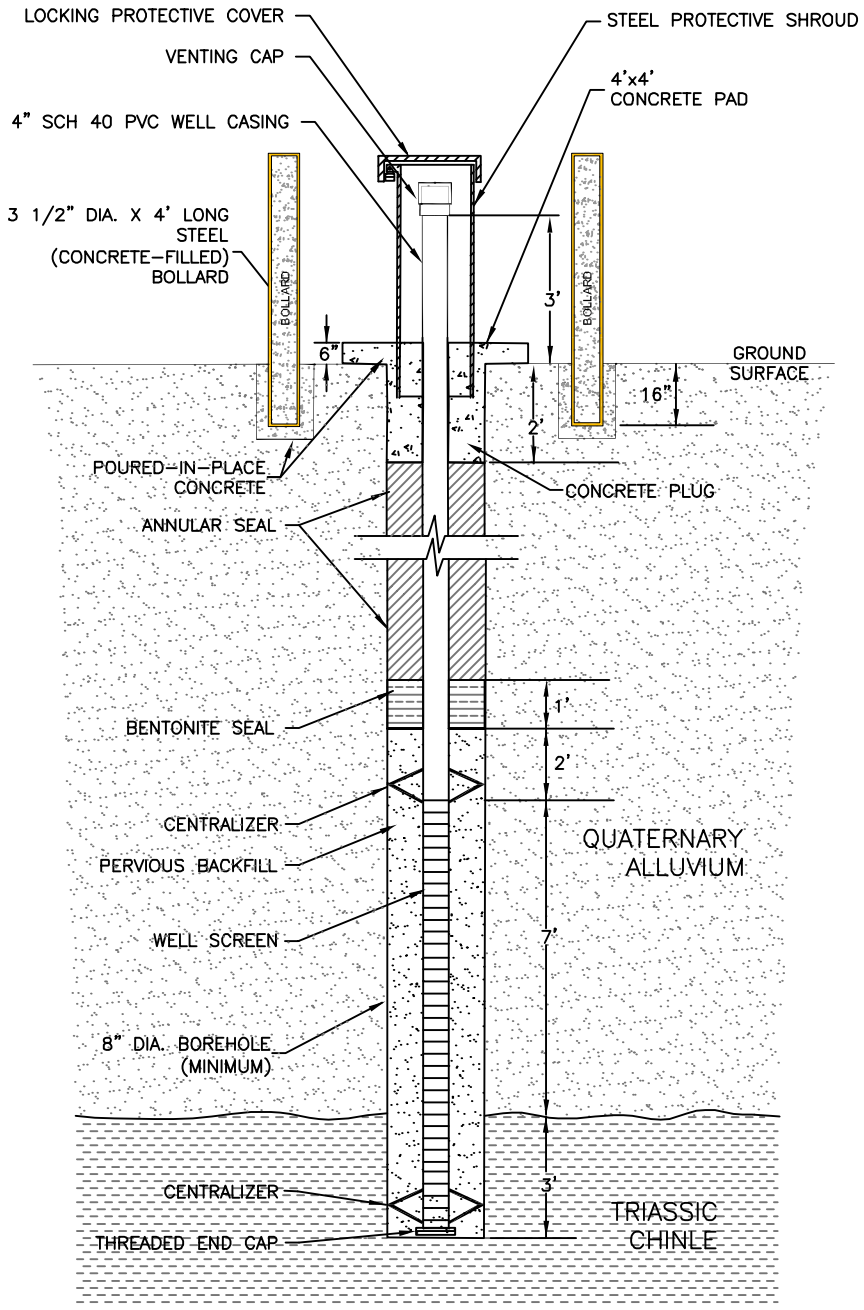
0 250 500

VADOSE ZONE MONITORING NETWORK

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: VADOSE WELL LOC.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: GEI	FIGURE 5
APPROVED BY: IKG	gei@gordonenvironmental.com	



TYPICAL VADOSE ZONE MONITORING WELL

NOT TO SCALE

LEGEND

CASING: 4" DIA. SCH 40 PVC

SCREEN: 4" DIA. 0.010" MACHINE SLOT SCH 40 PVC

PERVIOUS BACKFILL: 10-20 COLORADO® SILICA SAND OR EQUIVALENT

ANNULAR SEAL: NEAT CEMENT WITH 2% TO 5% BENTONITE

NOTE:

SPECIFIC VERTICAL DIMENSIONS FOR EACH NEW WELL WILL BE INCLUDED IN OSE AND OCD SUBMITTALS.

VADOSE ZONE MONITORING WELL CONSTRUCTION DETAIL

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: VADOSE MW .dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: MJC	FIGURE 6
APPROVED BY: IKG	gei@gordonenvironmental.com	

ATTACHMENT II.8.A
Proposal for Vadose Zone Monitoring
DNCS Environmental Solutions
Lea County, New Mexico

ATTACHMENT A-1

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+	
			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)		
60'				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:
80'			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.
85'				100+	NEW "ANVIL" INSTALLED FOR SS SAMPLES
90'			85'–90', CLAYSTONE AND SILTSTONE; PALE RED (2.5YR 6/2), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)	100+	
95'				100+	SOME MnO_2–CALCITE VEINLETS AND PARTING COATINGS NO MORE SPLIT-SPOON SAMPLING ONLY AIR-ROTARY CUTTINGS FROM 90.25' TO 150' BGS
100'			90'–110', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 7/8), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		
105'					
110'					
115'			110'–115', CLAYSTONE AND SILTSTONE; LIGHT RED (2.5YR 7/6), AND VARIEGATED BROWN TO GREENISH LAYERS AND SPOTS (POORLY GRADED; MODERATELY INDURATED)		
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

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 **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 FILLING, 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")

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'		SS BR CC AC	0–3' SAND, FINE AND SILT; BROWN (POORLY TO MODERATELY INDURATED)		"BERM" 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'				100+	STRONGLY CALICHIFIED FROM 3' TO 10'
			5'–10', CALICHE AND SAND; FINE, PINKISH WHITE (5YR 8/2), (POORLY GRADED; MODERATELY INDURATED)		
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	
			25'–45', SAND, FINE, CALICHE, GRAVEL AND CALCITE CLASTS TO 1"; PINK (5YR 7/4), (POORLY GRADED; MODERATELY INDURATED)		
30'				36	
35'				100+	MnOx–CALCITE VEINLETS, VENTIFACTS AND ROOT CASTS @ 35'–38' (UNCONFORMITY OR PEDOGENIC HORIZON?)
40'				60	
45'	Qs		45'–50', SAND, FINE, CALICHE AND GRAVEL TO 2"; LIGHT REDDISH BROWN (2.5YR 6/4), (POORLY GRADED; POORLY TO MODERATELY INDURATED)	74+	
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'	Qs		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

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.: 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 FLIGHTS, 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 - Artex Boehm

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)	BGV 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 38' 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 / Calcrified. 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								

ATTACHMENT II.8.A
Proposal for Vadose Zone Monitoring
DNCS Environmental Solutions
Lea County, New Mexico

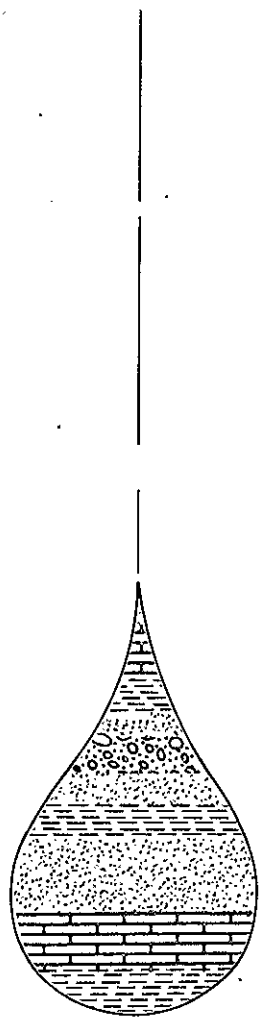
ATTACHMENT A-2

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

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ILLUSTRATIONS

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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	

ATTACHMENT II.8.A
Proposal for Vadose Zone Monitoring
DNCS Environmental Solutions
Lea County, New Mexico

ATTACHMENT A-3

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

ATTACHMENT A-3
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

ATTACHMENT A-3
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			32d46m54.1	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

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 Eaton 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 AM 8:35 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

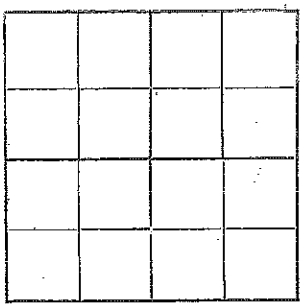
change the location on map
to read Sec. 1. 22233
Was plotted @ 1. 33322

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 1 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.

E 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 1/4 E. LINE 1/4 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		Thickness in Feet	Description of Water-Bearing Formation
	From	To		
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		Feet	Type Shoe	Perforations	
			Top	Bottom			From	To
[illegible]	Heavy	[illegible]	0	255	255	Halliburton	215	255
						open end		

Section 4

RECORD OF MUDDING AND CEMENTING

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

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

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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. 17.32.2.433431

#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 17.32.2.433343
				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

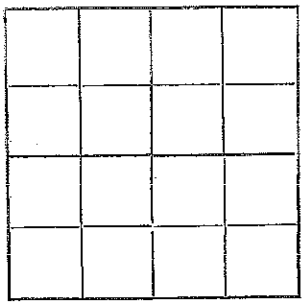
17.32.2.433

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

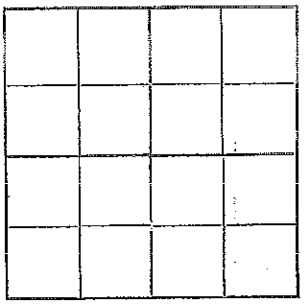
17.32.2.434

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.

Allan 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		Thickness in Feet	Color and Type of Material Encountered
From	To		
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 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.

Form WR-23

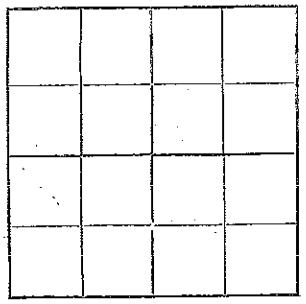
FIELD ENGR. LOG

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 Harry Cocco

Street and Number

City Maljamar State New Mexico

Well was drilled under Permit No. Misc. 2-L-59 and is located in the E ¼ NE ¼ NW ¼ of Section 19 Twp. 17S Rge. 32E

(B) Drilling Contractor C. C. Alcorn License No. W.D.79

Street and Number Box 379

City Loving, New State New Mexico

Drilling was commenced December 29 19 61

Drilling was completed January 1, 19 62

Elevation at top of casing in feet above sea level Total depth of well 156

State whether well is shallow or artesian Shallow Depth to water upon completion 132

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	132	156	24	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
6 5/8	Welded		0	156	156	None	136	156

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
		7			5 sacks of drilling mud placed
					in top of hole while drilling
					well to keep hole from caving

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

STATE ENGINEER OFFICE
DISTRICT II
ROSWELL, N. MEX.
JAN 18 AM 8:14 1962

Date Received

File No. Misc. 2-L-59 Use Dom Location No. 17.32.10.122

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	5	5	Brown	Top Soil
5	42	7	White	Caliche Rock
42	132	12	Brown	Sandy Clay
132	150	24	Red	Red Rock Sand

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

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well ConocoPhillips Owner's Well No. EW-1

Street or Post Office Address P.O. BOX 2197

City and State Houston, TX 77252

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

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section 21 Township 17 S Range 32E N.M.P.M.,

b. Tract No. _____ of Map No. _____ of the S.W. Qtr. MALJAMAR E+P/

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

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

(B) Drilling Contractor SCARBOROUGH DRILLING, INC. License No. WD 1188

Address P.O. Box 305, LAMESA, TX 79331 806-872-3285

Drilling Began 5-14-2007 Completed 5-15-2007 Type tools AIR ROTARY Size of hole _____ in.

Elevation of land surface or UNKNOWN at well is _____ ft. Total depth of well 125 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well N/A 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)

STATE ENGINEER OFFICE RECEIVED MAY 2007

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
4"	sch 40	PVC	+2	95		.020	95	125

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
0	80	8 3/4	CEMENT		POURED
80	120	8 3/4	BENTONITE		POURED
120	125	SAND	SAND		POURED

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

Date Received

Quad _____ FWL _____ FSL _____

File No. No File Number w 055 Use monitor well Location No. 17.32.21 Sw

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	SAND: Yellowish RED, vfg, dry, damp, loose.
5	20	15	Silty SAND: REDDISH brown - REDDISH yellow, loose.
20	25	5	SANDSTONE: Loosely consolidated, very pale brown
25	60	35	SAND Minorly Consolidated, lt. reddish brown, soft, dry, silty, vf-fine, non plastic
60	80	20	SAND Loosely consolidated, very pale brown vf-fine, silty, non plastic, dry
80	90	10	SANDSTONE w/ SHALE interbeds; lt yellowish brown loosely consolidated, vf-f, dry.
90	110		SAND interbedded w/ SHALE; SAND - yellowish brown, loose, slightly damp, silty. SHALE; brown, very fine
110	120	10	SAND interbedded w/ SHALE; SAND - yellowish brown, loose, slightly damp, non plastic, silty. SHALE: greenish gray, silty, dense
120	125	5	SAND, lt. yellowish brown, damp, slightly plastic, loose, vf-fine, silty.

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.

Lee Sedlacek
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office [illegible]. All sections except Section 5 shall be answered as completely and accurately as possible when any well is

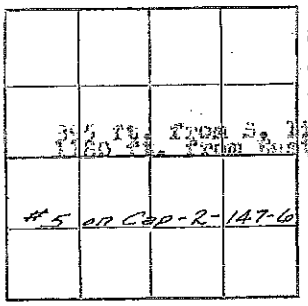
Form WR-23 FIELD ENGR. LOG

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 Texaco, Inc.

Street and Number Box 2109

City Midland, State Texas

Well was drilled under Permit No. L-5288 and is located in the ¼ SE ¼ ¼ of Section 36 Twp. 17s Rge. 34E

(B) Drilling Contractor U. S. Pipeline License No. 1099

Street and Number Box 66

City Robbs, State New Mexico

Drilling was commenced Jan. 11, 1965

Drilling was completed Jan. 17, 1965

3786

Elevation at top of casing in feet above sea level Unkown Total depth of well 231

State whether well is shallow or artesian Shallow Depth to water upon completion 30

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	105	155	50	Sand, consolidated, course
2	175	195	20	Sand
3	220	228	8	Sand & gravel
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	32.75	8	0	231	231	None	105-231	

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 JAN 21 1965 AM 8:24

File No. L-5288 Use Comm. Location No. 17.34.36443134

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2	Black	Soil & rock
2	26	26	White	Caliche & rock
26	80	52	Grey	Sandy shale
80	85	5	"	Sand rock
85	140	55	"	Sand
140	155	15	"	Sand rock
155	165	10	"	Sandy shale
165	195	30	"	Sand & sand rock
195	220	25	"	Sand rock
220	228	8	"	Sand & gravel
228	231	3	Red	Red bed, shale

L S Elev 3988'

Depth to K Trc. 228'

Elev of K Trc. 3760'

Loc. No. 17.34.36.443134

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.

O. R. Musselwhite

Well Driller

L-5288

17.34.36.443

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well George Kenemore Owner's Well No. RA 8855

Street or Post Office Address PO Box 154

City and State Maljamar NM

Well was drilled under Permit No. RA 8855 and is located in the:

a. SE ¼ NW ¼ NW ¼ ¼ of Section 10 Township 17 S Range R 32 E N.M.P.M.

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

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

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

(B) Drilling Contractor J & K Drilling License No. WD 1235

Address Box 1493 Lovington NM 88260

Drilling Began 7/28/94 Completed 8/4/94 Type tools Cable Size of hole 8¼ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 158 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 0 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)
			No water was found drilling	
			this well.	

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
	No csg was ran in well							

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

Date Received August 10, 1994 Quad _____ FWL _____ FSL _____

File No. RA-8855 Use Domestic Location No. 17.32.10.11421

150

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	18	18	Sand top soil light brown in color
18	20	2	Caliche
20	38	18	red sand
38	40	2	med hard sandstone, red in color
40	50	10	white sand with red gravel
50	60	10	red sand with red and black flintstone gravel
60	80	20	Brown colored sand with red and white colored sandstone gravel.
80	135	55	Red shale with mixture of multi-colored grave.
135	157	22	Red colored shale with red, blue, and gray gravel
157	158	1	Red bed

Section 7. REMARKS AND ADDITIONAL INFORMATION

Drilled well to 158 feet, 1 foot into Red Bed lormation. No water was encountered.while drilling this well. Owner wants to go on to 200 feet. Rigged down and moved off hole. Hole was left openmwith 12 foot 9 5/8 csg in top of well.

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.

Earl Illston
Driller

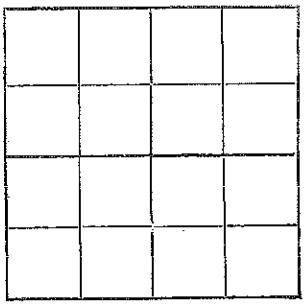
INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. A[illegible]ions, except Section 5, shall be answered as completely and accurate[illegible] possible when any well is drilled, repaired or de[illegible]hen this form is used as a plugging record, only Section 1(a) and Secti[illegible]d be completed.

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 Maljamar Cooperative Repressuring Agreement

Street and Number Room 200, Booker Bldg.,

City Artesia, State New Mexico

Well was drilled under Permit No. L-2-L51 and is located in the NW ¼ SW ¼ NE ¼ of Section 11 Twp. 17 Rge. 32

(B) Drilling Contractor Burke License No.

Street and Number Hobbs,

City State New Mexico

Drilling was commenced 19

Drilling was completed September 10, 19 47.

Elevation at top of casing in feet above sea level Total depth of well 140 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				
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	139	139			

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. 2-L-51 Use S.R.O. Location No. 17.32.11.231 44

Well 47 Mod. 2-/32-/

23/432

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	5			Top soil
5	22		white	Packed sand
22	48		gray	Soft sand
48	93		red	Soft sand
93				Top of water sand
93	131			Coarse water sand
131				Bottom of sand
131	140		red	Clay
140				Total depth.
				139' of 7" OD Lapwell pipe run, consisting
				of the last two joints perforated, which
			4142	amounted to 43'. Total water sand thickness
	L S Elev			38'. Hole was bailed in an effort to create
	Depth to K		Trc 131	a crevice and remove as much sand as possible.
	Elev of K		Trc 4011	
	17.32.11.23144			Well was gravel packed with 9½ yards. It is
				hoped that more gravel can be placed between
Loc. No.				casing and the outer wall after well has
Hydro. Survey	Field Check X			been pumped.
				It is estimated that the well is capable of
				producing 100 gallons per minute. This well
	SOURCE OF ALTITUDE GIVEN			was completed on September 10, 1947. It was
	Interpolated from Topo. Sheet X			drilled by Burke, Phone No. 90, Hobbs, N. M.
	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.

Burke
Well Driller

L-2-L-51

17.32.11.231

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 Oil Location No. 17.32.26.41000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	15		Caliche
15	80		Red clay
80	105		Red shale
105	210		Red bed
210	265		Blue shale
265	710		Red bed
710	850		Red sand (water 710-810)
850	983		Red bed
983	995		Red sand
995	1024		Red bed
			L S Elev 3936
			Depth to K Trc 15
			Elev of K Trc 3921

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.26.41000 Elevation: 3936' DF
Owner: Continental Oil Co.
MCA Battery 4 #189
Record of Casing: 8 1/4" - 1062'

Cable

1980' FSL--1980' 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 FLO CO2 INC. Owner's Well No. _____
Street or Post Office Address 3700 Kermit Hwy.
City and State Odessa, TX 79764

Well was drilled under Permit No. RA-10175 and is located in the:

a. _____ ¼ _____ ¼ NE ¼ NW ¼ of Section 28 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. WD 1044

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

Drilling Began 2-4-02 Completed 2-4-02 Type tools rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 158 ft.

Completed well is ☒ 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)
87	89	2	Sand & Gravel	
89	116	27	Sandy yellow & blue clay	
116	124	8	Hard gray shale	

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
5 3/4	160psi				158		118	158

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 T# 222219

Date Received 03/06/2002
File No. RA-10175 Quad _____ FWL _____ FSL _____
Use Drink & Sanitary Loc. No. 17S.32E.28.12

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	1	1	Top Soil
1	8	7	Sand w/ clay & Sandstone Stringers
8	44	36	Sand & Sandstone Stringers
44	55	11	Sandy Red Clay
55	87	32	SAndy yellow & blue clay
87	89	2	Sand & Gravel
89	116	27	Sandy yellow & blue clay
116	124	8	Hard gray shale
124	158	34	Yellow, blue & 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.

Allan Eades by Andrew Boot
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 Oil Location No. 17.32.29.11000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	70		Surface sand
70	190		Red bed
			L S Elev 3937
			Depth to K Trc 70
			Elev of K Trc 3867

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.29.11000 Elevation: 3937' GR
Owner: Continental Oil Co.
MCA Unit Battery 2 #109
Record of Casing: 8" - 873'

Cable

660' FNL - 660' FWL

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 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 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. 17.32.29.24000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	85		Surface sand and caliche
85	105		Sandstone
105	755		Shale
			L S Elev 3984
			Depth to K Trc 105
			Elev of K Trc 3879

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.29.24000 Elevation: 3984' DF

Owner: Continental Oil Co.
MCA Unit Battery 2 #154

Record of Casing: 8" - 860'

Cable

1980' FNL - 660' 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 7 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 Oil Location No. 17.32.29.32000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	55		Sand and caliche
55	350		Red mud
350	470		Red shale
	✓		
			L S Elev 3933
			Depth to K Trc 55
			Elev of K Trc 3878

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.29.32000 Elevation: --- 3933

Owner: Continental Oil Co.
MCA Unit Battery 2 #170
Record of Casing: 8" - 990'

Cable

1980' FSL - 1980' FWL

✓

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 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 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 107.1.0 FWL _____ FSL _____

File No. _____ Use 011 Location No. 17.32.29.33000

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	45		Sand and caliche
45	85		Red sand
85	125		Caliche
125	400		Red bed

L S Elev 3919 ?
Depth to K ____ Trc 85 ?
Elev of K ____ Trc 3834 ?

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.29.33000
Owner: Continental Oil Co. 2/4
MCA Unit Battery 2 ~~#124~~
Record of Casing: 8" - 1050'

Elevation: 4091' DF OK
Topo. Elev. 3909
DF Elev. 3919

Cable

660' FSL - 660' FWL OK

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 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. 17.32.30.13000

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	50		Surface formation
50	575		Red bed
575	580		Shale (water)
580	675		Red bed
675	810		Anhydrite
810	820		Sand water
			L S Elev 3895 Depth to K Trc 50 Elev of K Trc 3845

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.30.13000 Elevation: 3895' DF
Owner: Continental Oil Co.
MCA Unit Battery 1 #163
Record of Casing: 8" - 870'

Cable

1980' FNL - 660' FWL

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 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. 17.32.30.33000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	50		Surface sand and caliche
50	545		Red bed and red rock
545	590		Red bed, sandy
	✓		
			L S Elev 3871
			Depth to K Trc 50
			Elev of K Trc 3821

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.30.33000 Elevation: 3871' DF

Owner: Continental Oil Co.
MCA Unit Battery 1 #218
Record of Casing: 10 3/4" - 68'
8 5/8" - 1018'
Cable

660' FSL - 660' FWL

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 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 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. 17.32.34.241111

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	64		Sand and caliche
64	82		Red bed
82	792		Sand, red, and shale
			L S Elev 3963 DF
			Depth to K Trc 64
			Elev of K Trc 3898

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.32.34.241111 Elevation: 3952' Sea Level
Owner: Continental Oil Co.
Pearsall BX #2
Record of Casing: 8 5/8" - 59'
5 1/2" - 3515'
Rotary

1345' FNL - 1295' 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 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 6 need be completed.

SECTION _____

TOWNSHIP 17S

RANGE 33E

Form WR-23 STATE ENGINEER OFFICE STATE No. 1

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 WARTON DRILLING COMPANY
Street and Number Box 2807
City Odessa State Texas
Well was drilled under Permit No. ____ and is located in the
¼ SE ¼ NW ¼ of Section 1 Twp. 17 S Rge. 33 E
(B) Drilling Contractor Abbott Brothers License No. WD-46
Street and Number Box 637
City Hobbs State New Mexico
Drilling was commenced December 19 1957
Drilling was completed December 31 1957

Elevation at top of casing in feet above sea level ____ Total depth of well 180
State whether well is shallow or artesian shallow Depth to water upon completion 150

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	150	180	30	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	16	10	0	180	180	plain	150	180

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:

____
State Engineer Representative

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 DEC 30 1957
OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3750 Use O.W.D Location No. 17.33.1.190

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		soil
1	20	19		caliche
20	150	130		dry sand
150	160	10		water sand

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.

Merrill Abbott

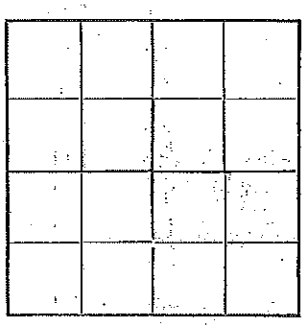
Well Driller

Form WR-23 Orig. & 5. 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 Denver Drilling Company
Street and Number Box 669
City Odessa State Texas
Well was drilled under Permit No. L-3782 and is located in the
S E ¼ S E ¼ S E ¼ of Section 2 Twp. 17 S Rge. 33 E
(B) Drilling Contractor Cayton Drilling Co. License No. WD-183
Street and Number Box 1021
City Lovington State New Mexico
Drilling was commenced Feb. 6 19 58
Drilling was completed Feb. 8 19 58

Elevation at top of casing in feet above sea level Total depth of well 183 Ft.
State whether well is shallow or artesian Shallow Depth to water upon completion 153 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	151	170	19	Water Sand
2	176	183	7	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
6 5/8	17	10	0	183	184	None	140	183

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
18	183	10	400 lbs.		Dry Mix - Hole Gravel Packed

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 FEB 20 1958

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3782 Use O. & U. D Location No. 17.33.2.444

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	4	3		Rock
4	12	8		Caliche
12	18	6		Boulder
18	26	8		Caliche
26	80	54		Sandy Clay
80	151	71		Dry Sand
151	170	21		Water Sand
170	176	6		Sandy Clay
176	183	7		Water Sand

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.

CAYTON WATER WELL DRILLING COMPANY
Well Driller
Grady Backus

STATE ENGINEER OFFICE

WELL RECORD

Revised June 1972

Section 1. GENERAL INFORMATION

(A) Owner of well Yates Petroleum Owner's Well No. _____

Street or Post Office Address 105 South 4th. Street

City and State Artesia, New Mexico 88210

Well was drilled under Permit No. L-10,212 and is located in the:

a. _____ ¼ _____ ¼ SE ¼ SE ¼ of Section 2 Township 17-S. Range 33-E 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 Glenn's Water Well Service, Inc. License No. WD 421

Address P.O. Box 692 Tatum, New Mexico 88267

Drilling Began 7-7-94 Completed 7-7-94 Type tools rotary Size of hole 14 3/4in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 273 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 168 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)
168	268	100	sand	120

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
8 5/8	.250		1	273	273	none	153	273

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

Date Received 07/13/94

Quad _____ FWL _____ FSL _____

File No. L-10.212 Use secondary recovery of oil-water flood Location No. 17S.33.2.44423

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	soil
1	27	26	caleche
27	168	141	sand and rock with stringers of clay
168	268	100	sand (water)
268	273	5	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.

Corky Herm
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.

Form WR-23

FIELD ENGR. LOG

STATE ENGINEER OFFICE

DATA OPE[...]ING COMPANY
STATE "[...]" No. 2

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

	0		

(Plat of 640 acres)

(A) Owner of well CARPER DRILLING COMPANY

Street and Number 300 Carper Building

City Artesia State New Mexico

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

SW ¼ SE ¼ NW ¼ of Section 2 Twp 17 S Rge. 33 E

(B) Drilling Contractor Ed. D. Burke License No. WD-111

Street and Number P.O. Box 300

City Hobbs State New Mexico

Drilling was commenced July 11 19__

Drilling was completed July 12 19 62

Elevation at top of casing in feet above sea level ______ Total depth of well 204

State whether well is shallow or artesian shallow Depth to water upon completion 162

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	162	201	39	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	20	10	0	197	197	none	165	197

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 STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX. 1962 JUL 19 AM 8:29

File No. L-4935 Use OWD Location No. 17.33.2.120

OWD – ok

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		top soil
1	22	21		caliche
22	66	24		Sand sand, pack
66	71	5		hard sand
71	78	7		loose sand
78	102	24		peak sand
102	201	99		water sand
201	206	5		tight sand

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.

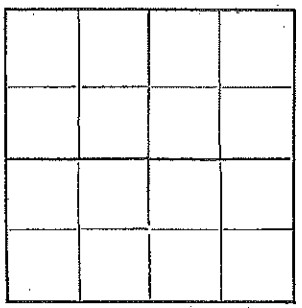
Edward B Burke
Well Driller

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 Pete Lomax Drilling Co.

Street and Number Box 424

City Hobbs State New Mexico

Well was drilled under Permit No. L-3012 and is located in the ¼ SE ¼ NW ¼ of Section 3 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Clayton & Porter License No. WD-163

Street and Number Box 1021

City Lovington State New Mex.

Drilling was commenced Nov. 1 19 55

Drilling was completed Nov. 1 19 55

Elevation at top of casing in feet above sea level ..... Total depth of well 210

State whether well is shallow or artesian Shallow Depth to water upon completion 155

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	166	198	32	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	16	10	0	210	210	none	100	210

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 NOV 10 1955

File No. L-3012 Use Oil Location No. 17.33.3.140

OFFICE GROUND WATER SECTION

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2		Rock & Soil
2	14	12		Rock
14	20	6		Caliche
20	180	160		Sand & Rock Shells
180	186	6		Rock
186	198	12		Water Sand
198	210	12		Sandy Clay

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.

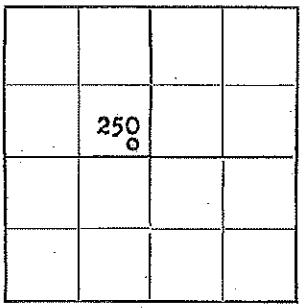
Jack Cayton
Well Driller

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 Continental Oil Company
Street and Number P. O. Box 460
City Hobbs State New Mexico
Well was drilled under Permit No. L-3528-S-3 and is located in the
SE ¼ SE ¼ NW ¼ of Section 3 Twp. 17S Rge. 33E
(B) Drilling Contractor Walco Drilling, Inc. License No. WD-349
Street and Number P. O. Box 806
City Hereford State Texas
Drilling was commenced December 20 1968
Drilling was completed December 21 1968

Elevation at top of casing in feet above sea level 4,195 Total depth of well 271
State whether well is shallow or artesian Shallow Depth to water upon completion 155

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	150	212	62	Sandrock and red fine sand
2	212	237	25	Clean red sand
3	237	239	2	Red clay and sand
4	239	265	26	Sand and small gravel
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
12-3/4	49.56	---	0	270	270	---	181	227

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 JAN 14 1969 8:02 AM

STATE ENGINEER OFFICE

File No. L-3528-S-3 Use WATERFLOOD Location No. 17.33.3.144

#2 Caprock 2-174-25

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	6			Top Soil
6	30			Rock, caliche and sand
30	50			Sand, sandrock and caliche
50	88			Sand and sandrock
88	90			Rock
90	150			Sand and sandrock
150	212			Sandrock and fine red sand
212	237			Clean red sand
237	239			Red clay and sand
239	265			Sand and small gravel
265	270			Red Bed

L S Elev 4183'
Depth to K Trc 265'
Elev of K Trc 3918'

Loc. No. 17.33.3. 14443'
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.

WALCO DRILLING, INC.
Well Driller
BY: R. Paul Conway
R. Paul Coneway
President

Form WR-23 Original & 5 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

660	N of	S. line	
660	W of	E. line	
W ter	Lease	W 99	
			0

(Plat of 640 acres)

(A) Owner of well Maljamar Co-op Repressuring Agreement
Street and Number 200 Booker Building
City Artesia State New Mexico
Well was drilled under Permit No. L-3528 and is located in the ¼ SE ¼ SE ¼ of Section 4 Twp. 17 S Rge 33 E
(B) Drilling Contractor Abbott Bros. License No. WD-46
Street and Number Box 637
City Hobbs State New Mexico
Drilling was commenced December 11 1957
Drilling was completed December 16 1957

Elevation at top of casing in feet above sea level ______ Total depth of well 265
State whether well is shallow or artesian Shallow Depth to water upon completion 158

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	225	65	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
16			0	19	19			
10 3/4	34	Welded	0	265	265	plain	170	232
							6 rows 1/8"x12"	

12 cu. yds. gravel pack before pumping.

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 DEC 30 1957 OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3528 Use Oilfield water flooding Location No. 17.33.4.44322

#1 Maj. 2-137-1

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	21	20		Caliche
21	150	129		Pack Sand
150	160	10		Hard Shell
160	225	65		Water Sand
225	240	15		Sandy Clay
240	265	25		Red Bed

L S Elev _____ 4179'
Depth to K _____ Trc 240'
Elev of K _____ Trc 3939'

FV 17.33.4.44325

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

Well Driller

L-3528

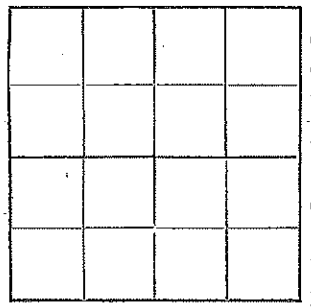
17.33.4.440

Form WR-23 FIELD 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 Yucca Water Co.

Street and Number Ft. Worth Natl. Bank Building

City Ft. Worth 2 State Texas

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

SE ¼ SE ¼ NE ¼ of Section 5 Twp. 17S Rge. 33E

(B) Drilling Contractor Abbott Bros. License No.

Street and Number Box 637

City Hobbs State New Mexico

Drilling was commenced June 18 19 59

Drilling was completed June 25 19 59

Elevation at top of casing in feet above sea level Total depth of well 272

State whether well is shallow or artesian shallow Depth to water upon completion 160

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	260	100	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
10 3/4	24	weld	0	272	272	open	165	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

FILED

JUL 7 1959

OFFICE GROUND WATER SECTION ROSWELL, NEW MEXICO

File No. L-3598-X Use ~~D-60 P/S~~ Location No. 17.33.5.222 20

#1 Map 2-25-2

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	14	13		Caliche
14	95	79		sand and gravel
95	160	65		tight sand (hard)
160	260	100		water sand
260	272	12		red clay

L S Elev 4198'

Depth to K Trc 260'

Elev of K Trc 3938'

Formation 17.33.5.222 20'

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.

Well Driller

L-3598-A

17.33.5.222

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

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

(A) Owner of well Yucca Water Company

Street and Number 300 Park Avenue

City New York 22 State N. Y.

Well was drilled under Permit No. L-3598 and is located in the NW ¼ NW ¼ NW ¼ of Section 6 Twp. 17S Rge. 33E

(B) Drilling Contractor B. E. Greenwood License No. WD-115

Street and Number 215 Birdway Avenue

City El Paso, State Texas

Drilling was commenced June 18, 1962 19

Drilling was completed June 25, 1962 19

(Plat of 640 acres)

Elevation at top of casing in feet above sea level 4223 ~~3800~~ Total depth of well 287 feet

State whether well is shallow or artesian shallow Depth to water upon completion 210 feet

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	~~155x~~	~~170x~~	~~20~~	~~Sandy clay and small gravel~~
2	230	255	25	Sand with streaks of clay
3	255	260	5	~~Small gravel~~ Brown sand and clay - gray gravel
4	265	270	5	Brown sand
5	270	280	10	Brown small gravel and sandy clay

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
12-3/4	30	welded	~~228x~~		287	welded	~~247~~ 242 ~~242~~	~~287~~ 282

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

1962 JUL 12 AM 8:23

File No. L-3598 Use SRO Location No. 17.33.6.111 26

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20	20	White	Dolomite
20	60	40	Brown	Caliche and sand
60	220	160	Brown	Fine Sand
220	230	10	Brown	Clay
230	255	25	Brown	Sand with Streaks of clay
255	260	5	Gray	Gravel
260	265	5	Brown	Clay
265	270	5	Brown	Sand
270	280	10	Brown	Small gravel and sandy clay
280	285	5	Brown	Clay
285	287	2	Purple	Clay

L S Elev 4243'
Depth to K Trc 280'
Elev of K Trc 3963'

Loc. No. 17.33.6.111D
Hydro. Survey ____ Field Check X

SOURCE OF ALTITUDE GIVEN
Interpolated from Topo. Sheet ____
Determined by Inst. Leveling ____
Other Altitude Rept.

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.

B. E. Greenwood
Well Driller

B. E. Greenwood

L-3598

17.33.6.111

Form WR-23 FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

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Section 1

(Plat of 640 acres)

(A) Owner of well B. E. Paschall

Street and Number 605 S. 14 th St.

City Artesia State New Mexico

Well was drilled under Permit No. L-1524 and is located in the

¼ SE ¼ SE ¼ of Section 6 Twp. 17 S Rge. 33 E

(B) Drilling Contractor P & P Drilling Co. License No. WD-281

Street and Number 1121 N. Love

City Lovington State New Mexico

Drilling was commenced Sept 23 19 60

Drilling was completed Sept. 26 19 60

Elevation at top of casing in feet above sea level ________ Total depth of well 100 ft.

State whether well is shallow or artesian shallow Depth to water upon completion 90

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
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
				None				

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
		7			

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 OFFIC DISTRICT II ROSWELL N MEX 1960 OCT 26 AM 8:3

File No. L-1524 Use Dom. Location No. 12.33.6.440

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				This was a clean out job from
				75 ft. to 100 ft. on a domestic well, for
				Stock watering only.

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.

Otis N. Powell
Well Driller

Form WR-23 FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

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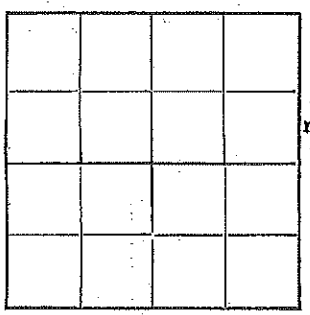
Section 1



(Plat of 640 acres)

(A) Owner of well Duel Drilling Co; c/o S. O. Lamb

Street and Number

City Colorado City State Texas

Well was drilled under Permit No. L-4122 and is located in the near center ¼ NE ¼ SW ¼ of Section 7 Twp. 17 S Rge. 33E

(B) Drilling Contractor P & P Drilling Co. License No. WD-281

Street and Number 1121 South Love

City Lovington State New Mexico

Drilling was commenced May 1 19 59

Drilling was completed May 3 19 59

Elevation at top of casing in feet above sea level Total depth of well 249 ft.

State whether well is shallow or artesian Shallow Depth to water upon completion 214 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	214	249		
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
		None						

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
		7		None	

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

FILED
JUN 24 1959
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-4122 Use O I & D Location No. 17.33.7.32322

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1			Soil
1	4			Rock
4	25			Clichie
25	75			Sandy Clay
75	140			Dry Sand
140	194			Sandy Clay
194	214			Water Sand
214	230			Sandy Clay
230	244			Sand
244	247			Sand & Gravel
247	249			Red Bed

L S Elev 4229'
Depth to K Trc 244'
Elev of K Trc 3985

Loc. No. 17.33.7. 32325
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.

Otis W. Pruett
Well Driller

L-4122

17.33.7.320

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 KENNAMER OIL COMPANY
Street and Number BOX 124
City HALJAMAR State NEW MEXICO
Well was drilled under Permit No. STATE WATER WELL #5 and is located in the PRINCIPAL USE
C ¼ SE ¼ ¼ of Section 7 Twp. 17S Rge. 33E
(B) Drilling Contractor C. O. ALDREDGE License No. 79
Street and Number BOX 379
City LOVINGTON State NEW MEXICO
Drilling was commenced JUNE 28 19 55
Drilling was completed JULY 13 19 55

Elevation at top of casing in feet above sea level ____ Total depth of well 227
State whether well is shallow or artesian SHALLOW Depth to water upon completion 182

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	164	188	24	LIGHT WATER SAND
2	188	215	27	GOOD WATER SAND AND GRAVEL
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	32	8	0	217	217	HOOD	183	217

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
		12¼			6 SACKS OF AQUAGEL POURED IN TOP OF HOLE TO HOLD BACK QUICKSAND WHILE DRILLING WELL

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: Cement Plugs were placed as follows:

Basin Supervisor

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

FOR USE OF STATE ENGINEER ONLY

Date Received JUL 28 1955

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-2771 Use Munic Location No. 17 33 7 4000

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	4	4	WHITE	TOP ROCK
4	12	8	RED	SAND
12	17	5	WHITE	HARD ROCK
17	51	34	RED	SAND
x988 51	64	13	GRAY	CALICHE
64	104	40	RED	SAND
104	117	13	GRAY	HARD CALICHE
117	134	17	GRAY	LIME AND STREAKS OF SAND
134	149	15	GRAY	BROKEN LIME
149	155	6	BROWN RED	SAND
155	164	9	GRAY	BROKEN LIME
164	188	24	RED	SAND - LIGHT WATER SAND
188	189	1	GRAY	LIME SHELL
189	215	26	BROWN	SAND AND GRAVEL - GOOD WATER SAND
215	220	5	RED	SANDY SHALE
220	222	2	RED	PACK SAND
222	227	5	RED	SHALE
	SET 10" PIPE AT 217 2 FEET INTO RED SANDY SHALE			
	TOTAL DEPTH 227			
				L S Elev 4217
				Depth to K Trc. 222
				Elev of K Trc. 3995
				PBO 17.33.7.400
				Loc. No.
				Hydro. Survey Field Check X

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. B. Aldridge
Well Driller

SOURCE OF ALTITUDE GIVEN

Interpolated from Topo. Sheet X

Determined by Inst. Leveling

Other

L-2771

17.33.7.400

Form WR-23 STATE ENGINEER OFFICE

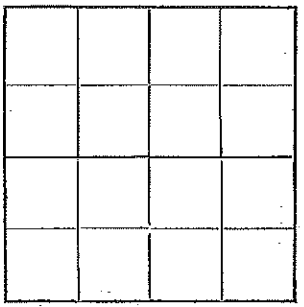
FIELD [illegible] LOG

WELL RECORD

Phil[illegible]s State # 1

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 Thunderbird Drilling Co.

Street and Number 322 Fidelity Union Bldg.

City Dallas State Texas

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

¼ SW ¼ SW ¼ of Section 9 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Abbott Bros. License No. WD-46

Street and Number Box 637

City Hobbs State New Mexico

Drilling was commenced Dec. 19 19 57

Drilling was completed Dec. 21 19 57

Elevation at top of casing in feet above sea level ____ Total depth of well 230

State whether well is shallow or artesian Shallow Depth to water upon completion 160

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	230	70	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

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 DEC 30 1957

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3749 Use D.&D. Location No. 17.33.9.330

.342113

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	19	18		Caliche
19	160	141		Dry Sand
160	230	70		Water Sand

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.

Well Driller

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

CORRECTED COPY

WELL RECORD

Unit Well 245

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 Continental Oil Company

Street and Number P.O. Box 460

City Hobbs State New Mexico

Well was drilled under Permit No. L-3528-S-2 and is located in the NW ¼ SW ¼ SW ¼ of Section 9 Twp. 17S Rge. 33E

(B) Drilling Contractor Abbot Brothers License No. WD-46

Street and Number P.O.Box 657

City Hobbs, State New Mexico

Drilling was commenced 7-8-67 19

Drilling was completed 7-19-67 19

Elevation at top of casing in feet above sea level Total depth of well 262'

State whether well is shallow or artesian Shallow Depth to water upon completion 180'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	198	262	64'	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
12 3/4	36	welded	-1	262	263	open	170	250
							4 rows 3/16 X 12	

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 OCT 18 1967

File No. L-3528-S-2 Use S R (Corrected) Location No. 17.33.9.33/432'

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		surface soil
1	26	25		caliche
26	78	52		sand, tight
78	96	18		sand, loose
96	129	33		sand, tight
129	232	103		sand
232	252	20		sandy clay
252	262	10	red	clay

4200'
L S Elev
Depth to K Trc 2525'
Elev of K Trc 3948'

SP 17.33.9.331432

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.

Murrell Abbott
Well Driller

L-3528-S-2

17.33.9.331

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

FIELD ENGR. LOG

Section 1. GENERAL INFORMATION

(A) Owner of well Ideal Basic Industries, Inc. %Potash Company of America Owner's Well No. # 8

Street or Post Office Address P.O. Box 31

City and State Carlsbad, New Mexico 88220

Well was drilled under Permit No. L-1880-S-3 and is located in the:

a. ___ ¼ NW ¼ SE ¼ NW ¼ of Section 12 Township 17S Range 33E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

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

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

(B) Drilling Contractor Abbott Bros. Drilling License No. WD-46

Address Hobbs, New Mexico 88240

Drilling Began 4/21/81 Completed 5/4/81 Type tools Cable Size of hole 24 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 268 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 155 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)
159	230	71	Sand	

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
14	36.71	Welded	0	269	269		155	268

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 Rep[illegible]

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

FOR USE OF STATE ENGINEER ONLY

Date Received May 14, 1981

Quad ___ FWL ___ FSL ___

File No. L-1880-S-3 Use ~~IND.~~ MOO Location No. 17.33.12.14142 .14/LC

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	Soil
1	26	25	Caliche
26	125	99	Sand
125	159	34	Sand and sand rock
159	230	71	Sand-water
230	241	11	Sand
241	258	17	Sand and clay streaks
258	268	10	Red clay

L S Elev 4148'
Depth to K Trc 241'
Elev of K Trc 3907'

Loc. No. 17.33.12.14110
Hydro. Survey ____ Field Check PCA Survey

~~SOURCE OF ALTITUDE GIVEN~~
Interpolated from Topo. Sheet ____
Determined by Inst. Leveling ____
Other ____

Section 7. REMARKS AND ADDITIONAL INFORMATION

'81 MAY 14 AM 8 28
STATE ENGINEER OFFICE
ROSWELL, N.M.

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.

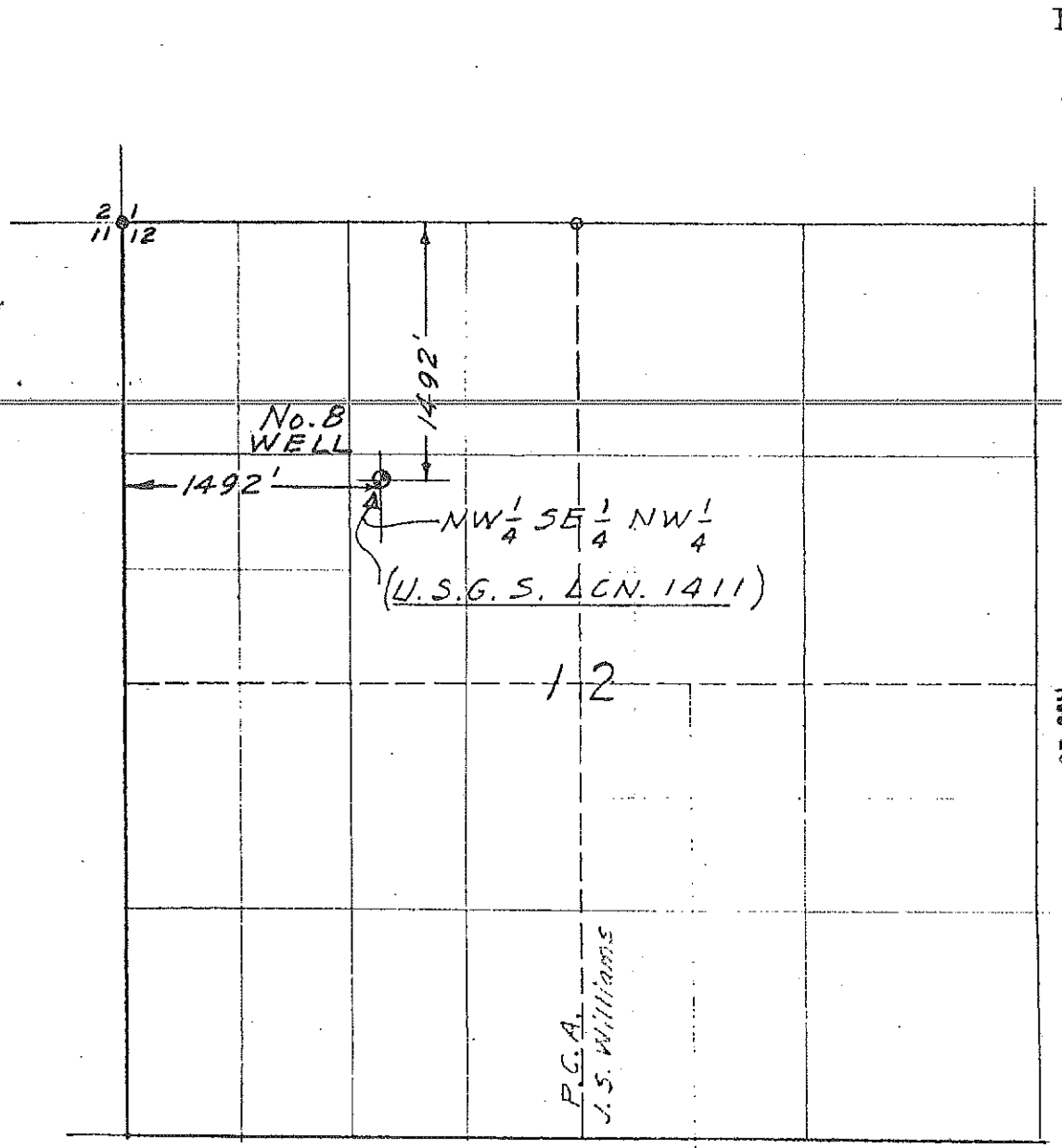
Murrell Abbott
Driller 3-6

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.

LOCATION - CAPROCK NO. 8 WATER WELL.
POTASH CO. OF AMERICA - CARLSBAD, N.M.

SECT. 12, T. 17 S., R. 33 E.

($W\frac{1}{2}$ of Sect. - P.C.A. deeded land.)



1" = 1000'

L-1880-S-3 .14110

ECJ
8/17/81

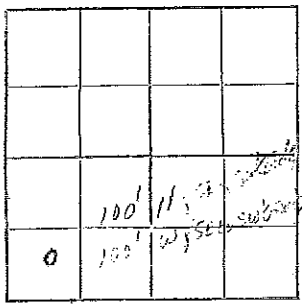
Form WR-23 STATE ENGINEER OFFICE

FIELD ENGR. LOG

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 Potash Company of America

Street and Number P. O. Box 31

City Carlsbad State New Mexico

Well was drilled under Permit No. L-1880 thru L-1884 Comb. 5 and is located in the SE ¼ SW ¼ SW ¼ of Section 12 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Abbott Bros. License No. WD- 46

Street and Number P. O. Box 837

City Hobbs State New Mexico

Drilling was commenced May 3 19

Drilling was completed May 5 19 66

Elevation at top of casing in feet above sea level Total depth of well 250

State whether well is shallow or artesian shallow Depth to water upon completion 115

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	115	230	115	Water sand
2	235	250	15	Sand and gravel
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
14	85	Weld	0	250	250	open	120	240
Drilled 24" hole								

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 ✓

STATE ENGINEER OFFICE
DISTRICT II
ROSWELL, N. M.

SEP 29 AM 8:31 1966

File No. L-1880 thru L-1884 Comb 5 Use Ind. & Com Location No. 17.33.12.33844 ✓

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	23	22		Caliche
23	70	47		Sand
70	115	45		Sand, dry
115	230	115		Sand, water
230	235	5		Sandy clay
235	250	15		Sand and gravel
250	259	9	red	Clay

L S Elev 4132'
Depth to K Trc 250'
Elev of K Trc 3883'

Loc. No. 17.33.12.334AAA1
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.

Murrell Abbott
Well Driller

L-1880 Then 1884 Comb. S

17.33.12.334

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

Street and Number Donnelly Drilling Company

City Box 432 State

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

¼ ¼ ¼ of Section Twp. Rge.

(B) Drilling Contractor Ed Burke License No. 338

Street and Number #3111

City Box 306 State

Drilling was commenced November

Drilling was completed December 4 19 59

December 4 59

Elevation at top of casing in feet above sea level Total depth of well 237

State whether well is shallow or artesian Shallow Depth to water upon completion 165

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2	165	202	37	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
7	20	30	0	198	198	Open	177	198

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 STATE ENGINEER OFFICE DISTRICT II

1959 DEC 10 AM 8:51

File No. L-4333 Use D.D. Location No. 17.33.13.110

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	14	14		Caliche
14	68	54		Sand (tight)
68	83	15		Sand (loose)
83	140	57		Sand (tight)
140	165	25		Sand (loose)
165	202	37		Sand (water)
202	217	15		Sand (tight)

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.

Edward B Burke
Well Driller

Form WR-23

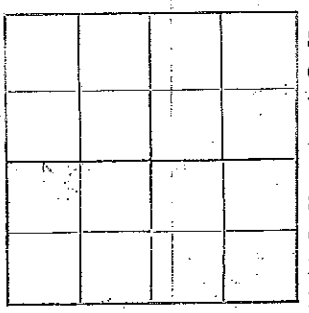
STATE ENGINEER OFFICE

FIELD ENGR. LOG

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 Potash Company of America

Street and Number Box 31

City Carlsbad, N.M. L-1880-S-2 State

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

NE¼ NW¼ SW¼ of Section 13 Twp. 17S Rge. 33E

(B) Drilling Contractor Abbott Bros. License No. WD-46

Street and Number Box 637

City Hobbs, N.M. State

Drilling was commenced March 9, 1972 19

Drilling was completed March 16, 1972 19

Elevation at top of casing in feet above sea level Total depth of well 235

State whether well is shallow or artesian shallow Depth to water upon completion 151

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
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
14	30	welded	1	238	238	none	118	228

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-1880-S-2 Use COM Location No. 17.33.13.3143

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	4	4	brown	surface soil
4	28	24	gray	caliche
28	45	13	brown	sand tight
45	102	57	brown	sand loose
102	153	51	brown	sand tight
153	154	1	red	shale
154	198	44	brown	sand
198	201	3	red	shale
201	218	17	brown	sand
218	225	7	brown	sandy clay
225	230	5	gray	gravel
230	235	5	red	clay

L S Elev 4124 ✓
Depth to K Trc 230 ✓
Elev of K Trc 3894 ✓

Loc. No. 17.33.13.31413
Hydro. Survey Field Check HWP

SOURCE OF ALTITUDE GIVEN
Interpolated from Topo. Sheet 4124
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.

Murrel Abbott
Well Driller

Form WR-23 STATE ENGINEER OFFICE

Orig in S.E.

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 Potash Company of America

Street and Number

City Carlsbad State New Mexico

Well was drilled under Permit No. L-1880 and is located in the SW ¼ SE ¼ SW ¼ of Section 13 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Gaynon & Porter License No. WD-183

Street and Number Box 1021

City Lovington State New Mexico

Drilling was commenced August 18 1955

Drilling was completed August 18 1955

Elevation at top of casing in feet above sea level Total depth of well 245

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				
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

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 SEP 30 1955

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-1880 Use Ind & Dom. Location No. M.33.13.343

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
This was work done on a repair Permit.				
Well was cleaned out from 232' to 245'.				

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.

Jack Compton
Well Driller

Form WR-23 *Orig in S.F.*

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 Potash Company of America
Street and Number P. O. Box 31
City Carlsbad, State New Mexico
Well was drilled under Permit No. L-1882 and is located in the SE ¼ SW ¼ SE ¼ of Section 13 Twp. 17 S. Rge. 33 E.
(B) Drilling Contractor Randolph Johnston License No. WD-22
Street and Number West Grand Ave.
City Artesia State New Mexico
Drilling was commenced February 2, 19 48
Drilling was completed March 16, 19 48

Elevation at top of casing in feet above sea level 4128 Total depth of well 245
State whether well is shallow or artesian shallow Depth to water upon completion 144

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
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

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 SEP 12 1950
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-1882 Use *Ind & Dom.* Location No. 17.33.13.434441

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				I. S Elev 4128
				Depth to K Trc ≥ 240
				Elev of K Trc ≤ 3888
				Loc. No. 17.33.13.43444
				Hydro. Survey Field Check X
				SOURCE OF ALTITUDE GIVEN
				Interpolated from Topo. Sheet
				Determined by Inst. Leveling X
				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.

Randolph Johnston
Well Driller

No. 3 Caproch Water Well

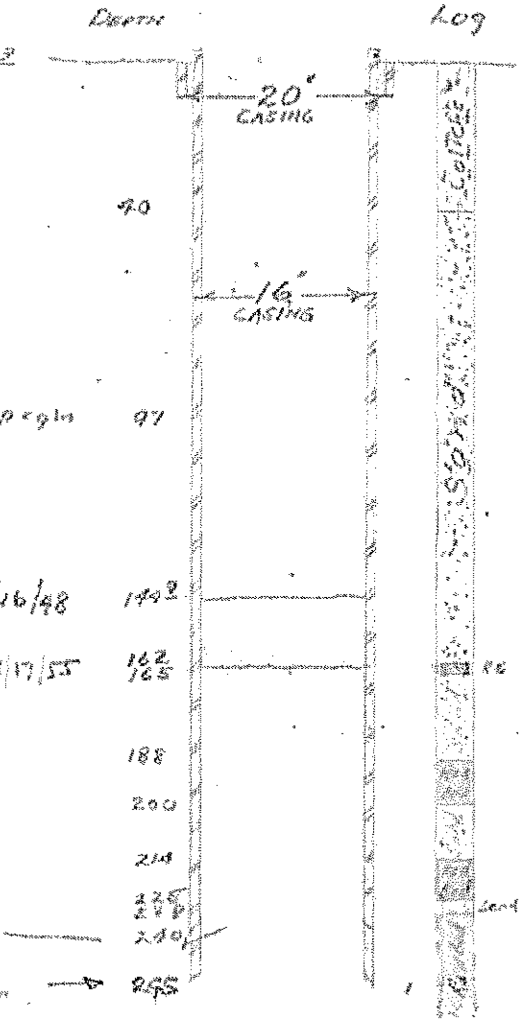
No L-1882 Lea County Basin

Drilled Feb 2, 1948
To Mar 16, 1948

By - Buck Thierac

Location SE¼, SW¼ SE¼
Sec 13 T17S R33E

Collar Elev. 4129.05



APPROVED BY	LOG OF No 3 CAPROCH WATER WELL	POTASH COMPANY OF AMERICA CARLSBAD, NEW MEXICO	
		DRAWN BY DEP ENG	DRAWING NO.
		CHECKED BY	3-1374
	SCALE- 1" = 50' / DATE- 8-24-55	DIRECTED BY RRD	

Form WR-23

FIELD ENGR. L[illegible]

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 Potash Co. of America

Street and Number Box 31

City Carlsbad, State New Mexico

Well was drilled under Permit No. L-1882 and is located in the SE ¼ SE ¼ SE ¼ of Section 13 Twp. 17 S Rge. 33 E

(B) Drilling Contractor P & P Drilling Co. License No. WD-281

Street and Number 1121 S. Love

City Lovington State New Mexico

Drilling was commenced Sept. 22 19 64

Drilling was completed Sept. 24 19 64

Elevation at top of casing in feet above sea level ____ Total depth of well 245

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				
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
14			226	245	14			

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 ✓

OCT 30 [illegible]

File No. L-1882 Use Ind & Dom (Repair) Location No. 17.33.13.434

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				This was a repair Job-on Potash Mine well
				Cleaned & Drilled Fr 220 ft to 240 ft.
				Run Pipe Scratcher- Set 14 ft. of 14 in
				casing -in Bottom of Hole & Bailed.

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.

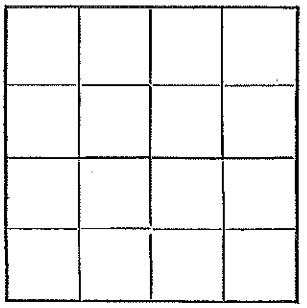
Otis W. Pruett
Well Driller

Form WR-23 Orig. S.E. 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 Potash Company of America

Street and Number

City Carlsbad State New Mexico

Well was drilled under Permit No. L-1883 and is located in the SE ¼ SE ¼ SE ¼ of Section 13 Twp. 17 S. Rge. 33 E.

(B) Drilling Contractor Emmatt Barron License No.

Street and Number

City Carlsbad State New Mexico

Drilling was commenced June 11 19 52

Drilling was completed July 24 19 52

Elevation at top of casing in feet above sea level Total depth of well 259

State whether well is shallow or artesian Shallow Depth to water upon completion 147

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	120	135	15	Br. hard chunky sand
2	219	239	20	Br. muddy sands very little gravel
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
16			0	150	150			
13 5/8			12'3"	259				

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 November 1, 1955

File No. L-1883 Use Ind. & Dom. Location No. 17.33.13.444 44

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20	20		Lime & Caliche
20	50	30		hard fine sand
50	60	10		fine red sand
60	65	5		br. hard sand
65	80	15		fine red sand
80	95	15		br. hard chunky sand
95	120	40		fine sand
120	135	15		br. hard chunks sand
135	145	10		fine sand
145	147	2		hard sand
147	150	3		red bed
150	170	20		fine sand
170	173	3		red bed
173	210			fine & cores sand some gravel
210	219	9		red bed
219	239	20		br. muddy sands
239	241r	2		course gravel
241	259			red bed-some gravel

L S Elev 4123r
Depth to K Trc 241r
Elev of K Trc 3882r

17.33.13.444

Loc. No.

Hydro. Survey 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.

/s/ Emmett Barron
Well Driller

L-1883

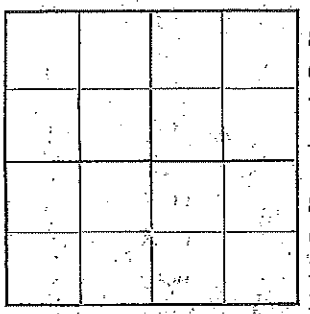
17.33.13.444

Form WR-23 Declaration S.F. 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 Pethick Company of America

Street and Number

City Carlsbad State New Mexico

Well was drilled under Permit No. L-1883 and is located in the

SE ¼ SE ¼ SE ¼ of Section 23 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Cayton & Porter Drlg. Co. License No. WD-183

Street and Number Box 1021

City Lovington State New Mexico

Drilling was commenced Sept. 20 19 55

Drilling was completed Sept. 26 19 55

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

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				
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

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

FILED
JUL 16 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-1883 Use Ind & Dom. Location No. 17.33.13.444

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness In Feet	Color	Type of Material Encountered
				Pull 230 ft. 6" pump. Clean out mud hole and reset pump.

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.

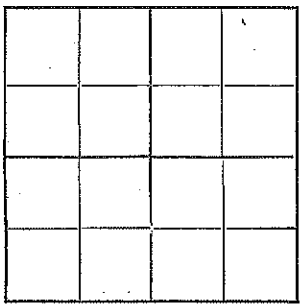
CATTON & PORTER DRILLING COMPANY
Well Driller
M. R. Porter

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 POTASH COMPANY OF AMERICA

Street and Number Box 31

City Carlsbad State New Mexico

Well was drilled under Permit No. L-1883 and is located in the ¼ SE ¼ SE ¼ of Section 13 Twp. 17 S Rge. 33 E

(B) Drilling Contractor P & F Drilling Co. License No. WD-281

Street and Number 1121 S. Love

City Lovington State New Mexico

Drilling was commenced Aug 21 19 60

Drilling was completed Aug 21 19 60

Elevation at top of casing in feet above sea level ..... Total depth of well 100 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				
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
				None				

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
		7	None		

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 AUG 24 1960 AM 8:1

File No. L-1883 Use Ind & Dom. Location No. 17.33.13.440

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				This was a clean out job, on a Domestic well, for a Potash Mine.
				Pished out suction pipe, and cleaned well from 70 ft to 100 ft.

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.

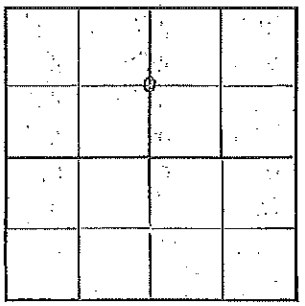
Otis H. Truett
Well Driller

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 Midland Drilling Company

Street and Number 110 W. Ohio St.

City Midland State Texas

Well was drilled under Permit No. L-3622 and is located in the

Center¼ ¼ NW ¼ ¼ of Section 17 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Cayton Drlg. Co. License No. WD-189

Street and Number Box 1021

City Lovington State New Mexico

Drilling was commenced July 22 19 57

Drilling was completed July 25 19 57

Elevation at top of casing in feet above sea level Total depth of well 226 Ft.

State whether well is shallow or artesian Shallow Depth to water upon completion 180 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	180	200	20	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	17	10	0	226	226	None	180	226

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
18	226	10	500 lbs.		Dry Mix. Hole Gravel packed

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

FILED
AUG 1 1957
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-3622 Use Owner Location No. 17.33.17.12444

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2		Soil
2	12	10		Caliche
12	18	6		Boulder
18	180	162		Sand, Shell, & Clay
180	200	20		Water Sand
200	224	24		Sand, Shell, & Gravel
224	226	2		Red Bed

L S Elev 4209 ✓
Depth to K Trc. 224 ✓
Elev of K Trc. 1985 ✓

Loc. No. 17.33.17.12444 ✓

Hydro. Survey ____ Field Check X (Not Found)

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.

CAYTON Drilling Company
Well Driller
Jack Cayton

L-3622

17.33.17

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 KEWANEE OIL COMPANY

Street and Number MALJAMAR, NEW MEXICO

City _____ State _____

Well was drilled under Permit No. STATE WATER WELL #4 MUNICIPAL USE and is located in the C ¼ NE ¼ ¼ of Section 18 Twp. 17S Rge. 33E

(B) Drilling Contractor C. O. ALDREDGE License No. 79

Street and Number BOX 379

City LOVINGTON State NEW MEXICO

Drilling was commenced JUNE 6 19 55

Drilling was completed JUNE 28 19 55

Elevation at top of casing in feet above sea level _____ Total depth of well 214-6

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	169	180	16	LIGHT WATER SAND
2	185	213	28	GOOD 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
10	32	8	0	214-6	214.6	NONE	182	214.6

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
		12¼			6 SACKS OF AQUEGEL POURED IN TOP OF HOLE TO HOLD BACK QUICKSAND WHILE DRILLING WELL

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 JUL 28 1955

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-2770 Use Manic. Location No. 17.33.18 24111 200

#4 in 00-2-2034

Section 6

LOG OF WELL

Depth In Feet From	Depth In Feet To	Thickness in Feet	Color	Type of Material Encountered
0	3	3	BROWN	SOIL
3	68	65	RED	SAND
68	71	3	GRAY	LIME
71	98	17	WHITE	CALICHE
98	117	19	RED	SAND
117	129	12	WHITE	CALICHE
129	163	34	RED	SAND
163	165	2	BROWN	SHALE
165	189	24	RED	SAND AND GRAVEL LIGHT WATER SAND
189	192	3	LIGHT GRAY	LIME SHELL
192	198	6	RED	SAND
198	213	15	BROWN	WATER SAND - Good
213	214	1	RED	SHALE
RUN 10" PIPE TO 213-6 CLEANED OUT DROVE PIPE FROM 213-6 TO 214-6 - ONE FOOT IN RED BED				
		TOTAL DEPTH 214.6		L.S Elev 4215
				Depth to K Trc 213
				Elev of K Trc 4002
				PRO 17.33.18.200
				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.

G. B. Aldredge
Well Driller

L-2770

17.33.18.200

Form WR-23

STATE ENGINEER OFFICE

L-2773

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

#3 on OC-2-203-1			

(Plat of 640 acres)

(A) Owner of well KEWANEE OIL COMPANY

Street and Number

City MALJAMAR State NEW MEXICO

Well was drilled under Permit No. CLEAN OUT OIL CAMP WELL # 2 and is located in the EXTREME CORNER N.E. ¼ CORNER SW ¼ ¼ of Section 18 Twp. 17 Rge. 33

(B) Drilling Contractor C. O. GLOREDGE License No. 79

Street and Number Box 379

City LOVINGTON State NEW MEXICO

Drilling was commenced JUNE 1 19 55

Drilling was completed JUNE 6 19 55

Elevation at top of casing in feet above sea level Total depth of well 214

State whether well is shallow or artesian SHALLOW Depth to water upon completion 184

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	196	214	18	QUICK 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
10			± 0	214	214 →	RED BED		
	WELL ALREADY CASED WHEN CLEANED OUT							

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
		No 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 JUL 11 1955

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-2773 Use Manic Location No. 17.33.18.a 322

#3 on OC-2-203-1

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
196	214	18	RED	QUICK SAND

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. O. Wheeler
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 KEWANEE OIL CO.

Street and Number BOX 124

City MALJMAR State N. MEX.

STATE WATER WELL DRILLED ON 4-1947 MUNICIPAL USE

Well was drilled under Permit No. 2090 FROM WEST LINE and is located in the

¼ ¼ ¼ of Section 18 Twp. 17S Rge. 33E

(B) Drilling Contractor C. O. ALDRIDGE License No. 9

Street and Number BOX 379

City LOVINGTON State NEW MEXICO

Drilling was commenced JULY 14 55

Drilling was completed JULY 16 19 55

Elevation at top of casing in feet above sea level 4230 Total depth of well 220

State whether well is shallow or artesian SHALLOW Depth to water upon completion 202

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	202	215	13	QUICK 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
10 3/4	40.5#	8	0	215.2	215.2			
		WELL WAS	DRILLED	4-19-47	WAS ALREADY CASED	WHEN CLEANED OUT		

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
			NO MUD	USED	

FILED JUL 28 1955 OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

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 FILED JUL 28 1955 OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-2773 Use Municip. (Repair) Location No. 17.33.18 322 323331

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
202	215	13	RED	QUICK SAND
215	220	5	RED	RED BED

L S Elev 4225
Depth to K Tre 215
Elev of K Tre 4010

FV 17.33.18.32233

Loc. No.
Hydro. Survey Field Check X

SOURCE OF ALTITUDE
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.C. Aldredge
Well Driller

L-2773

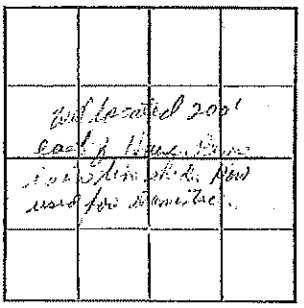
17.33.18.322

Form WR-23 Orig S.E. 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 Henry Black Drilling Company
Street and Number Box 174
City Midland State Texas
Well was drilled under Permit No. L-3726 and is located in the ¼ ¼ N E ¼ of Section 28 Twp. 17 S Rge. 33 E
(B) Drilling Contractor Cayton Drlg. Co. License No. WD-183
Street and Number Box 1021
City Lovington State New Mexico
Drilling was commenced November 25 19 57
Drilling was completed November 30 19 57

Elevation at top of casing in feet above sea level 4216 Total depth of well 208 Ft.
State whether well is shallow or artesian Shallow Depth to water upon completion 188 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	188	194	6	Water Sand
2	203	207	5	Water Sand & Gravel
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	20	10	0	208	208	None	148	208

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
20	208	10	400 lbs.		Dry Mix; hole gravel packed

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 FEB 10 1958

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3726 Use D.&D. Location No. 17.33.19.230

2-21-58

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	8	7		Caliche
8	12	4		Boulder
12	18	6		Caliche
18	26	8		Boulder
26	188	162		Sandy Clay Shell
188	194	6		Water Sand
194	203	9		Sandy Clay
203	207	5		Water Sand & Gravel
207	208	1		Red Bed

L S Elev 4216'
Depth to K Trc 207'
Elev of K Trc 4009'

Loc. No. 17.33.18. 22113
Hydro. Survey Field Check X

SOURCE OF ALTITUDE GIVEN
Interpolated from Topo. Chart 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.

CATTON DRILLING COMPANY
Well Driller
Jack Catton

L-3726

17.33.18.230

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: Warren and Bradshaw Expl. & Drlg. Co.
Street and Number: 2504 West Brunson
City: Midland State: Texas
Well was drilled under Permit No. L-2875 and is located in the NE ¼ NE ¼ ¼ of Section 20 Twp. 17 S Rge. 33 E

(B) Drilling Contractor: Abbott Brothers License No. [illegible]
Street and Number: P.O. Box 637
City: Hobbs, State: New Mexico
Drilling was commenced: May 16 1955
Drilling was completed: May 20 1955

Elevation at top of casing in feet above sea level ______ Total depth of well 250
State whether well is shallow or artesian: shallow Depth to water upon completion 190

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	190	235	45	Water sand [illegible] (Low yield)
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	17	8	0	250	250	no	190	250

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

FILED
MAY 26 1955
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

FOR USE OF STATE ENGINEER ONLY

Date Received: May 26, 1955

File No. L-2875 Use: Oil Location No. 17.33.20.220

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	9	8		Caliche
9	60	51		Tight sand
60	120	60		Sand
120	190	70		Tight Sand
190	235	45		Water Sand
235	250	15		Sandy Clay

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.

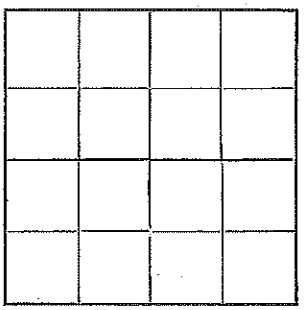
Morrell Abbott
Well Driller

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 Phillips Petroleum Corp.
Street and Number Box 1351
City Odessa State Texas
Well was drilled under Permit No. Applied for L-3133 and is located in the
Center ¼ NW ¼ SW ¼ of Section 23 Twp. 17 S Rge. 33 E
(B) Drilling Contractor Clayton & Porter Drlg. Co. License No. WD-153
Street and Number Box 1021
City Lovington, State New Mexico
Drilling was commenced February 29 19 56
Drilling was completed March 4 19 56

Elevation at top of casing in feet above sea level ____ Total depth of well 230
State whether well is shallow or artesian Shallow Depth to water upon completion 160

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	158	198	40	Water Sand-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	32	8	0	230	230	None	160	230

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: Cement Plugs were placed as follows:

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

Basin Supervisor

FOR USE OF STATE ENGINEER ONLY

Date Received MAR 14 1956

FILED
MAR 14 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-3133 Use Oil Location No. 17.33.23.300 313207

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	8	8		Rock
8	12	4		Caliche
12	20	8		Rock
20	112	92		Sand
112	158	46		Sandy Clay
158	198	40		Water Sand & Gravel
198	220'	22		Sand
220	230	10		Red Clay

L S Elev 4143'
Depth to K Tre 220'
Elev of K Tre 3923'

DL 17.33.23.3130'

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.

Well Driller

L-3133

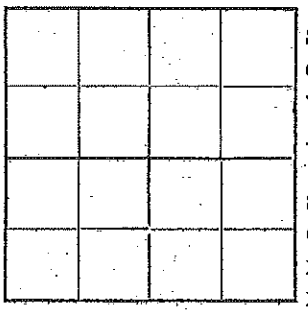
17.33.23.310

Form WR-23 Original S.E. 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 Phillip Petroleum Co.
Street and Number Box 758
City Hobbs State New Mexico
Well was drilled under Permit No. L3133 and is located in the
¼ NW ¼ SW ¼ of Section 23 Twp. 17 S Rge. 33 E
(B) Drilling Contractor P & P Drilling Co. License No. WD 281
Street and Number 1121 South Love
City Lovington State New Mexico
Drilling was commenced Sept 2 19 58
Drilling was completed Sept 3 19 58

Elevation at top of casing in feet above sea level ____ Total depth of well 230 ft
State whether well is shallow or artesian Shallow Depth to water upon completion 70 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				
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 In.	hole				no casing			

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 SEP 26 1958

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3133 Use I.&D. Location No. 17.33.23.310

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				This is an old well drilled March 1956
				and later plugged, well was 230 ft. of 7"
				casing. We drilled out plug, clean out
				and bailed out hole; to be used for oil well
				Drilling purposes

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.

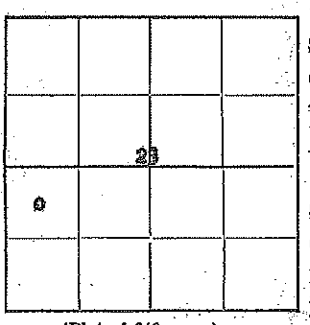
Grady Backus
Well Driller

Form WR-23 FIELD R. 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 Phillips Petroleum Company
Street and Number Box 2105
City Hobbs State New Mexico
Well was drilled under Permit No. L-3133 and is located in the
¼ NW ¼ SW ¼ of Section 23 Twp. 17S Rge. 33E
(B) Drilling Contractor Clayton Water Well License No. NR
Street and Number P. O. Box 1021
City Lovington State New Mexico
Drilling was commenced 19
Drilling was completed Well reopened 11-21-59 19

Elevation at top of casing in feet above sea level 4144 Total depth of well 230'
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				* See original well record.
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"	20 & 23	8	0	230	230	-	*	

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
					None

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 1959 NOV 27 AM 8:20 STATE ENGINEER OFFICE

File No. L-3133 Use O.W.D. Location No. 17.33.23.3.1.0

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				See original well record.

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.

W. W. Crosier

PHILLIPS PETROLEUM COMPANY 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.

Land Commissioners
Prospectors No. M2902

Section 1

# 5-	C-2-	153-5	

(Plat of 640 acres)

(A) Owner of well: Southwest Potash Co.
Street and Number: Box 472
City: Carlsbad State: N. M.
Well was drilled under Permit No. ____ and is located in the SE ¼ SE ¼ NE ¼ of Section 25 Twp. 17 S Rge. 33E
(B) Drilling Contractor: T. M. Theriac License No. ____
Street and Number: P.O.Box 1434
City: Hobbs State: N.
Drilling was commenced: April 8 19 50
Drilling was completed: April 21 19 50

Elevation at top of casing in feet above sea level ____ Total depth of well 230
State whether well is shallow or artesian ____ Depth to water upon completion 137 (reported)

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	137	187	50	Tertiary Sands and gravels
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
13 3/8		New seamless			194'8"	Bethleham Texas Pattern	94'2"	193'4"

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 December 29, 1952

File No. L1695 Use ____ Location No. 17.33.25.244 4/4 C

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	18			Hard crust top soil; caliche various hardness
18	28			Harder caliche fragments
28	38			Larger caliche fragments
38	50			Caliche and fine sil, approx. 20% brown sand
50	60			Fine dry sand, clear red brown particles
60	105			Red, brown and clean sand, few particles hard limestone
105	110			Fine sil and brown sand-quicksand
110	115			90% small clear & brown sand, trace of lime
115	130			Sil of various size, small brown & clear sand
130	135			Sil and brown and red sand
135	137			Hit water at 137', brown and clear quicksand
137	160			Larger particles sil-sand more porous
160	174			Few large particles brown and clear sill & quarts. Small flakes of red compaction shale
174	180			Clear, brown, red and orange sand
180	185			Sand same - few ½" to 1" and gravel, small flakes of red clay
185	190			Red and brownish clay in much larger quantity
190	200			Solid red bed, sand disappearing fast
200	225			Red bed solid, no sand encountered.

USGS Elev 4093
Depth to K Trc 190
Elev of K Trc 3903

Loc. No. 17.33.25.244444
Hydro. Survey Field Check X

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

T. M. Theriac
Well Driller

SOURCE OF ALTITUDE GIVEN
Interpolated from Topo. Sheet X
Determined by Inst. Leveling
Other

17.33.25.244

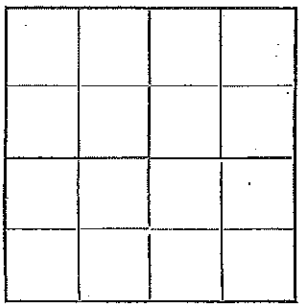
Form WR-23 Roswell S.E. STATE ENGINEER OFFICE

WELL RECORD

Phillips State Lease Water well

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 ZAPATA PETROLEUM CORP.

Street and Number Box 2216

City Midland State Texas

Well was drilled under Permit No. ____ and is located in the SW ¼ SE ¼ NW ¼ of Section 28 Twp. 17 S Rge. 33 E

(B) Drilling Contractor Abbott Brothers License No. WD-46

Street and Number Box 637

City Hobbs State New Mexico

Drilling was commenced October 21 19 57

Drilling was completed October 23 19 57

Elevation at top of casing in feet above sea level ____ Total depth of well 210

State whether well is shallow or artesian shallow Depth to water upon completion none

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	None			
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

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 DEC 30 1957

OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

File No. L-3713 Use O.W.D. Location No. 17.33.28.144

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		soil
1	16	15		caliche
16	210	194		dry sand

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.

Murrell Abbott
Well Driller

Form WR-23 STATE ENGINEER OFFICE East Maljamar Plant W.W. #1

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 El Paso Natural Gas Company
Street and Number P. O. Box 1492
City El Paso State Texas
Well was drilled under Permit No. Misc. 2-L-58 and is located in the NE ¼ NE ¼ NE ¼ of Section 29 Twp. 17S Rge. 33E
(B) Drilling Contractor Abbott Bros. License No.
Street and Number P. O. Box 637
City Hobbs State New Mexico
Drilling was commenced 19
Drilling was completed July 22, 1958 19 58

Elevation at top of casing in feet above sea level Total depth of well 244'
State whether well is shallow or artesian Shallow Depth to water upon completion 204'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	165	228	43	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
6 5/8			0	244	244		168	244

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 STATE ENGINEER OFFICE DISTRICT II MAR 31 PM 2:20 1961

File No. Misc. 2-L-58 Use Ind & Dom. Location No. 17.33.29.222R

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		Soil
1	18	17		Caliche
18	80	62		Sand
80	85	5		Sand rock
85	125	40		Sand
125	185	60		Tight sand and Rock
185	228	43		Water, sand
228	244	16		Sand and Red Clay

L S Elev 4188 ft.
Depth to K Trc 244 ft.
Elev of K Trc 3944 ft.

Loc. No. 17.33.29.222 22.

Mydro. Survey 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.

Well Driller

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. 17.33.30.11000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	28		Caliche and gravel
28	223		Shale and shells
223	515		Red rock
515	533		Anhydrite
		✓	L S Elev 4039
			Depth to K Trc 28
			Elev of K Trc 4011

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.33.30.11000 Elevation: 4039' DF
Owner: Continental Oil Co.
MCA Unit Battery 4 #133
Record of Casing: 10" - 21'
7" - 3913'
Rotary

660' FNL - 660' FWL

✓

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 Oil Location No. 17.33.30.12000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	45		Caliche and sand
45	375		Red bed
375	1145		Red bed, red rock
			L S Elev 4057
			Depth to K Trc 45
			Elev of K Trc 4012

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.33.30.12000 Elevation: 4057' DF

Owner: Continental Oil Co.
MCA Unit Battery 4 #134

Record of Casing: 8" - 1185'

Rotary

660' FNL - 1980' FWL

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 7 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 Oil Location No. 17.33.30.14000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	30		Caliche
30	85		Caliche and sand
85	810		Red bed and red rock
	✓		L S Elev 4072 DF
			Depth to K Trc 85
			Elev of K Trc 3987

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.33.30.14000 Elevation: 4062' GL
Owner: Continental Oil Co.
MCA Unit Battery 4 #135
Record of Casing: 10" - 20'

Rotary

1980' FNL - 1980' FWL

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 Oil Location No. 17.33.30.31111

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	66		Sand
66	73		Rock
73	96		Sand
96	160		Red bed
160	270		Red sand and red bed
270	437		Red bed
437	546		Red bed and shells
546	608		Red bed and blue shale
608	628		Red bed
628	650		Sand
650	791		Red bed, sand, shells, shale
791	806		Lime shells
806	1078		Shale, red bed
			L S Elev 4037
	✓		Depth to K Trc 96
			Elev of K Trc 3941

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.33.30.31111 Elevation: 4037' DF
Owner: Continental Oil Co.
MCA Unit #197
Record of Casing: 8 5/8" - 128'
7" - 3963'

Rotary

2615' FSL - 25' FWL

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 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 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. 17.33.30.42000

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	98		Caliche and sand
98	145		Sand and gravel
145	1171		Red rock and red bed
	✓		
			L S Elev 4060
			Depth to K Trc 145
			Elev of K Trc 3915

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Location: 17.33.30.42000 Elevation: 4060' DF

Owner: Cities Service Co.
S. M. G. S. A. Unit Tract 1 #2

Record of Casing: 8 5/8" - 1199'

Rotary

1980' FSL - 660' 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.

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 Dillard & Waltermier Drilling CO.
Street and Number PO. Box 1206
City Odessa, State Texas.
Well was drilled under Permit No. L - 4363 and is located in the N W ¼ N E ¼ S W ¼ of Section 35 Twp. 17 S Rge. 33 E

(B) Drilling Contractor C. O. Aldredge License No. W D 79
Street and Number PO. Box 379
City Lovington State New Mexico.
Drilling was commenced Dec. 29 1959
Drilling was completed Jan. 5 1960

Elevation at top of casing in feet above sea level ______ Total depth of well 226
State whether well is shallow or artesian Shallow Depth to water upon completion 160 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	170	180	10	Brown water sand
2	183	200	17	Brown water sand & gravel
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
6 5/8	Welded		0	222	222	None	176	222

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
					6sacks of aquagell pored in hole while well was beeing drilled

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 1960 JAN 19 AM 8:25 STATE ENGINEER OFFICE

File No. L-4363 Use O.W.D. Location No. 17.33.35.321 (381421)

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2	Brown	soil
2	30	28	White	Calchie rock
30	70	40	Brown	sand
70	140	70	Red	sand
140	150	10	White	Caliche
150	152	2	Red	~~Sandx~~ Shale
152	170	18	Red	Sand
170	180	10	Brown	water sand
180	189	3	Red	shale
183	200	17	Brown	water sand &gravel
200	222	22	Red	Shale & sand rock
222	226	4	Red	Red bed

L S Elev 4122'
Depth to K Trc 222'
Elev of K Trc 3900'

17.33.35.32142

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.

C.C. Aldredge
Well Driller

L-4363

17.33.35.321

Form WR-23 STATE ENGINEER OFFICE

FIELD ENGR. LOG

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

		O	

(Plat of 640 acres)

(A) Owner of well GULF OIL CORPORATION

Street and Number P.O. BOX 2107

City HOBBS State NEW MEXICO

Well was drilled under Permit No. ____ and is located in the SE ¼ SW ¼ SE ¼ of Section 35 Twp. 17 S Rge. 39 E

(B) Drilling Contractor LOCKE BROTHERS License No. WD-46

Street and Number P.O. Box 697

City Hobbs State New Mexico

Drilling was commenced April 6 19____

Drilling was completed April 6 19 63

Elevation at top of casing in feet above sea level ____ Total depth of well 233

State whether well is shallow or artesian shallow Depth to water upon completion 150

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	150	230	80	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	20	10	0	233	233	open	150	233

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 STATE ENGINEER OFFICE ✓ DISTRICT II ROSWELL, N. MEX.

1963 APR 11 AM 8:05

File No. L-5696 Use OWD Location No. 17.33.35.433

OWD-RR

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1	1		soil
1	10	17		caliche
10	150	132		sand
150	230	80		water sand
230	239	9		sandy clay

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.

Murrell Abbott Jr.
Well Driller

Form WR-23

STATE ENGINEER OFFICE

~~[illegible]~~ FIELD ENGR. LOG

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) — 280 FSL, 2410 FEL

(A) Owner of well [illegible]

Street and Number [illegible]

City [illegible] State [illegible]

Well was drilled under Permit No. L-5096 and is located in the [illegible] ¼ [illegible] ¼ [illegible] ¼ of Section [illegible] Twp. [illegible] S Rge. 3[illegible] E

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

Street and Number [illegible]

City [illegible] State [illegible]

Drilling was commenced March [illegible] 19

Drilling was completed March [illegible] 19 63

Elevation at top of casing in feet above sea level ______ Total depth of well 239

State whether well is shallow or artesian Shallow Depth to water upon completion 150

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation
	From	To		
1	150	230	80	water sand
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth		Feet	Type Shoe	Perforations	
			Top	Bottom			From	To
7	20	10	0	230	230	open	150	230

Section 4

RECORD OF MUDDING AND CEMENTING

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

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		No. of Sacks Used
	From	To	

FOR USE OF STATE ENGINEER ONLY

Date Received ✓

ROSWELL, N. MEX.
DISTRICT II
STATE ENGINEER OFFICE
1963 APR 11 AM 8:06

File No. L-5055 Use OWD Location No. 17.33.35.43332

OWD-OK

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	1 ft	1		soil
1	16	17		caliche
16	150	132		sand
150	230	80		white sand
230	235'	5		sandy clay

L S Elev 4120'
Depth to K Tr 3235'
Elev of K Tr 3887'

Loc. No. 17.33.35.43332'

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.

Murrell Abbott

Well Driller

SECTION _____

TOWNSHIP 18S

RANGE 32E

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well B.E. Frizzell Owner's Well No. _____
Street or Post Office Address P.O. Box 190
City and State Hobbs, New Mexico 88240

Well was drilled under Permit No. CP-566 and is located in the:

a. _____ ¼ SE ¼ SE ¼ NW ¼ of Section 4 Township 18S Range 32E N.M.P.M.

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

c. Lot No. _____ of Block No. 13 of the Chapparel Subdivision, recorded in Lea County.

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

(B) Drilling Contractor Abbott Bros. License No. WD-46

Address P.O. Box 637, Hobbs, New Mexico 88240

Drilling Began 6/1/77 Completed 6/3/77 Type tools Cable Size of hole 8¼ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 133 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 65 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)
65	133	68	Sand	

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 5/8	21	Welded	0	133	133	None	65	133

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
					Cement at top

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

Date Received June 13, 1977

Quad _____ FWL _____ FSL _____

File No. CP-566 Use Dom Location No. 18.32.4.144

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	2	2	Surface soil
2	26	24	Caliche
26	65	59	Sand-tight
65	91	26	Sand-water
91	107	16	Sand-tight
107	129	22	Sand-water
129	133	4	Sandy clay

'77 JUN 13 AM 8 21
STATE ENGINEER OFFICE
ROSWELL, N. M.

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.

Murrell Abbott
Driller H.B.

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 7 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Virgil Linam Estate Owner's Well No. _____
Street or Post Office Address % Faye L. Klein, P.O. Box 1503
City and State Hobbs, New Mexico 88241

Well was drilled under Permit No. CP-672 and is located in the:

a. Center of ¼ ¼ SE ¼ SE ¼ of Section 7 Township 18S Range 32E N.M.P.M.

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

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

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

(B) Drilling Contractor Abbott Bros. Drilling License No. WD-46

Address P.O. Box 637, Hobbs, New Mexico 88240

Drilling Began 7/17/92 Completed 8/7/92 Type tools Cable Size of hole 10 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 524 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 430 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)
460	517	57	Sand	

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
9 5/8	33	Welded	0	125	125		None	
5½	15	Welded	0	527	527		459	524

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

Date Received August 12, 1992 Quad _____ FWL _____ FSL _____

File No. CP-672 Use CLOW STOCK Location No. 18.32.7.44233

18.32.7.44233

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	6	6	Top soil
6	21	15	Caliche
21	94	73	Red and brown clay
94	100	6	Grey sand (Water cased off with 9 5/8" pipe)
100	402	302	Red bed with brown & blue streaks
402	456	54	Red clay
456	460	4	Brown clay
460	489	29	Sand W/clay streaks (WATER)
489	493	4	Red clay
493	517	24	Sand W/clay streaks
517	524	7	Red Bed

Section 7. REMARKS AND ADDITIONAL INFORMATION

STATE ENGINEER OFFICE
ROSWELL NEW MEXICO
'92 AUG 12 AM 10 41

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.

Murrell Abbott
Driller

J.B.

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 6 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well: Virgil Linam Est. by Faye L. Kline — Owner's Well No. _____
Street or Post Office Address: Carlsbad Hwy.
City and State: Hobbs, NM 88240

Well was drilled under Permit No. Cp672 and is located in the:

a. ____ ¼ ____ ¼ SE ¼ SE ¼ of Section 7 Township 18S Range 32E N.M.P.M.

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

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

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

(B) Drilling Contractor Larry's Drilling License No. WD882

Address 2601 W.Bender, Hobbs,NM 88240

Drilling Began 1-22 --85 Completed 1-29-85 Type tools tricone Size of hole 83/4 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 540 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 460 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)
498	510	12	clay & gravel, small amt. of sand	12

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
65/8	160PVC		-1	540	541		480	540

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

Date Received February 8, 1985 Quad _____ FWL _____ FSL _____

File No. CP-672 Use STOCK Location No. 18.32.7.44144

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	6	6	blowsand
6	12	6	gray & white sand
12	16	4	soft caliche
16	64	48	brown clay
64	150	86	red clay
150	220	70	brown clay
220	498	278	red clay with stricks of brown & gray clay
498	510	12	small gravel, brown clay
510	540	30	brown & red clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

STATE ENGINEER
ROSWELL, NM
FEB 8 8 37 AM '85

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.

Larry Parkins
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 6 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Billy Williams Owner's Well No. TH #1

Street or Post Office Address

City and State Maljamar, N. Mex.

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

a. SE ¼ SW ¼ NE ¼ NE ¼ of Section 16 Township 18S Range 32E 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 Larry Felkins License No.

Address Hobbs, N. Mex.

Drilling Began 9/3/91 Completed 9/3/91 Type tools Rotary Size of hole 5¼ in.

Elevation of land surface or at well is ft. Total depth of well 100 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well Dry 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)

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

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

Date Received

Quad FWL FSL

File No. None Use EXP Location No. 18.32.16.223433

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	20	20	sand
20	36	16	sand – some gravel
36	42	6	sand, some gravel, red clay
42	70	28	red clay and sand
70	79	9	red clay, some gravel
79	85	6	sand
85	94	9	sand and gravel
94	100	6	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.

Jerry Fellers by Joe
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. If 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 T X O Prod. Owner's Well No. _____
Street or Post Office Address c/o Glenn's Water Well Service, Inc.
City and State Box 692 Tatum, New Mexico 88267

Well was drilled under Permit No. CP-677 and is located in the:

a. _____ ¼ W½ ¼ NW ¼ NW ¼ of Section 26 Township 18-S. Range 32-E. 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 Glenn's Water Well Service License No. WD 421

Address Box 692 Tatum, New Mexico 88267

Drilling Began 5/9/85 Completed 5/9/85 Type tools Rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 700 ft.

Completed well is [X] 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)
			Dry Hole	

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

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
	well was pluged	with sand	and mud		

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

Date Received May 15, 1985

Quad _____ FWL _____ FSL _____

File No. CP-677 Use OWD Location No. 18.32.26.11143

18.32.26.11143

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	12	12	sand-loose
12	24	12	clay
24	47	23	caleche
47	58	11	sand
58	84	26	sandy clay
84	102	18	red clay sticky
102	116	14	sand and gravel
116	142	26	red clay sticky
142	315	173	brown clay
315	325	10	purple clay
325	378	53	red clay
378	408	30	pink red clay
408	440	32	brown shale and blue streaks
440	500	60	brown shale-grainey
500	530	30	sand rock -fine
530	545	15	brown shale
545	605	60	sand rock-medium
605	616	11	brown shale
616	675	59	sand rock
675	700	25	red shale

Section 7. REMARKS AND ADDITIONAL INFORMATION

STATE ENGINEER
ROSWELL, NM
MAY 15 8 28 AM '85

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 report 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 Duval Corporation Owner's Well No. _____
Street or Post Office Address 5357 East Pima St.
City and State Tucson, AZ 85712

Well was drilled under Permit No. 0-13-002 and is located in the:

a. NE ¼ NW ¼ NW ¼ NW ¼ of Section 32 Township 18 S Range 32 E 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 Boyles Bros. License No. _____

Address 1624 Pioneer Road, Salt Lake City, Utah 84104

Drilling Began May 31, 1977 Completed June 22, 1977 Type tools _____ Size of hole _____ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 2060 ft.

Completed well is ☐ 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)
274			TRC	
575			TRS	

Section 3. RECORD OF CASING

Diamcter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
7			0	20				
4½	9½		0	1195				

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
1195		5 7/8		10	Displacement

Section 5. PLUGGING RECORD

Plugging Contractor Boyles Bros.
Address 1624 Pioneer Rd, Salt Lake City, U
Plugging Method Displacement
Date Well Plugged June 22, 1977
Plugging approved by: _____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1	0	2040	165
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received July 20, 1981

Quad _____ FWL _____ FSL _____

File No. 0-13-002 Use EXP Location No. 18.32.32.111244

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		

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.

____
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 [illegible] need be completed.

SECTION _____

TOWNSHIP 18S

RANGE 33E

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Oxy USA Inc. Owner's Well No. _____
Street or Post Office Address PO Box 56250
City and State Midland, Texas 79710

Well was drilled under Permit No. CP-758 Exploratory and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ SW ¼ of Section 4 Township 18S Range 33E 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 Dubose Drilling Inc. License No. WD-1107

Address 5407 N. Golder, Odessa, Texas 79764

Drilling Began 5-8-91 Completed 5-10-91 Type tools rerun Size of hole 12 3/4 in.

Elevation of land surface or _____ at well is XXX ft. Total depth of well 250 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well absent 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)
			ABSENT	

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

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 Dubose Drilling Inc.
Address _____
Plugging Method Back fill with cuttings
Date Well Plugged 5-10-91
Plugging approved by: Ken Fraquez
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

Date Received May 16, 1991

Quad _____ FWL _____ FSL _____

File No. CP-758-Exploratory Use EXP Location No. 18.33.4.34233

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	Surface soil
5	32	27	caliche
32	50	18	purple / grey clay
50	65	15	clay and shale conglomerate purple and g
65	90	25	brown clay wiht rgrey stringers
90	120	30	red bed
120	190	70	Brown clay
190	195	5	color change to light brown clay
195	250	55	brown clay
			no water, back fill hole with cuttings

Section 7. REMARKS AND ADDITIONAL INFORMATION

2015 OCT 15 AM 10 46

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 [illegible]ns, except Section 5, shall be answered as completely and accuratel[illegible]ssible when any well is drilled, repaired or deepene[illegible]n this form is used as a plugging record, only Section 1(a) and Section [illegible] be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

FIELD ENGR. LOG

Section 1. GENERAL INFORMATION

(A) Owner of well B. J. Woolley dba Caprock Sand & Gravel Owner's Well No. _____
Street or Post Office Address Box 776
City and State Eunice, New Mexico 88231

Well was drilled under Permit No. CP-546 and is located in the:

NW¼ SE¼ a. NE ¼ NE ¼ SE ¼ ¼ of Section 9 Township 18-S Range 33-E N.M.P.M.

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

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

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

(B) Drilling Contractor W. L. Van Noy License No. WD-208

Address Box 74 Oil Center, New Mexico 88266

Drilling Began June 1, 1975 Completed June 3, 1975 Type tools Spudder Size of hole 10 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 90 / 70 ft.

Completed well is ☐ 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)
70	85	15	fine water sand.	

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 5/8"	welded		0	90	90	none	70	85

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

Date Received October 2, 1978

Quad _____ FWL _____ FSL _____

File No. CP-546 Use COM. Location No. 18.33.9.42241

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	top soil
5	30	25	caliche
30	65	35	brown sand rock
65	70	5	hard rock
70	85	15	fine water sand
85	90	5	red bed.
			L S Elev 3978
			Depth to K Trc 82
			Elev of K Trc 3893
			Loc. No. 18.33.9.422 41
			Hydro. Survey Field Check FB
			SOURCE OF ALTITUDE GIVEN
			Interpolated from Topo. Sheet X
			Determined by Inst. Leveling
			Other

Section 7. REMARKS AND ADDITIONAL INFORMATION

1970 OCT -2 AM 8:27
STATE ENGINEER OFFICE
ROSWELL, N.M.

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.

W. L. Van Tray
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 6 need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Heyco's Harvey Yates Owner's Well No. _____
Street or Post Office Address c/o Glenn's Water Well Service, Inc.
City and State Box 692 Tatum, N.M. 88267

Well was drilled under Permit No. CP- 702 and is located in the:

a. _____ ¼ SE ¼ NW ¼ SW ¼ of Section 11 Township 18-S. Range 33-E. 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 Glenn's Water Well Service, Inc. License No. WD 421

Address Box 692 Tatum, N.M. 88267

Drilling Began 10/21/86 Completed 10/21/86 Type tools Rotary Size of hole 9 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 100 ft.

Completed well is ☒ 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)
52	82	30	gravel	40

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 5/8	.158						50	90

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

Date Received October 27, 1986

Quad _____ FWL _____ FSL _____

File No. CP-702 Use OWD Location No. 18.33.11.314112

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	2	2	soil
2	24	22	calecche
24	52	28	sand
52	82	30	gravel
82	100	18	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.

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. If 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 Heyco's Harvey Yates Owner's Well No. _____
Street or Post Office Address c/o Glenn's Water Well Service, Inc.
City and State Box 692 Tatum, N.M. 88267

Well was drilled under Permit No. CP-701 and is located in the:

a. _____ ¼ E½ ¼ NW ¼ SW ¼ of Section 11 Township 18-S. Range 33-E. 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 Glenn's Water Well Service, Inc. License No. WD421

Address Box 692 Tatum, New Mexico 88267

Drilling Began 10/20/86 Completed 10/20/86 Type tools Rotary Size of hole 9 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 100 ft.

Completed well is ☒ 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)
54	84	30	gravel	40

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 5/8	.156						50	90

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

Date Received October 27, 1986

Quad _____ FWL _____ FSL _____

File No. CP-701 Use OWD Location No. 18.33.11.314121

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	2	2	soil
2	22	20	caleche
22	54	34	sand
54	84	30	gravel
84	100	16	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.

Driller

INSTRUCTIONS: This report 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

FIELD ENGR. LOG

Section 1. GENERAL INFORMATION

(A) Owner of well B. J. Wooley Owner's Well No. _____

Street or Post Office Address P.O.Box 207

City and State Hobbs, NM 88240

Well was drilled under Permit No. L-8288 and is located in the:

a. ____ ¼ ____ ¼ SW ¼ SW ¼ of Section 12 Township 18S Range 33E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

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

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

(B) Drilling Contractor Larry's Drilling License No. WD882

Address 2601 W. Bender Hobbs, NM 88240

Drilling Began 5-11-82 Completed 5-11-82 Type tools button bit Size of hole 9 7/8in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 79 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 60 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)
60	80	20	sand & gravel	60

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 5/8	160PVC		+1	79	80		XX 60	79

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

Date Received September 24, 1982

Quad 107.2.0 FWL ____ FSL ____

File No. L-8288 Use COMMERCIAL Location No. 18.33.12.33334

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	2	2	blow sand
2	15	13	caliche
15	59	44	sand
~~RAW~~ 59	79	20	gravel
79	80	1	gray yellow clay
			L S Elev 3993
			Depth to K Tre 79
			Elev of K Tre 3914
			Loc. No 33 12. 23334
			Hydro. Survey Field Check L-5
			SOURCE OF ALTITUDE GIVEN
			~~Interpolated from Topo. Sheet~~ X XX 80
			Determined by Inst. Leveling
			Other

Section 7. REMARKS AND ADDITIONAL INFORMATION

SEP 17 3 42 PM '82

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.

Larry Jelkins
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 6 need be completed.

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 S. P. Yates Drilling Company

Street and Number 311 Carper Building

City Artesia State New Mexico

Well was drilled under Permit No. L-2878 and is located in the ¼ SE ¼ SE ¼ of Section 12 Twp. 18S Rge. 33E

(B) Drilling Contractor Claude Tatum License No. WD33

Street and Number 524 West Washington

City Lovington State New Mexico

Drilling was commenced May 22 1955

Drilling was completed May 30 1955

Elevation at top of casing in feet above sea level unknown 4090 Total depth of well 205

State whether well is shallow or artesian shallow Depth to water upon completion 150

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	150	205	55	Water sands
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
6	20	8	0	205	205	none	150	205

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

FILED
JUN 29 1955
GROUND WATER SUPERVISOR
OFFICE
ROSWELL, NEW MEXICO

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 June 29, 1955

File No. L-2878 Use Oil Location No. 18.33.12. 440

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness In Feet	Color	Type of Material Encountered
0	30	30	white	caliche and rock
30	40	30	white	caliche and rock
40	80	40	red	dry sand
80	160	80	white	coarse red
160	200	40	red	water sands
200	205	5	red	clay

L S Elev 4029 ✓

Depth to K Trc 200'

Elev of K Trc 3829 ?

Loc. No. 18.33.12 444123

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.

Claude Tatum

Well Driller

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

FIELD ENGR. LOG

Section 1. GENERAL INFORMATION

(A) Owner of well B.J. Wooley Owner's Well No. _____
Street or Post Office Address P.O.Box 207
City and State Hobbs, NM 88240

Well was drilled under Permit No. CP-623 and is located in the:

a. ____ ¼ ____ ¼ NW ¼ NW ¼ of Section 13 Township 18S Range 33E N.M.P.M.

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

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

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

(B) Drilling Contractor Larry's Drilling License No. WD882
Address 2601 W. Bender Hobbs, NM

Drilling Began 5-10-82 Completed 5-10-82 Type tools button bit Size of hole 97/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 82 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 60 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)
70	80	10	sand & gravel	40

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 5/8	160PVC		+1	82	83		70	80

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

Date Received September 24, 1982 Quad 107.2.0 FWL _____ FSL _____

File No. CP-623 Use COMMERICAL Location No. 18.33.13.11112

18.33.13.1112

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	6	6	blow sand
6	11	5	caliche
11	70	59	sand
70	80 ~~XX~~	10~~XXX~~	gravel & sand
80	82	2	red bed
			L S Elev 3989
			Depth to K Trc 80
			Elev of K Trc 3909
			~~Loc. No.~~ 18.33.13.11112
			Hydro. Survey Field Check FB
			SOURCE OF ALTITUDE GIVEN
			Interpolated from Topo. Sheet X
			~~Determined by Inst. Leveling~~
			Other

Section 7. REMARKS AND ADDITIONAL INFORMATION

SEP 24 ... AM '82

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.

Larry ... 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 Sun Oil Owner's Well No. _____
Street or Post Office Address c/o Glenn's Water Well Service, Inc.
City and State Box 692 Tatum, N.M. 88267

Well was drilled under Permit No. CP-689 and is located in the:

a. _____ ¼ _____ ¼ NE ¼ NW ¼ of Section 13 Township 18-S. Range 33-E. 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 Glenn's Water Well Service License No. WD 421

Address Box 692 Tatum, N.M. 88267

Drilling Began 12/7/85 Completed 12/7/85 Type tools rotary Size of hole 9 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 100 ft.

Completed well is ☒ 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)
70	95	25	gravel	120

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
102'	.142	steel casing					65	100

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

Date Received December 13, 1985 Quad _____ FWL _____ FSL _____

File No. CP-689 Use OWD Location No. 18.33.13.12122

18.33.13.1

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	sand
5	29	24	caleche
29	65	36	sand
65	95	30	gravel
95	100	5	yellow 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.

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 shall be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well KMR, INC. Owner's Well No. _____

Street or Post Office Address P.O. BOX 1832

City and State HOBBS, NM 88240

Well was drilled under Permit No. CP-769-EXPLORATORY and is located in the:

a. _____ ¼ NW ¼ NW ¼ NE ¼ of Section 13 Township 18S Range 33E 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 LARRY'S DRILLING, INC. License No. WD882

Address 2116 W. BENDER HOBBS, NM 88240

Drilling Began 5-6-92 Completed 5-6-92 Type tools BUTTON BIT Size of hole 97/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 115 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 70 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)
80	115	35	SAND & SANDSTONE	20

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 5/8	160PVC		0	115	115		90	110

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

Date Received May 21, 1992

Quad _____ FWL _____ FSL _____

File No. CP-769-Exploratory Use EXP Location No. 18.33.13.21142

(THIS WELL WILL NOW BE CP-72-A - TO BE USED FOR COM USE) 18.33.13.21142

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	12	12	SAND
12	21	9	CALICHE
21	36	15	SAND & GRAVEL
36	52	16	~~XXXXXAN~~ SAND, RED & GRAY CLAY
52	66	14	RIO SAND & SOME CLAY
66	85	19	SAND & SOME GRAVEL
85	110	25	SAND & GRAVEL
110	115	05	RED BED

Section 7. REMARKS AND ADDITIONAL INFORMATION

'92 MAY 21 AM 10 10
STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

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.

Larry Graham
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.

Form WR-23

STATE ENGINEER OFFICE

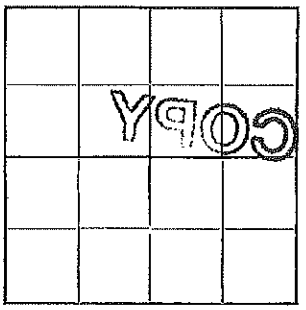
COPY

FIELD ENGR. LOG

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 Scharbauer Cattle Company

Street and Number Box 1471

City Midland, State Texas

Well was drilled under Permit No. L-6347 and is located in the

¼ SE ¼ SE ¼ of Section 12 Twp. 18S Rge. 33E

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

Street and Number Box 56

City Hobbs, State New Mexico

Drilling was commenced July 11, 19 68

Drilling was completed July 12, 19 68

Elevation at top of casing in feet above sea level ..... Total depth of well 170

State whether well is shallow or artesian Shallow Depth to water upon completion 130

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				Cleaned out old well.
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
6	10							

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

FILED
JUL 22 1968
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. L-6347 Use Stock Location No. 18.33.12.440

41229

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
				Cleaned out old well.

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.

A R Musselwhite
Well Driller

Form WR-23

STATE ENGINEER OFFICE

Orig. to S.E.

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 Mr. W. H. Ellison

Street and Number Star Route B.

City Hobbs State New Mexico

Well was drilled under Permit No. L-3454 and is located in the

NE ¼ NE corner ¼ of Section 30 Twp. 18 S Rge. 33 E

(B) Drilling Contractor O.R. Musslewhite License No. W D 99

Street and Number P.O. Box 56

City Hobbs State New Mexico

Drilling was commenced March 29 19 57

Drilling was completed March 30 19 57

Elevation at top of casing in feet above sea level ..... Total depth of well 100

State whether well is shallow or artesian shallow Depth to water upon completion 35

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	70	97	27	Red sand and sand rock
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
6 5/8	20	none	0	100	100	none	75	100

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 rougbage .....

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

APR 17 1957

OFFICE

ROSWELL, NEW MEXICO

FOR USE OF STATE ENGINEER ONLY

Date Received .....

File No. L-3454 Use Dom Location No. 18.33.30.220

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
1	25	24	White	Cleaghie and rock
25	50	25	Grey	Sandy shale
50	97	47	Red	Sand and sand rock
97	100	3	Brown	Quartsite
				L S Elev ____ ____
				Depth to K____Trc____
				Elev of K____Trc____

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. R. Musselwhite

Well Driller

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 8: VADOSE ZONE MONITORING PLAN

ATTACHMENT II.8.B

VADOSE ZONE MONITORING FORM

(TYPICAL)

ATTACHMENT II.8.B

Vadose Zone Monitoring Form (Typical)

DNCS Environmental Solutions

Monitoring Personnel _____ _____

Weather Information

Date and Amount of Last Precipitation: _____

Temp: _____ °F

Wind Speed: _____ mph

Wind Direction: _____

Barometric Pressure: _____ inches mercury (Hg)

Weather Conditions: _____

Equipment Information

Monitoring Equipment Used: _____ **Monitoring Equipment Used:** _____

Date and Time Last Calibrated: _____ **Date and Time Last Calibrated:** _____

Well I.D.	Monitoring Date (dd/mm/yy)	Total Well Depth (fbtoc)	Depth to Water (fbtoc)	Field Parameter Measurement				Water Volume Removed (gallons)	Sample Collected?		Observations (e.g., color, odor, clarity, etc.)
				Temperature (^{o}C)	pH (standard units)	Specific Conductance (mS/cm)	Methane (%) or (% LEL)		Y	N	
VM-1											
VM-2											
VM-3											
VM-4											
VM-5											
VM-6											
VM-7											
VM-8											
VM-9											
VM-10											

Notes:

- *fmsl: feet above mean sea level*
- *fbtoc: feet below top of PVC casing*

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 9: LEACHATE MANAGEMENT PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

APPLICATION FOR PERMIT
DNCS ENVIRONMENTAL SOLUTIONS

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 9: LEACHATE MANAGEMENT PLAN

1.0 INTRODUCTION

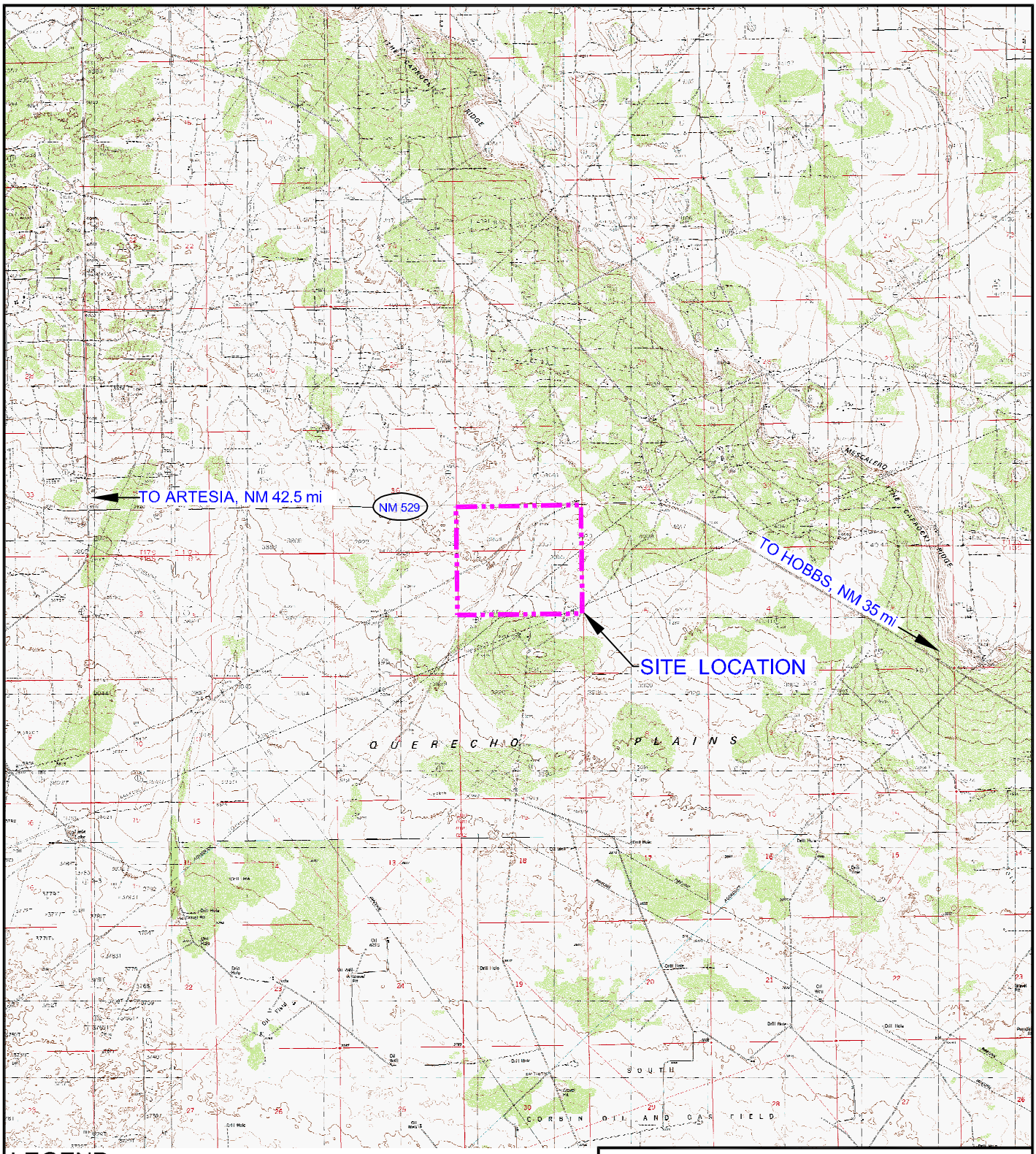
DNCS Environmental Solutions (DNCS Facility) is a proposed Surface Waste Management Facility for oil field waste processing and disposal services. The proposed DNCS Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility 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 south 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 II.9.1**). Site access will be provided via the south side of NM 529.

1.2 Description

The DNCS Facility is a proposed new Surface Waste Management Facility that will include two main component;, 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 **Permit Plans, Sheet 3** identifies the locations of the Processing Area and Landfill facilities.



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:Sep. 19, 2013-08:30:58 ; 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: 09/18/2013	CAD: SITE LOC MAP.dwg	PROJECT #: 542.01.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.9.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

1.3 Purpose

A leachate management plan must be developed per 19.15.36.8.C.(12) NMAC that describes the anticipated amount and quality of fluids collected, along with the proposed management, storage and disposal technologies. This Leachate Management Plan (the Plan) details the procedures that will be used to manage contact waters generated at the DNCS Facility Landfill during the permit period and following closure. This Plan has been developed to address the design and performance requirements of 19.15.36.14 NMAC, and addresses the following items:

1. Projected amounts and rates of leachate generation
2. Expected duration of leachate generation
3. Leachate disposal options
4. Proposed treatment and disposal methods

2.0 LEACHATE COLLECTION SYSTEM

The leachate collection system designed for the DNCS Landfill meets or exceeds the minimum design and performance standards specified in 19.15.36.14 NMAC, specifically:

1. The minimum design slope on the landfill liner is 2.8%; and the minimum slope on the leachate piping system is 2.0%.
2. The leachate piping system will consist of perforated and solid pipe with a minimum diameter of 6 inches.
3. Both schedule 80 polyvinyl chloride (PVC) and standard dimension ration (SDR) 11 high density polyethylene (HDPE) piping are demonstrated to meet the site-specific performance standards.
4. The protective soil layer (minimum 24 inches of pervious soil) will provide both protection for the liner and leachate flow to the piping and extraction system.
5. There is a geonet leak detection layer and secondary 60 mil HDPE below the primary liner and leak collections system.

Each new cell will be outfitted with perforated leachate collection piping that is enveloped in aggregate and geotextile to promote flow while minimizing the intrusion of fines. The cell floor and liner system will be sloped at 45º to each pipe, and leachate will flow through the protective soil layer (PSL).

Permanent leachate sumps are designed for each cell at the DNCS Landfill. Temporary sumps and cleanout risers may also be installed as filling progresses in each cell. Therefore, each cell is designed with its own collection piping. Two solid pipe risers will provide access to each permanent leachate sump at the toe of the slope:

- The leachate extraction riser will be used to measure leachate levels in the leachate sump, and to provide access for a submersible pump to remove accumulated fluids.
- A cleanout riser is connected with a pipe elbow to the collection pipe to facilitate cleaning or flushing if necessary.

Compliance with the design standards of 19.15.36.14 NMAC is demonstrated in the **Permit Plans** (**Volume III.1**). The performance standards specified in the same subsections are addressed as follows:

1. The Liner Construction Quality Assurance (CQA) Plan (**Volume II.7**) specifies the materials and installation techniques which will be used for construction of the leachate collection system and protective soil layer.
2. The performance of the design and the specified materials are documented to meet OCD requirements in the following Landfill Engineering Calculations:
    - Pipe Loading Calculations (**Volume III.5**)
    - Geosynthetic Applications and Compatibility Documentation (**Volume III.6**)
    - Settlement Calculations (**Volume III.9**)

3.0 LEACHATE GENERATION

Leachate in the permanent extraction risers will be measured monthly and after significant rainfall events. The storage capacity in each sump is approximately 1,500 gallons. The maximum head accumulation on the liner is not to exceed 12 inches per 19.15.36.14.F NMAC. Fluid levels on the cell floor will be maintained below the regulatory threshold through regular pumping as recorded and reported to OCD. DNCS will maintain a record of actual leachate generation and management volumes, using a form similar to the one provided as **Attachment II.9.A** to track the amount of leachate removed from the sumps throughout a given year at the Facility.

Leachate production is projected to approach zero because of the solid nature of the waste and the paint filter restriction. Therefore, leachate generation is attributable solely to precipitation; and particularly fluids from precipitation in the very early stages of cell development.

The leachate generation rate decreases to nearly zero following the placement of the first lift of waste on the liner. This has been calculated in the HELP Model (**Volume III.4**) and confirmed through experience at other facilities. As demonstrated in the HELP Model, the field capacity of the waste and the local evaporation rate far exceed the volume of rainfall experienced at the site, and therefore liquids do not typically reach the leachate collection system. As discussed in detail in the Operations, Inspection, and Management Plan (**Volume II.1**), routine site operation procedures will dictate that a loose lift of waste (approximately 5 feet thick) be placed over the entire floor of a newly constructed cell as soon as practical. This process will protect the liner and leachate collection system; and reduce the generation of contact water, which is stormwater collected within the cell footprint. During the post-closure care period, the site will have been capped and vegetated (**Permit Plans**); and leachate production is modeled to decline to near zero.

4.0 LEACHATE MONITORING

Routine monitoring of leachate levels and extraction of leachate from the sumps will ensure that the fluid accumulation on the liner will not exceed the regulatory 12-inch threshold. Procedures to ensure leachate does not accumulate on the liner will include the following:

- The level of the leachate in the sumps will be monitored at least monthly, and leachate will typically be extracted on a minimum quarterly basis; or as needed to maintain <12 inches of head on the liner.
- The leachate will be extracted from the sumps with portable submersible pumps, vacuum trucks, or other suitable devices.
- In the future, the leachate sumps may be equipped with remote level sensors and/or dedicated submersible pumps, if routine leachate removal is required.

The Leachate Monitoring Form provided as **Attachment II.9.A** is a template for monitoring levels and extraction data, as well as the disposal technique used.

5.0 LEACHATE DISPOSAL

DNCS is requesting approval to recirculate leachate over lined areas of the landfill during the active life of the DNCS Facility. The following procedures will be adhered to when performing recirculation of leachate at DNCS:

- On an as-needed basis (initially anticipated to be quarterly), leachate will be pumped from the sump(s) with a portable submersible pump or vacuum to a tank truck, equipped with appropriate fluid transfer hoses, and will be transported to the active cell. Prior to applying daily cover to the cell, the leachate will be sprayed onto the exposed waste. Cover will be placed after the recirculation activities are complete.
- For the most effective recirculation, and to avoid short-circuiting, the leachate will be applied only in areas where the cell surface is at least 10 feet above the liner system. In addition, the leachate will be applied on cells upgradient in the collection system whenever possible. No leachate recirculation will be conducted within 50 feet of the solid waste boundary.
- Monitoring and recirculation activities will be documented on the Leachate Monitoring Form (**Attachment II.9.A**). The information will be maintained in the Facility Operating Record.

Leachate recirculation will be accomplished via similar collection, transport, and application methods in future cells. Alternatively, leachate may be applied directly to waste deposits in lined cells with pumps and hoses attached directly to the collection system. DNCS is seeking OCD's approval of additional leachate management alternatives that include, but are not limited to:

- disposal onsite through the Produced Water processing/evaporation process
- use of dilute leachate for dust control over lined cells
- disposal offsite at a publicly owned treatment works (POTW) facility or permitted liquids processing facility (as necessary, following closure)

Disposal of leachate onsite through the Produced Water evaporation process will be accomplished by pumping leachate directly from the sump with a submersible pump or extraction hose to a tanker truck, equipped with appropriate fluid transfer hoses. The leachate will be transferred to the Produced Water Load-Out Station and unloaded into the Produced Water Receiving tanks for processing.

The use of dilute leachate for dust control over lined cells will be accomplished as follows:

- Leachate will be diluted with collected stormwater to minimize the potential for odors.
- The leachate application method will consist of spraying the dilute leachate with the site's water wagon, or similar type vehicle.
- The application of leachate will be conducted only over lined cell areas.
- Leachate will be sprayed evenly and thinly over lined cell areas to provide for effective dust control and evaporation, and to minimize the potential of recirculation through the waste.
- To enhance safety, leachate will be sprayed only when personnel are not near the spray surface. In addition, leachate will not be sprayed on windy days.
- If there are any issues regarding the potential composition of the leachate (for example, leachate being generated by some means other than heavy rainfall on a new cell), leachate may be analyzed prior to beneficial use in consultation with OCD.

Disposal of leachate offsite at a POTW or permitted liquids processing facility following closure may be conducted by pumping leachate directly from the sump with a submersible pump or extraction hose to a tanker truck, equipped with appropriate fluid transfer hoses. If the leachate is required to be sampled and analyzed by the disposal facility, the parameters to be analyzed will be determined in consultation with the POTW. Prior to transport, leachate samples will be collected and analyzed to demonstrate compliance with the disposal facility's leachate acceptance criteria for analytical parameters and concentrations. Prior to disposal, the Leachate Management Plan may be updated with OCD approval to reflect the analytical parameters and concentrations, as well as transport methods specified by the selected disposal facility. The updated Plan will be submitted to OCD for approval as an administrative change to the existing Plan prior to implementation of disposal activities. The analytical test results for leachate disposal at the off-site Facility will be maintained in the Facility Operating Record.

Following closure, the most effective treatment and disposal technology for leachate (if produced) will be determined and implemented with the approval of OCD. This disposal technology may include spray irrigation, hauling off-site for treatment at a POTW, etc. Leachate monitoring during post-closure will be conducted at least semi-annually. Leachate management information will continue to be documented and maintained in the Facility Operating Record.

6.0 LEAK DETECTION MONITORING

Routine inspection of the leak detection system and sump in each of the Landfill cells and evaporation ponds will be conducted on at least a quarterly basis; and documented on the Leachate Monitoring Form (**Attachment II.9.A**), or the Pond Integrity/Leak Detection Inspection Form (**Attachment II.9.B**). At a minimum, the following items will be documented:

- Inspection date, time, and conditions
- Inspector identification
- Depth of liquids in sump
- Sump and piping condition and status
- Volume collected

Prior to placing a newly constructed landfill cell or evaporation pond (or an evaporation pond that has undergone repair or cleaning) into service, liquids will be removed from above the primary liner and from the leak detection system. Once in service, it is anticipated liquid may be present at all times due to condensation and nominal leakage through the primary liner. The sumps are 2 feet deep and have a capacity of approximately 1,500 gallons (gal) using a porosity of 0.40 for the granular material.

Attachment II.9.C is a summary table from an authoritative publication on potential geomembrane liner leakage for 40 mil HDPE lined ponds. As shown on the table, the combined projected permeation/pinhole leakage rate ranges from 9.5 to 138 gal/acre/day. Using a very conservative value of 75 gal/acre/day for the combined leakage/permeation rate (**Attachment II.9.C**), this provides 16 days of storage at a depth of 2 ft in the sump. The rate of 75 gal/acre/day is considered very conservative as it is based on 40 mil HDPE (vs. the actual 60 mil); a fluid depth of 10 ft; and a high number of large pin-holes. Considering that the Landfill leachate collection system is designed to maintain less than 1 ft of liquid on the liner this is and extremely conservative analysis for the Landfill.

The liquid levels in the sumps will be monitored at least quarterly and immediately after the cells or ponds are put into service and documented. Should the lack of liquids become apparent after a series of inspections, the monitoring frequency will be extended to semi-annual. In the event and excessive liquid level [i.e., > corrective action level (ACL)] is observed in a leak

detection system, OCD will be notified within 24 hours. If this liquid level is observed in a Landfill cell the Facility will initiate corrective action which may include but is not limited to:

- Additional sump liquid level monitoring and pumping frequencies
- Liquids analytical testing
- Enhanced vadose zone monitoring (if applicable)

If this liquid level is observed in an evaporation pond, the affected pond area will be drained. Prior to placing the pond back into service, the Facility will initiate corrective action which may include but is not limited to:

- Actions undertaken to locate source of leakage
- Repair procedures
- Additional sump liquid level monitoring and pumping frequencies
- Liquids testing
- Groundwater monitoring (if required)

Any liquids recovered from the Leak Detection Sump will be disposed of in the same manner as leachate generated from the landfill cells.

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ATTACHMENT II.9.A

LEACHATE MONITORING FORM (TYPICAL)

ATTACHMENT II.9.A
Leachate Monitoring Form (Typical)
DNCS Environmental Solutions

Leachate Level Data				Pumping Data			Notes
Date	Sump I.D.	Time	Monitored By	Date	Company	Volume Pumped (gal)	

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ATTACHMENT II.9.B

POND INTEGRITY/LEAK DETECTION INSPECTION FORM (TYPICAL)

ATTACHMENT II.9.B
Pond Integrity/Leak Detection Inspection Form (Typical)
DNCS Environmental Solutions

Date: _____ **Inspector(s):**

Time: _____ _____

_____

Weather:

Temperature _____ deg. F Precipitation (last 24 hours) _____ inches

Skies _____

Wind Speed _____ mph

Wind Direction _____ *(direction blowing from)*

NOTES:
"X" indicates that a Deficiency has been noted. "P" indicates that a Photograph has been taken. "S" indicates that a Sample has been collected. Complete descriptions of Deficiencies, Photographs, and Samples are provided on attached pages. Items are referenced by Location.

Pond Condition

Location	Item			
	Erosion	Vegetation Established	Vectors	Sample

Leak Detection System

Riser #	Deficiency	
	Depth of H_2O	Structural Defect

NOTES: _____

_____

_____

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ATTACHMENT II.9.C

POTENTIAL GEOMEMBRANE LINER LEAKAGE

Attachment II.9.C
Potential Geomembrane Liner Leakage
DNCS Environmental Solutions

Title: Leakage Through Liners Constructed with Geomembranes - Part 1. Geomembrane Liners

Written by: J.P. Giroud and R. Bonaparte
Published in: Geotextiles and Geomembranes **Volume:** 8 **Issue:** 2 **Pages:** 27 to 67
Phone: +31 20-485-3757 ~ **Web Site:** http://www.elsevier.com

How impermeable are 'impermeable liners'? All liners leak, including geomembranes, but how much? What are the mechanisms of leakage through liners constructed with geomembranes? To answer these questions, a detailed review of leakage mechanisms, published and unpublished data, and analytical studies has been carried out with the goal of providing practical design recommendations. In particular, it appears that a composite liner (i.e. geomembrane on low-permeability soil) is more effective in reducing the rate of leakage through the liner than either a geomembrane alone or a soil liner (low-permeability soil layer) alone. However, the paper shows that the effectiveness of composite liners depends on the quality of the contact between the geomembrane and the underlying low-permeability soil layer.

Table 1
Calculated Leakage Rates Due to Pinholes and Holes in a Geomembrane

	Water depth on top of the geomembrane, h_w					
	Defect Diameter	0.003 m (0.01 ft)	0.03 m (0.1 ft)	0.3 m (1 ft)	3 m (10 ft)	30 m (100 ft)
Pinholes	0.1 mm (0.004 in)	0.006 (0.0015)	0.06 (0.015)	0.6 (0.15)	6 (1.5)	60 (15)
	0.3 mm (0.012 in)	0.5 (0.1)	5 (1)	50 (13)	500 (130)	5000 (1 300)
Holes [a]	2 mm (0.08 in)	40 (10)	130 (30)	400 (100)	1300 (300)	4000 (1 000)
	11.3 mm (0.445 in)	1 300 (300)	4 000 (1 000)	13 000 (3 000)	40 000 (10 000)	130 000 (30 000)
	Values of leakage rate in liters/day (gallons/day)					

Table 2
Calculated Unitized Leakage Rates Due to Permeation of Water Through an HDPE Geomembrane

	Water depth on top of the geomembrane, h_w					
	0 m (0 ft)	*0.003 m (0.01 ft)*	*0.03 m (0.1 ft)*	*0.3 m (1 ft)*	*3 m (10 ft)*	*>10 m (>30 ft)*
Coefficient of migration, m_g(m^2/s)	0	$9x10^{-20}$	$9x10^{-18}$	$9x10^{-16}$	$9x10^{-14}$	$3x10^{-13}$
Unitized leakage rate, q_q	0	$9x10^{-17}$	$9x10^{-15}$	$9x10^{-13}$	$9x10^{-11}$	$3x10^{-10}$
(m/s)	0	$8x10^{-5}$	0.008	0.8	80	260
(lphd)	0	$8x10^{-6}$	0.0008	0.08	8	28
(gpad)						

Notes: These values of utilized leakage rates were calculated using eqn (5) and assuming a geomembrane thickness of 1 mm (40 mils). The coefficients of migration used to calculate the unitized leakage rates in this table were obtained from eqns (19) and (20), with $C_1 = 1x10^{-22}$ m^4 $kg^{-2}s^3$, $n = 2$, and $m_{gmax} = 3x10^{-13}$ m^2/s.

The water depths used here correspond to the typical values defined in Section1.3.6. (To use eqn (19), it is necessary to know the pressure difference, Δp. According to eqn (1), water depths, h_w, are approximately equal to hydraulic head differences, Δh, which are related by eqn (12) to pressure differences, Δp.)

- data used in calculations